

Audio

THE AUTHORITATIVE MAGAZINE ABOUT HIGH FIDELITY • MARCH 1978 \$1.25

47425 

Build A Speaker
Power Indicator

Equivalent Mass— Fact or Fiction?

Heyser on Hearing Vs. Measurement

The Perils of Patchwork



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2608 CENTRAL BLVD

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PRESENTS ACT II. STAND MADE THEM BETTER.

to let you get everything out of your tuner. Perfectly.

Our output stage, for example, features a new parallel push-pull circuit that reduces total harmonic distortion to less than 0.1%. Again, well below anything you can possibly hear.

To all but eliminate cross-talk, the SA9500II comes with a separate power transformer for each channel, instead of the usual single transformer for both.

And where some amps give you two, or three tone controls, the SA9500II gives you four. Two for regular treble and bass, and two for extended treble and bass. They're calibrated in 2 decibel click stops, which means you have a virtually endless variety of ways to get the most out of your music.

But that's only the beginning. To get the most out of your cartridge, the SA9500II has a switch that lets you "tune" the amplifier to the cartridge manufacturer's optimum capacitance. And to get the most out of your records, our three-stage phono equalizer features an incredibly high phono overload level of 300 millivolts. With no more than 0.2 dB variation from the RIAA curve. So even the most complicated passage on one of today's highly engineered records will sound exactly the way it was recorded in the studio.

Obviously, both the SA9500II and the TX9500II are very sophisticated pieces of equipment. But all of the engineering skill that went into making them has also gone into every other tuner and amplifier in our new series II. No matter what the price, no matter what the specifications.

And that's something you don't have to be an expert to appreciate.

	SA9500II TX9500II	SA8500II TX8500II	SA7500II	SA6500II TX6500II	SA5500II TX5500II
POWER MIN. RMS, 20 TO 20,000 HZ	80	60*	45	30	15
TOTAL HARMONIC DISTORTION	0.1%	0.1%	0.1%	0.1%	0.5%
PHONO OVERLOAD LEVEL	300mV	250mV	200mV	200mV	130mV
INPUT: PHONO/AUX/ TAPE	2/1/2	2/1/2	1/1/2	1/1/2	1/1/1
SIGNAL TO NOISE RATIO	95dB	95dB	95dB	93dB	87dB
FM SENSITIVITY (IHF '58)	1.5uV	1.8uV	not applicable	1.9uV	1.9uV
SELECTIVITY	(wide) 35dB (narrow) 85dB	(wide) 35dB (narrow) 80dB	not applicable	60dB	60dB
CAPTURE RATIO	(wide) 0.8dB (narrow) 2.0dB	(wide) 0.8dB (narrow) 2.0dB	not applicable	1.0dB	1.0dB

U.S. Pioneer Electronics Corp., 75 Oxford Drive, Moonachie, New Jersey 07074.

* Minimum RMS continuous power output at 8 ohms, from 20 to 20,000Hz, with no more than 0.1% total harmonic distortion.



TX9500II
SA9500II



TX6500II
SA7500II

High Fidelity Components
PIONEER
WE BRING IT BACK ALIVE.

NEW PIONEER AMPS AND TUNERS.

PIONEER PR WE STARTED WITH THE BES

Last year, the experts paid Pioneer's integrated amps and tuners some of the highest compliments ever.

The challenge was obvious: to build even better amps and tuners. Amps and tuners that would not only surpass anything we'd ever built before, but anything anyone ever built before.

Here's how we did it.

THE NEW PIONEER TX9500II TUNER: EVEN CLOSER TO PERFECT.

When Popular Electronics said our TX9500 tuner was as "near to perfect" as they'd encountered, they obviously hadn't encountered our TX9500II. It features technology so advanced, some of it wasn't even perfected until this year.

Our front end, for example, features three newly developed MOS FETs that work with our 5-gang variable capacitor to give the TX9500II an incredible FM sensitivity of 8.8dBf. In mono. In English, this means you can pull in beautiful FM reception no matter how far you live from the transmitter.

Where most tuners give you one band width for all FM stations, the TX9500II gives you two. A wide band with a surface acoustic wave filter to take advantage of strong stations, and a narrow band

with five ceramic filters to remove all the interference and noise from weaker ones. (Distortion measured stereo at one kilohertz is an incredibly low 0.07% in the wide band; and 0.25% in the narrow band. Both well below the threshold of human hearing.)

Where conventional multiplex circuits cut out some of the frequencies that add depth and presence to music, the multiplex circuit in the TX9500II doesn't. It features an exclusive integrated circuit that's far more accurate than anything else around. Plus a multipath switch that lets you align your antenna perfectly without an oscilloscope.

And where you simply have to guess about the proper recording levels off most tuners, the TX9500II provides you with a tone generator that lets you pre-set the recording levels on your tape deck before the broadcast starts.

So your tapes can sound just as clear and beautiful as your tuner.

THE NEW SA9500II AMPLIFIER: HOW TO GET THE MOST OUT OF THE BEST.

After building one of the world's best tuners, we had no choice but to create an amplifier that could match it.

The result is the new SA9500II. An 80-watt integrated amp that was designed



TX8500II
SA8500II

THE TYPE II A

LAST YEAR'S REVIEWS PRESENTED US WITH A TOUGH ACT TO FOLLOW.

"IT CANNOT BE FAULTED."

SA9500 — Stereo Review

**"AS NEAR TO PERFECT
AS WE'VE ENCOUNTERED."**

TX9500 — Popular Electronics

**"CERTAINLY ONE OF THE BEST...
AT ANY PRICE."**

TX9500 — Modern Hi Fi

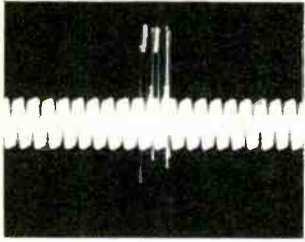




Audio

March 1978

Vol. 62, No. 3



Actual, unretouched photo of an oscillograph test.

The oscillograph you see is an actual photo of a high-quality audio system "playing" a fingerprint.

You're hearing fingerprints now through your speaker system. Instead of the sound your precious discs are capable of. And no vacuum record cleaner, brush-arm or treated cloth will remove them. None.

The sound of your fingerprint

But Discwasher™ — with new **D3** fluid — removes fingerprints completely. Along with dust. And manufacturing lubricants (added to make pressing faster) that can act like groove-blocking fingerprints. All this cleaning without pulling polymer stabilizers from your vinyl discs.

Discwasher™. The only safe, effective way to silence the printed finger. At Audio specialists world wide.



Discwasher, Inc.
Columbia, Mo. 65201

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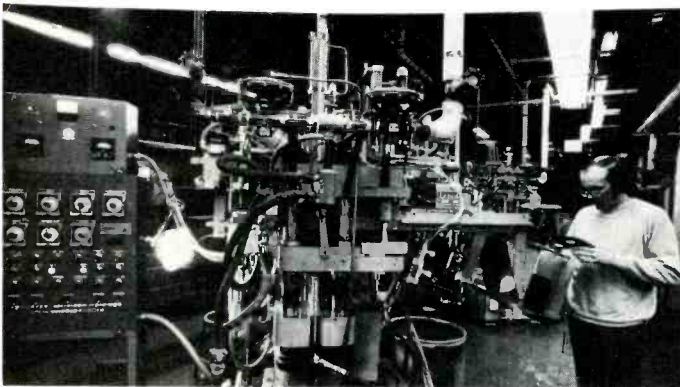
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About the Cover: The phono cartridge is the heart of your disc reproduction system, and good cartridges deserve the "white glove" treatment. Photo by Charles P. Mills Studios, Phila., Pa.

The importance of precision in quality control and accurate playback for analysis of sound, are the reasons MCA states... "Stanton is totally reliable, we depend on it" .

Inspecting a metal mother in the Plating Department.



MCA (Music Corporation of America) is one of the truly big ones in record production. Quality control in every aspect of their manufacturing, plating and printing is of crucial importance. That is why they use Stanton's Calibrated 681 Series, both in their quality control operation and in their playback for analysis of audio quality.

They even go so far as to "use the needle to test the Mother (Nickel) . . . and it stands the wear"

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Whether your usage involves recording, broadcast, or home entertainment, your choice should be the choice of the professionals . . . the **Stanton 681**.



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If your cartridge is more than three years old, don't replace your stylus!

Don't get us wrong. There is nothing worse than playing your records with a worn stylus. And no better way to restore your old unit to its original glory than a new diamond.

But frankly, there have been significant strides made recently in the phono cartridge field. And the new cartridges of today stand head and shoulders above even the finest of a few short years ago.

Here's the choice: Get fresh—but outdated—performance with a replacement stylus, or enjoy all the benefits of modern cartridge research and development for just a few dollars more. You'll find that you can update your system for less than you might imagine. It's probably the most dramatic single improvement you can make.

For instance, Audio-Technica offers Universal™ cartridges equipped with a genuine Shibata stylus and our uniquely effective Dual Magnet™ system beginning at just \$75.00 list. Or you can replace your present cartridge with a fresh new Audio-Technica cartridge with high-y-polished elliptical tip for as little as \$45.00 list.



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Are these new models worth the difference? Absolutely. You'll be amazed at what you hear from today's generation of phono cartridges. Improved frequency response. Lower distortion. Better separation. Less record wear. Truly better sound.

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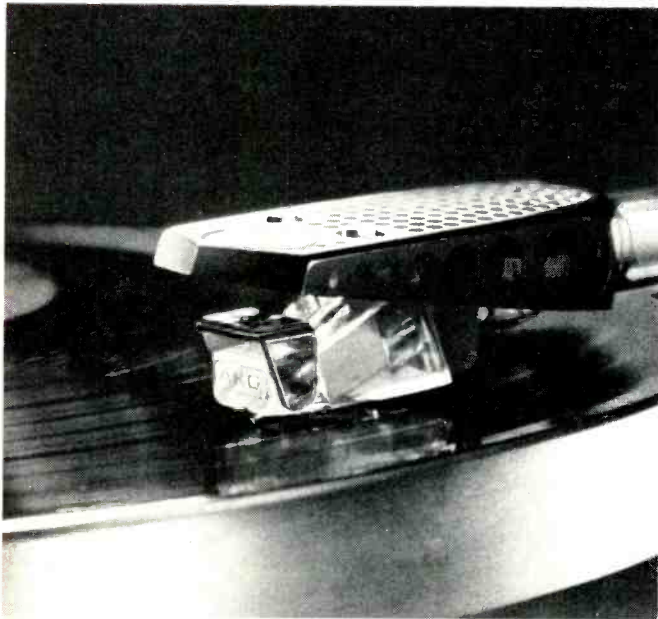
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Tape guide

Herman Burstein

Impedance Mismatch

Q. My two tape decks have input impedances of 100 kilohms and 50 kilohms. I wish to record radio broadcasts. May I record into the tape deck using the earphone jack of my transistor radio? I am concerned about an impedance mismatch.—David Martin, APO San Francisco.

A. While I don't know the exact impedance of the earphone on the radio you are using, I am quite sure that it is low compared to the input impedances of your tape decks. Therefore, you may safely make a connection from the earphone jack to the tape decks. I have done this a number of times with satisfactory results.

Re-recording Noise

Q. How many times can sound-on-sound recordings be made for one song before there is a great amount of distortion?—Preston Schaffer, Brooklyn, N.Y.

A. Distortion does not tend to rise appreciably with successive sound-on-sound recordings unless these recordings are made at excessively high levels. What does tend to go up is noise—about 3 dB with each recording. Also, there tends to be a progressive loss of treble response from the earlier recordings.

Tape Calibration

Q. My tape deck has a switch for changing between conventional and low-noise tape. As I understand it, the switch just changes equalization and doesn't affect the bias. I have been contemplating lowering the sensitivity of the VU meter so that a VU reading of 0 dB would really be +3 dB. I have been told that I don't really have to drive the tape with a higher input signal if I adjust the machine for the proper bias... but this is not my understanding. Please clear this matter up.—Thomas Arntson, APO New York

A. Tape switches generally adjust the bias in order to give the user a choice between conventional and low-noise tape. Sometimes the switch also adjusts treble boost in recording. For low-noise tape, more bias and less tre-

ble boost is required. Furthermore, for low-noise tape the sensitivity of the VU meter should be reduced about 2 to 3 dB so that it takes a stronger signal to drive the meter to 0 VU. The proper calibration of the meter is such that, using the tape you plan to record on, a 400-Hz signal causes the meter to read 0 VU when the signal level is such to produce about 1 per cent distortion on the tape.

Static Electricity

Q. A peculiar problem has occurred to myself and two friends in recording on high-output tape at a high volume... while rewinding the tape every few seconds a spark jumps from the reel to the tape deck. I realize that somehow there is a static buildup on the reel that increases until it is large enough to arc over the machine's ground. What causes this buildup and do you think this will cause the metallic surface of the machine to become pit marked? What can be done to remedy this situation?—Michael Smith, Middle Village, N.Y.

A. I cannot give you a specific explanation for the phenomenon you describe except to associate it with the tape material and conditions of low humidity in the tape environment. I doubt that this arcing will cause pit marks, but it depends on the nature of your machine's metallic surface. To alleviate this problem you might try a ground between the chassis of your tape deck and earth, or you might try to conduct the electric charge on the tape to chassis by mounting a strip of aluminum or some other metallic foil so that it contacts both the chassis and the tape. Also, try increasing the tape's humidity by storing it for a few days in a box with moist blotting paper.

VU Level Settings

Q. What is the proper VU meter setting when recording on a low-noise, high-output tape and on a standard tape? If 0 VU is the correct overload level for standard tape, would +3 to +6 dB be the proper overload level for the low-noise, high-output tape?—Larry Scherer, St. Joe, Mich.

A. If the record level indicator is properly calibrated for standard tape, the maximum indication when recording should be about 0 VU for standard tapes and about 2 to 3 dB higher for the low-noise tapes.

Peak Recording Levels

Q. Can you please give me an idea as to the relationships between the European CCIR and the American NAB peak recording levels and the readings given by the VU meter?—R. Newbury, Ottawa, Ont., Canada

A. In the U.S., the standard NAB recording level is approximately that at which a 400 to 700 Hz signal results in 1 per cent harmonic distortion on tape. However, the maximum permissible distortion is widely considered to be about 3 per cent and one would think that the VU meters would be set to read 0 VU at a signal level producing 3 per cent distortion, since this level is about 6 to 8 dB above the signal producing 1 per cent distortion. But the VU meter is an average-reading device rather than a peak-reading one, and on brief, strong signals it may read substantially below the true signal level. Therefore, a margin of safety of about 6 to 8 dB is provided in calibrating the VU meter, though it is generally set to read 0 VU for a signal producing about 1 per cent distortion.

European practice is to use meters that, as I understand, are closer to peak-reading devices than average-reading ones. Thus, they could be set to read 0 VU for a signal that produces about 3 per cent distortion on the tape—in other words, for a signal about 6 to 8 dB higher. Apparently, the European standard level (CCIR) hasn't gone all the way in this respect. They have, as I gather, elected a standard recording level about 4 dB higher than the U.S. one, hence the two standard levels reconcile within 2 dB—not a profound difference.

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



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Audio etc.

Edward Tatnall Canby

Visions! Practicalities. If in these last months I have written about light-guide communications, the laser disc, digital audio, even out-front binaural, then these are areas we must keep tabs on if we are to have a useful perspective on the present and a feel for the future. These things offer the possibility, even the certainty, of tremendous improvements to come. But the present is with us, and it is jammed full of equal marvels—marvelous because they are practical and actually exist, which is a triumph in itself. Birds in the hand! A state-of-the-art production amplifier, if you are feeling nowminded, is worth any dozen future visions.

And then there are the littler improvements along the way. Modest, unspectacular but often vital for those who listen to a lot of hifi.

Visions. If I suggested rhetorically that light-guide communication might signal the end of electronics, I meant, rather, the end of exclusively electronic circuitry. The electron is now joined by the photon of light as a basic communicative entity. The two techniques, however, are so closely related that obviously they will work together, or separately, each to its own best uses, as in the present pioneer phone installation. And if I enthused over light-wave bandwidth, so incredibly vast, then I could have added that sequential digital techniques—passing those flying bits around in regular sequences into n different outlets—will be the normal light-wave usage, as it definitely is not in much present standard electronic communication, notably via records and radio. There, we have long since split our skimpy bandwidths into simultaneous segments, each under-nourished and with the barest of margins around

the edges—we couldn't help it. Bandwidth poverty. And yet look what we have done, even so! That's the triumph of it. Don't throw out your FM tuners and your non-light, non-digital hi fi quite yet. And hang onto your LPs. Or else you might have some long years of total silence, before those fancy visions become practical.

As for binaural-out-front, it is not as visionary as you might think, though in truth this is one of those intellectual

Audio Surprises

... And then there are the little improvements, I love to savor them. My cyclical home sampling of updated equipment often brings me pleasant surprises. With an endless oversupply of records to be played and a weekly taped hour of radio program to fill up, I can be very practical in respect to the equipment I use. The slightest failure or clumsiness and, especially, any tendency towards malfunction or maladjustment can drive me nuts. As the woodchuck said, while eating up my chrysanthemums, *I have work to do. Let me get on with it.*

Like today, when in the last two minutes of an hour-long radio tape, the reel support platform on the left side of my recorder slipped down a peg on its motor shaft and the reel suddenly set up a hideous scraping sound against the tension arm. I swore so loudly (into the mike) that I couldn't erase the sound and had to cut out a piece of tape. *It shouldn't happen!* An unwisely

designed set screw, inaccessible without removing the entire upper chassis from its box. Please—not in the middle of a session! I tried everything, just to get those two minutes done and out of the way—lifting the reel with my fingers (it slowed down and my voice went falsetto in the playback), jimmying the reel holders, bending the aluminum flanges out of the way—no go. I ended up with a square of corrugated cardboard cut to fit under the reel as a temporary crutch, but you should have seen the skew of the tape when I finished. Lopsided. But no scraping.

I do not use a home-type turntable for radio, no matter how fancy. You can't. For this job you need torque, to keep the table turning at speed while



challenges that just has to be faced up to, because it is there. Practically speaking, there is a more mundane aspect, maybe even for profit. Mind you, our visual communications always come to us from out front, whether for entertainment on stage, screen, TV, just plain walking around, or reading the newspaper. So if reproduced binaural sound, two-eared, two-miked, can somehow be persuaded to conform to the out-front law of the two eyes, then we might have something. My experiments may have been "pretty primitive" (reader comment) but I *did* it. Why do you think there is so much expensive work going on at such outfits as Sennheiser in Germany and JVC in Japan? Shall we say, for potential practicalities? I think so.

Nikko Audio Puts It All Together for Your Professional Component System

Nikko builds more than outstanding professional components and separates. And for good reason.

Firstly, we don't think stereo gear of any sort should be spread willy-nilly over the studio.

Secondly, we've created these designer-crafted hand-rubbed walnut veneer equipment racks. And in keeping with our professional attitude, two of the hardwood cabinets are 19-inch standard width.

Thirdly, we've made it possible for you to assemble three fantastic custom packages to fit the cabinet of your choice.

End of commercial on cabinets.

We now invite you to read about a few of Nikko Audio's newest electronic products.

As with every Nikko Audio product features abound in the NT-850 (far top), an AM/FM stereo tuner.

A switchable (normal/narrow) IF band and advanced circuitry are employed to insure low distortion, signal stability, maximum stereo separation and outstanding reception.

Below the tuner is the NA-850 integrated stereo amplifier. It delivers 60 watts, continuous power output, minimum RMS per channel, driven into 8 ohms from 20 to 20kHz, with no more than 0.05% THD.

Take a hard look at the cabinet below with the Gamma I stereo FM broadcast monitoring tuner. A simply remarkable product.

It has a switchable wide and narrow IF stage for low distortion, high sensitivity ($1.8\mu\text{V}$) and the ability to pull in distant stations with clarity.

Nikko Audio's ultra-slim stereo preamp, the Beta II, has both an input equalizer and amp circuit powered by independently regulated voltage supply to help eliminate interference distortion. There is no end to its professional features.

Each dual power supply on the Alpha II power



amplifier has dual filters to eliminate channel crosstalk and improve stereo separation. Exterior heat sinks keep the amp running cool, necessary when it delivers 110 watts per channel, continuous power output, minimum RMS into 8 ohms, from 20Hz to 20kHz, with no more than 0.03% THD.

The heavyweight of the new Nikko Audio professional gear is the Alpha I basic stereo power amplifier, shown in the bottom cabinet.

However, there is nothing really basic internally about the Alpha I. It uses a 3-stage Darlington direct-coupled OCL, pure-complementary quadruple push-pull circuit, rarely found on anything less than exotic amp circuits.

The Alpha I delivers 220 watts per channel, continuous power output minimum RMS per channel into 8 ohms from 20Hz to 20kHz, both channels driven. THD is 0.08%.

The revolutionary Beta I pre-amp's circuitry consists entirely of high-voltage FET's. It's a mate to the Alpha I and is DC and non-coupling for better frequency response.

The Gamma I stereo FM tuner also appears in the lower cabinet below the Beta I stereo preamplifier.

Now, that's enough product and specs to satisfy the most discerning audiophile and professional.

Ask your Nikko Audio dealer for a definitive tour of the new Nikko product line.

Nikko Audio

For those who take their stereo seriously

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you hold a record on cue with one finger. Years ago I bought a sturdy, old heavyweight from England, the famed Connoisseur table and one of the best of its day; it still works perfectly. Old-fashioned, big rubber rollers driving the rim, a mechanical gearshift and, believe it or no, a mechanical friction system for setting exact speed—which never falters, even after many years of service. And the rumble is reasonably low. Not all genius engineers live in the present.

But out in my living room, condi-

tions are different, if just as demanding in a businesslike sense. Critical listening, no background music, unattended, plenty of sustained driving, so to speak, with frequent lane changes—from band to band, side to side, album to album, back to the beginning, back to the middle, and so on. Handling, then, is all important for the living room player, and any little design clumsiness or proness to malfunction can be really exasperating. Like the manual table I had for awhile some years back. It had a new convenience,

automatic shut-off. Fine—but it would not allow me to play any inner LP band. It just grabbed the arm from my hand, each time I tried, and obstinately returned the arm to rest. No recourse but to play the entire side from the beginning. Clumsy design.

Things like slow action, variably wrong drop points (even after adjustment), miscalculated anti-skate (it still skates), too-light point pressure (correct, but the stylus tends to hop over small obstructions and land in a different groove), resonances of all sorts between table, base, arm, cartridge, loose floorboards—all these can cause chaos in any active living room. I bless the table that leaves me in musical peace. Even if I have to start and stop the thing by hand.

Floorboard Flutter

Thus, I used the original AR manual table for years for this very reason. Also, of course, because of its excellent performance characteristics—just so long as I remembered not to step on the famous “Canby Loose Floorboard.” (It was once apocryphally rumored that an early AR redesigning resulted from that very floorboard. I never believed it.) When eventually the little AR motor spindle was accidentally knocked into a flutter that made pianos sound like guitars, I took the chance to move on to a succession of much newer tables, out of sheer curiosity as much as anything else. To see what had happened in the meantime.

My very first was a total automatic, a big change and a real laugh. Say no more—it is an excellent table, if awfully complicated. It acted up immediately—turned out to have a bent part inside, nothing serious at all. But what zany results! I’d show it off (on an old record) just for kicks. Until two genius friends came along and fixed it for me. So help me, here’s what that bent mechanism did. Trip the lever and the arm rose up majestically, swung over, dropped the stylus at the extreme outer edge of the record—then dragged it across the grooves to the middle, whereupon it lifted up again, high in the air, and dropped it a second time. Insane.

Once fixed (the bent part unbent), it worked like a charm in all its complexity for a long time. Until one day the machine decided to convert to 45. The 33 speed just wasn’t there any more. Now in any of the old two-speeds or three-speeds or four-speeds, this would have been a simple mechanical problem, maybe a stuck puck or the shift mechanism a bit off. No longer! I called in my geniuses but this time they

12

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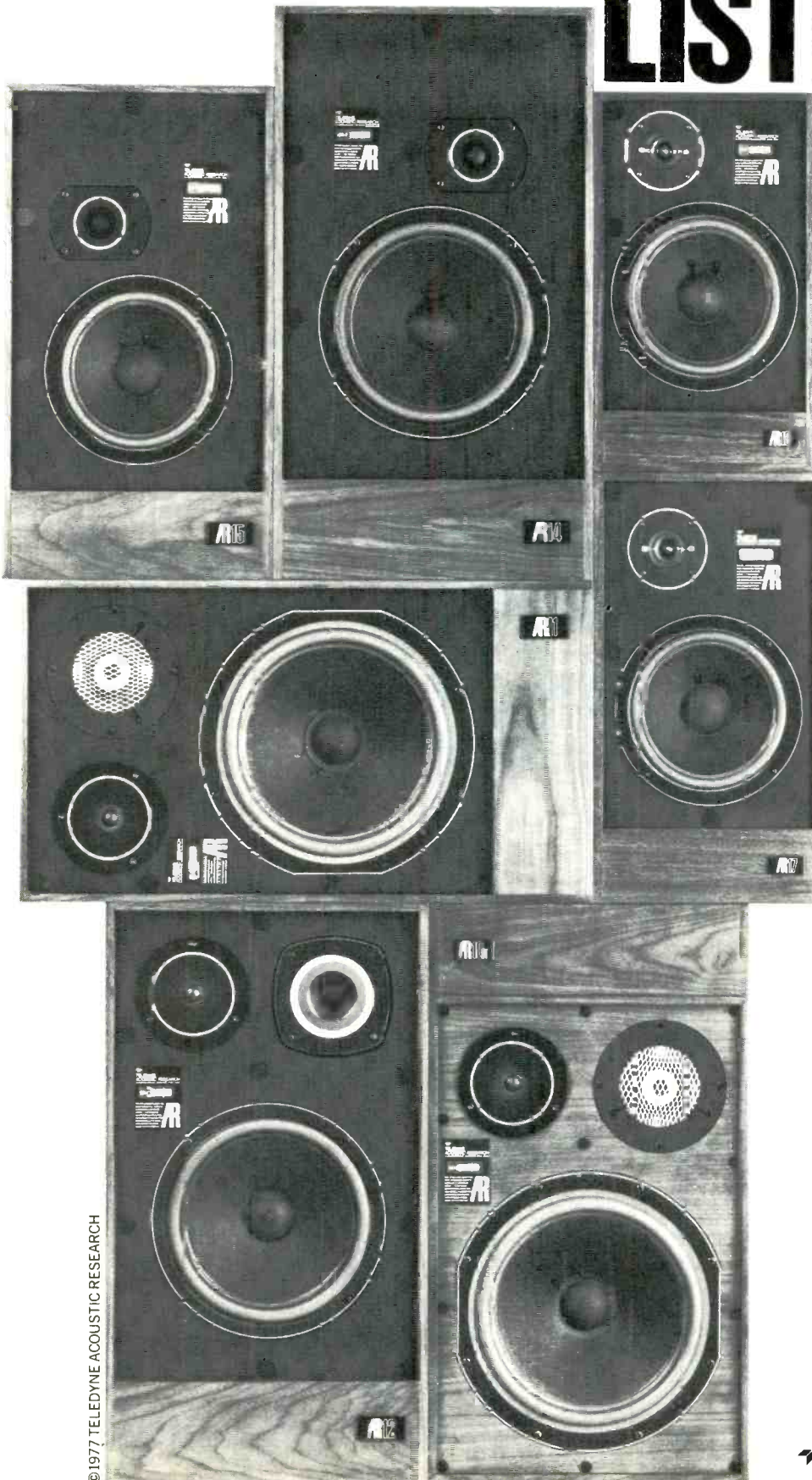
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were baffled. Nothing could persuade that machine to play at 33. Since I was not about to convert myself to 45, we shipped it back to its parents.

Automatic Accolades

I have never had use for a changer, not being temperamentally suited to that kind of programming, but I do enjoy an automatic shut-off, if it works. One of our minor miracles today is that they do work. Always a clean stop after the end of the music (some old ones tripped too soon), and yet it is astonishingly hard to provoke them into grabbing the arm out of your manual-play hand, even right to the last groove. For *that*, I have more thanks than for a dozen hi fi amplifiers. As for automatic turn-on, that is less vital. After all, I am right there at the table, and it takes but a moment to start the record manually. Faster, too.



I suppose most people don't mind, but I am all impatience, just watching that slow, stately progression of arm from rest position, out and over, then down ever so slowly. Like waiting for an obstinate red light. Silly. But when the stylus hits the wrong spot, I switch to manual in a hurry. After all, the automatic makers face big problems in record variability and so on. And I can think faster than their machines. A major problem in this respect is the rounded slant now built into the record edge where the lead-in grooves begin. Good idea; it preserves the main record surface when discs are stacked. But too many styli, landing on that raised portion, just skitter sideways downhill and into the music with accompanying plops and squawks. Or, if muted, with missing music. The solution? Use manual start. Easy.

Two more improvements before space runs out. I am delighted by the new and easy speed adjustments, complete with strobe, which are found on

almost all recent tables. Big advance! Older audio people will recall that home players used to have fixed (non-adjustable) speeds—and very many of them *ran fast*, irrevocably. Whether the idea was to compensate for wear, I do not know (most wear in mechanical drive does not affect pitch); more likely, they had to count on a slowing down under a full stack of records. Anyhow, this drove my musical ear crazy and you could often find me desperately grinding a heavy file against a motor spindle, trying to reduce at least one speed to proper pitch. It helped, but I was outraged just the same.

Synchromesh Speeds

No more. The present modest speed adjustments are exactly right for tuning, to pianos, other records and whatnot. You don't need much. And it is reassuring to know you are right on the beam, via the strobe, when you want to be right. Really a profound improvement for music.

Finally, I think that the synthesis of the old manual player and the changer into the modern automatic is a superb improvement in music-minded handling, with the values of both types and very few of the old faults. In particular, I find it wonderful that on my present automatic, the Technics SL-1350 direct drive, I have an unobtruded choice to start either all automatically or totally manually—and no grabbing of the arm out of my hand. Pick up the arm off its rest, the motor starts. Put the stylus down and the music plays. Beautiful. Or, *without any changes of control setting*, flip the lever and the entire operation is done automatically. This, after generations of players that would NOT do it, year after year, model after model! I call that real progress.

O yeah, briefly one more. That loose floorboard. At last, it has been tamed, by those new stubby spring legs that sit under the four corners of your table, looking like fat stilts. Or McPherson struts. They work! Unbelievable. My Technics has four of them under it and never skips a groove. After all, what good is all your fi if your table jumps. It does happen, and especially in wood frame houses and most especially in old ones. They have their vibes, they shake at very low frequencies when you walk around, and they can joggle your table in ways that no human stylus can withstand, no matter how nicely tuned and resonated. If your table is springless, Audio-Technica sells them, to fit any old table. Get some springs and be happy. *A*



Yes, the new Dual 604 is direct drive. Now let's talk about something really important.

You may have noticed that most turntable stories begin and end with the drive system. The tonearm is more or less an afterthought.

But not with Dual. Because the tonearm can make a big difference in how records sound and how long they last. Which is why Dual is very serious about tonearm design and performance. And why we can be very serious about tonearms in our advertising.

Let's consider the 604 tonearm.

The straight-line tubular design provides maximum rigidity with minimum mass. The four-point gimbal centers and pivots the tonearm precisely where the vertical and horizontal axes intersect. And the counter-balance houses two specially-tuned anti-resonance filters that absorb parasitic resonances originating in the tonearm/cartridge system and chassis.

Operation is semi-automatic, with another unique

Dual difference: the mechanical sensor. Switch it in and you feel when the stylus is positioned precisely over the 12" and 7" lead-in grooves. At the end of play, the tonearm lifts and returns to its post, and the motor shuts off. Automatically.

Now let's talk about the direct-drive system. It employs a newly developed DC electronic motor, with speed regulated by a CMOS integrated circuit and digital reference circuit. Speed accuracy is within 0.001 percent. Wow and flutter are less than 0.03 percent, rumble better than 70 dB. As with any great drive system, that's far beyond audibility.

But the important story with any turntable is simply this. The drive system merely turns the record. It's the tonearm that plays it.

Dual 604, semi-automatic, less than \$260. Dual 621, fully automatic plus continuous repeat, less than \$300. Both with base and cover. Actual resale prices are determined individually and at the sole discretion of authorized Dual dealers.



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Behind the scenes

In last month's column I related how digital recording technology was the dominant feature of the 58th AES convention. The shock waves of this development have been reverberating through every sector of the audio industry. For the next few months, you won't be able to pick up an audio or hi-fi publication that doesn't feature an article on digital recording. In audio engineering labs everywhere, a massive rethinking of audio design and reshuffling of production priorities is taking place. Even this early in the game, engineers are beginning to realize that digital recording is going to require that virtually every link in the recording chain be "digitized" if the full potential of digital recording is to be achieved.

Sound waves will still impinge on microphone diaphragms, but the mike pre-amp will be digital, as will all the myriad circuits and functions in the recording console. Digitized signal processing devices will give recording engineers undreamed of flexibility. John Woram, writing in his "Soundwaves" column in the Dec. 17th issue of "Billboard," in a follow-up story on digital developments at the AES convention, points out the limitations of present analog equalizers, especially in the areas of high-level equalized signals causing tape saturation and phase shift. He notes that with a digital equalizer, even the most drastic use of it will simply change the bit structure ... "the number stream" ... and level and phase will not be affected. John also points out that equipment to manipulate various psychoacoustic phenomena of sound localization, including devices like the "bi-phonic" and "Q-biphonic" processors which depend on relative phase manipulation, will be infinitely more effective in digitized versions. It is clear the digital revolution has begun, and there are some exciting years ahead as the audio industry makes its gradual transition to digital technology. In the meanwhile, returning to the practical realities of the present audio scene, here are some interesting items that caught my eye at the 58th AES convention.

More and more companies seem to be getting into the production of specialized measurement equipment.

Ivie Electronics of Orem, Utah, created quite a stir last year with the introduction of their tiny hand-held audio spectrum analyzer and sound level meter, IE-10A, and companion IE-20A pink noise generator. The IE-10A shows SPL and full-octave frequency response with an LED grid with 1-, 2-, or 3- dB display ranges. Up to 140-dB SPL can be measured, there is an output for connection to a scope or a chart tracer, and the unit is powered by rechargeable ni-cad batteries. Ivie was kind enough to send me one of these units, and I have found it invaluable for many acoustic measurements. Not the least of which was the checking of peak SPL in Avery Fisher Hall (*Mahler 5th*, triple fortissimo, first balcony seat approximately 55 feet from stage was 102 dB) and Carnegie Hall (*Shostakovich 7th—"Leningrad Symphony,"* triple fortissimo, orchestra seat approximately 65 feet from stage was 105 dB). Now Ivie has outdone themselves with the introduction of their IE-30A Audio Analysis System. It is somewhat larger than the previous unit, but at 8 X 3- $\frac{3}{8}$ X 2- $\frac{1}{8}$ inches it still is eminently hand-holdable. The IE-30A now offers real-time, $\frac{1}{3}$ -octave analysis from 25 Hz to 20 kHz in 30 ISO bands. Display is via the same LED grid as on the IE-10A, and the $\frac{1}{3}$ -octave display can be weighted with "A," "C," or flat filters. The sound level meter portion of the unit now provides *Fast, Slow, Impulse*, and true rms Peak readings. Really outstanding on a unit of this size is that it has dual involatile memories that will store or accumulate data (which incidentally will "remember" data for weeks, even with the IE-30A switched off!) and an "alternate" selector button for comparing memory data with the real-time display. The IE-30A even has a gated-mode operational feature which can sample and store any signal pattern using remote digital commands. Start and stop times of the sample can be controlled to help in the analysis of reflections and room resonances in time-delay spectrometry. There are many other features, such as the use of the IE-30A for equalization and alignment of tape machines (the IE-10A will do this too, but the $\frac{1}{3}$ -octave display of the IE-30A gives better resolution of

the interaction of equalizer circuits) which we will delve into in a full review of this fascinating instrument.

Studio recording engineers, who must get cockeyed looking at up to 24 VU meters in their multi-channel mixes, will get aid and comfort from the new "Vidigraf" bar-graph display generator, Model 970 from United Recording Electronics Industries. This generator operates into any N.T.S.C. standard video monitor, or with an inexpensive accessory, into any black and white TV set. The generator can produce 16 or 32 simultaneous VU channels, with standard VU ballistics and adjustable 0 VU reference and a 30-dB dynamic display range. In addition, the Model 970 can give real-time frequency spectrum display on ISO $\frac{1}{3}$ rd-octave frequencies. It is possible to simultaneously display 16 VU channels plus 15 bands of frequency spectrum and one composite level of the full spectrum as an aid in adjusting equalization and frequency balance. One can also display 16 VU channels plus 16 channels of automation control voltages. The unit has built-in programmable character generators, which eliminates the need for screen overlays and masks. Input capability is from d.c. to 20 kHz, from balanced or unbalanced sources. The whole idea of this device is, of course, to help the recording engineer concentrate his attention to multiple VU levels in a relatively compact screen area, rather than have his eyes jumping all over the usual wide horizontal array of VU meters on a typical console. With another new product shown at the AES, UREI joins Lexicon and Eventide in offering a digital delay line, Model 927. The device has a 4K by 14 bit static memory, no pre- or de-emphasis used, and the dynamic range is better than 90 dB. While the Model 927 is primarily for use in sound-reinforcement work, with delay adjustable in one millisecond increments from 0 to 127 milliseconds, UREI stresses the application of the unit for simulation of early reflections to feed into typical reverberation devices.

Barclay Recording and Electronics, of Narberth, Pa., one of the most elaborate hi-fi emporiums anywhere, run by that affable neurosurgeon Clay

So you're thinking about a subwoofer!

To obtain superior overall listening characteristics from a loudspeaker system, it is critical for the sound to progress smoothly from bass to midrange to treble. In order to achieve the smoothest possible transition, most designers have purposefully limited ultra-low bass response.

That's why supplementary subwoofers are becoming increasingly popular. And that's why you're thinking about a subwoofer.

The no-holds-barred way to extend the range of your system is to bi-amplify the low end with an electronic crossover and an additional amplifier.

The problem

The problem has been that this required routing the signal through circuits which produce electronic distortion, degrading listening quality.

This problem no longer exists.

The solution

The Dahlquist DQ-LP1 crossover is a simple but elegant solution. It combines an electronic circuit for the low bass output and a passive circuit for the frequencies above the crossover point.

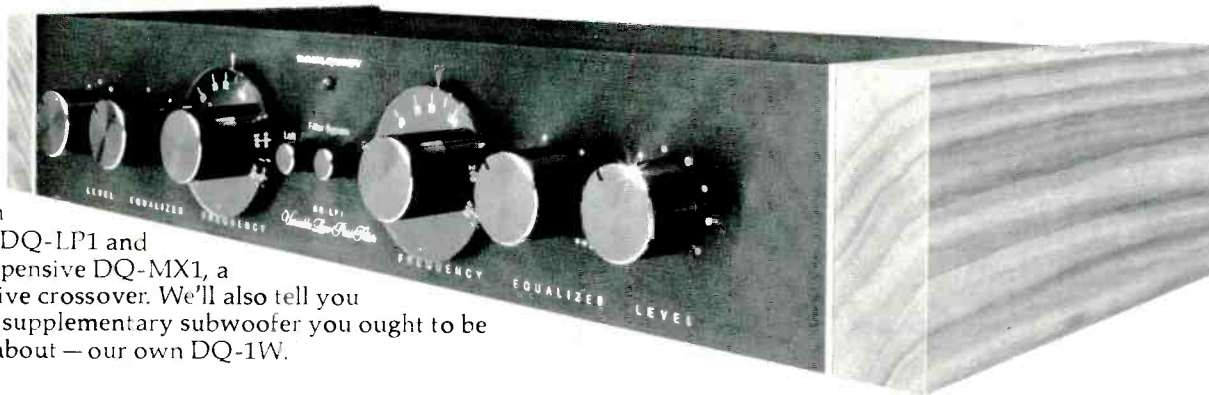
Thus, the upper range emerges pure and undistorted, with no alteration whatever of clarity and depth imaging.

How has the DQ-LP1 been received? Without exception, the reviews haven't simply been good — they've been enthusiastic.

The DQ-LP1 delivers utterly clean performance through variable frequency electronic low-bass sections with 18dB/octave slopes; 3 cascaded stages, with staggered time-constants for non-ringing, low phase-shift curves at any frequency setting; completely passive high-pass sections easily adjustable to give you any desired bass rolloff frequency, but with no effect on midrange and high frequency quality. The DQ-LP1 features independent adjustments in each channel to compensate for room placement; separate output circuits for stereo and mixed center-channel bass modules, level controls and instantaneous

AB comparison switches. Write to us. We'll send technical information

about the DQ-LP1 and the less expensive DQ-MX1, a fully passive crossover. We'll also tell you about the supplementary subwoofer you ought to be thinking about — our own DQ-1W.



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Barclay, is a surprise entry into the measurement instrument sweepstakes. They were showing their Badap One Audio Micro Computer for simultaneous peak and average real-time analysis on a 21-inch N.T.S.C. color monitor. The device has an 8000-bit, random access memory for multiple data storage and synthesizes its own graticules and display labels. Mono display is standard, with stereo display optional. Among applications listed for this prototype unit are 1/3-octave real-time analysis, peak versus average mixdown control display, tape recorder alignment, and cartridge and tonearm alignment.

I can't leave this section on measurements without mentioning a publication that recently was sent to me. Entitled "Spectrum Analysis—Theory, Implementation, and Applications," issued by Rockland System Corp., 230 W. Nyack Road, West Nyack, N.Y. 10994, this is an invaluable guide for those who are not conversant with the mysteries of Fourier transforms and spectrum analysis. Written in a very lucid style with a minimum of mathematical hieroglyphics, this is the best explanation of this complex subject I've ever read.

There usually are new microphones shown by various manufacturers at

an AES convention, and the 58th was no exception. However, things were a bit different too, as we may be seeing the beginnings of a trend back to microphones suitable for the recording of classical music in the M-S (cardioid and figure eight) and Blumlein (coincident pair of figure of eight) techniques. There has been a mini-revival of the Blumlein techniques in England, and, in fact, in my recent recording of Arthur Fiedler and the Boston Pops, I did a Blumlein experiment.

AKG has plunged rather boldly into this area. They were showing their C-424 FET quadrasonic microphone, which is really two of their well-known CK-12 units, each providing two cardioid characteristic outputs. One CK-12 is fixed to the main housing, the other swivels through 0-180 degrees. The AKG C-422 FET stereophonic mike has also two CK-12 capsules, one adjustable to 0 or 45 degrees in reference to the main housing, the other rotatable through 0-180 degrees. Each capsule is remotely adjustable to nine patterns from omni through cardioid and hypercardioid to figure eight, which, of course, allows plenty of latitude for M-S or X-Y recording techniques. A unique feature of this mike is the provision of two LEDs, each lined up with the inphase axis on each corresponding capsule, to aid in lining up the capsules in distant miking situations. Another AKG stereophonic mike is the C-34 condenser, which is based on the C-450 modular mike system. As with the other AKG stereo condenser mikes previously described, there are twin capsules one fixed and one rotatable 0-180 degrees. Here too each capsule is remotely controlled for nine different patterns. Rounding out the AKG line-up of stereo condenser mikes is the C-33, a fixed cardioid pattern in each capsule and really a less expensive version of the C-34. When these new stereo mikes are available, I will do some M-S or Blumlein recordings with them and report on the results.

Needless to say, as always there are many new items at an AES convention, but the digital revolution overshadowed everything, and the items above sparked my interest.

It is unfortunate that we will have to end this report on a tragic note. Dr. Peter Goldmark, inventor and "father" of the long-playing, 33 1/3-rpm record and the guest speaker at the 58th AES Awards banquet, was killed shortly thereafter in an automobile accident on an icy road. Much of what we have today in the recording business and in audio is the result of his pioneering efforts, and we can ill afford to lose men of his stature.



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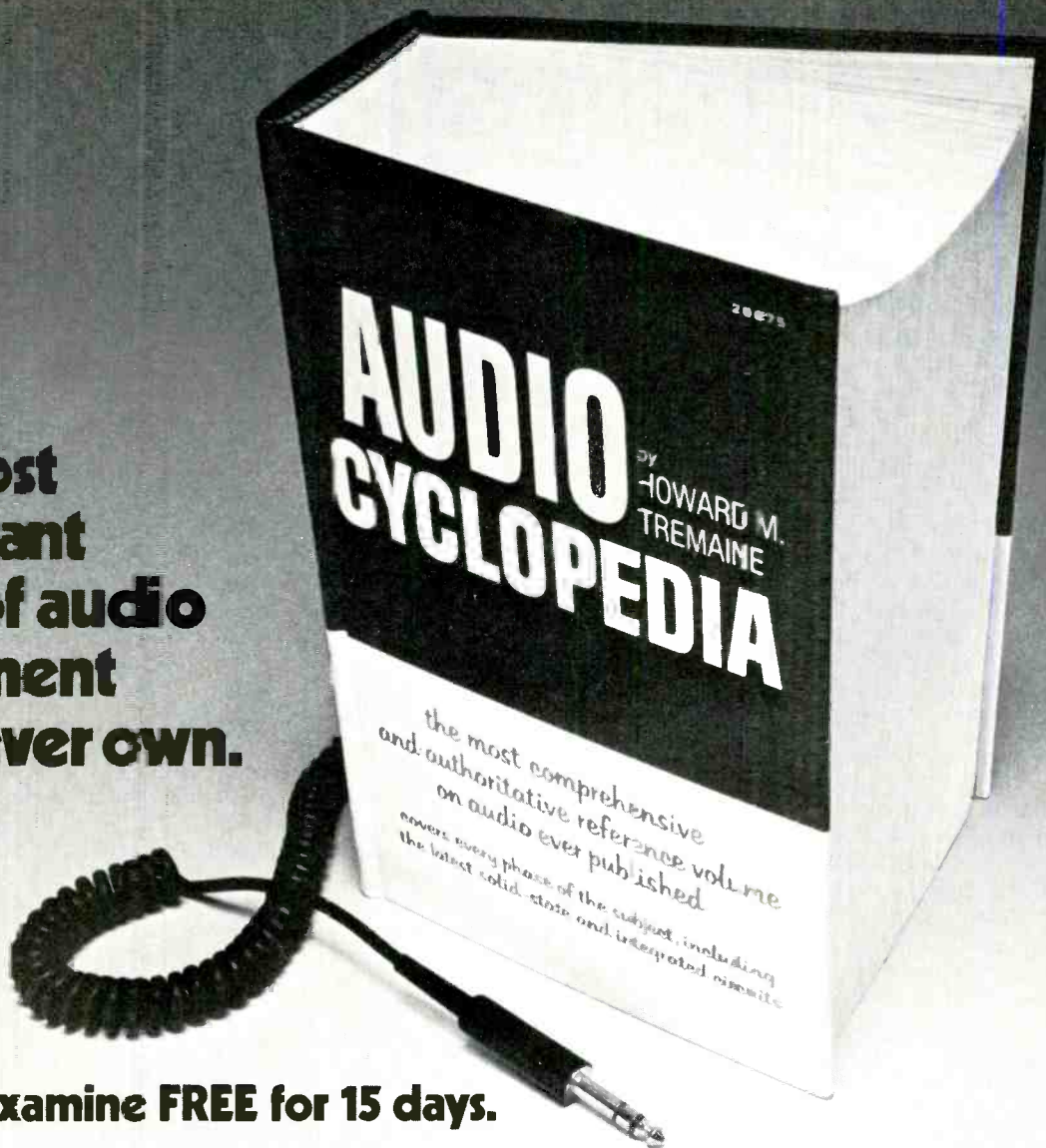
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Ohms per Volt

Q. I need a way to find out the ohms per volt rating of my voltmeter. The manufacturer is now out of business, so I cannot check there.—Michael D. Snyder, Pittsburgh, Pa.

A. A simple way to determine the "ohms per volt" of your voltmeter is to set this meter to its lowest d.c. range and with another meter measure its resistance. Should it happen that this lowest range is one volt, you will have your answer directly. However, if the full scale indication is something other than one volt, such as 1.5 volts, then divide the resistance by the 1.5 volts. This will be the answer in "ohms per volts."

Large Midrange Speakers

Q. Do you approve of a wide-range, 15-in. speaker for use as a midrange (700 to 5,000 Hz) speaker?—Robert Watson, Dover, Del.

A. In general, I would say that a 15-in. speaker used as a midrange unit would not be acceptable. While it is true that some 15-in. speakers will produce an output up to 5 kHz, this range beyond a few hundred Hertz tends to be colored. Smaller cones vibrate more easily at higher frequencies, so will work better; also smaller speakers produce less "beaming" of the higher frequencies than a larger one.

Record Changer Repairs

Q. I have a problem with an old record changer. . . . the platter spins normally until the record is over, but the unit does not complete the change. The platter slows down and stops, then, given a little push, it begins to turn again and complete the cycle. In an effort to solve the problem, I took off the platter and cleaned it . . . I also cleaned the idler and drive wheel. When I put it all back together again and turned it on, there was no difference, it acted the same way. What can I do?—Doug Stadler, Allison Park, Pa.

A. What kind of solvent did you use to clean the parts? Alcohol is probably the best solvent for this purpose as it won't damage the rubber parts as some other solvents will. Clean the motor shaft "steps" as well as the inside rim of the turntable and the

rubber drive idler. If this cleaning doesn't improve the operation of the changer, very lightly sandpaper the idler to roughen it up a bit. It is possible that it has become glazed so there is insufficient friction to maintain good drive during the loading that occurs during the change cycle. There is also a compound called "No Slip" which may be used on rubber wheels to increase friction.

There should be a spring associated with the idler which pulls the idler into the space between the turntable rim and the motor shaft. If this spring is loose or missing, pressure may not be sufficient to bring about adequate drive at the time of increased loading during the change cycle.

Finally, remove all the old grease and oil from the changer portion of the mechanism. Here a more powerful degreasing solvent, rather than alcohol, should be used. Clean the turntable bearing in the same way. Then, relubricate the entire mechanism, making sure not to get any lubricant on either the inner rim of the platter or the rubber drive pucks.

Component Ventilation

Q. Because the room in which my component cabinets are located has relatively poor air circulation, I am concerned with heat buildup, so I have hooked up a.c. cooling fans with adjustable bimetallic switches. These are connected in parallel with an a.c. relay, which in turn operates the fans. The circuit works fine, however, when the relay closes unacceptable interference in the form of "pops" is produced. To remedy this I have tried to locate a switch that operates on a.c. which will close at a preset temperature in order to eliminate the relay, but with no luck. Is there a circuit that could be designed to eliminate the noise? Can you recommend something neither too complex nor expensive?—Gary L. Mull, Morton, O.

A. Generally speaking, most rooms don't have much moving air in them and most equipment is designed with that in mind. Given good ventilation at the rear of the cabinet (and sometimes at the bottom), convection will usually take care of air flow problems. Furthermore, where heat can be a real problem, there are slow-speed fans

which can be left constantly on during the time when the equipment is operational so there is never any heat build up. These fans operate quietly and will not disturb the listener, and with such fans there is no need for complex switching arrangements.

Any fan can be made to turn more slowly if a light bulb is placed in series with it. The wattage, of the bulb will determine the speed of the fan, the lower the wattage, the slower the fan will turn. Because it only requires a small amount of air to remove the heat from most equipment, a fan slowed down in this manner should prove satisfactory.

Circuitry of the kind you are now using can be made to perform with a minimum of interference to your audio system if a network consisting of a 100-ohm resistor and a 0.2- μ F capacitor in series can be placed across the contacts of the bimetal element and across the contacts of the relay.

Record Care

Q. It is important to me that my large LP album collection is kept in the best possible condition. Someone suggested that the frequent removal from and insertion of the disc into the record sleeve is harmful to the disc's surface. Certainly it would be easier to discard the paper sleeve and simply slip the record into the album jacket only. Ease of handling, however, is not as important to me as proper record care and handling.—Kent Wingerson, Topeka, Kan.

A. Don't discard the paper sleeves which are included with the disc and album cover. True, there is friction when the discs are either inserted or withdrawn, but more friction would result from the same process with the album covers. Furthermore, the sleeves provide added dust protection when properly inserted at right angles to the opening of the jacket.

Never touch the surface of the record with your fingers as oil from your fingers will be deposited upon the record surface, which, in turn, will attract dust to the surface of the record.

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

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

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

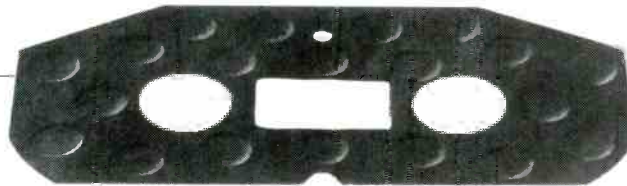
Precision Molded Cassette Shells—are made by continuously monitored injection molding that virtually assures a mirror-image parallel match. That's insurance against signal overlap or channel loss in record or playback from A to B sides. Further insurance: high impact styrene that resists temperature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



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

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

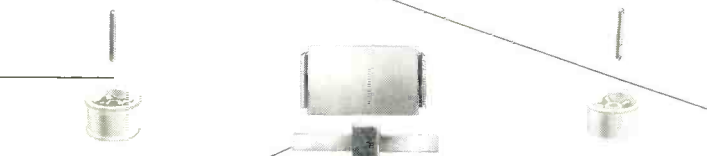
An Ingenious Bubble Surface Liner Sheet—commands the tape to follow a consistent running angle with gentle, fingertip-embossed cushions. Costly lubricants forestall drag, shedding, friction, edgewear, and annoying squeal. Checks channel loss and dropouts.



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

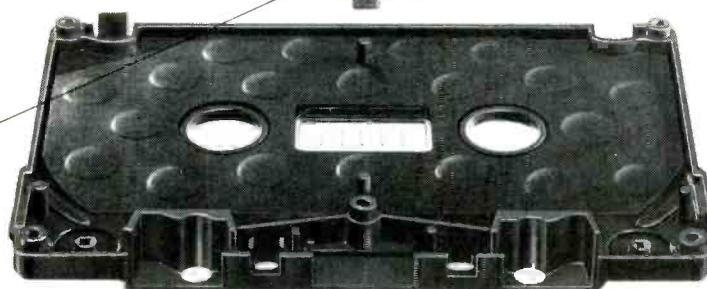


Tapered, Flanged Rollers—direct the tape from the hubs and program it against any up and down movement on its path towards the heads. Stainless steel pins minimize friction and avert wow and flutter; channel loss.



Our famous SA and AD Tape Performance—two of the finest tapes money can procure are securely housed inside our cassette shells. SA (Super Avilyn) is the tape most deck manufacturers use as their reference for the high (CrO₂) bias position. And the new normal bias AD, the tape with a hot high end, is perfect for any type of music, in any deck. And that extra lift is perfect for Dolby tracking.

Resilient Pressure Pad and Holding System—spring-mounted felt helps maintain tape contact at dead center on the head gap. Elegant interlocking pins moor the spring to the shell, and resist lateral slipping.



TDK Cassettes—despite all we put into them, we don't ask you to put out a lot for them. Visit your TDK dealer and discover how inexpensive it is to fight dropouts, level variation, channel loss, jamming, and other problems that interfere with musical enjoyment. Our full lifetime warranty* is your assurance that our machine is the

machine for your machine. TDK Electronics Corp., Garden City, N. Y. 11530. Canada: Superior Electronics Ind., Ltd.



The machine for your machine.

*In the unlikely event that any TDK cassette tape ever fails to perform due to a defect in materials or workmanship, simply return it to your local dealer or to TDK for a free replacement.

What's new

QSC Electronic Crossover

The Model Electronic Crossover 1.1 has a fully active high-pass filter, a constant-phase complimentary low-pass derivative, a 12 dB per octave slope, and high-low frequency matching without amplitude and phase errors. The power amplifier circuit delivers 70 W rms into 4 ohms with 0.25 per cent THD and IM distortion, and a frequency response of 20 Hz to 20 kHz, ± 1 dB. A set of crossover inputs, outputs, and line level inputs allows the power amp to be used independently, and a d.c. blocking capacitor is installed on one of the outputs to prevent horn damage to the speakers from accidental low frequency signals. Price: \$278.00.

Enter No. 105 on Reader Service Card

24

Audire Power Amplifier

The Model Two power amplifier uses an input stage consisting of a differential amplifier with an input impedance of 24 kilohms, and fully complimentary, direct-coupled outputs. An



active circuit protects against overloads and direct shorts. Power rating is 100 W rms per channel, 20 to 20,000 Hz, both channels driven, THD and IM are 0.05 per cent; hum and noise are -100 dB, and the damping factor is 150. Price: \$450.00.

Enter No. 106 on Reader Service Card

Packburn Transient Noise Suppressor

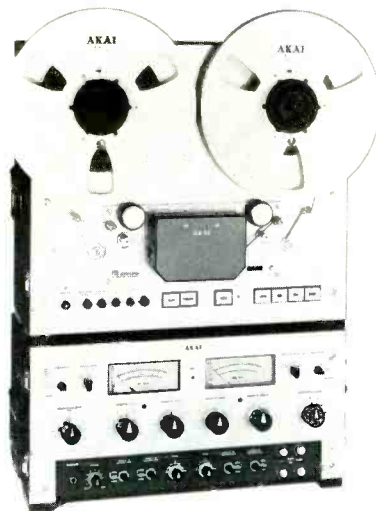
The Model 101 is designed to reduce or eliminate transient noises in the reproduction of all types of disc and cylinder recordings, including those caused by particles of filler material in the record mix, dirt, mildew, pits, bumps, scratches, gouges, and cracks.

The Switcher, the first of two processors, achieves noise reduction by using the principle that the two side walls of the groove of a monophonic, lateral-cut record have identical signal information but differ in surface noise. The Blanker unit, the second processor which institutes blanking of noise transients, is equipped with two Blankers that can be cascaded in series for monophonic recordings or be used separately for each channel of a stereophonic record. The unit may also be employed to reduce dropouts in the reproduction of old monophonic tapes. Price: \$1,500.00.

Enter No. 107 on Reader Service Card

Akai Reel-to-Reel Deck

The Model Pro-1000 is a four-head, three-motor, 10½ in., reel-to-reel tape deck with separate tape transport and amplifier sections. The transport section features a dual-capstan drive system and three motors. GX glass and crystal ferrite heads are a half-track recording and playback head, a full-

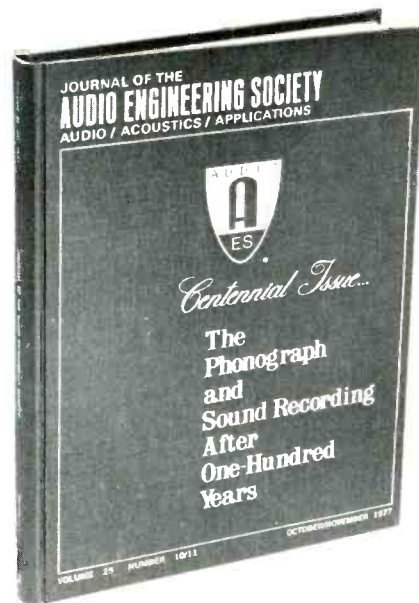


track erase head, and a quarter-track, two-channel playback head. Harmonic distortion is 0.1 per cent, tape speed deviation ± 0.5 per cent, wow and flutter (at 15 ips) 0.025 per cent W rms. Price: \$1895.00.

Enter No. 108 on Reader Service Card

AES Book

The 300-page, October/November Audio Engineering Society Centennial publication honors the first century of sound recording and reproduction. The



subjects covered range from a paper on Thomas A. Edison through to microphones, pickups, loudspeakers, home reproducing equipment, recording techniques, tape cartridges, cassettes and reels, record materials and manufacturing methods, etc. Price: \$20.00 hardbound, \$8.00 softbound.

Enter No. 109 on Reader Service Card

Uher Cassette Deck

The Model CG-362 cassette deck features two noise reduction systems, IC equipped Dolby B and DNL circuitry; an electronic logic-interlock system, an automatic tape flow control which switches the unit off upon tape jamming, automatic end-of-tape shutoff during record and fast wind, a three-motor transport system, a switchable MPX filter, mike/line mixing, two sets of inputs and outputs, a three-position bias/equalization selector allowing for use of any type of tape, and a 16 dB gain adjustment which adapts inputs for low level and microphone inputs. S/N ratio is 68 dB

You may have seen this machine in a dream. It comes true for substantially under \$2000.



It takes much more than
an impressive array of features
and numbers to realize a
product of dreams.

Unique to Nakamichi is
technology of the kind that
produced the most advanced and
accurate cassette deck
known to man—the 1000 II.

But it also takes the courage
and vision to risk doing
the dangerously unconventional.

Write for more information:
220 Westbury Avenue
Carle Place, New York 11514

 **Nakamichi**

Products of unusual creativity and competence...

Enter No. 26 on Reader Service Card

BEST-SELLERS IN RECORDED HISTORY.

AKAI's exclusive glass and crystal ferrite (GX) head is just one reason AKAI's an industry leader. It's totally unsurpassed for optimum sound and wearability... guaranteed for 150,000 hours, the equivalent of playing 24 hours a day for 17½ years.

See the 11 AKAI reel-to-reel decks today. And make recorded history of your own.

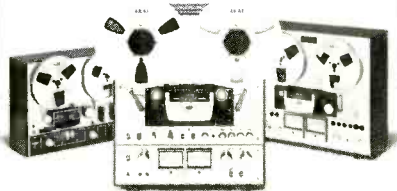
GX-650D Reel Capacity: up to 10½" reel; Tape Speed: 15, 7½ and 3¾ ips; Wow/Flutter: less than 0.04% RMS at 15 ips; Frequency Response: 30 Hz to 30,000 Hz (± 3 dB) at 15 ips; Distortion: less than 0.4% at 15 and 7½ ips (1,000 Hz "O" VU); Signal-to-Noise Ratio: better than 58 dB (measured via tape with peak recording level of +6 VU); Heads: (3) one GX Playback, one GX Record and one Erase Head; Motors: (3) one AC Servo Motor for capstan drive, two Eddy Current Motors for reel drive.

GX-270D Reel Capacity: up to 7" reel; Tape Speed: 7½ and 3¾ ips; Wow/Flutter: less than 0.06% RMS at 7½ ips; Frequency Response: 30 Hz to 23,000 Hz (± 3 dB) at 7½ ips; Distortion: less than 1% (1,000 Hz "O" VU); Signal-to-Noise Ratio: better than 60 dB (measured via tape with peak recording level of +6 VU); Heads: (3) one GX Forward Playback, one GX Reverse Playback, one combination GX Record/Erase Head; Motors: (3) one AC Servo Motor for capstan drive, two Eddy Current Motors for reel drive.

4000DS Mk II Reel Capacity: up to 7" reel; Tape Speed: 7½ and 3¾ ips; Wow/Flutter: less than 0.12% WRMS at 7½ ips; Frequency Response: 30 Hz to 23,000 Hz (± 3 dB) at 7½ ips; Distortion: less than 1% (1,000 Hz "O" VU); Signal-to-Noise Ratio: better than 56 dB (measured via tape with peak recording level of +6 VU); Heads: (3) one 1-micron gap Playback head, one Record head, one Erase head; Motor: 4-pole induction motor.

AKAI

You never heard it so good.



with FeCr tape, wow and flutter are ± 0.15 per cent rms, (± 0.20 per cent DIN); frequency response (MPX filter out) is 20 Hz - 18 kHz for FeCr or CrO₂ tape, and 20 Hz - 14 kHz with Fe₂O₃ tape. Price: \$945.00.

Enter No. 110 on Reader Service Card

Inovonics Acoustic Analyzer

The Model 500 is a self-contained, a.c. battery-operated, one-third octave sound level and reverberation time analyzer. In the real-time mode, it displays wideband or weighted sound pressure levels from 25 Hz - 20 kHz. In the RT₆₀ mode, the unit displays reverberation time up to 10 seconds with 10 mS resolution for either 15 or 30 dB decay. It also features a built-in pink noise generator, a keyboard control panel, two independent memories, data and oscilloscope outputs, and a choice of microphone or line input. Price: \$2750.00.

Enter No. 111 on Reader Service Card

Pioneer Turntable

The Model PL-518 direct-drive turntable is constructed with a solid particle-board base and patented foot insulators to help eliminate acoustic feedback, along with a fiber headshell to help eliminate resonances above 75 Hz, and a platter mat whose outer



edge is 0.3 to 0.5 mm higher than the center to provide greater stability for warped records. The tonearm has a die-cast base, oil-damped cueing, a spring operated anti-skate mechanism, and two machined ball-bearing assemblies for smooth movement and sensitivity in the horizontal plane. The S/N ratio is 73 dB, and wow and flutter is 0.03 per cent. Price: \$175.00.

Enter No. 112 on Reader Service Card

Infinity Speaker System

The Quantum Reference Standard (QRS) loudspeaker system combines a six-ft. dipole line source, electromagnetic induction tweeters, a new dipole electro-magnetic induction mid-range driver, and a 15-in. (38-cm) Infinity/Watkins dual-drive woofer. It stands



six ft. high, three-ft. wide, and two-ft. deep. The new mid-range driver utilizes an aluminum ribbon bonded to a light-weight plastic membrane and suspended in an intense magnetic field. The three mid-range drivers are arranged in a vertical line source five ft., six in. high, and less than one in. wide, providing uniform sound dispersion, and having a radiating area for a low-frequency cut-off of 100 Hz. Each QRS speaker uses 20 EMIT tweeters, 13 forward facing and seven rear mounted. The woofer cone, treated with damping materials, deadens spurious resonances and increases the cone's opacity. Bi-amplification is required for these speakers, and suggested use is 150 watts minimum per channel for bass, and 100 watts minimum per channel for the high frequency. Frequency response is 18 Hz to 32 kHz, ± 2 dB, and horizontal dispersion is -2 dB, ± 60 degrees. Price: \$6,500.00.

Enter No. 113 on Reader Service Card

Heveatex Vinyl Foam

This perforated vinyl foam ceiling and wall cover is used for the reduction of sound from 100 to 88 dB at 1 kHz. The pressure sensitive, peel-away backing, in beige and black, is available in ¼ in., ½ in., and 1 in. thicknesses. Price: ¼ in. \$1.50 per sq. ft., ½ in. \$1.65 per sq. ft., and 1 in. \$1.80 per sq. ft.

Enter No. 114 on Reader Service Card

THE TAPE THAT'S TOO GOOD FOR MOST EQUIPMENT.

Maxell tapes are not cheap. In fact, a single reel of our most expensive tape costs more than many inexpensive tape recorders.

Our tape is expensive because it's designed specifically to get the most out of good high fidelity components.

So it makes no sense to invest in Maxell unless you have

no one gets into our manufacturing area until he's been washed, dressed in a special dust-free uniform and vacuumed.

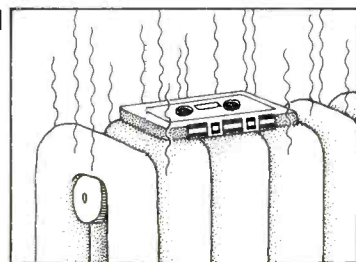
WE CLEAN OFF THE CRUD OTHER TAPES LEAVE BEHIND.

After all the work we put into our tape, we're not about to let it go to waste on a dirty tape recorder head. So we put special non-abrasive head cleaner

OUR TAPE COMES WITH A BETTER GUARANTEE THAN YOUR TAPE RECORDER.

Nothing is guaranteed to last forever. Nothing we know of, except our tape.

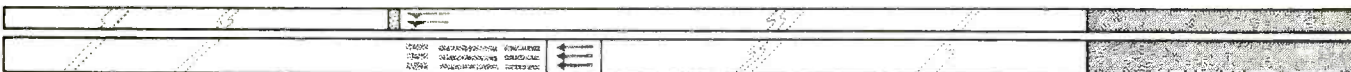
So our guarantee is simplicity itself: anytime you ever have a problem with any Maxell cassette, 8-track or reel-to-reel tape, you can send it back and get a new one.



Our guarantee even covers acts of negligence.

sounds at your nearby audio dealer.

(Chances are, it's what he uses to demonstrate his best tape decks.)



No other tape starts off by cleaning off your tape recorder.

equipment that can put it to good use.

THE REASON OUR TAPE SOUNDS SO GOOD IS BECAUSE IT'S MADE SO CAREFULLY.

Every batch of magnetic oxide we use gets run through an electron microscope. Because if every particle isn't perfect, the sound you hear won't be either.

And since even a little speck of dust can put a dropout in tape,



Every employee, vacuumed.

on all our cassettes and reel-to-reel tapes. Which is something no other tape company bothers to do.

OUR CASSETTES ARE PUT TOGETHER AS CAREFULLY AS OUR TAPE.

Other companies are willing to use wax paper and plastic rollers in their cassettes. We're not. We use carbon-impregnated material. And Delrin rollers. Because nothing sticks to them.

A lot of companies weld their cassettes together. We use screws. Screws are more expensive. But they also make for stronger cassettes.

GIVE OUR TAPE A FAIR HEARING.

You can hear just how good Maxell tape

You'll be surprised to hear how much more music good equipment can produce when it's equipped with good tape.



Maxell Corporation of America, 130 West Commercial Ave., Moonachie, New Jersey 07074

Enter No. 23 on Reader Service Card

Sony quality that speaks for itself.



The TC-K7II front-loading cassette deck is its own best spokesman.

Switch it on, and that disciplined Sony engineering will come through loud and clear.

And no wonder. Sony's been making tape recorders for 30 years. And today, we're still pushing back the frontiers. The K7II shows how.

Its transport mechanism is a DC servo-controlled motor, with a frequency generator. It emits a signal which is relayed to electronic circuitry that locks in the tape movement exactly.

Our heads are ferrite-and-

ferrite. And they're Sony's own formula—we don't buy them, we use our heads and make them.

You'll also find a direct-coupled head-playback amplifier. This means we've eliminated the middleman—the coupling capacitor—from the signal path. You get your sound direct, with minimum distortion.

Another reason the K7II is the logical choice: our logic controlled feathertouch push-buttons actually go from fast-forward, to rewind, to play, without going

through the stop position.

The K7II also speaks for itself with Dolby Noise Reduction System.[™] Large, professionally calibrated VU meters. Three LED's for peak level indication.

There's also bias and equalization switches for standard, Ferri-Chrome and Chromium Dioxide tapes. In fact, with nine possible combinations, any tape possibility of the future can be accommodated.

Along with the K7II, Sony offers a complete line of cassette decks, including the K4 and K3.

So if you're intrigued by quality that speaks for itself, get down to your Sony dealer and check these new cassette decks.

Before they're all spoken for.

Sony quality that doesn't speak at all.



But it won't be silent for long. Because the moment you record on one of our blank tapes, that quality will make itself heard.

Witness our Ferri-Chrome cassette.

Everybody knows that ferric-oxide tapes are ideal for reproducing the low frequencies. And that chromium dioxide is ideal for the high frequencies.

As usual, Sony wouldn't settle for anything but the best of both.

And as usual, Sony's engineers solved the problem. With a process that allows a coating of chromium dioxide to be applied

over a coating of ferric-oxide.

Our two coats are leaving other brands of tape out in the cold. Because Ferri-Chrome boasts shockingly low distortion and startling dynamic range.

Now one reason Sony's tape engineering is so advanced, is that we're the only people in the world who make tape, tape heads, and tape recorders. We learn a lot that way. And we share it by talking to ourselves, before we talk to you.

Of course, in addition to Ferri-Chrome, Sony makes a complete line: Chrome, Hi-Fidelity, Low Noise, Elcaset and Microcassette.

Sony's been making tape for 30 years.

So when it comes to answering the tough questions about the manufacture of tape, no one fills in the blanks like Sony.

SONY
AUDIO

© 1978 Sony Corporation of America, 9 West 57th Street, New York, NY 10019

Enter No. 42 on Reader Service Card

TWO LEADERS LOST

Irving P. Tushinsky



Irving P. Tushinsky, Executive Vice President and Director of Superscope, Inc., passed away following an illness of several weeks. Mr. Tushinsky, who, with his brother Joseph, founded Superscope in 1952, was born in Cincinnati in 1912. The family moved to St. Louis in 1921, and, following graduation from high school, Mr. Tushinsky was awarded a four-year music scholarship to the Univ. of Missouri. He subsequently joined the Mutual Broadcasting Network as a studio musician and later moved to Southern California where he was employed with the Metro-Goldwyn-Mayer studio orchestra.

In 1952, Mr. Tushinsky joined his brother, Joseph, in the development of an anamorphic lens process which became known as Superscope. This wide screen process, one of the first in the industry, was used in such lavish film productions as Disney's reissue of

"Fantasia" and in "Vera Cruz," starring Gary Cooper and Burt Lancaster. Five years later, in 1957, the company became the exclusive U.S. distributor for all tape products of Sony Corp., and two other brothers, Nathan and Fred, entered into the emerging audio home entertainment enterprise.

Superscope acquired the Marantz Co. in 1964 and today—having earlier commenced a phase-out process in its distribution of Sony products—the company manufactures and markets throughout the world both Marantz stereo high-fidelity components and its own line of Superscope audio products.

A tireless and enthusiastic worker, as well as a hobbyist—he was widely known for his large and unique collection of classic automobiles, in addition to his fondness for boating—Mr. Tushinsky also possessed one of the world's most precious collections of musical instruments and was recognized as a distinguished sponsor of both artistic and charitable causes as reflected by his membership in the Young Musicians Foundation and his receipt—along with his brothers—of the City of Hope's Humanitarian Award.

Dr. Peter C. Goldmark

Dr. Peter C. Goldmark, President and Director of Research of Goldmark Communications Corp., was fatally injured in an automobile accident on a Westchester, N.Y., highway during the first week of December.

Dr. Goldmark retired as President and Director of Research of CBS Laboratories and Vice President of Columbia Broadcasting System, Inc., on December 31, 1971, having joined CBS in 1936 as Chief Television Engineer. Born in Budapest, he studied at the Univ. of Berlin and the Univ. of Vienna, where he earned his Ph. D. in Physics.

Holder of some 160 patents, Dr. Goldmark is widely known for his creation of the long-playing phonograph record and the first practical color television system, along with his work

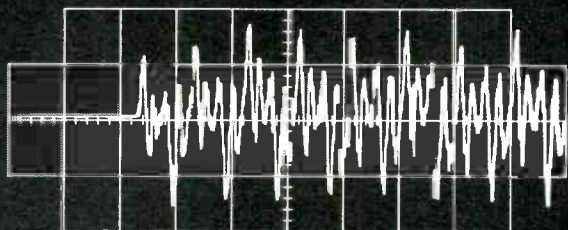


in communications in space. He was responsible for the development of the high-resolution readout and ground recording system used in the United States Lunar Orbiter Space Program.

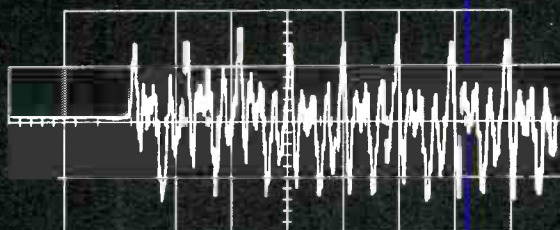
The development of the long-playing record in 1948 literally created a new industry in the field of home entertainment. The LP 33 $\frac{1}{3}$ rpm record made it possible to present on one record long classical compositions as well as the scores of Broadway musicals without interruption—eliminating the frequent record-changing requirements of the 78.

The original field sequential color system developed by Dr. Goldmark pioneered the use of closed-circuit television and is becoming increasingly prevalent in medical education and clinical diagnosis. His field sequential system—used in the first successful color television broadcast on August 27, 1940, from atop New York's Chrysler Building—has been shrunk to a fraction of its original size by modern technology to make possible the spectacular color television broadcasts to earth from the moon's surface by the Apollo astronauts.

Will the real B.B. King please stand up.



B.B. King live.



B.B. King reproduced by SB-7000A.

What the legendary B.B. King's rapid guitar picking style did for players like Eric Clapton, Mike Bloomfield and Alvin Lee is music history. He fathered a generation of blues-influenced rock guitarists.

But what B.B. King is doing with Technics Linear Phase Speaker Systems is making another kind of history. Hi-fi history.

Look at the waveforms. On the left is B.B. King playing live. On the right is the same music reproduced by Technics Linear Phase SB-7000A.

It's hard to tell the difference. And that's our point. Technics Linear Phase Speaker Systems are the first speaker systems with not only a wide frequency response but also flat amplitude and complete linearity. And that makes them the first speaker systems capable of reproducing a musical waveform that's virtually a mirror image of the original.

How did we do it? First by conducting exhaustive amplitude and phase studies in acoustically perfect chambers. Then by developing a unique new phase-

controlled crossover network that not only compensates for the time delays caused by different frequencies but simultaneously corrects any acoustic differences in the drivers. And finally by staggering each driver unit for the optimum acoustic position.

Technics Linear Phase SB-7000A, SB-6000A and SB-5000A. For music that sounds as it was originally played.

Technics Professional Series
by Panasonic

Enter No. 47 on Reader Service Card



SB-6000A

SB-7000A

SB-5000A

The Audio Critic is growing.

By the time this ad is first seen in print, the fifth issue of The Audio Critic should be on its way to more than 6000 paid-up subscribers. Every day of the week, 15 or 20 and occasionally even 30 new subscriptions come in from serious audio enthusiasts all over the world. Since The Audio Critic didn't even exist a little over a year ago, there must be a reason for this explosively affirmative response.

There are, in fact, several reasons. One of them is undoubtedly the basic editorial format of The Audio Critic: the longest, toughest, most persnickety equipment reviews in the business, illuminated by in-depth explanatory articles and uninterrupted by advertising of any sort. Since The Audio Critic derives no advertising revenue from either manufacturers or dealers, no one can stop it from puncturing the most inflated balloons or from limelighting deserving newcomers that rock the boat.

32 A further reason is The Audio Critic's unique combination of hypercritical listening evaluations and sophisticated laboratory tests. For example, a recent survey of 15 speaker systems showed an undeniable correlation between impulse response and audible accuracy. Another survey delved deeply into the cartridge/arm/turntable relationship and analyzed the astonishing difference made by even slightly incorrect and 100% correct playback geometry. Detailed instructions to achieve the latter were given.

And then there's The Audio Critic's special writing style, which substitutes large doses of irreverent humor for the usual cultist pomposity.

The Audio Critic is published at intervals averaging two to three months (that's twice or three times the actual frequency of the "undergrounds") and is available by subscribing to six issues for \$28, first-class mail only. (No Canadian dollars, please!) For overseas airmail, add \$5. No single copies are sold for any reason whatsoever, but the unused portion of canceled subscriptions is refundable on request.

We strongly suggest that you begin your subscription with Volume I, Number 1, in order to own a complete set and be thoroughly familiar with our approach.

If you wish, however, we'll start you with any issue you specify.

Send \$28 for your first six issues today to The Audio Critic, Box 392, Bronxville, New York 10708.

The Audio Critic

Dear editor

Comments on Greiner

Dear Sir:

The article by R.A. Greiner in the November, 1977, issue of *Audio*, "Amp Design and Overload," is quite interesting. While the article makes a number of quite valid and very important points, there are a number of issues on which comment is appropriate.

Inasmuch as Prof. Greiner has referred to my work, his interpretations should be viewed in the proper context. They are not, for several reasons. Reference 7 cites the *initial* two parts of a four-part series on slew-induced distortion (SID), which appeared in February, 1977. Therefore, many of the comments in the text relevant to THD tests (i.e., Figure 5) are off base, simply because they have already been answered^(1,3).

The third part of this series "Transient IM tests for SID"⁽¹⁾ was not referenced and discussed, and it makes points which are certainly germane to Greiner's discussion. The work of coauthors Mark Stephens of Sound Technology and Craig Todd of Dolby Labs sheds highly important light on the efficacy of the sine-square test for TIM⁽²⁾ and correlates results of this form of test with the THD and two-tone IM methods.

Without going too deeply into the many issues involved, it can be stated that the results of this work and further studies⁽³⁾ generate very serious questions as to the validity of the open-loop bandwidth criteria (Greiner, rule 3b Pg. 60) and reference⁽²⁾. Our tests show that TIM or SID performance is relatively independent of the amplifier open-loop bandwidth as long as a minimum slew rate criteria is satisfied. In one specific instance an IC op-amp shows superlative results for TIM and THD tests with a 20 Hz open-loop bandwidth, but a 10V/ μ S slew rate.

It is not apparent to me how an open-loop bandwidth of less than 20 kHz can in itself cause distortion, if amplitude clipping and slew rate limiting are avoided. In fact, many measurements have been made to test for such distortion, with results thus far always indicating slew rate as the dominant frequency dependent non-linearity. I would like to see some test

results which support the open-loop bandwidth criteria, as independent of slew rate. Could it be that rule 3 should really say "the open loop large signal bandwidth," which then specifically qualifies it to mean slew-limited bandwidth? Our work has shown that a safety factor of 4 or more is justified here, not just as an equal bandwidth.

This is not to say that such a large open-loop, small-signal bandwidth would not be a valuable asset; to the contrary. In practice, however, such wide open-loop bandwidths are highly uncommon, and if you apply the criterion generally to the whole audio signal chain, the result is an impossibly large requirement for open-loop bandwidth by the time the signal reaches the power amp (1MHz!). This is because the required open-loop bandwidth increases for each stage, and there are usually at least three of them in the path.

It is unfortunate that Greiner has not, in his attempt at a "unifying" article, made use of all the information available. Perhaps if this had been done, some of his skepticism as to the validity of THD tests for SID detection would not be so apparent. Also, Part IV of reference⁽¹⁾ includes an interesting correlation of electrical/audible results, while reference⁽³⁾ includes a theoretical prediction of SID performance. Both of these may have influenced some of the comments in the article.

Walter G. Jung
Forest Hill, Md.

References

1. W.G. Jung, M.L. Stephens, C.C. Todd, "Transient IM tests for SID," *JAES* preprint [Feb., 1977]. "Slewing Induced Distortion in Audio Amplifiers," *Audio Amateur* [March, 1977].
2. J. Curl, E. Leinonen, M. Ojala, "Method for Measuring Transient IM Distortion," *JAES* 25, 4 [April, 1977].
3. W.G. Jung, M.L. Stephens, C.C. Todd, "Slewing Induced Distortion and Its Effect on Audio Amplifier Performance," *AES* preprint 1252 [May, 1977].

And from Madison . . .

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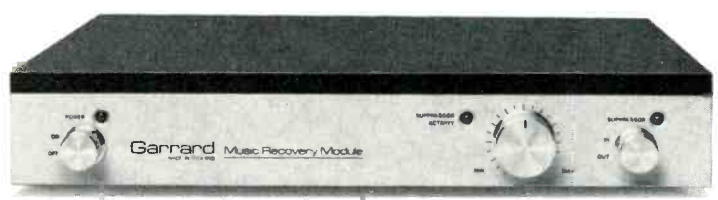
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his articles on distortion in operational amplifiers. Only parts I and II were available to me in Spring of 1977 while I was revising my paper for *Audio*. I made reference to the first two parts because I thought they were an *important contribution* to finding good ways to measure slew induced distortion in amplifiers. I have now had a chance to review the final parts of this work and, as I said in the *Audio* article, this work is quite convincing. Mr. Jung and his colleagues have carried out an immense number of measurements and shown good correlation of these measurements with listening tests. It certainly looks like their technique can be used to select operational amplifiers for various uses.

My skepticism of the technique relates only to the question of how this measurement technique, or any other for that matter, can be related to a detailed understanding of the actual internal mechanisms that cause the distortion. It is possible that the overload mechanisms may be slightly different, or occur at a different point in the circuit, in power amplifiers as compared to operational amplifiers. Thus, I would like to see these same techniques applied to a large variety of power amplifiers which are used under load conditions that approach real loudspeaker loads.

It seems quite possible that the same measurement techniques will give good results for power amplifiers and that this test should be applied more widely. In any case, Mr. Jung's articles should be required reading for amplifier designers, manufacturers, and audiophiles alike.

With reference to rule 3b in my *Audio* article, I can only assume a misunderstanding of it by Mr. Jung. The conditions for application of rule 3b are stated in the parenthetical sentence following it. I did, of course, mean the bandwidth under large signal or full power conditions. This rule is rather difficult to follow since it has implications not only for individual parts of a system but for the system as a whole. The rule, as stated, does guarantee that there will not only be no slew rate limiting but that there will be no internal overdrive within the feedback loop. It is possible to not follow this rule exactly if the internal active stages in the amplifier have good amplitude headroom and if the high frequency content of the program material is not too great.

All in all, I would consider my attempt to show that essentially linear measurements, and concepts, can be made to correlate well with non-linear measurements and phenomena to be

supportive of the work of Mr. Jung. For too long writers have implied that transient measurements somehow had no relation to steady state measurements when in fact they do. While this relationship gets more diffuse as the nonlinearities get very large, we would not usually want to drive an amplifier much beyond its linear output capacity in any case.

In summary, I find no major disagreement with Mr. Jung on either the validity of his method of measurement or his desire to sort out the status of the many amplifier types available.

R. A. Greiner
Professor Of Electrical Engineering
University of Wisconsin
Madison, Wisconsin

R.F. Interference

Dear Sir:

A problem of growing concern to the serious audiophile of today is the radio frequency interference being picked up by high-quality audio equipment. Although the problem is often caused by an improperly or illegally operated transmitter, or by "interference prone" audio equipment, it is usually difficult to enforce either legal or technically proper operation of most private transmitters or enlist the help of the transmitter operator in dealing with the situation (If the operator can be located at all). This is especially true if the transmitter is located in a moving vehicle.

It does not seem fair to require the audiophile to modify his expensive equipment to free it of interference from such transmitters, especially when the modification may very well cause a noticeable deterioration of the frequency response, phase response, etc. of the audio system. However, in the case of an impossible to locate offending transmitter or if the operator is reluctant to co-operate, modification of the audio equipment may be the only reasonable solution for the audiophile.

In such a situation a switchable filtering device would be highly desirable because any adverse affects of the filter on the sound of the system need only be endured when the offending r.f.i. is present, and said adverse affects on the sound will almost certainly be less annoying than the r.f.i. itself.

Walter M. Scott III
Knoxville, Tn.

(Continued on P. 103)



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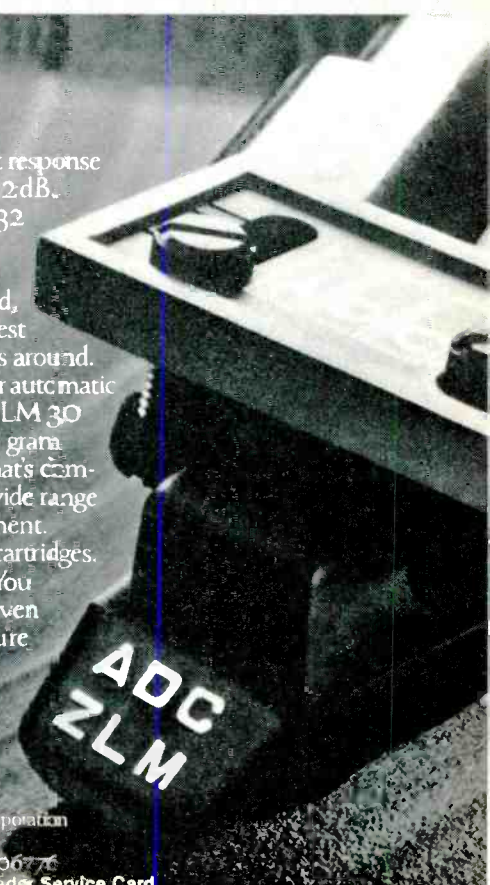
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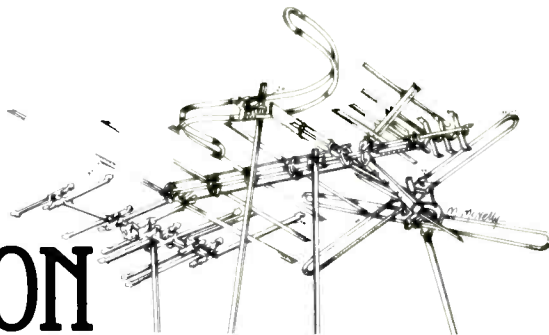
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ANTENNAS - PART III

TRANSMISSION LINES & SIGNAL DISTRIBUTION



M. J. Salvati

There are several reception problems that can occur whether you have the crudest antenna system possible or one of the best. In fact, the first problem to be discussed, overload, may actually be aggravated by a good antenna!

Overload

This is the result of too much signal for the tuner to handle under certain reception conditions. In the competition for the consumer dollar, tuner manufacturers engage in a "numbers race" in regard to tuner sensitivity. This is not their fault, since consumers feel a tuner is inferior unless it boasts a sensitivity figure below two microvolts. Yet, over 90 per cent of the purchasers of such tuners do not need this much sensitivity. In many cases, this high sensitivity works against them when a tuner is operated in a high-signal metropolitan environment. This is because the design techniques for high sensitivity and those for low cross-modulation susceptibility (resistance to overload) are quite dissimilar.

When local stations are the ones you want to hear, overload is easily solved by inserting an attenuator in the cable, preferably near the tuner input. The RMS Electronics CA-1121-20 barrel attenuator (Fig. 1) is ideal, as its fittings

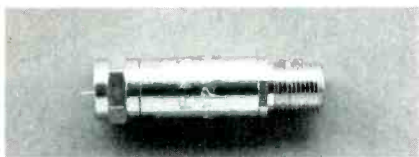


Fig. 1 — RMS CA-1121 barrel attenuator.

permit it to be installed without an extra cable. The amount of attenuation required depends on the signal level, although 20 dB is good as a starter and will do for most cases. An additional 20-dB attenuator can be connected for the rare case where the signal level is enormous and the tuner particularly susceptible to overload.

If you want to hear very weak (distant) stations and you are located very

close to an extremely powerful station, attenuation cannot be used. If the powerful local station is more than 5 MHz away from the desired station in frequency, a simple tuneable rejection filter can be used. The Jerrold RFT-300 (Fig. 2) and Radio Shack 15-1145 are

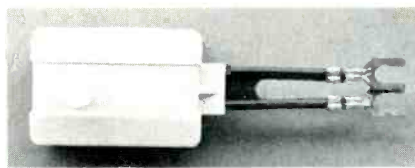


Fig. 2 — Jerrold RFT-300 notch filter.

very low priced filters that produce over 22-dB attenuation at the trap center frequency. These devices are installed in parallel with the 300-ohm antenna terminals. For installations using cable, disconnect the cable from the tuner's 75-ohm input and connect the cable to the 300-ohm input through a balun. The rejection filter is then connected across the tuner's 300-ohm input terminals in parallel with the balun.

If the weak distant station and powerful local station are very close in frequency, the trap cannot be used. (It is not selective enough to attenuate the strong station without also attenuating the weak one.) The only recourse in this case is to use the directional properties of a high-gain, narrow-beamwidth antenna (on a rotator, of course) to null out the powerful local station while boosting the level of the weak distant station. By careful positioning of the antenna via its rotator, you can reduce the pickup of the local station by 15-30 dB, depending on the null characteristics of your antenna. Hopefully this will reduce the local signal below the troublesome level.

CB Radio Interference

CB radio is the major cause of FM radio interference because of the number of CB transceivers in operation. With simple tuners, the interference mode is usually cross-

modulation (via front-end overload). A high-performance tuner may have stations near the upper edge of the FM band blacked out by 4th harmonic radiation at 108 MHz if the antenna of an ordinary CB transceiver is located next to the FM antenna. However, if an illegal power amplifier is used by the CBER, interference can occur even with considerable distance between the antennas.

An FM antenna will pick up the 4th harmonic of a CB signal as readily as it will pick up a 108 MHz FM signal. Directionality is the only means of discriminating between the CB and FM signals, so an FM antenna with a high front-to-back ratio and deep side nulls is needed. The antenna is oriented to reject the CB harmonic and/or increase the FM signal. (Suitable antennas were mentioned in the first part of this series.) Best interference rejection occurs when the direction of the CB signal is at or near a right angle to the FM station; then the CB signal will disappear in the null typically occurring at 90° or 270° while the FM station is picked up at full strength.

Once radiated, CB harmonics cannot be eliminated other than by the antenna "trick" just described. However, if you can locate the offending CB transmitter, the harmonic radiation may be eliminated at the source. A good low-pass filter installed on the output of a CB transceiver will usually solve this problem. The Electronic Specialists FLCB-LP (Fig. 3 top) is inexpensive and installs directly on the transceiver output jack. It will provide about 50-dB attenuation at 108 MHz. The Channel Master 5272 (Fig. 3 bottom) is more expensive but was measured to have over 70-dB attenuation at 108 MHz in the author's tests. This filter also produced incredibly high attenuation of the 2nd and 3rd CB harmonics (which may be ruining your TV reception!). A short jumper cable is required with this filter.

Harmonic energy escapes through the line cord of some transceivers and

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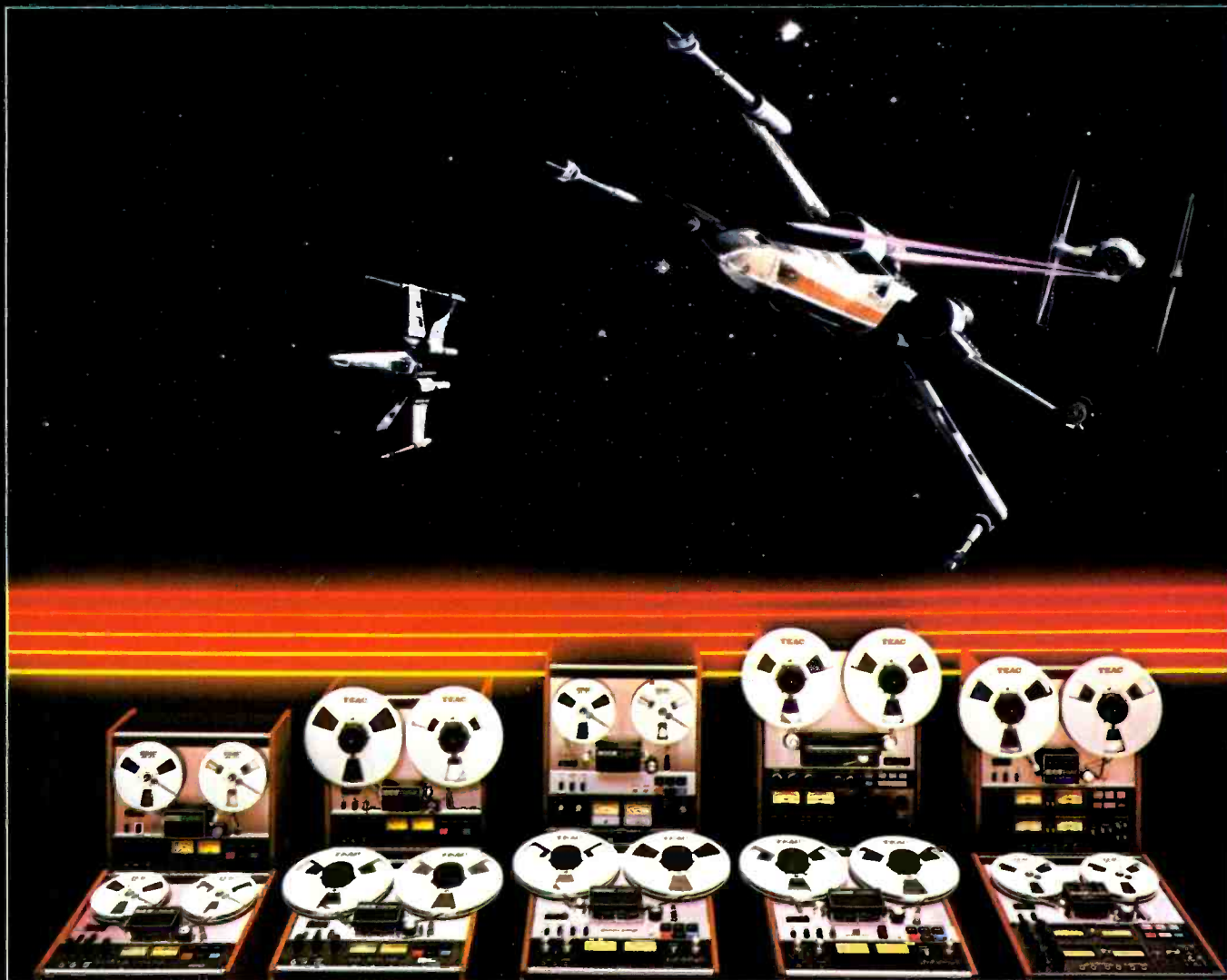
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Signal to Noise Ratio (IHF "A")	110dB	110dB	110dB	110dB
Residual Noise (IHF "A")	120uV	120uV	120uV	120uV
Forced Air Cooling	YES	OPTIONAL	OPTIONAL	NO
Suggested Retail Price	\$1349.95	\$879.95	\$599.95	\$399.95
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is radiated by the house wiring. A power-line filter installed between the transceiver's power cord and the a.c. outlet will prevent this. The Vidaire Electronics CF-5 (Fig. 4) is a low-cost filter that provides over 40-dB attenuation to the 108 MHz harmonic. The Radio Shack 15-1106 will do likewise.

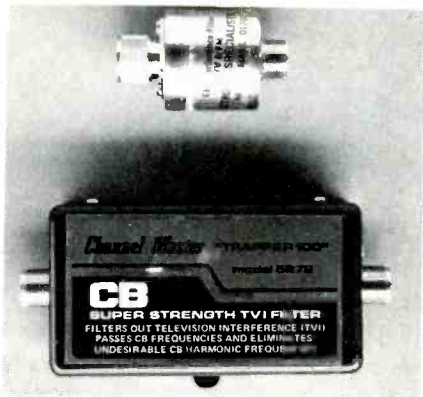


Fig. 3—CB low-pass filters; top, Electronic Specialists FLCB-LP; bottom; Channel Master 5272.

CB radiation may be picked up on the FM transmission line rather than the antenna. If the FM twinlead passes close to a CB antenna, replace the FM receiver's twinlead (or even standard coax) with one of the foil-and-braid coaxial cables or foil-shielded twinleads recommended in Part II.

Because some CBers use illegal power amplifiers, sufficient fundamental (27 MHz) signal may squeeze through a low-cost FM receiver's input circuits to overload the r.f. stage. In this case, one of the filters specified in Table I of this part of the series should be installed. CB fundamental filters are available in a variety of styles and impedances. Most of them are inserted between the transmission line and the receiver input terminals, but the Jerrold CBT-300 and Radio Shack 15-1146 are notch filters that are simply connected across the receiver input terminals in parallel with the antenna leads or balun. (Except for the lack of a tuning knob, these notch filters look just like the Jerrold RFT-300 in Fig. 2.)

Table I—CB Fundamental Filters.

Impedance		Model	Insertion Loss vs. Frequency	
Input	Output		27 MHz	100 MHz
300	300	Vidaire CBF-6	47 dB	0.1 dB
		Jerrold CBT-300	27-36	0.0
		Radio Shack 15-1146	27-36	0.0
75	300	Jerrold T-4040	42	0.6
		RMS CA-2600	45	0.5
75	75	Winegard HP-2700	33	0.1
		RMS CA-2700F	29	0.2

Note that the RMS CA-2600F and Jerrold T-4040 (Fig. 5) are combination high-pass filters and baluns; they match coax to the 300-ohm antenna terminals as well as filter. All of these filters did their job well in the author's tests and measurements.

If the FM stations have adequate signal strength, add attenuation to the transmission line with a 20-dB barrel attenuator, such as the RMS Electronics CA-1121M-20 (Fig. 1). This device should be connected between the coaxial cable and the filter (a 75-ohm input unit) or balun. This may reduce the combined level of the FM signal and interference below the level that causes cross-modulation. If the FM signal is not strong enough to do this, replace the existing FM antenna with one of the very high gain and directional models mentioned in Part I. The

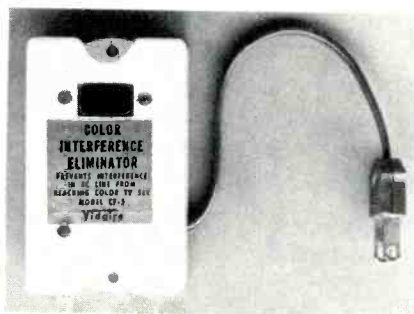


Fig. 4—Vidaire CF-5 line filter.

directionality will also improve the signal-to-noise ratio (specifically the FM signal-to-CB fundamental ratio). However, since this is an expensive step, it should only be tried if you are desperate (and wealthy).

Electric Motor Interference

While FM receivers are supposed to be inherently noise immune, they do respond when the interference is strong enough. Receiver manufacturers acknowledge this fact via the impulse-noise suppression circuits that appear now and then in the more expensive models.

Fortunately, if the interference is strong enough to be picked up on a modern FM tuner, it means the noise

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Build A Speaker Peak Power Indicator

Almon Clegg*

The speaker power indicator described here is intended to be used as a loudspeaker system accessory rather than an amplifier facility. It is not uncommon for amplifiers to have LED indicators built into their front

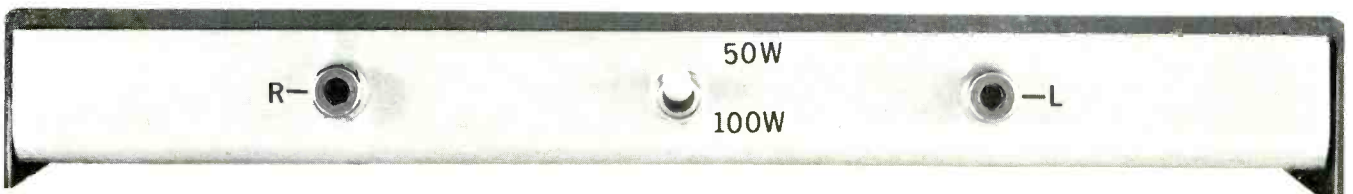
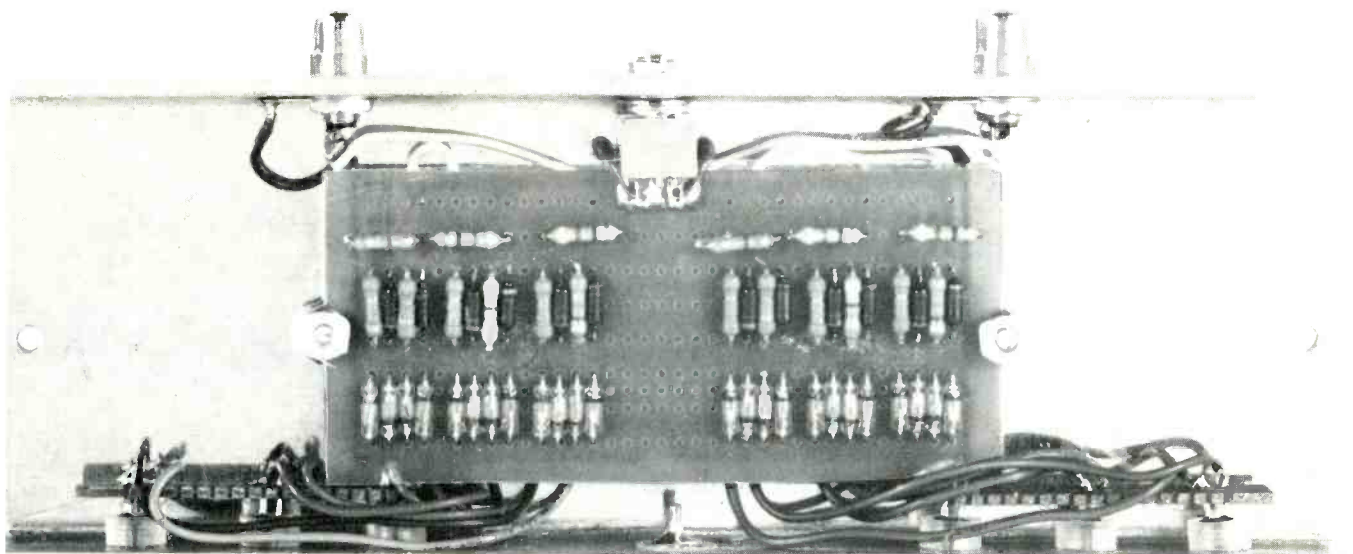
panel to indicate the amount of instantaneous power being supplied by the amplifier. By merely watching the LEDs as music is playing, it is easy to see the demands of the music signal and level upon the power amplifier. Unfortunately, the more likely position for a typical listener is facing the front of the listening room with his eyes toward the speaker system. Should the amplifier be located on the side or rear of the room (which is a more likely

location), the listener would be unable to observe the power indicating lights.

Thus, the idea of an indicator up front where the speakers are always located was born. Secondly, the idea of associating the power with the speaker system, rather than the amplifier, makes good sense since it is often the case that the amplifier is capable of producing much more power than the speaker is capable of safely handling. Therefore, with this

* Manager,
Audio Engineering Dept.,
Technics by Panasonic,
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Until Micro-Acoustics' direct-coupled design (U.S. Pat. No. 3952171), all high-fidelity cartridges concentrated on *tracking ability*: maintaining contact between stylus and groove at low forces, for minimum record/stylus wear. This reduces *transient ability*, because under-damped moving assemblies tend to remain in motion, impairing clarity and definition. On the other hand, earlier cartridges with stiffer stylus assemblies had better transient ability, but greater wear.

Unlike these single-pivot cartridges, which maximize one ability, Micro-Acoustics' 282-e has twin pivots optimized for *both* abilities. Resulting in superior transient and tracking performance from one cartridge on *all* records, including warped discs. Performance totally independent of tonearm cable capacity or preamp input impedance.

Visit your MA dealer and let your ears convince you. Or use our unique test record for evaluating and comparing cartridge tracking and transient ability. Just send \$5.00 for a postpaid copy, or write for free information. Micro-Acoustics Corporation, 8 Westchester Plaza, Elmsford, N.Y. 10523. In Canada, H. Roy Gray Ltd., Markham, Ont.

ma

Micro-Acoustics

"Because good tracking isn't enough."

© 1977, Micro-Acoustics Corporation.

system, the user can easily see when he is overstressing the speaker systems. Thirdly, since a pair of wires is already connected to the speaker system, it would be highly desirable to power the LED circuit from the speaker line to avoid the necessity of running any additional circuits from the amplifier on an a.c. outlet.

The speaker peak power indicator described here is designed to incorporate the above mentioned criteria. Furthermore, it utilizes only resistors, diodes, and zener diodes, in addition to the LEDs. To understand how the circuit works, refer to Fig. 1. The diode bridge allows either a positive or negative signal to excite the LED. The dropping resistor R_1 divides the voltage against R_2 . Since there are three forward diode junctions to overcome, approximately 1.8 V is required at the division point of R_1 and R_2 to cause the LED to become excited. The unilateral zener (or two zeners in series) merely limits the maximum voltage applied to the diode bridge with R_3 acting as a current limiter to keep the LED from being over dissipated.

Z_1 and R_3 are chosen to allow the LED to go to full brightness at about 3

dB after the LED first becomes visibly excited. This makes for an effective way to view the relative power being fed to the speaker. The average brightness is a function of power input and tells the listener that he is hitting the speaker "hard" when it flickers to full brightness.

By adding a switch and different values of series resistance to R_1 , it is easy to make the LED come on at many different power levels. Adding additional bridge circuits for different power levels will show the power levels below 0 dB. Figure 2 shows a schematic diagram for a three LED system where 0 dB, -6 dB and -12 dB are displayed for three power levels of 50, 100, and 350 watts as selected by a switch.

Parts List

1/2 W Resistors

- 1—100 ohm
- 3—120 ohm
- 1—150 ohm
- 1—220 ohm
- 1—390 ohm
- 2—470 ohm
- 1—560 ohm
- 1—680 ohm

Diodes

12—General purpose silicon diodes, such as 1N4001

Zener Diodes

3—5.1 V, 200 mW unilateral (or six each, 5.1 V, 200 mW conventional zeners)

LED

3—30 mA jumbo red (Lafayette, Radio Shack)

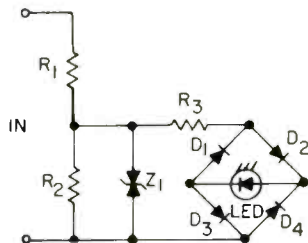
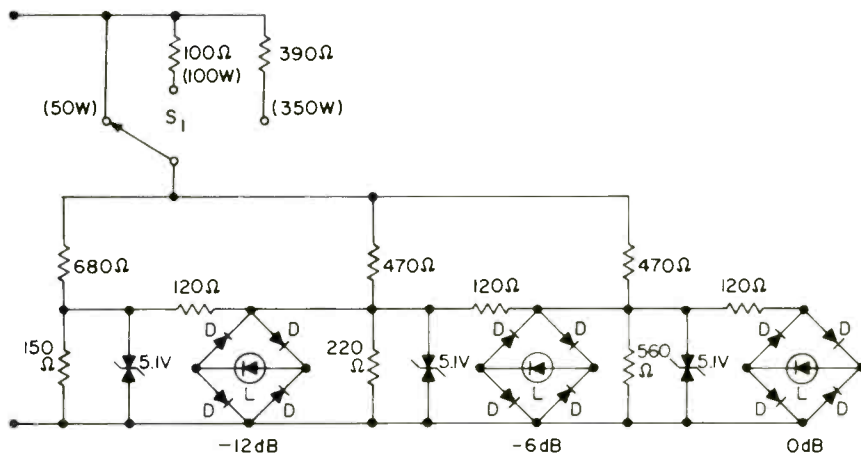


Fig. 1—Diagram of the basic circuit for the speaker power indicator.

Fig. 2—Schematic diagram for the unit shown, a three LED system with power levels of 50, 100, and 350 watts.



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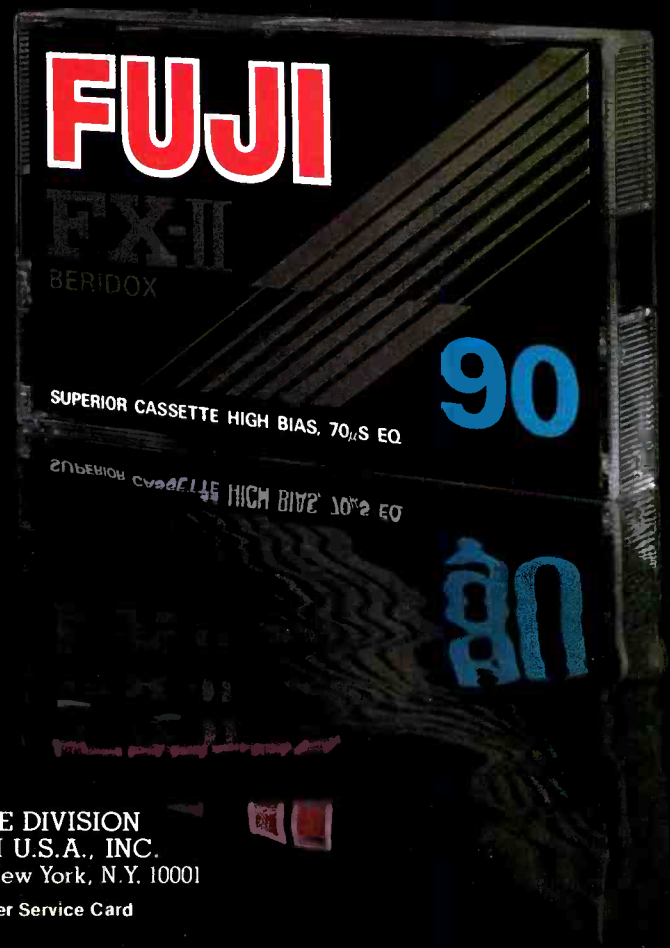
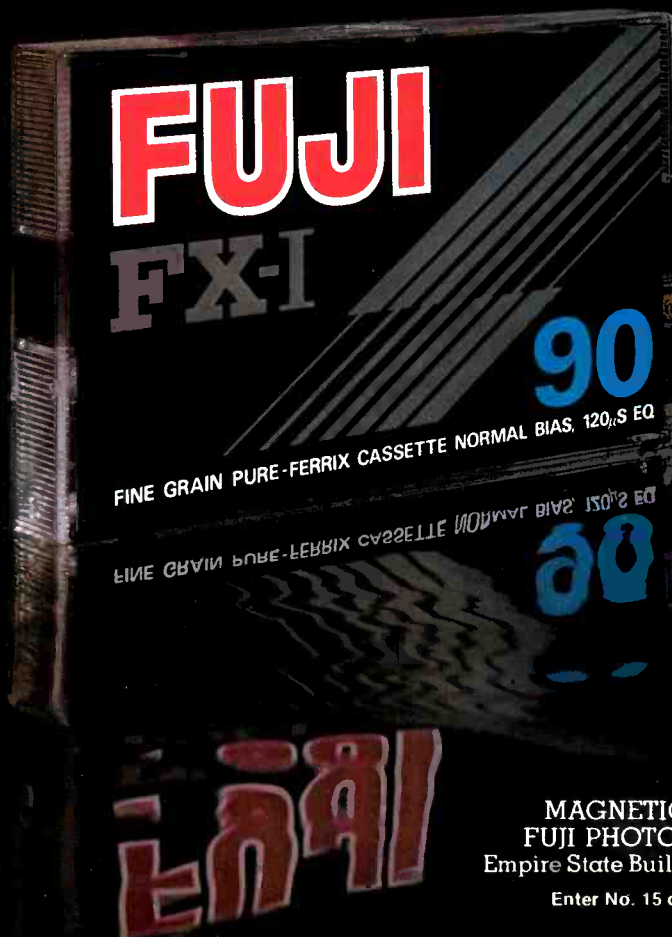
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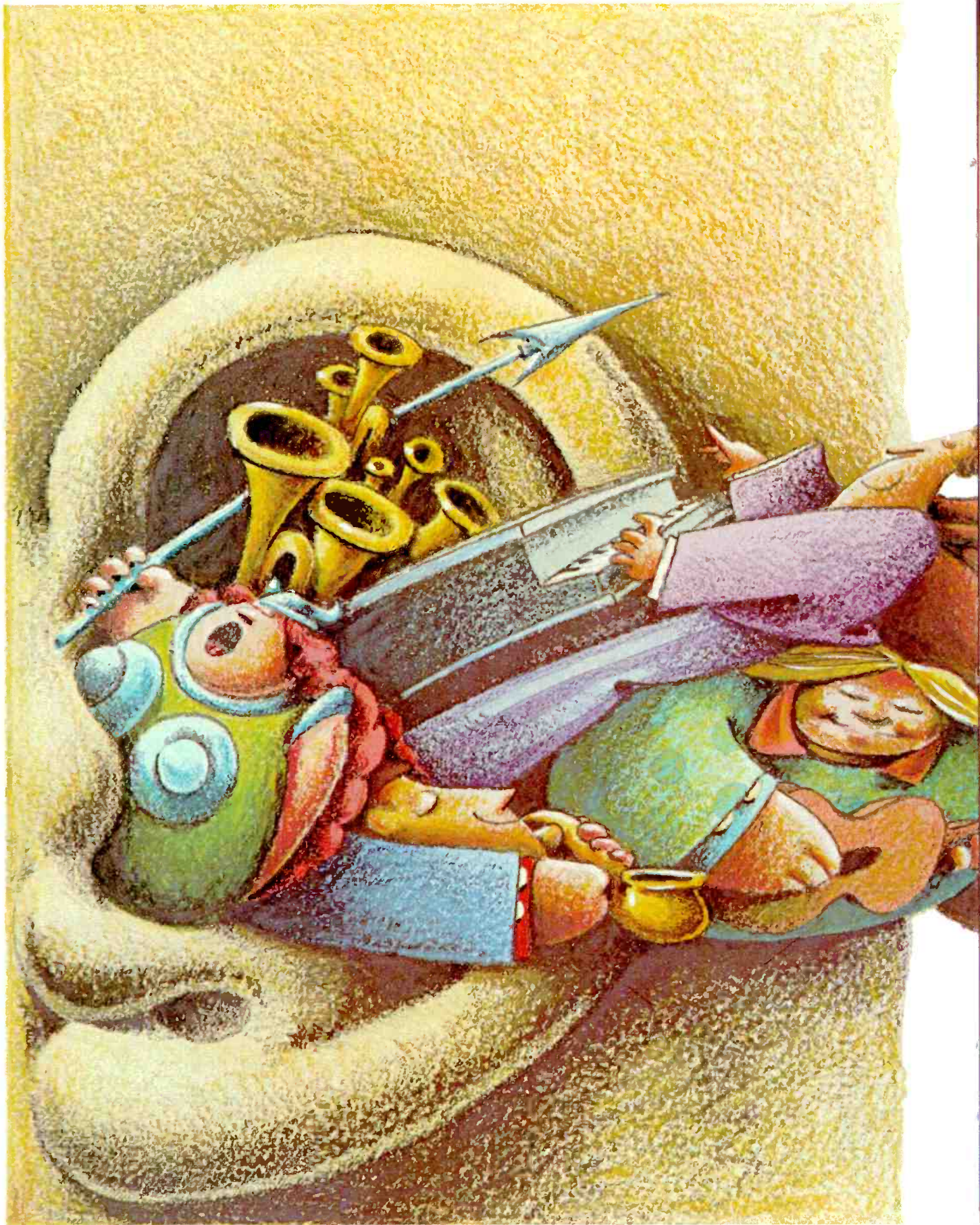
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Richard C. Heyser

Surely the end product of audio technology is the listening experience. We must never lose sight of this fact. No matter how exotic our instrumentation, no matter how impressive our mathematics, it is what we hear, not what we measure or compute, that is the final arbiter of audio quality.

But this does not mean that we should turn away from technology when attempting to assess or improve audio equipment. It means that we should become more aware of the proper role that is played by instruments and mathematics. For it is still the sole dominion of technology to give us objective and repeatable measures of our gradual climb toward perfecting audio systems. And until that day when we can quantify human experience and emotion, it is still our standard of improvement.

Yet we face a dilemma in modern audio technology: Our measurements do not always correlate with what we "hear." Are the measurements wrong? Is there something in human perception which transcends our technology?

Are there "hidden variables" that we overlook? Or are we fooling ourselves by creating a mystique of the golden ear? Whatever your personal views on this matter, there is one thought I would like you to ponder... the effect that modern sound reproduction strives to achieve is the creation of an acceptable illusion in the mind of the listener.

Illusions

It takes no small amount of intestinal fortitude to stand up and tell an industry striving for technological perfection that what we are really trying to do is create an illusion. Yet that is the inescapable conclusion to be drawn from analysis of our present situation.

Almost without exception, the physical sound field in a listening environment could not in any way be created by actual sound sources located where we perceive them to be. There can be no stage-center vocalist located between our stereo loudspeakers and 10 feet behind a back wall. There can be no string section stage-left and 30 feet back. Yet that may be the illusion we perceive from a good stereo reproduction. We fuse these illusions from two discrete sound sources plus internal reflections in our listening environment.

The physical sound field which a modern sound reproduction system creates is definitely not congruent with the apparent sound field which we hope the listener perceives. What a listener "hears" is not a reconstructed hologram of a live performance. Instead he is subjected to a carefully contrived sound field which is intended to stimulate a specific type of perception.

The listener is not a dupe in this circumstance, but is a willing participant who will often knowingly reject interfering sensory cues that would otherwise damage the illusion.

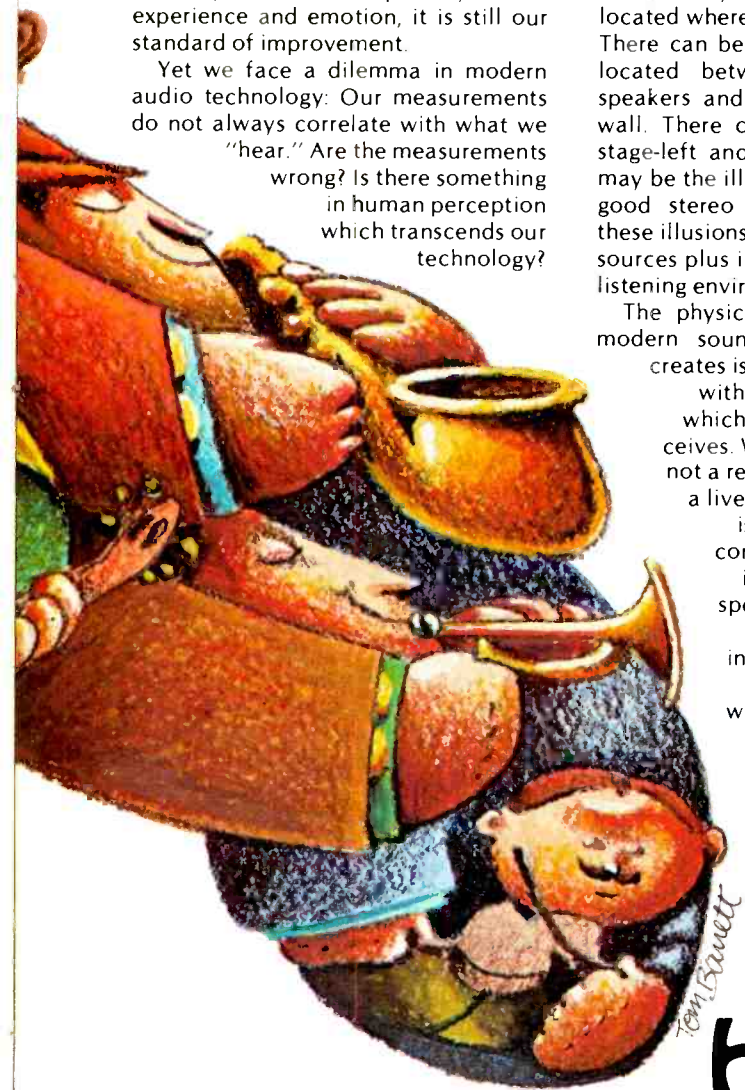
The enhancement of this illusion, as a commercial enterprise, involves art as well as science... psychology as well as physiology.

Ingredients of Listening

Consider the ingredients of this listening experience. Let me define perception as the awareness of the world about us which we gain principally through sensory experience. While the sensory stimulus may be the result of independent processes, the perceptual image which we fuse from these senses is combined within the higher levels of the mind into an inter-related structure. Sensory imagery involves a multi-dimensional structuring in which ordinary physical space comprises only part of the dimensional frame of reference against which we form perception. This perceptual structuring is based on physical and emotional experience and is such as to align the majority of sensory experience at any moment with a consistent world-picture in our minds. The perception of sound involves more than just what we "hear." It is a holistic experience that involves not only the other senses, but past experience and present emotional state as well.

Not all of the sensory stimuli or prior experience need necessarily agree in order for us to form a perceptual image. Consider the art of a ventriloquist. Through manipulation of acoustic, visual, and associative relationships, a ventriloquist can project an illusion quite inconsistent with reality. I suspect that a ventriloquist would find it difficult to confuse a blind person.

This deception, which we find so entertaining, indicates a deep structural compatibility within human perception. Not only can we cope in a world which presents us with a continuing barrage of sensory stimuli, some of which can be misleading, but we can willingly "shut out" certain cues in order to enhance our perception. These are things that I, as a reviewer, must recognize whenever I form a



Hearing Vs. Measurement

value judgment on the listening qualities of a product.

On a survival level, the structuring of perceptual cues should relate to physical reality. A cave man would have been easy prey for a tiger which was seen on the left, heard on the right, but could bite him from the rear. We align our perceptual cues into a meta-framework which I have referred to as a "rightness of perception." But on a more leisurely level, otherwise significant structural cues can be slotted into a lower hierarchical level of importance to perception. The world-image which we fuse in our perception may seem quiet real to us, but it does not necessarily coincide with ingredients of a physical reality.

Not A Hologram

The often overlooked art of recording lies in knowing how to structure the acoustic cues so as to enhance either the illusion of reality or the evoked emotional experience. Simply sticking microphones in a place where recordings are to be made will not do it if we want the proper listening experience from our present reproduction technology.

I must point out that it is theoretically possible to record a dynamic diffraction pattern of an acoustic performance—a hologram. Some day we will do that, but it is *not what we now record*. We do not record a hologram; we do not even pretend to record a hologram. Nor do we even pretend to play back a reconstructed holographic sound field. Yet, I submit, much of the hoopla of present audio component measurement technology is based on the assumption that we listen to a reconstructed hologram.

The component designer who, in good faith believes he is thoroughly measuring the performance of his product, tacitly assumes that perfection is a reconstructed hologram. He then compounds this problem by using distortion measurements which are based on linear mathematics (I will have more to say on this important matter at another time). When a non-technical listener hears this product as part of a modern sound reproduction system, he may perceive an unpleasant warping of the illusion. It is distorted as a perceived experience. The designer is enraged that his product—which measures double 0 nothing per cent "distortion"—can be perceived right through the much higher measured distortion of other components. Obviously, in the technologist's eye, the non-technical listener is a freak to be ignored. Particularly, since this listener uses weird

words such as *furry* to complain about the imperfections he perceives. The result is an industry split right down the middle, with math and fancy test instruments on one side and dissatisfaction expressed in flowery rhetoric on the other side.

Both sides of this controversy have been squared off against each other for at least 50 years, and neither will give an inch to the other.

It is my opinion that before we can try to answer the question "why can't we measure what we hear?" If we do not know what we are trying to do, then how can we expect to know how to do it better?

We align our perceptual cues into a metaframework which I have referred to as a "rightness of perception."

I submit that what we are trying to do *in today's technology* is provide a particular type of listening experience under the limitations imposed by our ability to recreate a physical sound field. A great many years from now we will be able to record and reproduce an acoustic hologram, assuming that this is what the listener wants.

Meta-Language

Once we recognize that the actual sound field in a listening environment is not identical to the sound field which we may perceive, we get a whole new perspective on the problem of being able to measure what we hear. It is the illusion of reality, not the reality itself, that we must measure.

Now, I know that such a statement may turn a lot of people off, but do not be misled by any emotional reaction to my observation that the listening experience involves the structuring of an acceptable illusion by means of artfully contrived sensory cues. This does not mean, as I pointed out earlier, that we must abandon technology. It does

not mean that at all. As a matter of fact it directs us back toward technology of a much higher level.

Consider this: Our entire multi-billion dollar sound reproduction industry depends, in one way or another, on the observation that most persons will experience the same type of illusion if subjected to the same type of stimulus. Stereo would have been a total flop if the illusion of lateralization and depth were a random occurrence among the listeners. In other words, there is a commonality of structuring which shows the promise of being analyzed by a higher level of technology than that which we now use.

This higher level of technology might serve as a meta-language which we can use to translate between certain objective and subjective descriptions of the same event. And isn't that really what we want to do if we are to correlate what we measure with what we hear?

Language of Perception

Let me pursue that particular point a little farther. If human perception is structured in the manner I indicated earlier, then any attempt to convey information about personal impressions of a perceived experience might use terminology dependent upon that structure. The language of perception may depend upon inter-sensory analogies of form. We might describe our impressions of a sound in terms of shared experiences of sight, touch, taste, or smell, as well as sound.

A language capable of conveying information about our perception may be syntactically structured to evoke the appropriate sensory imagery. Seen in this light, the symbolic, often flowery, terminology of subjective audio begins to make a bit more sense (no pun intended). There is a language here, and words such as *sharp*, *bright*, and *furry* do convey meaning at an experiential level.

But if this language of perception is based on structural rules derived from, or consistent with, physical experience, then there is a conceptual link with objective measures of the ingredients of that physical experience. But, let me come at this from another direction. If, as Einstein cautioned, it is the theory which decides what we can observe, then the frame of reference establishes the form which that theory will take. When two observations are related to the same event but use different frames of reference (such as our perception of a measurable sound field) then there is a conceptual link between these frames of reference if

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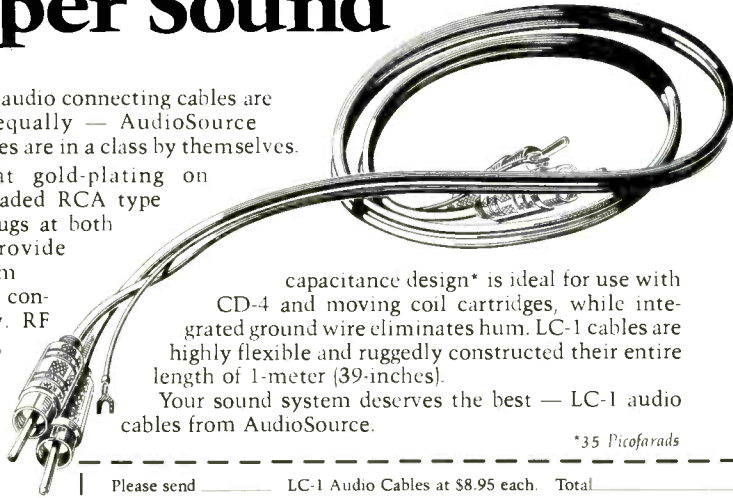
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the observations are internally self-consistent.

If we "hear" the same sort of thing every time we listen to the same set of physical stimuli, then, somehow, the measurements are related to what we hear. But that relationship is never a congruence when the frames of reference are not congruent. It is a foolish person who will draw conclusions about the "audibility" of certain technical flaws in the physical reproduction based on limited "listening" tests and ignorance of the possible differences in the frames of reference.

The first step we must take in quantifying perception is to learn the cipher of its language. But we must do more than just compile a dictionary of terms, because such a list of terms will remain a book of "seven seals" unless we try to understand the structure to which this language is applied—the frame of reference.

Altered Awareness

There is a final point I would like to address in this brief discussion. The illusion which we strive to achieve in the mind of the listener does not have to be an illusion of physical reality. The illusion can be that of an emotional experience based on a frame of reference in which the ingredients of physical reality are of minor importance.

No two persons need necessarily have identical frames of reference for perception. Indeed, our individual frame of reference can evolve and change from one time to another and from one situation to the next.

This altered awareness may be the result of a deliberate act on the part of the observer, or it may evolve quite subconsciously as a result of experience, training, or even emotional state.

I present this conclusion with no intent of becoming embroiled in philosophical discussions of: "What is reality?" or "How do I know that you hear a C major chord as I hear a C major chord?" Instead, I am sticking my neck out and presenting certain technical interpretations drawn from a transformational geometry based on the concept of frame of reference.

This structure of perception or conscious awareness, or whatever you choose to call it, is all too frequently overlooked when we consider the superficial technical aspects of audio. But these things are there when we really strive to understand what it is that we are attempting to do in audio—when we realize that the end product is the listening experience.

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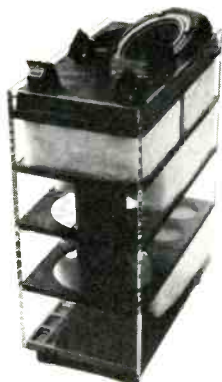
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Lowering distortion in power circuits without compromising their transient response remains a primary problem for designers of audio power amplifiers. Until fairly recently, the favorite technique for removing distortion components in linear amplifiers was to cascade many gain stages to form a circuit having enormous amounts of gain and then using negative feedback to control the system and correct for the many errors introduced by this large number of components.

While the sum of these components' distortions may cause large complex

nonlinearities, the correspondingly large amounts of feedback applied are generally more than equal to the task of cleaning up the performance with only one trade-off—the high frequency performance of the system. Because each amplifying device also contributes its own high frequency roll-off, and because the sum of many of these roll-offs creates a complex, multi-pole phase lag, a system using large amounts of negative feedback tends to be unstable at high frequencies, resulting in phenomena popularly referred to as Transient Intermodulation Distortion (TIM). As this phenomena has been well described elsewhere, it will be sufficient here to point out that two solutions to TIM

problems exist. The first solution is to not require any high frequency performance of the circuit, that is, not to feed it high frequency signals it cannot handle. While this solution works very well for many operational amplifier applications requiring only low frequency performance, it is judged to be unacceptable in high-fidelity applications where frequency response is required beyond 100 kiloHertz. Although human hearing is generally very poor above 20,000 Hertz, ultrasonic frequency roll-offs produce phase and amplitude effects in the audible region; for example, a single pole (6dB/octave) roll-off at 30 kHz produces about 9° phase lag and 0.5 dB loss at 10 kHz. The effects may be sub-

*Threshold Corp.
Sacramento, Cal.

Fig. 1—Characteristics of an ideal transistor.

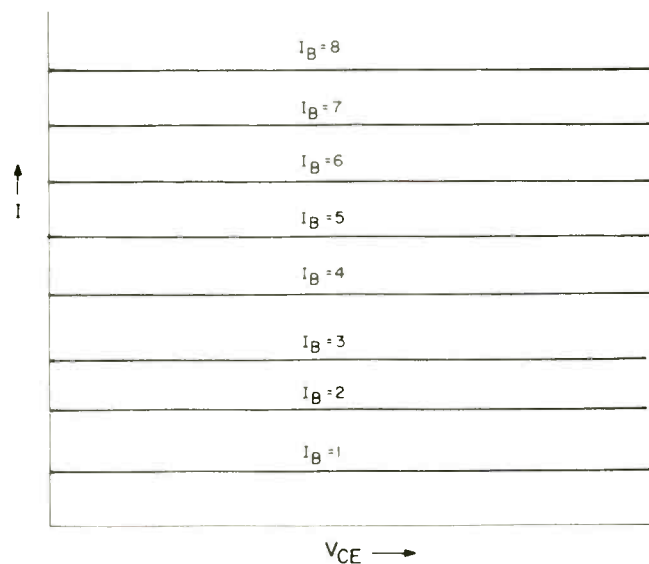
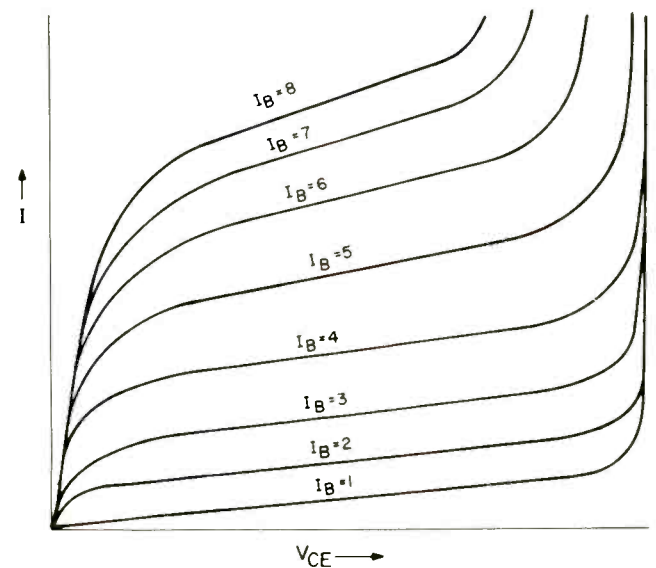


Fig. 2—Actual transistor characteristics.



HITACHI

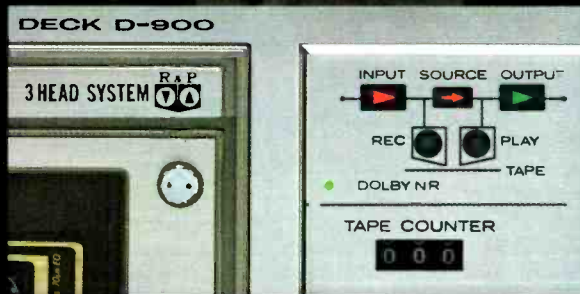
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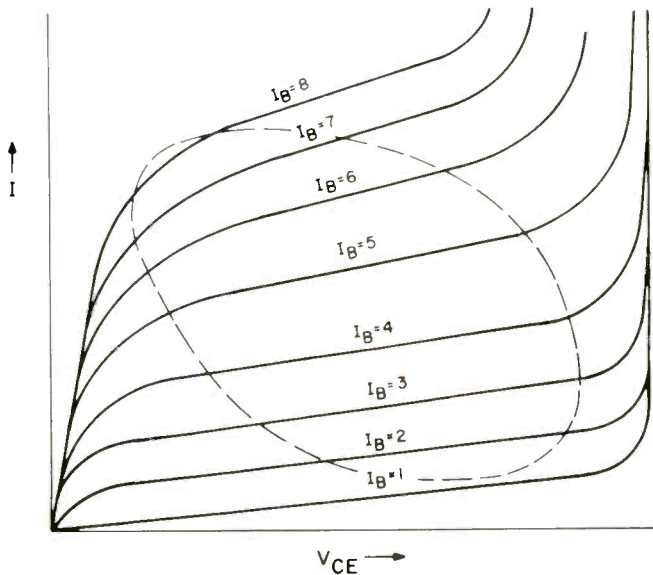


Fig. 3—Operating region of a class-A amplifier.

tle, but their audibility is undesirable in a piece of equipment whose performance is judged by its neutrality.

Because of this bandwidth requirement, designers of state-of-the-art amplifiers are turning to the other solution; simple circuits having few amplifying devices and relatively low open-loop gain. The simplicity and low gain

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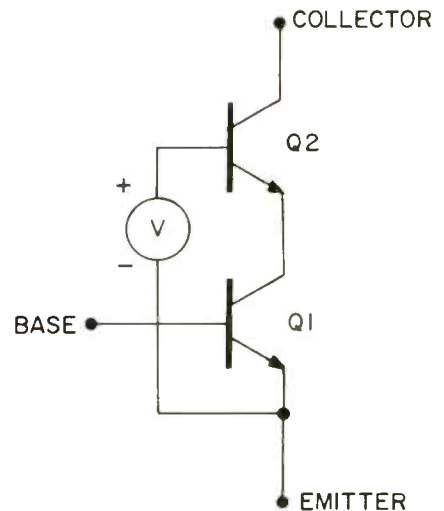


Fig. 4—Cascode operation of transistor Q₁ by the common-base connection of Q₂.

TIM effects, whose high order sidebands bear less resemblance to the naturally occurring harmonics in the music. Musical or not, the lower order harmonics and sidebands still deserve to be removed, and the attention of the best designers has turned to remov-

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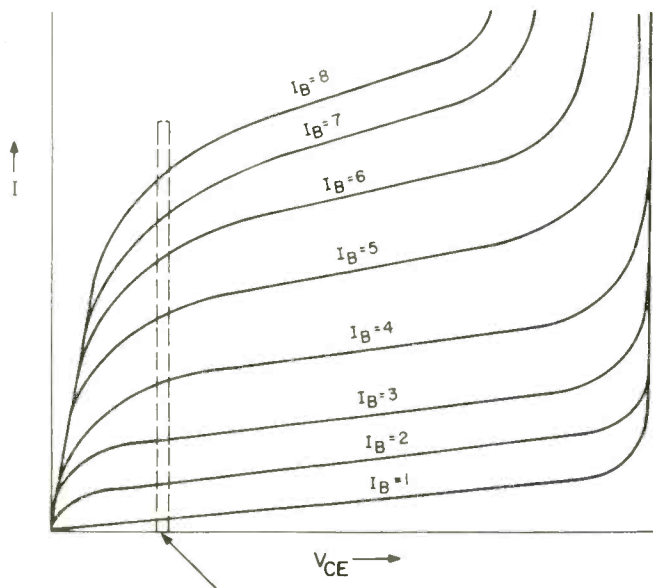


Fig. 5—Region of cascode operation.

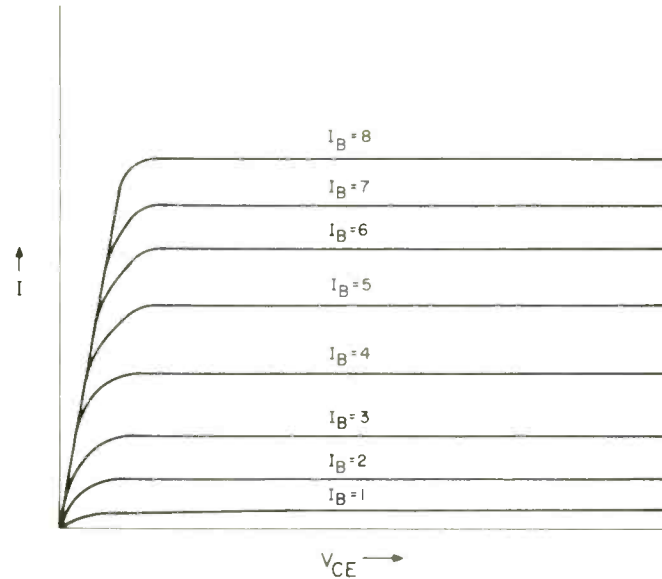


Fig. 6—Effective characteristic of cascode operation.

ing the distortions in the individual amplifying devices themselves, instead of applying corrective feedback to the system.

Altered Gain

To understand the approach to this problem, it is first necessary to note that all distortions arise when the gain

of an amplifying device is altered. A perfectly linear device has a transfer curve which is a perfectly straight line. Any deviations (distortion) from this straight line is the result of a gain factor which varies depending upon the operating conditions. In real life, the gain of a transistor, tube, or FET changes as the voltage across the

device changes and as the current through the device changes. As these conditions fluctuate, the device generates distortion, but if we hold these conditions to a constant, the device becomes distortionless. Figure 1 is a characteristic curve of an ideal distortionless transistor, showing absolute linearity under all conditions,

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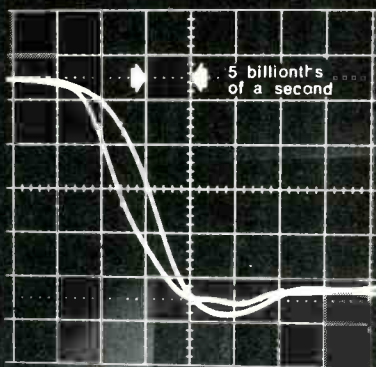
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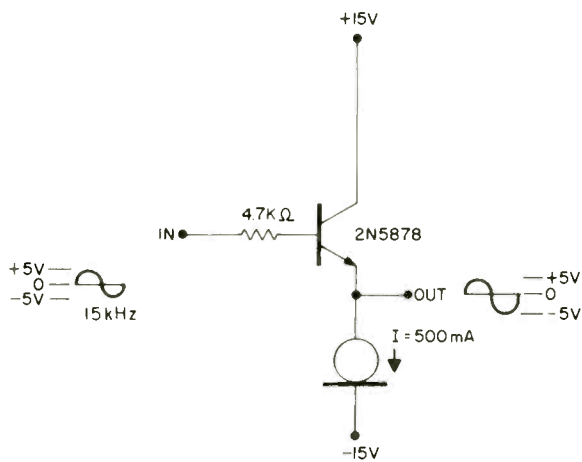


Fig. 7a — Emitter-follower operation.

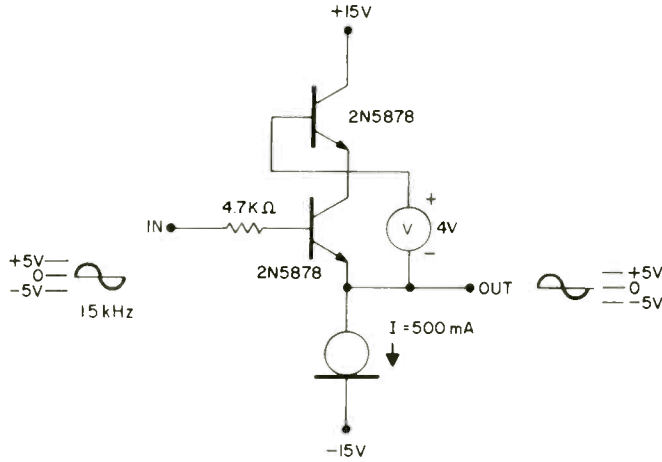


Fig. 7b — Cascode-emitter follower.

whereas Fig. 2 is the characteristic curve of an actual transistor. Notice that the spacing between the parallel lines is unequal, reflecting gain changes with different currents through the transistor, and that they are curved off the horizontal axis, showing gain changes dependent on the voltage across the device. As the transistor wanders through these regions in reproducing the audio signal, its gain alters, causing both harmonic and intermodulation distortion effects. If we can limit the region of operation on this curve, particularly to the area away from the boundaries, the distortion will be significantly reduced.

Recently, the most effective method employed for reducing distortion without feedback has been the use of class-A operation, in which the amplifying devices are idled at very high currents, keeping the transistor in a region on the curve where the nonlinearities are less spectacular, as shown in Fig. 3. While the characteristics of the transistor are less than perfect, the distortions within the boundaries shown are

relatively mild as compared with the more abrupt gain changes outside of the dotted lines.

Cascode Operation

At great expense of efficiency, class-A operation reduces nonlinearities due to current fluctuations through the transistor. However, it does not affect nonlinearities in the transistor due to voltage changes. There is a method for eliminating such nonlinearities called cascode operation, where the voltage across the transistor, tubes, or FETS is frozen at a constant value, completely eliminating voltage-induced distortions. In the case of transistors, the gain device can be operated in common-emitter or common-collector modes that utilizes a second transistor in the common-base mode whose emitter is connected to the collector of the gain transistor, as in Fig. 4. Having essentially unity current gain, extremely wide bandwidth, and no distortion, the common-base device shields the gain transistor from voltage changes in the circuit. Figure 5 shows the operating bound-

daries of such a system, where the operating voltage is frozen to a constant. Figure 6 shows the effective transfer characteristics of such a system, and we see that it more nearly approximates the curves of the ideal transistor in Fig. 1.

A graphic demonstration of the effectiveness of such an arrangement is clearly illustrated by the spectral analysis of a class-A emitter-follower operated without feedback. The circuits in Fig. 7 a & b were operated at 15 kHz at ± 5 volts. The spectral analysis of the outputs of each circuit are shown in Fig. 8 a, b, & c, where the vertical scale is 10 dB per division (80 dB), the horizontal scale is 0-100 kHz at 10 kHz division, and as can be easily seen, the cascode operation of the same transistor under otherwise identical conditions results in the reduction of distortion from several per cent to the residual of the test setup.

Increased Bandwidth

Besides eliminating voltage caused nonlinearities, cascode operation can yield an additional benefit in increased

Fig. 8a — Oscillator residual distortion components.

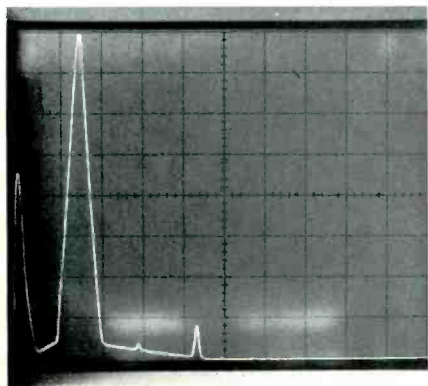


Fig. 8b — The output of the emitter-follower operation.

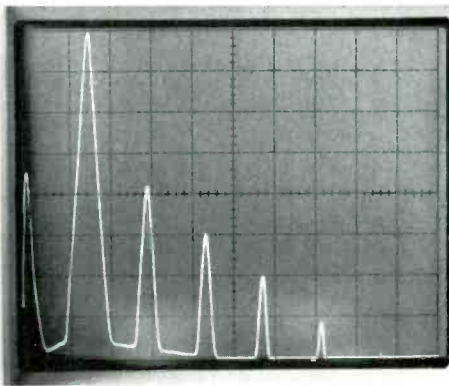
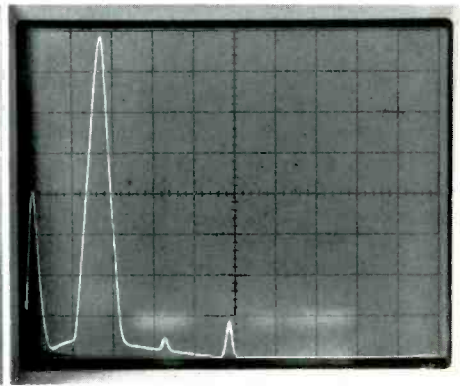


Fig. 8c — The output of the cascode emitter-follower.



bandwidth. Because the collector-base voltage is held constant, there is minimal charging of the collector-base junction capacitance in the transistor. Eliminating the effects of this internal lag capacitance allows higher frequency response, thus cascode circuitry is commonly found in ultra-high frequency amplifiers and wide bandwidth oscilloscopes where response is required beyond 100 megaHertz. Cascode circuitry has also found its way into preamplifier circuitry as manufactured by Dayton-Wright, Paragon, DB Systems, and Audio Directions among others.

current sources, I1, I2 seen near the negative supply rail. Output current gain is supplied by the complementary common collector darlington's formed by Q5-8, and Q9 and Q10 are the common base transistors which hold them at constant voltages. V1-5 are constant voltage sources ranging from two to 10 volts. The voltage sources on the cascode circuits can be generated by a number of arbitrary means, including zener diodes, resistors, or even batteries.

Because voltage-induced nonlinearities take the form of "compressive" intermodulation, it was not

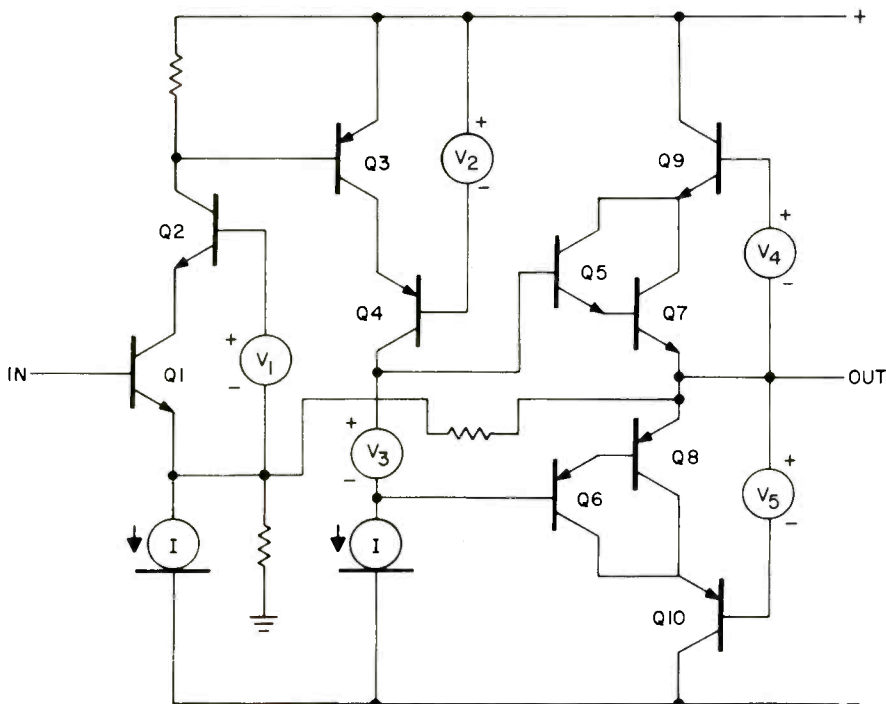


Fig. 9—Basic configuration of the cascode power amplifier.

With all these factors in mind, and noting that the output transistors in power amplifiers would enjoy the beneficial effects of cascode operation, we recently undertook the design of a cascode audio power amplifier (patent pending) where the gain stages and emitter-follower output stages are operated at constant voltages. The conceptual schematic of such a device can be seen from Fig. 9, which serves to illustrate the use of cascode operation on both the common-emitter voltage gain stage and the common-collector output stage. In this circuit, Q1 is the input transistor, held at a constant voltage by Q2. Q3 and Q4 form the cascode common-emitter, voltage-gain stage which generates the full voltage swing of the amplifier. Both parts of the circuit are biased using constant

surprising to discover the sonic effects of utilizing cascode operation throughout a power amplifying system corresponded to an impression of a dynamic range capability considerably beyond what the rated power would suggest. This effect is pronounced at high transient levels and imparts a sense of effortlessness in the reproduction of demanding material.

While the distortion characteristics of a fully cascode amplifier are not equivalent to those obtained through class-A operation, the lack of signal compression produces a subjective "ease" to the reproduced sound that closely approximates that of the smooth nonlinearities which characterize class-A operation and are achieved without the cost penalties attendant to a class-A output stage. Δ

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Equivalent Mass- Fact Or Fiction?

Roger Anderson*

Rare is the audiophile who has not encountered a quantity known variously as "equivalent mass," "effective mass," "tip mass," or some similar combination of words in the specifications for a phono pickup cartridge. The context in which this term is used shows that "smaller is better," but no one has bothered to either explain or define the quantity. From the figures which are sometimes quoted, it seems that this confusion may sometimes be intentional, since an absence of formal definition would permit each user to define it to his own advantage. This article will look at the basic idea of equivalent mass and show how to calculate a number consistent with the basic concept. Additionally, equivalent mass analyses of several popular pickups will be presented.

* Assistant Chief Engineer
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Evanston, Ill.

One may wonder why there should be such great concern over mass—especially fractions of one milligram, which is about the weight of $\frac{1}{16}$ inch square of magazine paper. The reason lies in the fact that the maximum driving force available from a phonograph record groove wall cannot exceed 0.7 times the stylus force without losing contact between the tip and groove wall (see Appendix I). At high frequencies, much of the force required from the groove wall is needed to vibrate the mass (or weight) of the particular moving system of that pickup.

Imagine a weight as in Fig. 1 (say 1 lb.), hanging from a long string. Now move the weight back and forth over a fixed distance (6 inches, for instance). For a one-second oscillation, only a mild force is required, but the maximum force required will be in direct proportion to the square of the number of oscillations per second. In other words, 100 oscillations per second will require 10,000 times more force than one oscillation per second. Consequently, forces which are insignificant at one frequency may well be overwhelming at a higher frequency. The maximum force (F) required to oscillate a mass with simple sinusoidal motion may be calculated from the formula:

$$F = KMa f^2 \quad (1)$$

where: f equals oscillation/sec., a equals total amplitude, K equals constant, and M equals mass.

This formula gives the force required when the force is applied directly to the weight. However, the force requirements may change drastically if a mechanical system is interposed between the driver and the weight. Figure 2 shows the weight driven through a lever system whose own weight may be ignored for this initial analysis. At point 1, the mass obviously looks to the driver like 1 lb., but the situation is more complicated at point 2. We can analyze point 2 by rearranging formula 1 above:

$$M = \frac{F}{Kf^2a}$$

Let us designate conditions at point 1 with the subscript 1, then

$$M_1 = \frac{F_1}{Kf^2a_1}$$

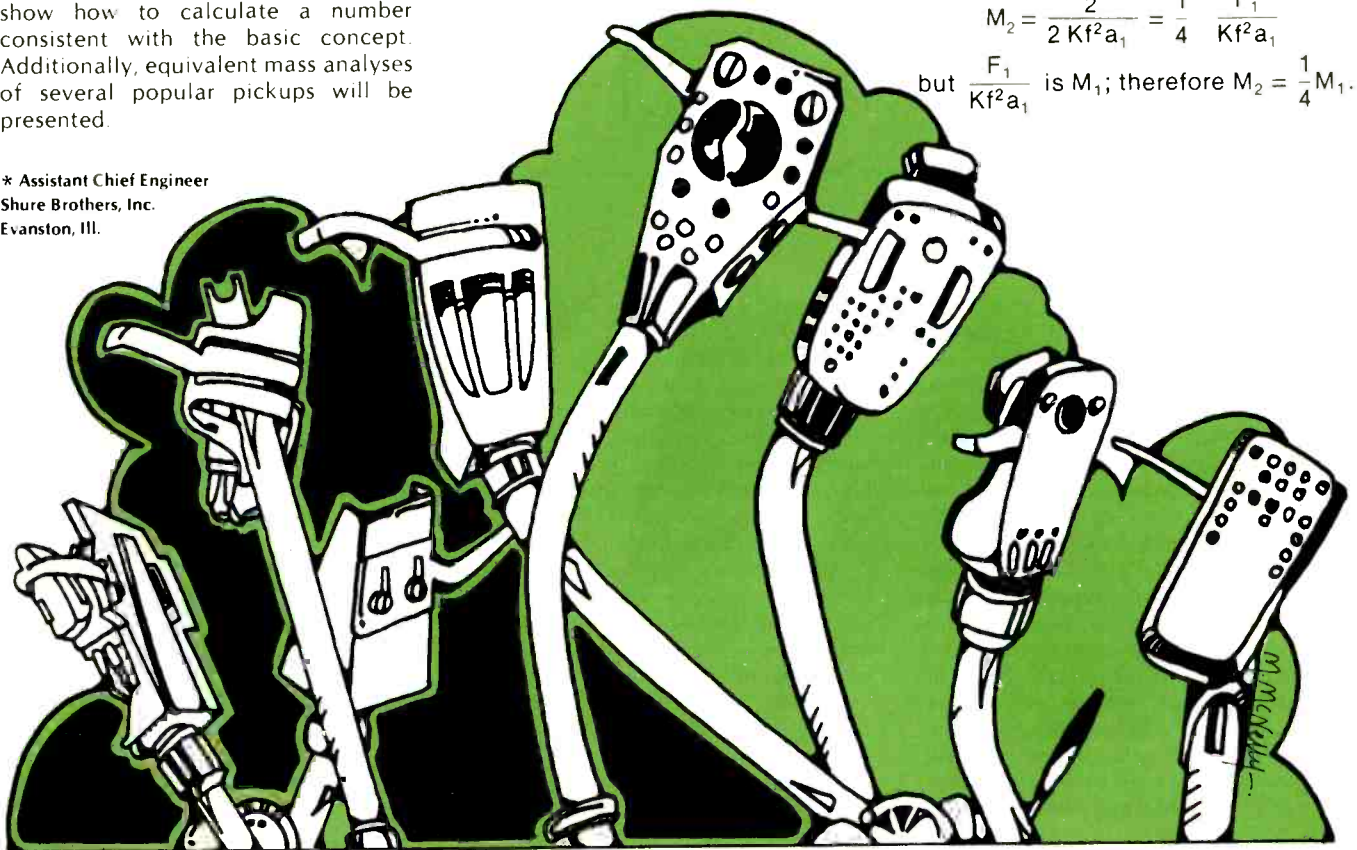
using subscript 2 at point 2,

$$M_2 = \frac{F_2}{Kf^2a_2}$$

Since we are dealing with the same units and frequency at both points, K and f will be the same. Because F is transformed by a 2:1 lever, F_2 will be $\frac{1}{2}$ of F_1 , and a_2 will be twice a_1 . Substituting:

$$M_2 = \frac{\frac{F_1}{2}}{2Kf^2a_1} = \frac{1}{4} \frac{F_1}{Kf^2a_1}$$

but $\frac{F_1}{Kf^2a_1}$ is M_1 ; therefore $M_2 = \frac{1}{4} M_1$.



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Consequently driving the mass through a 2:1 lever decreased the apparent mass to ¼ its former value. Thus, the geometry of a moving system has a profound effect on the apparent mass presented at the driving point.

In practical structures, the mass of any levers must also be considered. The moving system of a phono pickup will typically consist of a metal tube with a diamond tip at one end and one or more transducer elements at the other end, all supported in a pivot arrangement. This structure seems quite complex to evaluate.

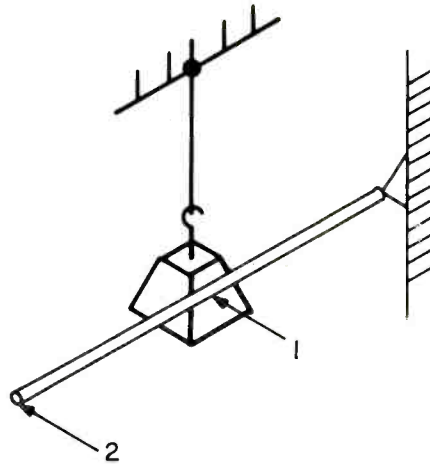
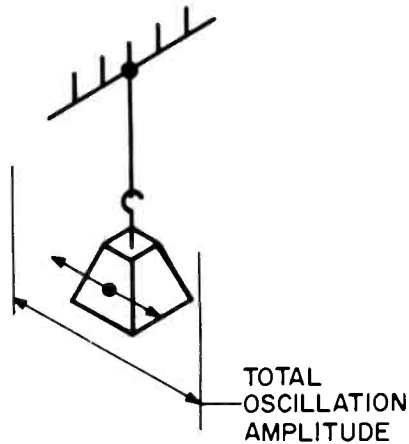


Fig. 2—The oscillating mass with lever drive.

How is Equivalent Mass Calculated?

As an example, consider an aluminum tube typically used for a stylus cantilever member (shank) shown in Fig. 3.

The first step is to find the area of cross section which is done by subtracting the area of the inner circle from the outer:

$$A = \pi(R^2 - r^2) = 0.0000534 \text{ in}^2$$

where R=outer radius=0.009 in. and r=inner radius=0.008 in.

The volume is obtained by multiplying the area by the length:

$$V = AL = 0.0000534/0.220 = 0.00001174 \text{ in}^3$$

where: L=length

Converting to metric (1 in.=2.54 cm):

$$V \text{ cm}^3 = V(2.54)^3 = 0.0001924 \text{ cm}^3$$

The mass is found by multiplying the volume by density (density for aluminum is 2.7 grams/cm³), M=Vd=0.0005194 grams.

The moment of inertia, I_c, about the center of the body is now calculated using reference formulas found in mechanical engineering books. The American Institute of Physics Handbook gives the following equation for a hollow cylinder about its center of gravity:

$$I_c = \frac{M}{4} \left(\frac{L^2}{3} + R^2 + r^2 \right) (2.54)^2 = 0.00001364 \text{ gram cm}^2$$

using the values shown above for M, L, R, and r.

However, the pivot is actually 0.125 in. from the center of gravity, so an additional quantity must be added.

$$I_p = Md^2 = 0.0005194 (0.125)^2 (2.54)^2 = 0.00005235 \text{ gm cm}^2$$

where: d=distance from the center of gravity to the pivot.

The total moment of inertia is the sum of the above:

$$I_t = I_c + I_p = 0.00006599$$

The equivalent mass contribution at the stylus tip is found by dividing by the stylus tip-to-pivot distance squared:

$$\text{Shank } M_{eq} = I_t / (0.235)^2 (2.54)^2 = 0.000185 \text{ grams} = 0.185 \text{ mg}$$

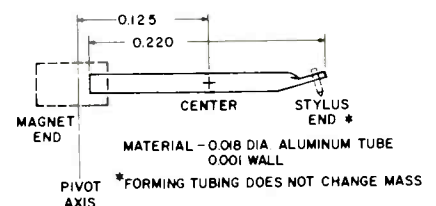
Each of the quantities in Table I is calculated in the same manner, with the exception of the stylus tip, which may be added directly.

Results

In Table I, the equivalent mass analysis is shown for four popular phono pickups. A is a moving-iron type, B is a moving-magnet type, C is a dual moving-magnet type, and D is also a moving-iron type. Comparison of the last two columns emphasizes the fact that the mass (as would be measured on a scale) is quite different from the equivalent mass. For instance, a ranking in terms of mass would be D lowest, then A, and B, with C heaviest at about two times greater than D. However, the equivalent mass ranking would be B lowest, then A, then C, and D. D is more than twice the equivalent mass of B! Consequently, impressions of relative size or measurements of mass can be quite misleading when compared to the equivalent mass, and this is well known by most pickup designers. The individual contributions of the component parts of each structure are also tabulated, both in equivalent mass, and as a percentage of the total.

This parts breakdown illustrates some surprising facts. By intuition, one might expect that the transducer element (magnet or armature) would contribute a large part of the total equivalent mass since it is made of heavy material, but this is not the case

Fig. 3—Typical shank for a stylus assembly.



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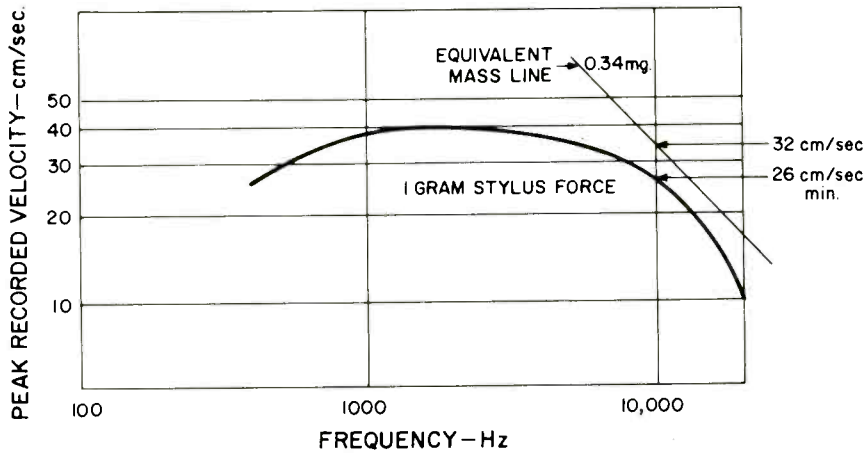


Fig 4—Trackability characteristic of the V15 Mk III phono cartridge.

in three of the four structures. Furthermore, the type with the greatest equivalent mass contribution from the transducer element is a moving-iron type, where the magnetic field is supplied by a stationary magnet.

In the three other types, B, C, and D, the largest single contributor of equivalent mass is the shank, perhaps suggesting that further reductions might be possible in this area. The shank, rather than the transducer principle, might be seen as the most limiting present problem since it is common to practically all pickups.

It is also interesting to note that the diamond tip contributes only 6 to 10 per cent of the total, and that the diameter of the tip influences this equivalent mass much more than the length.

Now that the definition and distribution of equivalent mass has been

discussed, the item which remains is its significance. It is apparent that the equivalent mass is a calculated, not a measured parameter, since it does not lend itself to direct measurement. How can this number be related to a measured parameter of performance?

The answer can be found in the tracking ability curve of the pickup (trackability for short). This curve is shown in Fig. 4 and is determined by finding the velocity at which the pickup mistracks for each frequency of interest. The curve thus defines the boundary between the operating and mistracking area on the curve. From Equation I and Appendix I, we can construct a line on the trackability curve which represents the theoretical trackability of an equivalent concentrated mass. That is, if the pickup had no mechanical characteristics other than its equivalent mass, its trackability

ty should match the theoretical line on the trackability graph.

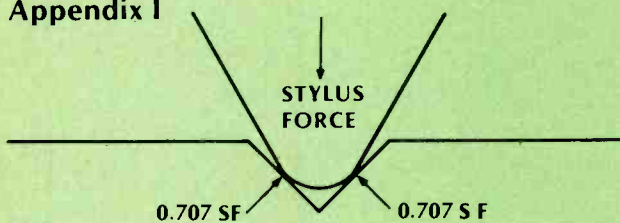
Of course, the gap between the theoretical line and the measured performance represents the extent to which other mechanical characteristics influence the performance of the pickup. Incidentally, the frequently observed effect of a flexibility in the drive system is to cause a resonance to appear which decreases the actual trackability!

The calculated equivalent mass forms a simplified reference point on the high-frequency tracking performance of the pickup, and the difference between this idealized reference and the measured trackability is an indication of the extent to which other mechanical characteristics affect the performance. Predicting the performance of a pickup from equivalent mass figures ignores the substantial difference between simplistic theory and delivered performance. A measurement of trackability, on the other hand, is a statement of delivered performance which involves no wishful assumptions.

Equivalent mass is an abstract concept which may, nevertheless, be calculated in a straightforward and well-defined manner and is easily distinguished from "mass." It has been periodically abused due (I suppose) to ignorance or poetic license, however, the equivalent mass is only one factor among many which determines the high-frequency performance of a pickup.

Therefore, the answer to the original question "Equivalent Mass—Fact or Fiction?" must be an emphatic "Yes!"

Appendix I



When a stylus tip interacts with a groove, two reaction forces are generated at the two points of contact. If either of these forces becomes zero, the tip loses contact and, therefore, positive guidances and mistracking results. Therefore, for the case of 45° modulation, dynamic forces greater than 0.7 times the stylus force will cause a reaction force to become zero. Vertical and lateral modulation may be resolved into simultaneous 45° modulation components, and each component examined to test for the 0.7 F criteria.

Appendix II

The theoretical trackability of a concentrated mass may be calculated from the Newtonian relation:

$$F = ma/980,000$$

where: F equals the force in grams, m equals the mass in milligrams, and a equals the acceleration in cm/sec².

However, in sinusoidal motion,

$$a = 2\pi fv$$

where: f equals the frequency in Hz and v equals the velocity in cm/sec.

F is supplied by the groove wall and is limited to 0.707 of the stylus force SF.

$$\text{Substituting: } 0.707 \text{ SF} = 2\pi fm v / 980,000$$

$$\text{Solving for v: } v = \frac{110,272 \text{ SF}}{fm}$$

Example: The V15 Type III has an equivalent mass of 0.34 mg. What is the trackability of this concentrated mass at 1 gram stylus force?

$$v = \frac{110,272 \times 1}{10,000 \times .34} = 32.43 \text{ cm/sec}$$

This point is plotted on the graph in Fig. 4. When the frequency is doubled, the trackability is halved, and vice versa.

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“Given its features, appearance and performance, this is no mere run-of-the-mill receiver. . . . The excellent audio-distortion ratings . . . obviously place it among the cleanest of the currently available receivers. . . . every aspect of the receiver’s operation and handling was as smooth and bug-free as its fine appearance would suggest.”

Typical of the circuitry and features that result in such fine performance are these: a dual-gate MOSFET front end for high sensitivity, and a special linear-phase filter array for high selectivity, low distortion and wide stereo separation. The preamplifier section has a two-stage direct-coupled amp for accurate

RIAA equalization and a good phono overload capability. And the power amplifier is direct-coupled DC, in a true complementary symmetry configuration, for excellent transient and phase response.

Operating features include a six-LED peak level indicator for each channel; tape-to-tape dubbing with simultaneous listening to other program sources; turn-on time delay; speaker protection plus automatic overload shutdown.

The sound of the R-1050 has been appreciated as much in England as here. For example, the British magazine *HiFi at Home* said: “. . . treble quality was light and delicate, something LUX engineers always seem to achieve. . . . bass output seemed plentiful and strong, as is often the case with enormous, low impedance power supplies.”

If we’ve encouraged you to experience the sound of a LUX tuner/amplifier, your next step is to visit one of our carefully selected dealers. We’ll be pleased to send you the names of those in your area.





Luxman R-1050: 55 watts per channel. THD 0.05%. Suggested price, \$595. Other Luxman tuner/amplifiers: R-1040, 40 watts per channel, THD 0.05%. Suggested price, \$445. R-1120, 120 watts per channel, THD 0.03%. Suggested price, \$895. (Power ratings are minimum continuous output per channel, with both channels driven simultaneously into 8 ohm loads, from 20 to 20,000 Hz, and no more than quoted total harmonic distortion.)

LUX Audio of America, Ltd.

160 Dupont Street, Plainview, New York 11803 • In Canada: White Electronics Development Corp., Ontario



Equivalent Mass Comparison

Structure		Magnet/ Arm.	Shank	Stylus	Other	Total Mass	Total Equiv. Mass
A  Material Mass-mg Moment of Inertia x 10 ⁻⁴ gm cm ² Equivalent Mass-mg % Equivalent Mass	Dimensions						
	Inches L	0.121	0.160	0.021			
	OD	0.031	0.022	0.008			
	Wall	0.0035	0.001				
	Offset	0.020	0.080	0.153			
	Mag. Alloy	Aluminum	Aluminum	Diamond			
	4.8	0.47	0.04		5.31		
0.53	0.259						
0.35	0.17	0.04				0.56	
62.5	30.3	7.2				100%	
B  Material Mass-mg Moment of Inertia x 10 ⁻⁴ gm cm ² Equivalent Mass-mg % Equivalent Mass	Dimensions						
	Inches L	0.070	0.220	0.030	0.100		
	OD	0.030 sq.	0.018	0.006	0.014		
	Wall		0.001				
	Offset	0	0.135	0.235	0.065		
	Alnico	Aluminum	Diamond	Beryllium			
	8.26	0.52	0.037	0.467	9.28		
0.258	0.66			0.153			
0.072	0.185	0.037	0.043			0.337	
21.4	54.8	11.0	12.8			100%	
C  Material Mass-mg Moment of Inertia x 10 ⁻⁴ gm cm ² Equivalent Mass-mg % Equivalent Mass	Dimensions						
	Inches L	0.062	0.280 tapered	0.025	0.035		
	OD	0.016	0.0235/0.017	0.008	0.082		
	Wall		0.0015				
	Offset	0.052	0.120	0.274	0.015		
	Alnico	Aluminum	Diamond	Plastic			
	1.63	1.01	0.05	6.9	11.22		
0.322	1.9			0.35			
0.067	0.391	0.05	0.072			0.58	
11.5	67.4	8.6	12.4			100%	
D  Material Mass-mg Moment of Inertia x 10 ⁻⁴ gm cm ² Equivalent Mass-mg % Equivalent Mass	Dimensions						
	Inches L	0.110	0.255	0.022			
	OD	0.038	0.031	0.0087			
	Wall	0.002	0.0015				
	Offset	0.020	0.163	0.282			
	Mag. Alloy	Aluminum	Diamond				
	3.26	1.57	0.05	4.88			
0.33	3.25						
0.0644	0.633	0.05				0.747	
8.6	84.7	6.7				100%	

NOTE: These calculations are based on dimensions which involve estimation and should be considered approximate.

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Audiophiles who frequently find themselves "back of the box," capitalizing on the flexibility and features of modern high fidelity components, are all too familiar with the humble patch cord — and with

The Perils Of Patchwork

Clyde J. Schultz*



Too often considered a "poor cousin" of the affluent audio system, the patch cord can be the weakest link in an otherwise powerful and responsive electronic network. When it's handled frequently or roughly, it can malfunction, causing signal losses, exasperating on/off operation—and even short circuits, if incorrectly matched.

So, unless you're a compact owner and are quite content just to plug it in and turn it on, it behooves you to know something about the construction, operation, and matching of patch cords—and to equip your music room and portable recording kit with the rudimentary adapters and connectors to handle any problems that may (and probably will) arise.

Basically, a patch cord is a length of cable with connectors at both ends designed to complete a circuit and carry current or a signal from one component function to another. The connectors used for over 90 per cent of patch cords are: 1) phone plug (¼-in. finger dia.), 2) miniature phone plug (⅜-in. finger dia.), 3) subminiature phone plug (0.097-in. finger dia.), and 4) phono plug (⅜-in. finger dia.). Occasionally other terminations are used, such as spade lugs, alligator clips, stripped-and-tinned leads, and banana plugs. Each common termination is described in the illustrated Glossary which accompanies this article.

Though it probably cannot ruin your audio system (unless you have a shorted speaker circuit), a poor, defective, or inadequate patch cord can diminish your high frequency reception, compromise your system's performance, prevent your using it to full advantage—or ruin a perfectly good evening.

Because audio connectors, it seems, follow their own corollaries of Murphy's Law, for example:

- "Anything that can go wrong with an audio connector usually will."
- "Any patch cord on hand is an inch too short."
- "You never have the right cord or connector with you when you're away from home—or when the audio stores are closed."

And it's not until you reach the most important passage of your favorite

symphony or the critical point in a recording session that these rules seem to come into play. At this point, you would be willing to pay any price for a better connection and regret that it was here, of all places, that you decided to save a few dollars.

Rags and Patches

The fact is, there's no such thing as a "bargain" patch cord. As is often the case, bargain prices in connectors usually indicate corner-cutting in manufacture. Though two connectors may look identical, it's trouble-free operation over the long run that counts. Cheaply made plugs may operate well in a "static" mode, but pulling, twisting and frequent handling can mean breakage, short circuits, and frustrating, intermittent operation.

Displaced tips or poor concentricity can mean shunted jacks that won't open. And the junction between cable and plug is the most susceptible to malfunction and the weakest point in "throw-away" cords.

It's difficult to judge quality in products you normally cannot inspect because of blister packaging, but among the features you should look for (or ask about) are 1) positive strain relief, 2) a soldered or crimped bridge sleeve, 3) one-piece molded cable assembly and, 4) shielding, where required.

Keep in mind that each feature requires additional production steps, and therefore adds to finished product's costs, but it's an investment that will prove well worth the extra few cents.

Quality construction is not enough, however. You also must make sure the cord matches its application in such areas as capacitance and impedance. Here again, the salesperson and product catalogs will be of assistance, though specialty cables, such as low capacitance, probably will be clearly marked on the package itself.

Capacitance Impedance

Capacitance is the measure of the amount of electrically separated charges a device (such as a patch cord) can store in the insulator between two conductors, when a given voltage is applied. It's commonly measured in microfarads (μ F) or picofarads (pF). Too-high capacitance can mean the loss of high frequencies, particularly with high impedance circuits and long cable runs.

And in CD-4 "discrete" four-channel systems, where frequencies up to as high as 45,000 Hz are critical, low-capacitance cables (about 15 pF per

foot or 50 pF for a 1-meter cord) are a must.

Impedance is another factor to be considered in selecting a connector, to be sure it's matched to audio levels involved. Impedance is a measure of a circuit's opposition to the flow of alternating current and is expressed in ohms. When it's important to an audio connection, as in microphones or speakers, it will be specified by the manufacturer.

High-impedance circuits themselves can act like microphones, picking up and amplifying stray signals from within or outside the system and introducing interference in the form of noise and hum. Here, low capacitance is important, but proper shielding is an even greater necessity. Shielding also is important in protecting against radio frequency interference (r.f.i.), which seems to be increasing daily as more and more citizens band radios take to the airwaves.

For microphone connections, specify a twisted pair of cables with good shielding (at least 90 per cent). This, in turn, requires connectors with at least three terminations (including one for the ground shield) and fully shielded housings.

With a high audio level (not impedance) outputs such as speaker connections, hum and noise are usually no problem. Current-carrying ratings, however, may be. With a 100-watt amplifier, rms output can be as high as 30 volts at 3.5 amps, with much higher peaks. At levels like these, arcing can occur at connector contacts and introduce noise, so phono connections are a poor choice for speaker applications; they simply are not designed for these levels.

For most speaker applications, a simple twisted pair or parallel two-conductor cable is usually adequate, since shielding is not required. Number 18 or 16 gauge lamp cord is even suitable, but preferably with spade lug or banana jack terminations.

Phono pickup cables require limpness and flexibility to eliminate "pull" on the delicate tracking mechanism, and require shielding to eliminate hum pickup from nearby 60-Hz components. To be sure, always follow the manufacturer's recommendations when replacing phono pickup cables.

Between preamp and amp, the leads are usually short, so resistance is not critical, but shielding and capacitance always are. How much shielding is "enough?" This will vary geographically (as in high CB-use areas) and with the totality of your system. The best test, of course, is to plug it in—then if you

*Vice President
Switchcraft, Inc.
Chicago, Ill. 60630

encounter hum, noise, or r.f.i. you'll know more shielding probably is required.

There's a trade-off between total shielding and flexibility at this stage of development. Belden, for example, sells a 100 per cent shielded cable, but it's very rigid and totally unsuited for microphone use, where movement is important. On the other hand, it may be just the thing for amp-preamp connections where cable flexibility is not nearly as critical.

Combinations and Permutations

At first glance, the variety of audio connectors on display at your stereo outlet or catalog seems bewildering, and usually is enough to send the budding audiophile running for a salesperson. But there's good reason for this seemingly endless proliferation of patch cords and attachments.

A prime factor in their design and construction is "idiot-proof" operation. An array of connector sizes and designs, together with color-coding, theoretically prevents one from inserting a plug in the wrong jack—with possibly disastrous, and certainly non-functional, results.

Technically, one plug/jack style could handle all of the outboard demands of an audio system. The history of connector design since World War II is one of increasing specialization and, particularly, miniaturization.

The DIN (European) design made its appearance just before the War, and the phono plug was introduced (along with the 45-rpm record) shortly thereafter. Since then the trend has been shrinking size, as the demand for compactness and portability has increased. Today, most commercially available connectors are variations on only three or four types, as the glossary that follows this article should make clear.

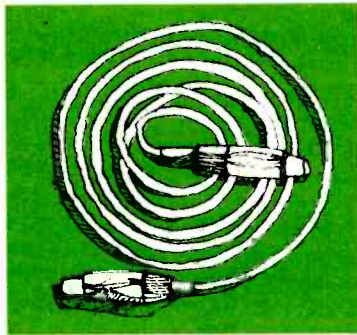
Why not standardize? First, there's really very little need for it, if the audiophile will learn the ABCs of connector language and logic. Second, adapters are readily available to "marry" any two types. And, third, the enormous amount of hardware already in use would make changing over a slow, painful, and perhaps impossible job.

There has been some movement recently within the Electronics In-

dustry Association to standardize dimensions within the various categories, but even here progress is slow, despite the worthiness of the goals—proper mating, better connections, and greater interchangeability of components.

The Complete Circuit

After questions of suitability have been answered by identifying the correct terminations, length, and electrical characteristics that you need for your particular application, it's time to ask the most important question: "How about quality?" We've all heard stories about the spacecraft or airplane that was mysteriously sabotaged—by a 12¢ washer or 9¢ screw. Sound systems operate on the "weak link" principle just like other systems, and performance equals only the "worst case" ability of the most inferior component. And an inferior component can as easily be a cheap



patch cord as an imperfect amplifier capacitor.

Electronic designers choose parts based on "cost/benefit ratio." Simply, this means spending what is reasonable for the necessary desired level of performance; no more—and certainly no less. Audiophiles who have been involved with electronics for a while and experienced salespeople can regale you with stories of plugs that stayed in jacks when cables didn't stay in the plugs, intermittent open/closed circuits that would give Sherlock Holmes nightmares, CB reception on hi-fi systems *when they were turned off* (caused by cabling), and many other practical examples of the perils of patchwork. Less dramatic, but even more insidious, is the very subtle and almost undetectable degradation of ultimate sound quality that can come from inferior connectors and cables. All it may mean is that the extra \$150.00 you spent on your system in a burst of enthusiasm was wasted because the added performance you bought is negated by patch cord-caused sound quality reduction.

Relieving the Strain

Some of the specific advantages that are yours with a quality patch cord have to do not with the connector or cable alone, but with their integration. For example, in-

sertion/withdrawal life is the measure of how well a patch cord will perform a few years in the future, when you've finally installed your system "for good"—after plugging and unplugging every connection who-knows-how-many-times. It is a function of internal and external cable strain reliefs, extra-strong molded construction, and other features that would not be apparent off-the-shelf with even the most sophisticated test equipment. The best measure of this quality is a reputable, manufacturer's name on the package.

Top features include extra-long handles for ease of insertion and withdrawal and minimum strain on internal connections. (Let us say here, since it hasn't yet been mentioned explicitly, that one should never put any strain on the cable; always pull only upon the plug.) Special construction, such as right-angle plugs for cramped back-panels, color-coding for easier-to-follow rat's nests, specific lengths to minimize clutter, all are benefits that come with a premium patch cord. And patching is one place that seeming aesthetic considerations like neatness and proper length also affect ultimate performance by minimizing interaction between signal and power cables.

The ultimate guide should be to choose exactly what is right and needed for your particular job. The discussion of insertion/withdrawal life, for example, wouldn't apply to the assembly of a compact, where connections are made just once, usually for the life of the unit. The value of high-quality patch cords becomes more evident with a component system, where components are rearranged, replaced, and moved, and mechanical flexibility is a decided asset.

For the Odd Couple

Adapters are available in most configurations for the connection of unmatched terminations. For example, DIN connectors on some European equipment, microphone connectors, or other terminations may not match your equipment. Rather than splicing on a new connector (time, trouble—and impossible on borrowed equipment), the correct adapter ensures continuity of all connections—including ground/shield conductors—through the circuit.

Special adapters, such as "Y" adapters, headphone-to-speaker-terminal connectors, remote headphone control centers, and so on will greatly expand both the possibilities and performance of your system.



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Most adapter problems can be solved by a "basic" kit such as Switchcraft model 331AP1, which it is estimated, will handle 90 per cent of the most common patching problems. The kit is especially valuable to field recordists who have to make quick

connections to unknown equipment for temporary use. Of course, for more permanent work, one should always obtain the correct patch cord at the beginning.

When you choose the proper patch cord, your reward will be freedom

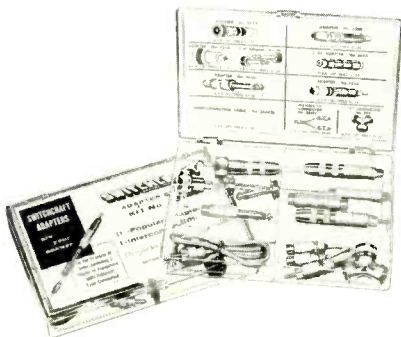
from the concern that anything is in the way of optimal performance by your system. That trouble-free performance will continue for a long time, during which you'll be able to do exactly what you bought your system for, Enjoy it.

GLOSSARY

Adapter A device which converts one type of connection to another. For example, a phone plug to phono plug, or microphone plug to phone jack. An



extremely wide variety of adapters is available; many are incorporated into highly reliable molded cable assemblies.



Adapter Kit An assortment of adapters designed to anticipate the needs of audiophiles or recordists to make a variety of connections quickly and conveniently.

Alligator Clips Spring-loaded metal-jawed clips with serrated inside edges for grasping a single bare wire or terminal; generally used for temporary



test connections. They may be bare or insulated with a flexible boot; some designs have a pin for piercing insulation.

Attenuation The decrease in amplitude of a signal during its transmission from one point to another. Usually expressed in decibels (dB).

Banana Plugs and Jacks A female receptacle and male plug capable of reliably handling rather large currents.

The plug has a single solid center post and four spring-like outer pieces which compress on insertion into the plug and form a large, high-pressure contact area. Some banana plugs "nest" for multiple connections. Some banana jacks also have a screw collar for bare wires or spade lugs. Their most frequent audio use is for loudspeaker connections.

Battery Connector Electrical connector provides power supply connections for battery operated devices. For use with 9-volt transistor batteries, the connector contains a male and female connector that snaps onto mating battery terminals.

Binding Posts Screw-down connectors which accommodate bare wires or spade lugs, frequently for speaker connections. They are sometimes combined with banana jacks as a "universal" connector.

Bushing The mechanical element of a jack usually attached to a panel. It is typically threaded, and held in place by a threaded nut or trim ring. The bushing also serves electrically as part of the sleeve circuit.

Cable An assembly of one or more conductors, usually within a protective jacket. Conductors are insulated from each other, and one conductor is often a shield formed of metal braid which encloses one or more other insulated conductors. Size of conductors (single or stranded) and size of insulation, as well as method of cable construction vary widely according to application.

Capacitance The property of storing electrically separated charges when potential differences exist in conductors separated by an insulator. Low-capacitance tonearm and patch cord wiring is required in CD-4 phono systems, where very high audio frequencies are used.

Clamp, Cable A mechanical device which holds a cable and prevents twisting, pulling and straining from damaging or separating internal connections of conductors from connector terminals.

Closed Circuit Phone Jack Phone jack with a shunt spring connected to tip. The shunt opens the circuit when a plug is inserted, and the shunt closes when the plug is removed. Shunts are used to switch audio connections, such as to divert the audio signal from



speakers to a set of earphones when the earphone plug is inserted in the earphone jack. When the earphone plug is removed, audio is automatically reconnected to the speakers. Three-conductor jacks may also have a shunt on the ring spring.

Connector, Multi-Pin This audio connecting device has two or more pins/contacts inside a metal shield body. Insertion is snap-lock, with a



release clip on the female. Both male and female halves are available for in-line and panel-mount use. Most frequent application is for microphone use in professional applications.

Connector, Single-Contact Microphone A coaxial connector with external threads for tight screw-on connection, which contains a single



center contact. It is usually used with microphones, and the entire body acts as a shield when attached to coaxial cable.

Dielectric The insulating material that separates the conducting parts of a plug or jack.

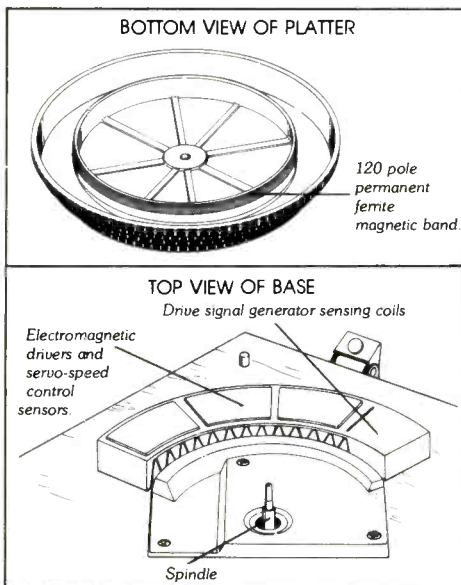
BEYOND DIRECT DRIVE: THE FISHER LINEAR MOTOR TURNTABLE

The direct drive turntable was a great advance in record playing precision. But, Fisher has now taken turntable technology a major step further with the MT6225 Linear Motor turntable system.

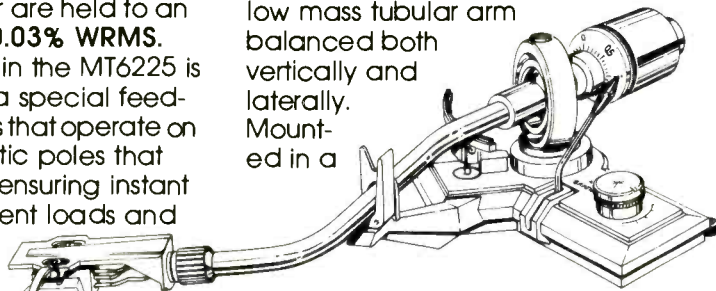
Conventional direct drive systems do a great job of reducing rumble. But the small diameter and relatively few poles (usually 12 or 16) of the motor result in low torque and a distinct "cogging" tendency that can make them susceptible to wow and flutter.

The Fisher linear motor, by contrast, uses **120 poles** and a unique 3-phase **electronic drive system** that produce a perfectly timed sequence of closely overlapped drive impulses. So, cogging is, for all practical purposes, eliminated. And wow & flutter are held to an **incredibly low 0.03% WRMS**.

Speed control in the MT6225 is accomplished via special feedback sensing coils that operate on the same magnetic poles that drive the platter, ensuring instant response to transient loads and long-term speed accuracy within 0.5%. Both 33 and 45 rpm speeds are independently adjustable over a $\pm 3\%$ range, and may be set exactly with the built-in stroboscope.



The tonearm of the MT6225 is as advanced as the drive system, and features an extra-long low mass tubular arm balanced both vertically and laterally. Mounted in a



low-friction gimbal assembly and equipped with calibrated anti-skating, the arm tracks even the most delicate audiophile cart-ridges with ease. Viscous damped

cueing and automatic shutoff are provided, plus a Reject button that returns the arm and stops the turntable at any time during play.

The MT6225 is mounted in a heavy, beautifully finished base equipped with a hinged, tinted dust cover.

Considering the extremely high performance and "beyond state-of-the-art" engineering of the MT6225, you might easily expect to pay \$400 or \$500 for it. But Fisher ingenuity (born of 41 years refining the high fidelity art) enables us to offer it at a price below that of many turntables that don't perform as well: \$200*. The same linear drive system with a slightly different tonearm is available in the MT6224, priced at \$180*.

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*Manufacturer's suggested retail value. Actual selling price determined solely by the individual Fisher dealer.



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Crimp A method of securing a wire within a hollow termination by compressing the terminal around the

Crimped bridge sleeve



wire. Crimping makes an excellent mechanical and electrical connection. No solder is used for crimping.

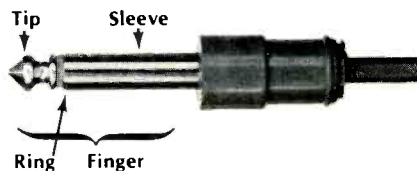
DIN Plugs and Jacks Miniature (Deutsche Industrie Norm) European plugs and jacks with a number of pins



and contacts. The number of circuits are from two through six.

Fahnestock Clips Spring-metal clips used mainly for breadboarding or experimentation. They can accommodate a variety of single-conductor terminations, including bare wires, and hold conductors securely yet temporarily.

Finger The portion of a plug that protrudes from the handle and is inserted into the mating jack. Contains the *tip* and *sleeve* elements (and the *ring* element in a 3-conductor plug), plus insulators for separating these



conductors. Standard phone plugs have 1/4-in. dia. fingers; miniature phone plugs have 3/16-in. dia. fingers; and subminiature plugs have 0.097-in. dia. fingers.

Ground A common reference connection point, such as a chassis of an electronic device, a shield of a coaxial cable, or a metal body of a connector.



Handle The metal or plastic shell which fastens to the main body to form a completed plug. Protects internal terminals and cable clamp.

Impedance Opposition to the flow of changing current. Values are specified

for some components (such as microphones) and their cables when the value is critical. Also sometimes known as the "load" on a circuit or audio device. Expressed in *ohms*.

Insulator Any part of a plug, jack, or cable designed to prevent the flow of an electric current. Insulation must be sufficient to isolate the highest current level that will pass through the conductor (see **Dielectric**).

Inductance The property of a component or circuit which opposes any change in an existing current. Inductance is expressed in *Henrys*.

Jack The female component of a plug/jack combination, which is generally panel mounted.

Jack, Phone A two- or three-conductor connector, originally developed for audio connection. It may be *open-circuit* or *closed-circuit*, and may also have isolated switching circuits as



well. Because of its long insertion/withdrawal life, the phone jack is usually used for headphones in audio applications, as well as high-impedance microphones. Sometimes called a commercial phone jack.

Jack, Miniature Phone A scaled-down version of the phone jack, the bushing I.D. is 3/16 in. as opposed to 1/4 in. for the standard phone jack/plug. It



is typically used in portable, battery-powered equipment. These jacks are usually two-conductor types.

Jack, Subminiature Phone This tiny jack mates with a plug with 0.101-in. finger diameter, and is used in ap-



plications where space is at a premium. Usually a two-conductor type.

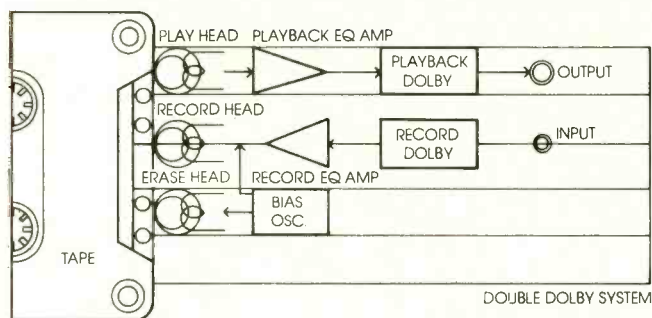
Jack, Phono Also known as an RCA jack, this two-conductor connector has a 3/8 in.-dia. bushing I.D. (nom.), and is a favorite for connections to and from



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Three-Head Design with Double Dolby.*

Not all three-head cassette decks are created equal. Some manufacturers have designed their decks with separate erase, record and playback heads primarily for convenience. So you can tape monitor as you record.

But our new KX-1030 uses separate heads primarily for performance. Each designed with the optimum gap to record or play back sound more accurately.

As a result, the KX-1030 has a frequency response of 35-18,000 Hz (± 3 dB using CrO₂ tape.)

And to let you take full advantage of the separate record and playback heads, the KX-1030 has a Double Dolby* system with separate circuits for the record amplifier and the playback preamplifier. That way, as you record

with Dolby, you can also tape monitor with Dolby, so you hear the sound precisely as it's being recorded.

The KX-1030 also has a Variable Bias Adjustment Control and a built-in oscillator, so you can adjust the exact bias for the type or brand of tape you use.

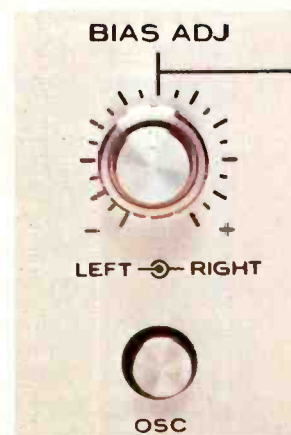
We also built in a number of other features like MIC/LINE mixing, memory rewind and a peak indicator.

But as good as all this sounds, wait until you hear the price. Because at \$375.00,** no other comparably priced cassette deck can match the performance and features of our new KX-1030.

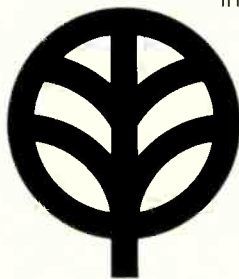
Of course the only way you're really going to appreciate the KX-1030 is to visit your Kenwood dealer. Once you do, you'll be convinced: Performance, convenience, and value set the KX-1030 apart from all the rest.

*Dolby is the trademark of Dolby Laboratories, Inc.

**Nationally advertised value. Actual prices are established by Kenwood dealers.



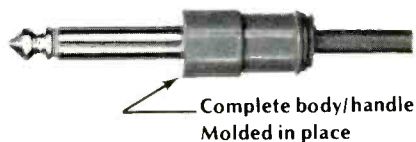
Variable Bias Adjust compensates for tape differences.



KENWOOD

For the Kenwood dealer nearest you, see your yellow pages, or write, KENWOOD, 15777 S. Broadway, Gardena, CA 90248

turntables. Its design is coaxial, providing shielding for low-level signals when connected to coaxial type cables and phono plugs.



Molded Cable Assembly An integral patch cord with connectors and cable fused together in one piece for added reliability, strength, and durability. Assemblies are available in a variety of

lengths, colors, and terminations to fit particular applications.

Plug, Phone A two- or three-conductor audio connector, used to mate with a phone jack. Comprises a body, handle, and finger assembly. (Some types have a cable clamp inside the handle.) Finger normally has 1/4-in. dia. Sometimes called a commercial phone plug. Phone plugs are normally used as terminations on the end of cables.

Plug, Miniature Phone A scaled-down version of the phone plug, usu-



ally a two-conductor type, which mates with a miniature phone jack. Finger dia. is 3/4 in.

Plug, Subminiature Phone An even smaller version of the phone plug, usually a two-conductor type, which



mates with a subminiature phone jack. Finger dia. is 0.097 in.

Open-Circuit Phone Jack A phone jack where the tip (and ring, if used) does not have shunt springs.

Resistance The non-reactive opposition to the flow of direct or alternating current. Heat is produced when current flows through a resistance. Conductors have a low resistance; insulators a very high one. Expressed in *ohms*.

Shielding A metal covering on a connector, or wire braid or wrap around a cable used to prevent undesired radiation, hum, or signal pickup.

Spade-Lug A U-shaped terminal which is usually *crimped* on a bare



wire and attached to a screw terminal or binding post. It is superior to bare wire connections because it prevents damage of the wire; most frequently used for speaker connections.

Spacer A non-conducting (insulating) jack element used to separate and electrically isolate the conducting elements of a phone jack.

Strain Relief A cable clamp or other device used to prevent mechanical twisting and pulling from disturbing the electrical connections within a plug.

Stripped-and-Tinned Leads Wires with insulation removed around the conductor at the end. Wire is then solder coated (this makes stranded



wires stiff). Stripped-and-tinned leads are ideal for making wire connections to screw terminals, and solder lugs on phone plugs, phone jacks, alligator clips, banana plugs and jacks, etc.

76



A superior TUNER on its own separate chassis
A superior PREAMP on its own separate chassis
A superior POWER AMP on its own separate chassis

These add up to three individual & discrete components perfectly molded into one integrated receiver, the TR 2075 Mk II, maintaining the specifications & characteristics that are normally associated with such components, and challenging systems costing much, much more.


In addition, the TR 2075 Mk II offers features available on no other receiver at any price: Pushbutton diode mode selection for silent, positive program switching. A mini-recording studio function that allows tone & filter controls to be switched into the Tape 2 output, plus fade between Phono 1 & Phono 2. Seven different protection circuits. And much more.




See the entire receiver line: 4 models offering the most advanced features & performance in their class. For your nearest Tandberg dealer, call toll-free 800-431-1506, or write: Tandberg of America, Inc., Labriola Court, Armonk, N.Y. 10504.

TANDBERG

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 RECORD

 COLBY NR

TAPE COUNTER
2 1 6



LEFT LEVEL

+7dB

+3dB

▲
PEAK
▲

COUNTER RESET

MEMORY

METER

INPUT SELECTOR

DOLBY NR (MPX)

OFF CH

VU TAPE TIME

LINE MIC/DIN

OFF ON (MPX ON)

3 Minute Warning from AIWA

With the AD-6550's unique new Remaining Tape Time Meter you never have to worry about running out of tape in the middle of recording your favorite music. In the past you monitored your tape visually and hoped that the musical passage and tape would finish together. Now, this extremely easy to use indicator gives you plenty of warning. It shows you exactly how many minutes remain on the tape. So that when you record the "Minute Waltz" it won't end in 45 seconds.

Wow and Flutter: Below 0.05% (WRMS)

The AD-6550 cassette deck achieves an inaudible wow and flutter of below 0.05% (WRMS) thanks to a newly designed 38-pulse FG servo motor and AIWA's special Solid Stabilized Transport (SST) system. And because we use Dolby* we also improve the S/N ratio to 65dB (Fe-Cr). So you can listen to the music instead of tape hiss.

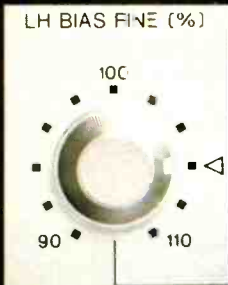
The AIWA AD-6550.
Be forewarned.

AIWA®

LH BIAS FINE (%)

Bias Fine Adjustment

But there's a lot more to the AD-6550. AIWA has included a Bias Fine Adjustment knob that permits the fine tuning of frequency response to give optimum performance of any brand of LH tape on the market.



*Dolby is a Trademark of Dolby Laboratories, Inc.

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Equipment profiles

Armstrong Model 625 Stereo FM Receiver



78

MANUFACTURER'S SPECIFICATIONS

FM Tuner Section

IHF Sensitivity (75 ohms): 1.5 μ V (14.7 dBf).

Frequency Response: 30 Hz to 14 kHz (-3 dB).

THD: Mono, 1 kHz, 40 kHz deviations, 0.2 per cent.

S/N @ 100 μ V (100% Modulation): 65 dB.

Image Rejection: 50 dB.

I.F. Rejection: 100 dB.

AM Suppression: 50 dB.

Selectivity: 56 dB.

Capture Ratio: 1.75 dB.

Stereo Separation @ 1 kHz: 40 dB.

38-kHz Rejection: 65 dB.

Amplifier Section

Power Output: 40 watts per channel continuous, into 8 ohms, 20 Hz to 20 kHz.

Rated THD: 0.18 per cent.

IM Distortion @ 35 watts: 0.08 per cent.

Frequency Response: Phono, 20 Hz to 20 kHz, ± 1 dB; High Level, 20 Hz to 25 kHz, ± 1 dB.

Damping Factor: 50.

Hum and Noise (all inputs): Better than 65 dB, unweighted.

Input Sensitivity: Phono, 3.0 mV/6.0 mV; Tuner & AUX, 120 mV, Tape, 250 mV.

Phono Overload: 75 mV/150 mV.

Bass Control: ± 15 dB @ 70 Hz.

Treble Control: ± 13 dB @ 15 kHz.

General Specifications

Power Consumption: 180 watts.

Dimensions: 19 $\frac{3}{4}$ in. (50 cm) W \times 3 $\frac{1}{4}$ in. (8.3 cm) H \times 11 $\frac{1}{4}$ in. (28.6 cm) D.

Weight: 15 lbs. (6.8 kg).

Price: \$495.00.

The very good looking Armstrong 625 stereo FM receiver tested for this report is part of a family of products distributed in this country by the Sindell Organization, of Los Angeles. The British firm of Armstrong Audio Ltd., located in London, has developed an entire family of high-fidelity component products, all of which use one or more identical circuit modules, as required. From these basic design modules, the company has created five similarly styled, low-profile units housed in rosewood-finished wood cabinets and

graced by matte black front panels equipped with contrasting silver control knobs. Included in the 600 series are an integrated amplifier (Model 621 selling for around \$359.00), an AM-FM tuner (Model 623 at \$359.00), an FM tuner (Model 624 at \$249.00) an FM-AM receiver (Model 626 at \$585.00) and the FM receiver, Model 625, which we evaluated for this report. As is the case with so many good sounding British and European high fidelity products, the emphasis seems to be less on impressive printed specifications and more on



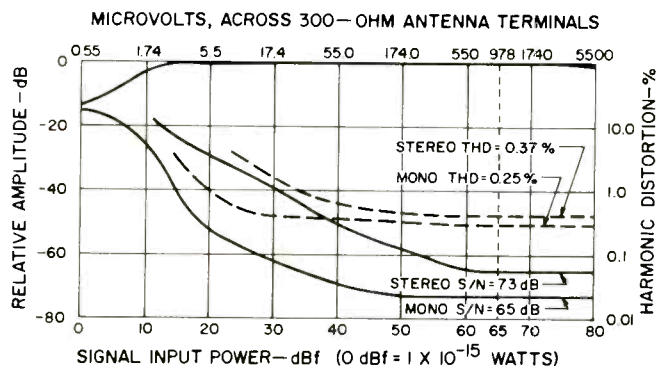


Fig. 1—Mono and stereo quieting and distortion characteristics.

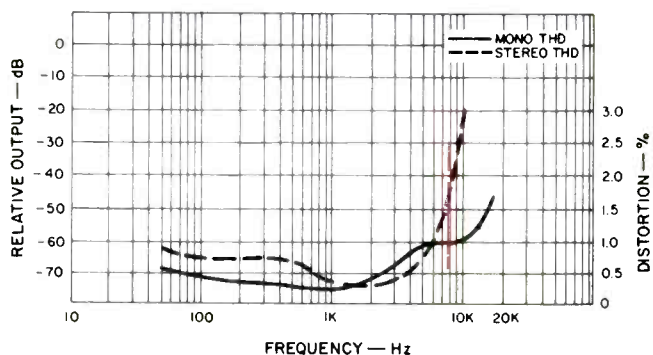
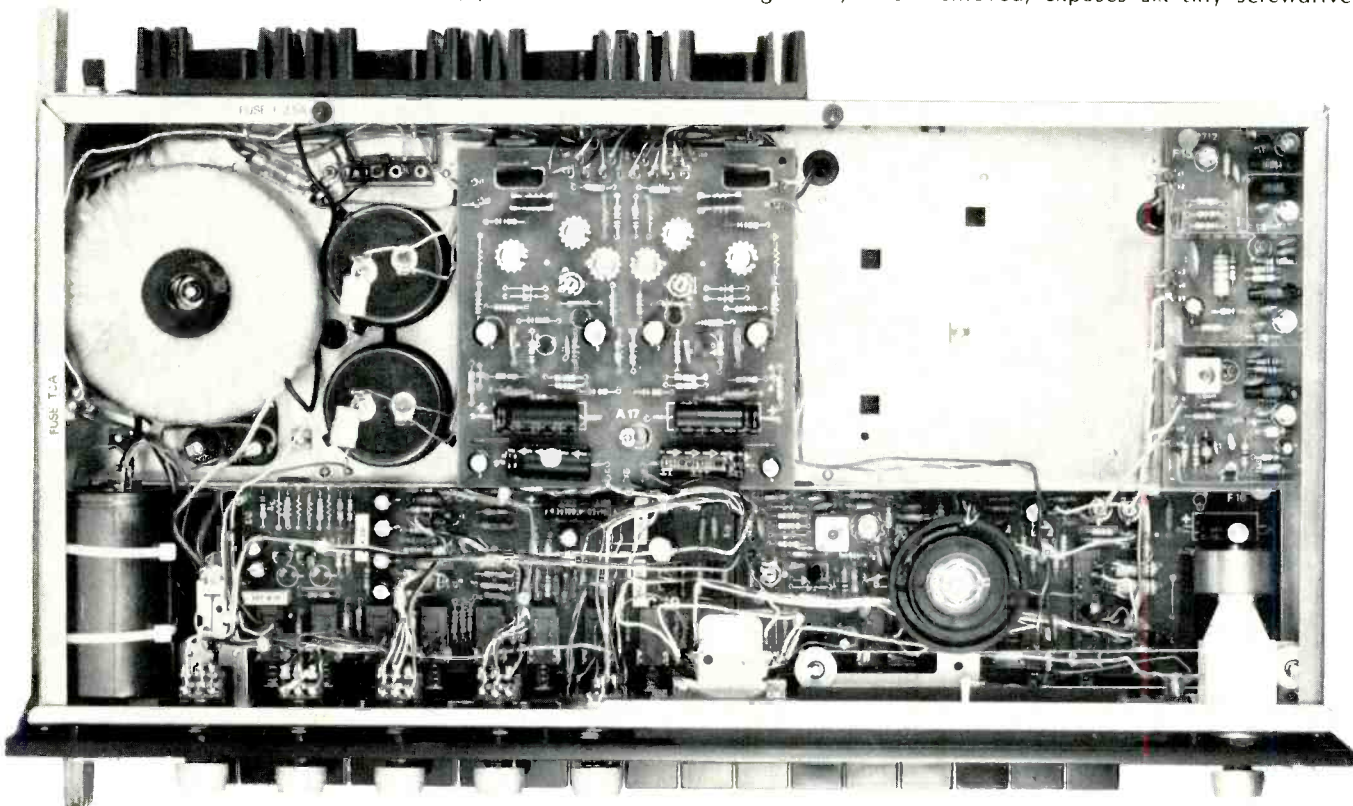


Fig. 2—Distortion vs. frequency of the Armstrong 625.

listening quality and elegance of styling. What Japanese or American manufacturer would dare come up with an amplifier THD rating as high as 0.18 per cent in a receiver expected to sell for nearly \$500.00 these days? And how many high-quality tuner sections would admit to a roll-off of 3 dB at 15 kHz? Well, don't let the seemingly "poor but honest" published specs fool you. This line is "high end" all the way.

The very slim front panel has rotary control knobs for volume, balance, treble, bass, and program source selection. To the right of these are two meter scales which, contrary to expectations are *not* just center-of-channel and signal strength meters. The *lower* meter actually performs both of

Along the bottom of the control panel are 17 piano-key pushbuttons. The first of these turns on power to the receiver. There are a pair of speaker selector buttons, loudness and tape monitor buttons, a button marked "slope" which determines the high-cut filter slopes of the two adjacent high-cut buttons, a low-cut filter button, mono/stereo selector, local-distant switch, AFC switch, a "tune" button (for manual tuning via the tuning knob), and three additional buttons numbered 1, 2, and 3 plus a fourth button identified by a square symbol. These last four buttons permit the user to preselect up to six favorite stations. A plastic cover below the tuning knob, when removed, exposes six tiny screwdriver



these functions (depending upon the setting of the AFC control), while the upper meter actually serves to indicate *relative* frequency settings when the six-station preselect facilities are employed. More about that in a moment. A non-linear FM frequency scale and dial pointer area comes next, with a stereo indicator light integrated into the dial area, and a manual tuning knob with flywheel-assist is at the extreme right of the front panel.

adjustments, each of which relates to one of the three numbered pre-select buttons. With the square-symbol button depressed, the three similarly identified screwdriver slots are used so that three numbered buttons allow for six station selections. This is where the second meter comes in. When a desired station is tuned to manually, this meter indicates a relative tuning voltage (this tuner section is varactor tuned), which makes it easier to find the desired station to be preset

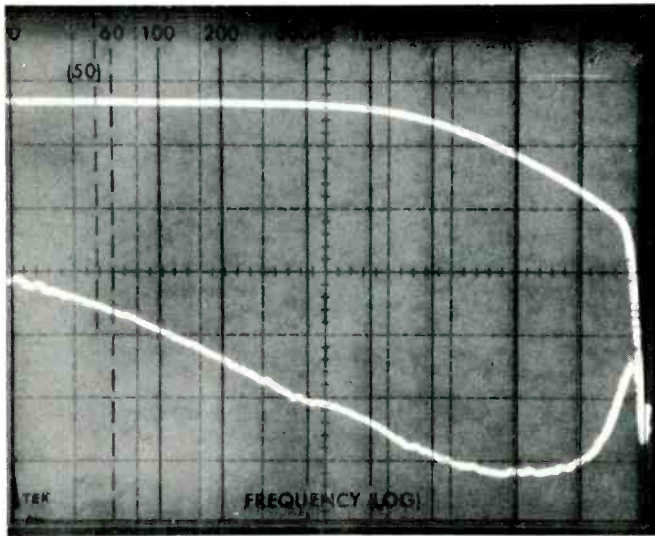


Fig. 3—Stereo separation vs. frequency.

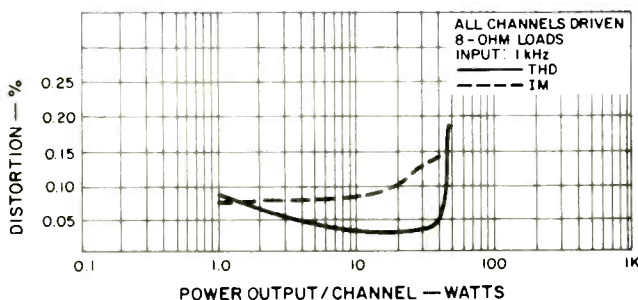
when using one of the multi-turn screwdriver adjustable variable resistors to set the proper pre-tuned varactor voltage.

As is true of many other European produced hi-fi products, all of the connections to the rear panel are made by means of special polarized plugs (for speaker systems 1 and 2) and multi-pin (DIN) plugs for the AUX inputs, phono inputs, and tape-in and out connections. In the case of the Model 625, proper plugs for speaker connection are supplied with the unit and stripped wires from speaker cables can be assembled to these plugs without soldering. As for the other inputs and outputs, our sample was supplied with the necessary phono-plug to DIN adaptor cables so that ordinary pin-plug terminated audio cables could be used with the receiver. Beneath the chassis are a pair of small output level controls which can be used to vary the level of signals at the tape-out terminals to match requirements of any connected tape deck. This under-the-chassis control group also contains a slide switch which varies the phono input sensitivity from 3 mV to 6 mV to suit the phono cartridge used with the receiver.

Circuit Highlights

The FM tuner section of the receiver uses a pair of dual-gate FETS for r.f. and mixer stages and, as mentioned earlier, four varactor diodes whose effective capacitance varies in accordance with d.c. voltages applied and constitute the "C" of the tuning circuits in the front end. Fixed ceramic bandpass filters are used between stages of the i.f. section, and a CA-3012 IC serves as the final amplifier-limiter of this section,

Fig. 4—Harmonic and intermodulation distortion characteristics.



driving a full Foster-Seeley discriminator FM detector circuit. The stereo decoder section utilizes a CA3090 phase-lock-loop MPX IC with frequency lock accomplished by means of a single adjustable coil. Outputs are passed through a low-pass filter for suppression of sub-carrier products.

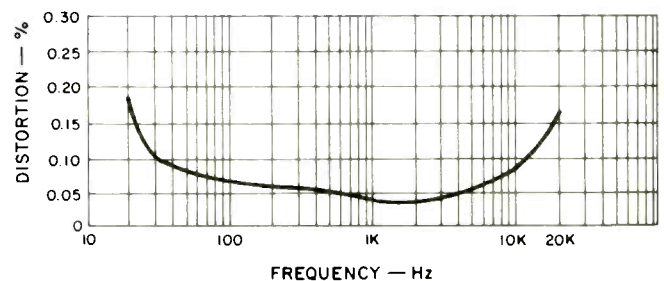
Program input selection is achieved by a new form of non-mechanical switching which Armstrong calls Electronic Gate switching. This diode switching arrangement makes it possible to switch from one program source to another without any audible clicks or pops. The phono low-level preamp circuit consists of two transistors per channel with an appropriate RIAA feedback network applied from collector of the second stage to the emitter of the input stage. Tone control circuitry is of the familiar Baxandall negative feedback type and, interestingly, the tape output terminals are located after the tone control stage so that signals applied to the tape deck can be "equalized" by means of the bass and treble controls before they are recorded. Low- and high-cut filters are all of RC circuit configuration.

The two n-p-n power output transistors are powered from a single +82 volt supply, so that the audio take-off center point between the pair must be capacitor isolated. A 4700- μ F coupling capacitor is used to isolate between this point and the speaker terminals. In terms of protection circuitry, the 625 has individual fuses in the voltage supply lines feeding the output stages of each channel as well as a thermal cutout in the ordinary circuit of the power supply transformer. The power transformer, clearly visible in the internal view of the receiver, is toroidally wound. Circuit layout within the chassis was orderly and well executed.

FM Performance Measurements

Even a cursory reading of the published specifications for the tuner section reveals that the British have not as yet adopted the new IHF/IEEE FM tuner measurement standards which we use in this country. For one thing, they quote usable sensitivity as 1.5 μ V (with a parenthetical reference to the 75-ohm input), which is actually equivalent to 3.0 μ V referred to 300 ohms. This is exactly why the term dBf was invented and, in this case works out to a value of 14.7. The 50-dB quieting sensitivity in mono was 4.5 μ V (18.3 dBf), while for stereo, 50 μ V (39.2 dBf) was needed for 50 dB of quieting. Usable stereo sensitivity measured 10 μ V (25.0 dBf). Ultimate S/N in mono was 73 dB, 65 dB for stereo. Quieting characteristics, as well as the distortion of a 1-kHz modulating signal versus signal input strength, are plotted for stereo and mono performance in the graphs of Fig. 1. At 65 dBf, THD in mono for a 1 kHz signal was 0.25 per cent, a bit poorer than the 0.2 per cent claimed. In stereo, THD was a bit higher, measuring 0.37 per cent. Capture ratio was almost exactly 1.75 dB, as claimed, while alternate channel selectivity was 55 dB. AM suppression was 54 dB, better than claimed, while image and i.f.

Fig. 5—Distortion vs. frequency.



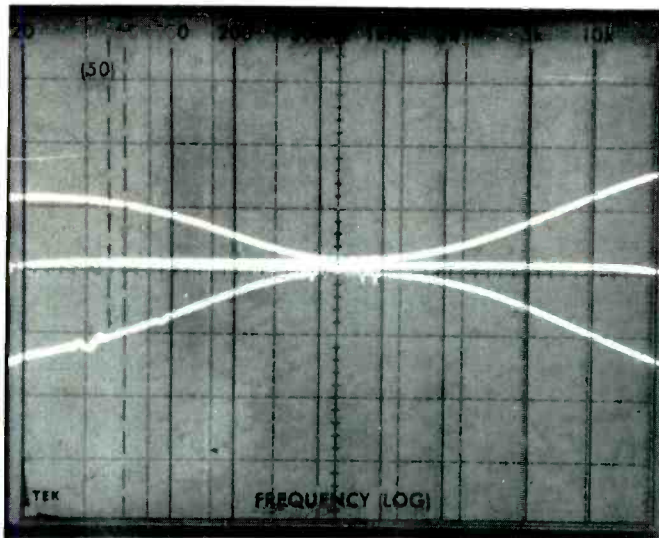


Fig. 6—Bass and treble control range.

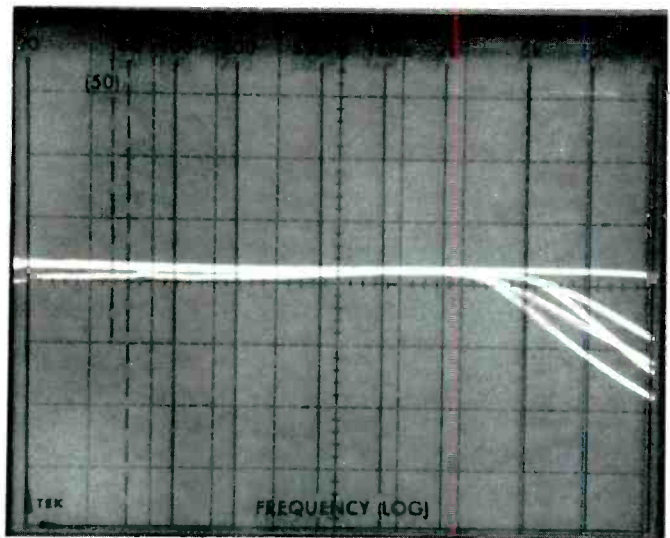


Fig. 7—High-cut filter characteristics.

rejection were measured as 55 dB and 95 dB respectively. Mono and stereo THD as a function of modulating frequency is plotted in Fig. 2.

The 'scope photo of Fig. 3 illustrates the stereo FM separation characteristics of the tuner section. At 100 Hz, separation measured 32 dB, increasing to 45 dB at 1 kHz and then decreasing to a very acceptable 32 dB at 10 kHz.

Power Amplifier Section

The power amplifier sections of the 625 delivered 47 watts per channel at mid-frequencies for rated harmonic distortion of 0.18 per cent. IM distortion measured 0.13 per cent for 35 watts of equivalent output per channel, both channels driven. As can be seen in Fig. 4, harmonic and IM distortion are well below the rated values at all power levels below clipping. Figure 5 is a plot of harmonic distortion versus frequency for 40 watts output per channel, and it is clear that the 40 watt rating (for 0.18 per cent THD) is the highest that could have been legally applied to this receiver's power section since, at the frequency extremes of 20 Hz and 20 kHz, the 0.18 per cent THD point is very nearly what we measured. Damping factor using an 8-ohm reference was 53 at 1 kHz.

Preamplifier Section Measurements

Phono input sensitivity measured exactly 3.0 mV or 6.0 mV, depending upon the setting of the input sensitivity switch. For the high-sensitivity setting, phono overload was 97 mV, while for the lower sensitivity setting, it was 180 mV. RIAA equalization was accurate to within 0.2 dB over the entire audio range, and signal to noise (measured for the more sensitive input setting) was 72 dB referred to actual input sensitivity and unweighted. Surprisingly, the high-level input also measured 72 dB of S/N, referred to rated output (we would have expected better).

Frequency response of the high level input circuits was flat within 1 dB from 15 Hz to 28 kHz and the -3 dB roll-off points occurred at 10 Hz and 38 kHz. Residual hum and noise (at minimum volume, with only the power amplifier in the circuit) was 92 dB below full rated output.

Tone control range is depicted in the 'scope photo of Fig. 6, while the various combinations of high-end filter roll-off are displayed in the 'scope photo of Fig. 7. The action of the sub-sonic filter is not visible in this photo because roll-off begins below 20 Hz, the lower limit of the sweep used to produce the results shown in Fig. 7.

Listening and Use Tests

All of which brings us to a dilemma faced by many an audio product tester. If you have read this report carefully to this point, you may have concluded that the Armstrong 625 receiver is really nothing special. Indeed, competitive products selling for considerably less have more impressive "measured" specs and even a few control features (such as twin phono inputs, double tape-monitor circuits, etc.) that the 625 lacks. All these logical and rational observations hold up well—until you start listening to the receiver. Reproduction in phono is absolutely superb. Given a decent outdoor antenna connection, FM reception is great, too. Dial calibration is very precise and, unlike other pre-set tuners and receivers that depend upon voltages applied to varactors for tuning, we detected absolutely no drift, regardless of whether we pushed the buttons for our six favorite pre-set stations or used the manual tuning mode (which is really nothing more than a precision potentiometer that picks off a varying d.c. voltage for application to those varactor diodes). Control operation is smooth and precise and, as claimed, there are no pops and clicks either at turn on or when switching from one program source to another.

According to a letter we received from the Sindell Organization, the U.S. distributors of the Armstrong line, the tuner section of this receiver (which is identical in the entire line) is used as a separate tuner for monitoring purposes by the BBC in Great Britain. Certainly, they could have chosen a tuner that "measures" better for that purpose—and so could you. But in terms of *audible* performance, we can fully understand the choice. The tuner *does* offer excellent FM reproduction when presented with signals of stations whose program practices are good. We do wish that Armstrong had elected to incorporate a more powerful amplifier in this line, since 40 watts of output does restrict one's choice of loud-speaker somewhat, but so long as higher efficiency speakers are chosen to work with the 625, this is not a serious limitation these days.

As for why the receiver sounds so good but "measures" just average, if I knew the answer to that question, many of the daily and weekly frustrations I experience in the course of testing equipment might be a thing of the past. For the moment, I can only judge by what I hear—and what I heard in the case of the Armstrong 625 was very good indeed.

Leonard Feldman

Circle No. 100 on Reader Service Card

The column



82

Moonflower: Santana
Columbia C2 34914, stereo, \$11.98.

When Santana is on their records are as hot as anyone's. Their problem has been erratic performance, and when they've been off they can induce sleep.

Moonflower closely follows the lukewarm **Festival** album. It is a double pocket album, mostly recorded live in England and Europe with several studio tracks filling out the album. The live material is a cross section of Santana's best stuff from over the years ranging from *Soul Sacrifice* originally done on their first album through *Toussaint L'Overture* and *Black Magic Woman/Gypsy Queen* to *Dance Sister Dance* and the lovely *Europa* from the excellent **Amigos** album and the *Let the Children Play* sequence from **Festival**. Live on **Moonflower** Santana is compelling, even the drum solos. The current Santana is one of the best versions

Devadip Carlos Santana has yet assembled. They play hard and well. The great location recording work of David Rubinson & Friends, Inc. captures all the intangibles, down to the raw excitement of the ambience. These European dates represent some serious concertizing.

Carlos produced the studio tracks with Tom Coster who has lasted with Santana longer than any of Carlos' band-mates. One of them is a master stroke. The idea of a Santana cover of the Zombies' mouldy oldie *She's Not There* only sounds unlikely until you hear it. Then Greg Walker's cool vocal backed by a smoking band rendered unforgettable by a searing Santana guitar solo will stun you. This one is one of the best single Santana tracks ever. Additionally the studio sound work is every bit as fine as the live work, very bright and present, and very responsive. Excellent quality.

Add a wrap-around cover photo that makes a professional-photographer-neighbor of mine salivate and you have, very possibly, Santana's most attractive album to date. M. T.

Sound: A Performance: A

Levon Helm & the RCO All-Stars
ABC AA-1017, stereo, \$7.98.

Levon Helm was The Band's drummer and one of their three lead singers, never a prolific writer. His RCO All-Stars are a little pick-up group that includes at its core Mac (Dr. John) Rebennack, Paul Butterfield, Fred Carter, and Booker T. Jones, with MG's Steve Cropper and Duck Dunn as well. Add a first-rate horn section and tie it up with sound by Eddie Offord renowned for his work with Yes, and you have got to have a winner of an album.

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You shouldn't need a separate shelf, elaborate motions or an act of Congress to clean your records. A comfortable, hand-held instrument that works best on a rotating turntable is ideal.

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The value of a truly fine record cleaner is justified by the cost of replacing your record collection. Fifteen dollars is a small investment in long-term protection.

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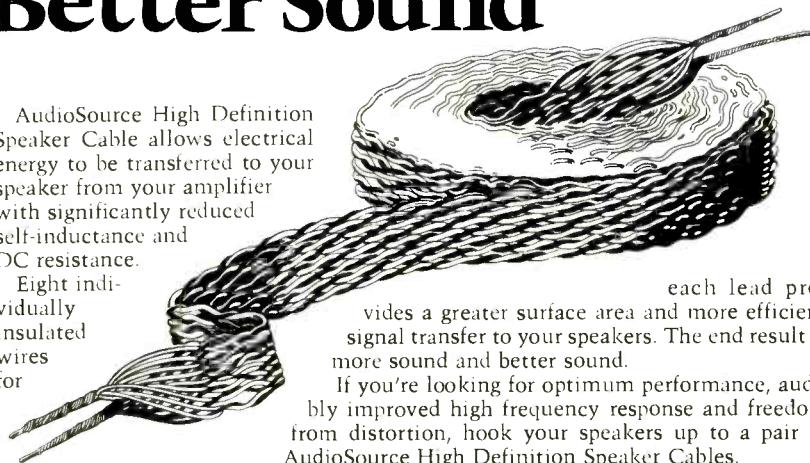


discwasher, inc. 1407 N. Providence Rd., Columbia, MO 65201

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 Signed _____
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 Name _____
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Enter No. 7 on Reader Service Card

The All-Stars play mostly blues in a 50s R&B vein, stuff like *Milk Cow Boogie*, *Blues So Bad*, and *Sing, Sing, Sing* on which fellow Band members Robbie Robertson and Garth Hudson sit in, Chuck Berry's off-beat *Havana Moon* given a superb thumping treatment, and band master Henry Glover's *Rain Down Tears*. Of slightly more recent vintage is Dr. John's *Washer Woman*. The musical approach is not too far afield from The Band's sound on the live *Rock of Ages* album only much more vital than The Band has been able to approximate in ages.

It's such a simple formula that it borders on genius. If you take players as good as they come and have them play some of the music they love most, you will record some dandy tracks. When they are taking that old music and not trying to recreate it, but instead making it their own (as The Band did on their oldies album *Moondog Matinee*), it'll verge on the extraordinary. And **Levon Helm & the RCO All-Stars** does just that.

Understand, this is no oldies album. This is a music album of the first order. M.T.

Sound: A Performance: A

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Live and Let Live: 10CC
 Mercury SRM-2-8600, stereo, \$11.98.

10CC has always been a band whose live performances have been inferior musically to their recorded works, but who seemed to be able to make up for it with an abundance of energy and a slice of flash guitar which usually didn't make it onto the studio creations. However, relatively recently half of the band (Kevin Godley and Lol Creme) left to make self-indulgent instrumental works, and the band sound has changed remarkably with their exit. The five CC of 10CC have been replaced by three fine players, but gone is the fiery interplay of individuals. For *Live and Let Live* is an album by a bunch of players who happen to have written the script but who don't necessarily know how to read it properly outside of their home territory, the recording studio.

This could just be a lackluster performance with all the parts played right, but even with that to consider, there's just not a whole lot happening here. The records of 10CC are highly dependent upon multitracked vocals and guitars, and the interesting modern orchestrations can easily make up for an occasional clinical atmosphere. Here the songs are provided with a relatively skeletal

track, but are treated no less antiseptically. The vocals are pushed way up front, which occasionally works on the hits (*The Things We Do For Love*), but more times than not makes it sound like the record was designed strictly for AM radio.

The playing is OK, the singing is fine, and if you've got any of their other records, you probably know already that Eric Stewart and Graham Gouldman can write some extremely catchy and progressive songs. But with a wooden performance, even the most powerful tunes are able to show only their faults, and so **Live and Let Live** only sets 10CC one step further back in their careers. It seems like the type of album a group would deliver to their record company solely to fulfill a contractual obligation; if this is the case, so be it—let it serve its legal purpose, but it's a shame to expose their fans to such below-par records.

J.T.

Sound: C— Performance: C

Draw The Line: Arrowsmith
Columbia 34856, stereo, \$7.98.

They must really have been hurting for tunes when they made this album. You can tell by just checking the

credits: They deliver a lackluster treatment of the old blues tune *Milk Cow Blues* and guitarist Joe "Do I Have My Ron Wood On Straight" Perry is allowed to sing one song, something which never could have happened if lead singer/Jagger-clone Steve Tyler had enough songs to fill up a record.

Speaking of credits, everybody gets a credit here but the individual members of the band. Only Tyler gets credit for playing (piano on *Kings & Queens*), and if the musicianship wasn't so lackluster, I'd be inclined to guess that outside musicians were brought in. Then again, after seeing this band in concert that is still a possibility, as I've never seen a high school band play with such a refined sense of ineptitude.

Enough slander. The lyrics aren't even up to their usual standard of stooopid-amusing, and the only song which qualifies as being interesting is the title track, *Draw The Line*. At least I can't tell where it's stolen from (their last hit which I enjoyed, *Sweet Emotion*, was lifted directly from The Rolling Stones' *We Love You*) and when a Mickey-Moused Tyler chimes in after the break, it's amusing.

So much for their redeeming social merits. This band's innate ability to rub

me the wrong way gets stronger every day, so let me just dismiss them with the words *They Ain't Got Nuthin'* and be done with it. J.T.

Sound: D+ Performance: F+

Life on the Line: Eddie & the Hot Rods
Island ILPS 9509, stereo, \$6.98.

Be Seeing You: Dr. Feelgood
United Artists UAS 30123 (import), stereo, \$7.98.

Both of these bands started as strictly blues outfits with punkish leanings, and both have grown up immensely in the past year or so. They may not be the most consistent groups around, but nobody can accuse them of being less than 100% energetic and every once in a while each of them comes up with a winner tune of the highest order. To tell you the honest facts, I didn't expect albums this entertaining from either one.

The Rods have all but dropped their blues repertoire and sound like a recharged version of The Who, or something thereabouts. The title track, *Leave This Town*, and the very catchy & incredible *Do Anything You Wanna Do* (a top-20 single in Great Britain) fuel the album with a pop sensibility which I find irresistible. The produc-

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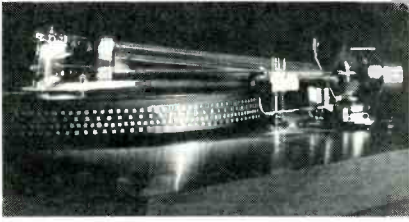
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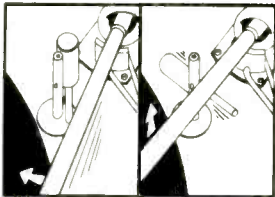
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86

tion of Eddie Hollis really works—the brutish, clean guitars, and Daltrey-like vocals make a winning combination almost all the time on side one and about half the time on side two.

The Feelgoods have made a major transition with the loss of guitarist/big attraction Wilko Johnson, the band's irrefutable on-stage personality, replaced by the more than competent John Mayo. Their instrumental sound has grown by leaps and bounds as a result of it, as Mayo plays rings around Wilko, and the band sounds more like a unit and less like one man's toy. If only they had a wealth of original material as strong as their latest composition, *She's a Windup*, this album would be an absolute delight. Unfortunately, their reliance upon outside writers for a good portion of the tunes leaves one feeling less than totally satisfied with **Be Seeing You** as a band statement. Nick Lowe's production is not to be faulted, but it would appear that more can be done with their sound—and more encouragement given to them as songwriters—when it comes time to do the next record. I mean, side two is practically unlistenable and after seeing them I know they can do better, but considering the major shuffle that just went on in the band, this is a most surprisingly good album. But now that they've proven that indeed there is a Feelgood beyond Wilko, they should keep on going and prove that there's a group that can write a whole album here. *J.T.*

Rods

Sound: A — Performance: B +

Feelgood

Sound: B + Performance: B

Spring Flowers: Vasant Rai

Vanguard VSD 79379, stereo, \$6.98.

Coming as it does out of the blue, Vasant Rai's first album, fusing Indian music with Western improvisational music, is an unexpected delight. Basically, he is backed by the shamefully under-recognized group Oregon, substituting Dilip Naik for Ralph Towner and adding charter Mahavishnu Orchestra violinist Jerry Goodman.

As with Oregon's music, **Spring Flowers** consists of textured music. The Eastern flavor is obvious and expected. The emphasis shifts between the varied sounds of Rai's sarod and flute, Naik's guitar, Goodman's violin, producer Collin Walcott split between various hand percussion items

and sitar, and Paul McCandless' oboe and horns. Glen Moore on piano and bass acts as foundation.

Though some pieces have the appearance of ragas, there is something rather different going on. Rai shows a fine sense of melody combined with an excellent feeling for structure, and his music should catch Western ears at once more easily and yet without compromise. That is the essence of fusion. The album flows as melifluously as its title. *Michael Tearson*

Bryter Layter: Nick Drake

Antilles AN-7028, stereo, \$4.98.

This, the second of the late Nick Drake's three albums, was his masterwork. His music was possessed of utter calm that flowered fullest in this collection. *At the Chime of a City Clock, One of these Things First, and Northern Sky* are gentle, probing songs. *Poor Boy* gradually levitates behind Ray Warleigh's sax and the voicings of Doris Troy and Pat Arnold. Joe Boyd's production is restrained and graceful, wonderfully attuned to this very sensitive and introspective artist. Boyd has also coaxed superlative support performances from then Fairport Conventioneers: Dave Mattacks, Richard Thompson and Dave Pegg plus John Cale, drummer Mike Kowalski and especially from arranger Robert Kirby.

Bryter Layter is very special for how it can take the complexities and vexations of a day and make them appear simple. It is a perfect calmative for over-heated friends and lovers.

As with **Five Leaves Left** (AN-7010), the Antilles release is a first in America. Both are albums of timeless, ageless music from a voice stilled much too early on. *M.T.*

Sound: B Performance: A +

The Joy

Fantasy F-9538, stereo, \$7.98.

The Joy reunites Terry Garthwaite and Toni Brown, the queenpins of the late and almented Joy of Cooking. As before, Terry's interests lie in the grittier material, Toni's in the more country and softer, more melodic. Oddly they complement each other, each making the other sound more effective.

Their music together has always had a warmth and maturity to it. On **The Joy** a crisp, clear, bracing sound further complements them. To old fans the reunion is long overdue, and to anyone it is like a fresh breeze. *M.T.*

Sound: A — Performance: B +

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AUDIO • March 1978

Tape & turntable

Mark Levinson Acoustic Recordings, Volumes 1 to 5

In the era of direct-to-disc recordings, it is refreshing to find that superb sounding records, without pops and clicks, can be produced from tape masters with results that are not far removed from the state-of-the-art sound of direct-to-disc records. Certainly, tape hiss and surface noise is almost totally nonexistent on this series. The source of these super records is Mark Levinson Acoustic Recordings Ltd. (55 Circular Ave., Hamden, Conn. 06514)—the same Mark Levinson who produces excellent moving-coil phono cartridge preamplifiers, as well as preamplifiers, amplifiers, all of those other "goodies" one finds in the esoteric audio systems. Since the usual records of today, emanating from both foreign and domestic record companies, are mixtures of tape hiss, surface noise, and music, Mark Levinson set out to make records using tape that will give perfect sound reproduction. After listening to the first five volumes, we believe that he almost succeeded in reaching his goal.

Others have, in the past, also come close to producing a perfect record using tape, however, the direct-to-disc records have generally been a bit better in terms of low noise. It is obvious that the technical leaders of the recording industry are making progress, and their discs are better than ever, witness these. However, it's my opinion that the direct-to-disc and recording-on-tape processes will not be the major methods of producing records for more than about two or three more years. Digital recordings and discs seem just over the horizon, what with the advent of the digital tape recorder and the laser beam playback equipment now being perfected for reproducing digitally encoded discs. Then, we will truly be able to listen to recorded music without the intrusion of pops, clicks, hiss, and other sundry noises presently available on records at no extra charge.

For the technically oriented

audiophile, the Levinson recording equipment consisted of a specially modified Studer A80 tape recorder, using one-inch tape (four channels) at 30 ips. Volume one was recorded on a Stellamaster, using ¼-in. tape (two channels) at 15 ips. The microphones used were the Bruel & Kjaer 2619 and 4133. We understand that the microphones went directly into the tape recorder without benefit of a console, thus reducing the possibility of distortion, noise, and an increase in the S/N ratio. Mark Levinson was the recording engineer in all cases. The mastering of Volume 1 was supervised by Robert Ludwig, and the remaining records were mastered by Robert Ludwig in France. The recording, mixing, and playback electronics were made by Mark Levinson Audio Systems Ltd. Mixing was done through a custom mixer directly into the cutting amplifier of a Neumann lathe (SX-68) that was highly modified by Philips. Filtering, limiting, noise reduction systems, reverb, or other effects were not used. The records were pressed in Antony, France, by C.I.D.I.S., using special pressing techniques developed by them to produce these quiet record surfaces.

Of special interest is the fact that there are no spliced passages so that the coherency and immediacy of the musical event, rather than the note-by-note perfection of spliced tape, are preserved.

These Mark Levinson Acoustic Recordings are available only from Mark Levinson audio dealers, so if you can't find these records locally, you may order them directly from the company at the address given above. These exceptional records also have an exceptional price, \$15.00 for each record, though the tape-based competition and direct-to-disc records are similarly priced. It is obvious, then, that these records are intended primarily for the advanced audio enthusiast with superior equipment, who is constantly looking for state-of-the-art recordings. The musicians may not be world famous, but the recordings could become world famous. The music may

not always be the best musical example, but the sound is certainly exciting. For the connoisseur of the superlative, we strongly recommend the Mark Levinson Acoustic Recordings.

Review of these five volumes was done on a system consisting of the Technics SP-10 Mk II turntable with EPA-100 tonearm and 205C—IIIX cartridge, Phase Linear 4000 preamplifier, Crown DC 300A amplifier, Duntech Labs DL-15B speakers, and Janis W-1 subwoofers.

J.S. Bach: The Six Schübler Chorales (S. 645/50), Myrtle Regier, organ; Prelude in E flat Major, *Organo Pleno* (S. 552), Britt Wheeler, organ; Rejoice in the Lord, Anon.; Magnifica, Tallis; Lord, Let Me Know Mine End, Greene; Battell Chapel Choir, Charles Krigbaum, director. **MAL-1 Volume I.**

The six Schubler chorales were not originally composed for the organ, but rather are Bach's transcriptions of movements of his own cantatas, composed for instruments and voice. These chorales were recorded in February, 1973, during a live concert in Dwight Memorial Chapel, Yale University on the H. Frank Bozyan Memorial Organ, built by Rudolf von Beckerath of Hamburg, Germany, consisting of 42-stops, three-manuals, and mechanical action. This is not an outstanding baroque organ, but quite adequate for these chorale preludes. The second side features excerpts from a concert for organ and choir as performed before a live audience. We found the program pages being turned, chairs shuffled, coughing and other sundry noises to be annoying and distracting. The performance is acceptable, considering the circumstances of recording before a live audience. Although this particular organ music has no spectacular bass notes, the pedal accompaniment for the Greene piece is very good, and can be best heard on audio systems having low frequency response to below 40 Hertz.

M. Ravel: Valses Nobles et Sentimentales. J. Haydn: Sonata No. 49 in E flat Major ("Genzinger"). Lois

Shapiro, piano. **MAL-2, Volume 2.**

Generally speaking, the piano is just about the hardest instrument to record. On this record, Mark Levinson succeeded admirably in recording the nine-foot Mark Allen Concert Grand with the result that appears to be a piano playing within our listening room, rather than a record. The Haydn sonata, seldom recorded in the past 10 years, is presented in a superb rendition.

Bill Elgart: A Life. Bill Elgart, percussion. **MAL-3, Volume 3.**

This unique piece in 10 movements consists of the artist utilizing cymbals,

drums, bells, and other percussion instruments. Each movement is vocally announced, probably by Elgart. Although the sound is about the best recorded percussion we have ever heard, the musical fare leaves us flat. However, the recording can easily indicate the ability of a stereo system to reproduce transients, etc. The composer/player is a jazz drummer who seems to have been influenced more by classical musicians than the Gene Krupa type.

Anyone having a copy of the original pressing of Elgart: A Life—Volume 3 (blue label and white jacket) may exchange it at no cost for a more quiet

version by returning the record to MLAR.

New Haven Brass Quintet: Presents Music for Brass by Bach, Debussy, Handl, Hindemith, Ives, and others. **MAL-4 (two records), Volume 4.**

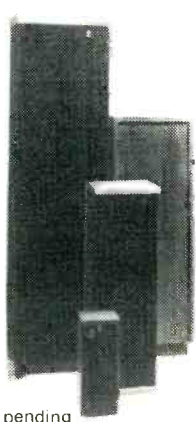
The quintet consists of two trumpets, horn, trombone, and tuba, and they present a myriad of music from the sixteenth century to the present. A speciality of the group is music by Charles Ives. There are four sides of terrific brass sound, with excellent arrangements that allow the quintet many chances for highly dynamic and expressive playing. The recording was made in April, 1974, in a series of sessions at Battell Chapel, a high-ceilinged-neo-Gothic stone structure at Yale University. For the audiophile, this record will indicate the abilities of his speakers' midrange better than almost any other recording; if it is good, then this album will sound exceptionally good.

J.S. Bach: The Art of the Fugue (S. 1080). Charles Krigbaum, organ. **MAL 5/1 to 5/4, (four records), Volume 5 (45 rpm).**

This music was not written for any particular instrument or ensemble, and it was instead up to the performer to make the choice. Thus, the listing cannot be found in Bach's organ works. Even the title, *The Art of the Fugue*, may have been chosen by someone (after Bach's death) at the time of publication. The final fugue was not completed at the time Bach died. On this recording the fugue stops with the last notes Bach wrote, ending the piece abruptly. The final fugue is followed by the hymn, "Vor Deinen Thron tret' ich hiermit," S-668, ("Before Thy Throne I Now Appear") which is better known as "Wenn wir in höchsten Nüthen sein" ("When we are in greatest need"). The four records cover 15 of the 18 counterpoint scores Bach wrote for this series. They are performed rather well by Charles Krigbaum on the von Beckerath organ at Yale University that was used for Volume I of this series. Since these fugues were not written for the organ, it would've been nice if the organ had been registered more towards an ensemble sound and played with a bit more imagination. The fugues are presented in the order of simple Fugues, Canon, Stretto Fugues, Canon, Double Fugues, Triple Fugues, Canon, and Quadruple Fugue. Since this is a four-record album of fugues, we cannot recommend that anyone try to listen to it all at one time—even Bach fugues can become tiring. It should be noted that this album has been recorded at 45 rpm.

B. V. Pisha

AUDIO • March 1978



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Jazz & blues



Gary Roseman

Lightnin': Lightnin' Hopkins
Tomato TOM-2-7004, stereo, two records, \$8.98.

This set was apparently released on the Poppy label about eight years ago, though there's no indication on the cover (other than a quote by the late Ralph Gleason) that this is a reissue. In any event, its reappearance is most welcome, as this is one of the great Lightnin' Hopkins albums.

This should come as no surprise when you consider that it was co-produced by Arhoolie Records' Chris Strachwitz, who always manages to extract the most out of Hopkins. Perhaps this is because Strachwitz allows Hopkins unrestricted freedom to create on his own terms. The 20 cuts in this album are, for the most part, split between the two formats Hopkins sounds most comfortable with—solo,

and in a duo with a drummer. Moreover, the drummer is ex-Muddy Waters veteran Francis Clay, who not only impels Hopkins onward, but more importantly complements the singer-guitarist's metric idiosyncracies by maintaining the beat with a flexibility that neither confuses nor clashes with Hopkins. Significantly, the one really lackluster track is *Rock Me Baby*, on which Hopkins is joined by a full band.

By himself or with Clay, Hopkins is uncommonly inspired here, both vocally and instrumentally. Though several of the songs are Hopkins standbys (*My Starter Won't Start This Morning*, *Ain't it Crazy*, and *Hello Central* among them), there is nothing trite or tiresome about these re-recordings, even when he sticks to tried-and-true guitar licks.

In addition, he fashions highly personalized renditions of blues and

r&b classics. Ray Charles' *What'd I Say* begins as a relatively straightforward vocal, but then Hopkins' curious structural eccentricities take over and transform it into a boogie-guitar showcase. *Baby, Please Don't Go* is notable for the way he lets his guitar "sing" for him. For example, the song's title phrase is shortened to *Baby, ple*, with the guitar finishing the rest of the line.

Three tracks are particularly noteworthy. *Black and Evil* is one of his highly emotional philosophical pieces, with a heart-rending, downcast vocal, lowdown guitar, and tenacious drums. *Mojo Hand* appears in two very different versions. The first is a vociferous, bass-heavy romp with Clay drumming hard; Hopkins' guitar break is higher and quicker than normal. The second version is unaccompanied,

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with fleshier, less bassy chording. Rounding out the album is an eventful assortment of moaners, shuffles, and boogies.

Hopkins' voice and guitar have rarely been so closely spotlighted—his mumbled asides, conversational phrasing, and tight picking have never stood out so audibly before. Clay is crowded into one channel, but is appropriately balanced nonetheless. Unhappily, these virtues are offset by excess tape hiss, and numerous pops, clicks, and bits of static. *Tom Bingham*

Sound: B+ Performance: A

Straight Ahead: Eddie "Lockjaw" Davis

Pablo 2310 778, stereo, \$6.98.

Eddie "Lockjaw" Davis is a straight-ahead, unrepentant swinger, and this is one of his best albums in some time. Nobody else sounds like "Jaws," and on this release, his strong, virile, tenor sax, supported by the superb Tommy Flanagan Trio, stretches out on nine tunes, most of them standards.

In this well-balanced selection of blues, ballads, and standard pops, the visceral Davis horn roams free—gruff and exciting on tunes like *Wave and Lover*, lustily romantic on *Gigi*, *I'll Never be the Same*, *On a Clear Day*, and *Watch What Happens*.

Davis is usually associated with blowing excitement when he plays with Count Basie, but there is tremendous all-around mastery of the tenor here as demonstrated on this well-recorded Pablo release. *John Lissner*

Sound: A Performance: A

Stomping On a Saturday Night: Blind John Davis

Alligator AL 4709, stereo, \$6.98.

Pianist-singer Blind John Davis' recent European comeback gets a much-needed American boost with the U.S. release of a live album originally issued in Germany on the Chrischaa label.

Though Davis is best known here as an accompanist on dozens of pre-war Chicago blues sessions, his repertoire is by no means limited to the 12-bar moaners and stomping boogies one would expect from a pure blues artist. Davis was a popular nightclub singer before he made his mark as pianist for Tampa Red, Bill Broonzy, Sonny Boy Williamson, et. al. His versions of *Got the World on a String* and *Summertime* on this album are hardly the work of a "natural" down-home bluesman, but an experienced stylist whose high,

gritty voice retains a goodly amount of jazz polish, albeit weathered by age and tempered by a dollop of Fats Waller-ish wit.

Similarly, *Limehouse Blues* and King Oliver's *Dippermouth Blues* are not—titles to the contrary—staples of the blues repertoire. Indeed, Davis' stride-like improvisations on *Limehouse*, throwing dashes of Teddy Wilson and Earl Hines into a bubbling boogie-stride cauldron, are more jazz than blues, and pretty solid jazz at that. *Dippermouth*, on the other hand, gets a lighthearted, raggy-boogie treatment.

Such eclecticism has made Davis the sort of "compleat entertainer" who invariably endears himself to club audiences, while risking the wrath of hard-core blues purists. But any doubts as to his blues/boogie credentials are instantly dispelled on the opening *Jim Town Blues*, with its fast-paced rolling bass and bright, syncopated right-hand chords. *It's My Boogie* is a genial tune, incorporating a few waggish quotations. His arrangements of blues-r&b standards are spiced with affable personal touches, such as his jump-rhythm ostinato on *Kansas City* and his churning bass lines on *When I Lost My Baby*, *Every Day I Have the Blues*, and *St. James Infirmary*.

The distinctly American-sounding German audience is warmly responsive and apparently acquainted with Davis' act, but their stiff, uncoordinated hand-clapping gets in the way of the romping *Cow Cow Boogie* and the pumping *Pinetop's Boogie Woogie*. Still, you can't put them down for having as good a time as Blind John himself, who obviously relishes every bit of the applause, cheers, and audience banter. Even purists should find the music's infectious spirit as totally irresistible on record as it must have been that night in Bonn's Club Popular. Enjoy it. *Tom Bingham*

Sound: B Performance: A—

Twin House: Larry Coryell & Phillip Catherine

Atlantic ATL 50342 (import), stereo, \$8.98.

Summit sessions like this rarely meet expectations. The musicians often play in a format to which they are not accustomed (Oregon and Elvin Jones), or they each play down their normal style in deference to the other. Here it's the latter as both musicians drop their better known electric axes in favor of acoustic guitars to bring their talents more into line with each other. Rather than the blistering sonic assaults which Coryell can harness, they rely on subtlety, speed, and intonation.

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Coryell is no stranger to acoustic music, having one near classic album of it with Ralph Towner and Oregon, **The Restful Mind**. Philip Catherine, while relatively unknown in the U.S., is a monster in Europe. His short stint with Focus was only a brief respite from people like Charlie Mariano, Kenny Drew, Charles Mingus, and Jasper van't Hof's Pork Pie. He plays clean, fast, and angular with none of Coryell's flash.

On **Twin House** they play unaccompanied duets with a rhythm line over-cubbed on a few tracks. They each alternate rhythm and leads

sometimes coming together for a quick flurry or some improvised counterpoint. The best cuts are the movers like *Twin House* and *Twice a Week* where the intricate lines become so blurred that the final resolve seems like it was plucked out of the air.

While Coryell's meeting with John McLaughlin on **Spaces** was more brilliant, and **The Restful Mind** was more cerebral, **Twin House** finds its place as a relaxed session by two virtuosos who are picking each other's brains out. *John Diliberto*

Sound: A Performance: A—

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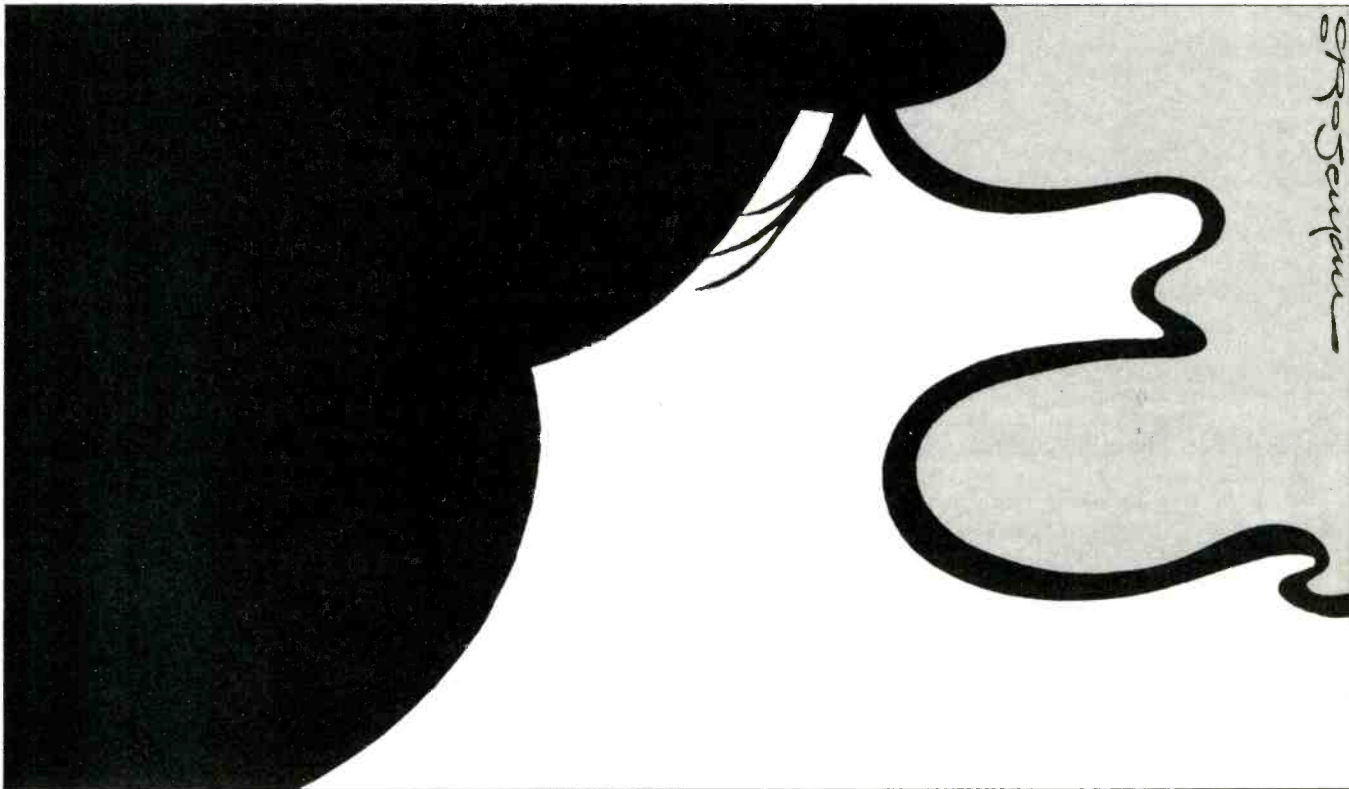
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Cary Roseman

92

Sailing Into Walpole's Marsh

Innisfree-Green Linnets SIF 1004, 70 Turner Hill Rd., New Canaan, Conn. 06840, stereo, \$6.98.

The title tune, we are told, refers to "the poachers who fished by night in Lord Walpole's waters." So here they come, four young Irish musicians, participants in the Smithsonian's Bicentennial Festival of American Folklife, slipping ashore to raid the nets, then off to the water again, smooth as silk, and neat and complete . . .

Here's Sean Corcoran, now. One of the founders of the Tradition Club at Slattery's Pub in Dublin, Sean offers you here four songs in the English, though he'd be just as comfortable in the Gaelic, as he sings that way back home too. Here, he lilt from the lament for *Bold Doherty* through *Johnny and Molly's* parting song, and the comic dialect piece, *The Mice Are At It Again*, to a (probably) 18th-century

Irish version of the Child ballad, *Johnny Scott*. He's a singer in the old "shan nos" style, familiar to those of you who have heard Cathal McConnell of the Boys of the Lough.

And there's young Maeve Donnelly. Only born in 1958, of all things, the slip of a lassie is still too young to compete as a senior in the All-Ireland fiddle championships, which is probably just as well, since she's won every other thing that's been made available for her already. To hear her, whether alone as in the otherwise untitled *Two Reels* (and who ever learns the names of tunes they pick off the wireless, anyway?) or together with Eddie Clarke's harmonica, in such a pairing as the *Two Jigs* whose names can't be recalled either (and do names really matter when you're playing tunes for pleasure?) is to be dazzled by virtuoso technique, firm control of tone, crispness of bowing, neatness of finger-

ing, and all of the other reasons why she's a celebrated fiddler for dancing. Maybe some other time we'll hear her on the slow airs; but there's no need to be greedy about it all, is there?

Especially not when you have Mairead Ní Dhomhnaill at your elbow, all set to burst into song at the tip of a hat. Mairead's flutelike voice will do you in, from the opening slides of a strange and ethereal *Barbara Allen* to the last dying notes of *Nobleman's Wedding*, one of those songs you wouldn't sing in front of the priest. When they made voices, they fitted the linnets and then Mairead, and then the rest of us.

Eddie Clarke, now, is a boy who plays an instrument as strange to Irish music as it is to bluegrass, and yet when once you've heard it, it seems so obviously right. The harmonica, or mouth-organ as it's called back home (some people also call it a "harp," but

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that would only confuse things in the land of Carolan), chimes right in with Maeve's fiddling in the opening reels, and he runs rings around *Music in the Glen/Green Fields of America* all by himself. And his Sligo reels, *The Morning Star/The Mountain Top*, show you how flute music sounds on his bonnie wee harp, too (mouth-harp, maybe?).

All in all, a lovely bit of poaching. It all makes you feel like the most pleasantly robbed and richly rewarded Lord of the Western world; and don't you just deserve it for buying their album?
John McLaughlin

Today: Marie Knight

Blue Labor BL 106, stereo, \$6.98.

Marie Knight rose to fame some 30 years ago as the late Sister Rosetta Tharpe's singing partner. After several years as one of gospel's top stars, she defected to r&b, quickly fading after a handful of early successes. Little has been heard from her in the past decade, though talent as enormous as hers is too valuable to go to waste.

Her bounteous contralto is as strong and sure as ever, particularly on slow, traditional-styled moaners like *Today* and *Where He Leads Me*, which show off her graceful tremolo, unostentatious embellishments, and sincere, deep-felt soulfulness. If you've been looking for a successor to Mahalia Jackson, listen to the heart-rending *In My Home Over There*, the moderately swinging *Jesus Met the Woman at the Well*, the acutely soul-stirring *His Eye Is on the Sparrow*, and her zealous wailing of Mahalia's theme, *Move On Up a Little Higher*, and your search may well be over.

Knight receives perfect, unfaltering support from a highly adept, wholly compatible combo. The keyboard work is superb, with sensitive idiomatic chords by pianist Floyd Waite and tastefully pertinent, bright-toned organ by Virgie Knight. Blues guitarist Louisiana Red is listed as "special guest," but he thankfully subdues his personality in favor of the group identity. Ex-Larry Coryell bassist Mervin Brunson and drummer Earl Williams could hardly be better.

Not only is the music choice, the engineering is just about the best I've ever encountered on a gospel album. The sound is clear, the balances well considered, and the surface clean. The only problem is perceptible pre-echo on those tracks accompanied by keyboards only. *Blue Labor* is located at 342 Madison Avenue, New York, N.Y. 10017.
Tom Bingham

Sound: A — Performance: A +

Pickin' Joins Audio

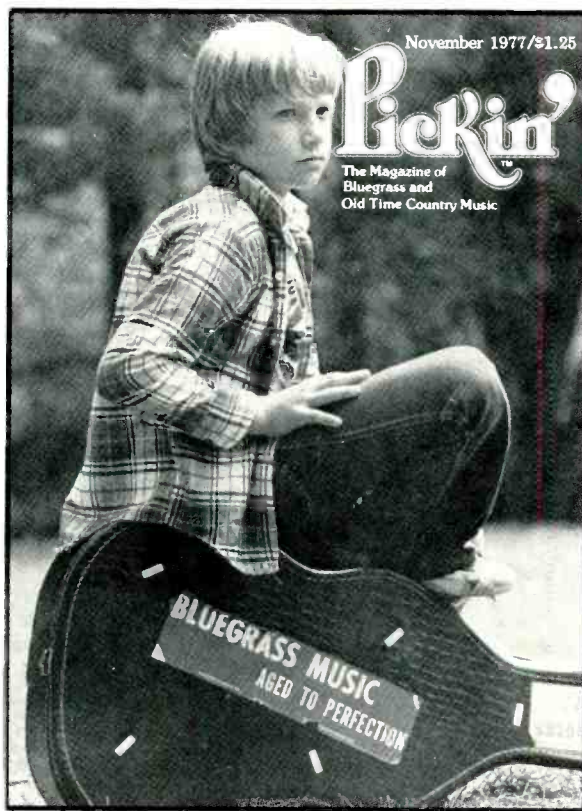
A new monthly, newsstand magazine, *Pickin'*, has been acquired by the North American Publishing Co. to complement *Audio*. Covering all aspects of acoustic music, *Pickin'* will be aimed at both the players of musical instruments and the listeners, and will have the same editorial excellence that audiophiles have come to expect from *Audio*.

Started three years ago as a magazine about bluegrass and old-time country music, publishers Alan Kesselhaut and Roger Siminoff have recently reworked the editorial content of *Pickin'* to include jazz, classical, blues, folk, country and western, old-time, and dixieland, in addition to bluegrass. The entire range of stringed music, with the exception of rock and roll, will be covered in forthcoming issues. The many features and departments will include interviews and articles with well-known and up-and-coming musicians, record reviews, music book reviews, new product information, features on stringed in-

struments, and concert and festival information. Originally sold in music stores and by subscription, with the new expanded music coverage, it will be available on the newsstands as well.

Pickin' will observe and report on the changes underway in traditional acoustic music with the introduction and blending with electronic and amplified instruments... a publication where the pure music is preserved and the new forms explored. The strength will be derived from the depth and documentation of the articles. Not a "groupie" publication, *Pickin'* will discuss the "big names" as musicians, not just as stars. There will also be feature articles on instrument repair and tech-talk columns that will become collector's items in every stringed-instrument musician's home.

One particular copy that is always worth keeping is the annual "Festival Guide" appearing in the April issue. If you're into live music, this is a *must*, as it's the most complete guide to music festivals published.



Tribe Ahl Serif: Master Musicians of Jajouka

Musical Heritage Society MHS 3292/93, stereo, two records, \$7.50.

The cult of the Master Musicians of Jajouka continues to expand following their mind-boggling appearance on Ornette Coleman's album **Dancing In Your Head**. This two-record set includes two sides each of Jajouka village music and their fabled ritual-festival music.

Sides one and three, informally recorded in the Moroccan village, shed additional light on the musical styles explored on the **Master Musicians' Adelphi** album. However, the MHS recordings lack the clarity and immediacy of the Adelphi set, which captured the special qualities of the *rhaitas*, *gimbris*, and flutes with uncommon authenticity. The *gimbris* heard here have a hollow sound; but even so, the various solo and duo tracks are much better defined than the unsatisfactorily balanced ensemble selections. (I can't hear any flutes on the track labeled *Flutes, Drums, Violin*, and the lead vocal is obscured by the drums—it's a rousing performance nonetheless.) The flute duets (or solo-with-drone), *gimbri*, and violin cuts are all musically exemplary, in any case.

Sides two and four give the fullest representation on record of the hillside ritual which Brian Jones unsuccessfully attempted to preserve on his **Pipes of Pan** album. These 46 minutes are excerpted from a veritable orgy of music and dance which extends continuously from late afternoon into the night. The festival begins with an intriguing, drawn-out *rhaita* invocation. Several *rhaitas* play dramatic processional melodies, while the others blow a super-extended drone; the effect is that of an ancient, occult bagpipe band. Marching drums enter for what sounds like an other-worldly military parade. Finally, nearly halfway into the side, the now-familiar Jajouka dance rhythms take over, and it's sheer, overwhelming energy from then on.

The *rhaitas* play short, hypnotically repeating unison melodies which build in emotional fury, then switch simultaneously to new tunes as if by cosmic instinct. Meanwhile the drum rhythms tumble over each other in increasingly frantic, furiously shifting, madly accelerating patterns. Side four was recorded several hours after side two, but the energy levels are unflagging, though the unison has degenerated somewhat, as individual *rhaita* players take to improvising thematic variations.

Note that the producers have sandwiched a side of village music between the two segments of festival music. No doubt they felt two consecutive sides of the ritual were more than the Western listener could take. Nonetheless, for maximum effect and intensity, I'd suggest you listen to the two sides together.

The *rhaitas* have a pinched, nasal tone to begin with, and the sharp-toned recording tends to over-emphasize their shrillness. Though it lacks the closeness and presence needed to fully communicate the savage power of the music, at least it hasn't been tampered with, like Brian Jones' electronically-altered tapes.

Available only from Musical Heritage Society, 14 Park Road, Tinton Falls, N.J. 07724. *Tom Bingham*

Sound: C— Performance: A

Novelty Guitar Instrumentals

Kicking Mule KM 127, stereo, \$6.98.

Presumably, the "novelty" referred to in the title is the "novelty rag," the style of ragtime composition that predominated in the teens and 20s, after the demise of classic ragtime. However, this anthology of 16 tracks by nine finger-picking guitarists includes not only novelty rags, but several classical rags (including three compositions by Joseph Lamb) and a few folk tunes.

All pieces are performed solo, aside from two duets by Lasse Johansson and Claes Palmquist. The Swedish duo skillfully executes intricate arrangements of *Cataract Rag* and *Ragtime Nightingale* which allow the various parts of the original piano score to be reproduced with a depth and integrity impossible to elicit from a single guitar. Johansson also has two solo tracks, played with a supple thumb-bass that brings to mind a ragtime Chet Atkins. Johansson gives Luckey Roberts' oft-recorded *Junk Man Rag* a cordial spring, while *Fizz Water* is an understandably restrained version of a complex Eubie Blake tune.

Bowery Buck is impeccably performed in a relaxed, back-porch-picking by Dick Fegy. Bob Evans plays *Sensation* and *Harlem Rag* in a sturdy, comparatively dense style reminiscent of the early 60s, before ragtime guitarists developed the more intimate approaches now in favor. Likewise, Tony Marcus plays in a thick, four-square Dave Van Ronk style which gives a bluesy cast to Joseph Lamb's *Bohemian Rag*. Indeed, Marcus' picking is so hard, it almost sounds like

flat-picking. Dave Laibman—one of the most significant figures in the current guitar-rag revival, thanks to his and Rick Schoenberg's pioneering **New Ragtime Guitar** (Folkways 3528)—shifts to traditional folk sources for his three numbers here. Unfortunately, his *Dallas Rag* pales in comparison with the mandolin original by the Dallas String Band.

Three of the guitarists contribute new compositions to the ever-expanding repertoire. Jim McLennan's *Joe Rag* is a catchy, if not particularly original piece in the East Coast raggy-blues manner. Tim Nicolai's *Circus Time* is an ingenious novelty rag which lends a syncopated bounce to a bigtop-flavored theme, while his *Plymouth House* is a lovely, harmonically advanced mood-rag. Ton Van Bergeyk, who at 24 is already a revered name among connoisseurs, offers up a short work, *T.N.T.*, inspired by both Bix Beiderbecke and Eddie Lang, as well as a gently mellow interpretation of the vintage pop song, *By the Waterfall*.

Even though the album was assembled from sessions at five cities in four countries, the sound quality is uniformly fine. Each musician's special touch and personality are preserved with admirable effectiveness.

Available from Kicking Mule Records, P. O. Box 3233, Berkeley, CA 94703. *Tom Bingham*

Sound: A— Performance: B+ to A

Irish Music from Cleveland: Tom Byrne and Tom McCaffrey
Folkways FS 3517, stereo, \$7.98.

With this release, Richard Carlin has jumped the gun on a number of other people who had been preparing to offer the American public samples of Irish music in the United States.

The buyer should beware, however. Just because this is the first of a probable series (look out for both Shanachie and Rounder to come out with material from Chicago, Philadelphia, the Bronx, and Boston in the near future), that alone should not persuade the casual record buyer that he has heard anything approaching the incredible riches of Irish music in America. Once he has listened to this pleasant but somewhat undistinguished album.

The fact is that any of the cities listed above—and including Cleveland—could offer the researcher much more illustrious musicians than the two pleasant gentlemen showcased here. The Bronx has people like Joe

Heaney and Joe McKenna; Chicago, a hotbed of Irish music since before Capt. O'Neill's day, could give Mr. Byrne and Mr. McCaffrey lessons any night of the week, and Philadelphia, home of Ed Reavey and Eugene O'Donnell, need take a back seat to none of these.

Why, then, did Richard Carlin, the young American producer of this record, choose two relatively non-spectacular, non-professional musicians to stand for **Irish Music in Cleveland**, when all of these alternative riches were available for him? One suspects that the answer is that, in fact, they were not available. A relative newcomer to the field, it seems probable that many of the fine musicians who might have been otherwise interested in working with him had already made commitments to deal with people who have been active in the field for a much longer time. In Philadelphia, for example, Mick Moloney has been working on putting out an album of Ed Reavey's music, together with transcriptions showing how other musicians over the years have reworked Ed's classic hornpipes and reels. Miles Krassen has been working on a similar project in Chicago, and Shanachie's Richard Nevins has been busy up in the Bronx.

And so Richard Carlin has put together a pleasant, if undistinguished, album of Irish kitchen music, combining a session organized in Cleveland by a friend, Gus Broland, with a concert recording at Oberlin College (his alma mater), some four days later, in April of 1977. The results are not unpleasant (apart from a couple of places where Tom McCaffrey's fiddle loses control sharply enough to make you wince for him or when Tom Byrne's fluté solos get unnecessarily complicated); indeed, there are some quite lovely moments on the album, as when Evan Stein, one of Carlin's friends, leads Tom Byrne into the *Rags and Tatters* reel that Evan apparently learned from Dave Swarbrick's recording and that Tom knew in a different form back home. But such moments are all too rare, and the cause of Irish music in America is given questionable service on this recording.

If you can't wait to hear the Ed Reavey album (and early tapes supposedly have a number of people excited about it), then by all means buy this album. It will certainly be enjoyed by many people. But if you want to hear classic Irish music by prize-winning musicians, then you will have to be patient a little longer. It will be worth it in the end. *John McLaughlin*

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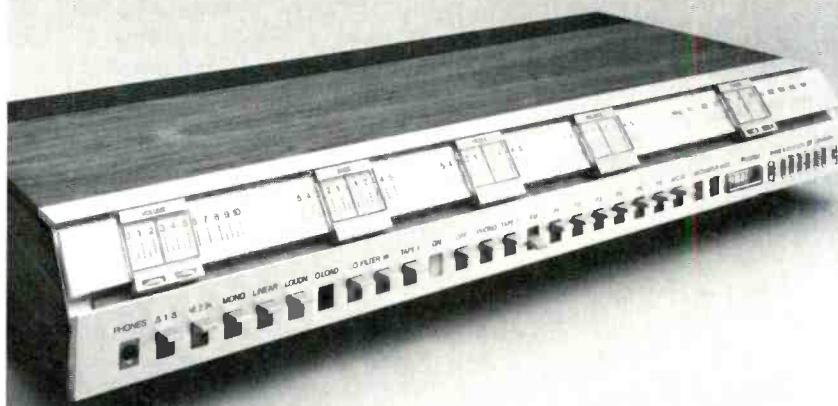
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AU/3/78

Columbus Stockade Blues: Jay Round with the Williams Family

TurneRound 564N6, stereo, \$5.50.

Where are all these hammered dulcimer players coming from all of a sudden?

In the mid-60s, Folkways issued an album by a Michigan octogenarian named Chet Parker (**The Hammer Dulcimer**) which was intended to document the last vestiges of an almost extinct instrument. Instead, the album inspired dozens of young folk musicians to begin the arduous task of mastering the somewhat demanding instrument. Most encouragingly, they started to experiment with it, testing it out in various new musical contexts and in unusual instrumental combinations. The result is a veritable onslaught of albums by some highly skilled dulcimerists doing some highly unexpected things.

Case in point—Jay Round, who introduces the hammered dulcimer to bluegrass. **Columbus Stockade Blues** is his second album, a vast improvement over the earlier **Hammered Dulcimer Album**. The first album was apparently recorded before Round was ready. He sounded inexperienced and self-conscious, though the potential was definitely there. His backup group was lackluster, without either body or oomph, while the material was much too hackneyed.

Columbus Stockade Blues is much more professionally produced (by Jay's father, Donald Round, who also built the dulcimers used), with more fully realized accompaniment, livelier and more ingenious arrangements, and above all considerably more expert dulcimer playing. It's hard not to get caught up in Round's incomparably infectious, high-spirited performances of such tunes as the title standard, *I'll Fly Away*, and Bill Monroe's *Cheyenne*, which give the illusion of a gigantic music box dancing a springing quickstep. His arousing dulcimer-bluegrass approach breathes new life into such time-worn fiddle tunes as *Liberty* and *Mississippi Sawyer*. He turns Hank Williams' *I'm So Lonesome I Could Cry* into a graceful country waltz, while his comfortably restrained versions of *Bonaparte's Retreat* and *Home Sweet Home* have a very amiable lilt. Only *Chicken Reel* fails, if only because it's an asinine tune to begin with.

The enthusiastic backing and solo breaks are by a top-notch Michigan bluegrass band, the Williams Family. Led by the sturdy fiddling of father Larry Williams, the group also features rippling banjo by Rick Williams and

chipper flat-picking by Dave Williams, as Ron Williams' resilient bass drives the band ahead.

The album is mostly instrumental, which is just as well considering Round's shaky, barely adequate singing on *Faded Love* and Grandpa Jones' *Four Winds a Blowin'*.

The recording is especially kind to the bright, ringing dulcimer, allowing overtones to build up without overpowering the band. The other instruments are somewhat lacking in presence, though. The privately pressed album is available from Mrs. Betty Round, 6470 8th Ave., Grandville, MI 49418.

Tom Bingham

Sound: C+ Performance: B+

Star of Bethlehem Youth Choir Glori JC 1035, stereo, \$5.98.

Harvey Lewis, Jr.'s Star of Bethlehem Youth Choir, from Washington, D.C., is one of the best of the progressive ensembles who've incorporated the innovations of such forward-looking directors as Myrna Summers and Edwin Hawkins.

Lewis' compositions and arrangements include concepts borrowed from soul (the horns of *By the Time I Get to Heaven*; also, several of the ear-catching melodies) and jazz (most obviously the uptempo second half of *Living In the Good Old Days*, plus many of the harmonies), without losing sight of his gospel roots. In addition, he's a skillful manipulator of dynamics and balances, as *God Wants a Man Like You* and *Walk Through This Room* demonstrate.

But a choir director is only as good as his choir, and this choir can cook on rousing, hand-clapping midtempo stomps like *By the Time I Get to Heaven* and *He'll Make It Work Out for the Better*. The slower material (*Oh Lord, How Long* and *I Will Never Be the Same*) is sung with genuine feeling and precision. The vocal soloists are mostly excellent. Tawatha Agee is an emotional wailer with an exceptional range. Kristle Murden is glowingly sensitive on the balladic *Walk Through This Room*. Kenneth Spears and Winona Lewis (though the latter is hemmed in by Lewis' erratically idiosyncratic *Don't Give Up*) could both make the transition to secular soul music quite handily.

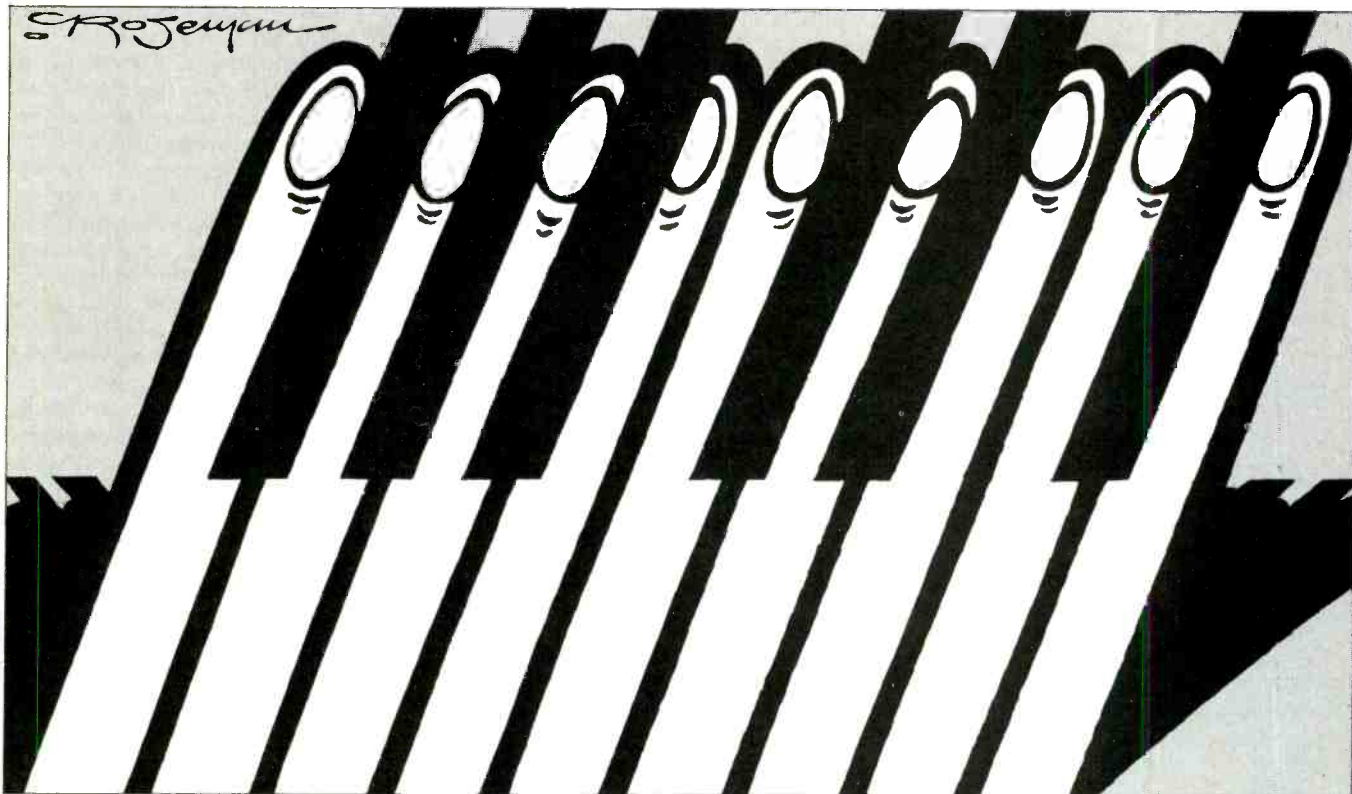
Available from Glori Records, Inc., P.O. Box 9104, Jersey City, N.J. 07304.

Tom Bingham

Sound: B Performance: A-

Classical reviews

Edward Tatnall Canby



The Young Cziffra. Paraphrases, Transcriptions & Improvisations. Connoisseur Society CS 2131, stereo, \$7.98.

Cziffra? In Europe, with 40 or more discs behind him now, plus concerts end to end, this piano genius is simply another Horowitz—or a Barère of Cherkassky, as the liner notes put it. He is a piano fire eater, well beyond the run-of-the-mill super-contest winners we hear every other day. In a plain word, he is unbelievable. As was his nearest counterpart in past history, Franz Liszt. Both came out of Hungary. These are his first spectacular recordings, dating from around 1960 and released then by EMI, though apparently out of Hungary. The sound is stereo and modern, clean but somehow a bit distant, perhaps the mike set-up, perhaps well-known inadequacies (as we now think of them!) in various parameters of headroom via 1960 tape. Piano is demanding, after all, in every sort of extreme.

As for the music—I could not help thinking of a pertinent analogy. This

man plays musical hi fi. Not sonic but piano-technical. Like a hi-fi demo, he uses music as a base to display his astounding technique, the fi of his fingers. The music is there but very incidental. It is practically buried in masses of extra notes played at lightning speed, all over the place up and down and around. For each tone of the original *Blue Danube* here, there must be 150 added notes! This is the “paraphrases, transcriptions and improvisations” mentioned on the cover.

In that sense, the recording has an extraordinarily old-fashioned sound. It is Liszt himself, brought curiously up to date and maybe trebled in degree. Such masses of near-preposterous decoration, added to the simplest of old-fashioned (now) melodies! True—it takes inventive musicality to do this, and few pianists have it. Most can't play a note that isn't written out for them ahead of time. For that, we must credit Cziffra a lot. But—the sound of him! Listening offhand, I would date the music as a synthetic 1857 to maybe

1880. Good Connoisseur surfaces, careful re-cutting and pressing

Kurt Weill: Mahagonny Songspiel; Kleine Dreigroschenmusik; Pantomime; Vom Tod im Wald; Berliner Requiem; Violinkonzert; Happy End. Soloists, the London Sinfonietta, Atherton. **Deutsche Grammophon 2709 063**, 3 discs, stereo, \$23.94.

Listening to this epochal collection of early Kurt Weill, you would never guess that it is all-English, including the solo singers. Names like Mary Thomas, Ian Partridge—and yet the performance is all-out German in sound and wonderfully authentic to the feeling and style of the 1920s, when most of this music was composed. Curious—because long before his emigration to the United States Weill was already inserting whole stretches of English into his German texts, in the Berlin style of that time, early-jazz influenced. You'll find both the

original English and translations of the German in the usual D-G accompanying multi-language book.

What is valuable here, in addition to the excellent and style-conscious performing, is the sonic overview of a vital period in Kurt Weill's development, and consequently an important turning point in music as a whole, not to mention civilization itself, on the downgrade towards Hitler and World War. Such incredible pessimism! Such ironic realism. You know it in the "Three penny Opera" (Dreigroschenoper); listen to it in far stronger terms

in these works that both preceded and followed the famous one. It's an album that will keep you busy for many a week.

How can I describe the fi? If I had to rate such records as this, and those from Philips and other European sources, I would simply give them a universal A—to match B and C and worse for average domestic production in the large. The voices, here, are a bit loud and not easy listening—certainly not for background music. They *should* be loud and brassy. The instruments are

recorded on the dry side, also correct for the style.

Ravel: Le Tombeau de Couperin. Griffes: Sonata; Three Tone Pictures. Susan Starr, piano. **Orion ORS 77270**, stereo, \$7.98.

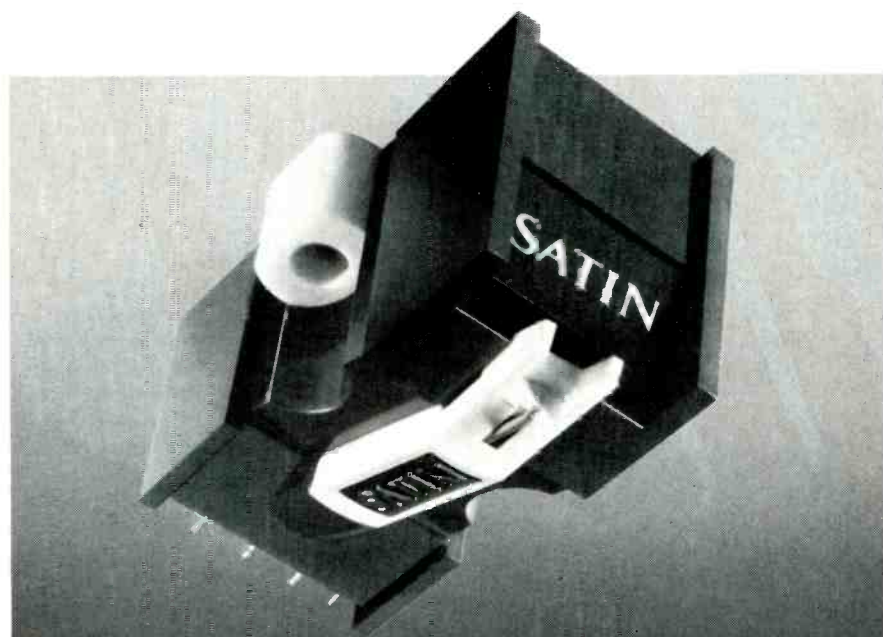
The interesting music here is the Griffes; the familiar Ravel is listed first, maybe as the likely better seller.

Charles Tomlinson Griffes was one of America's few outstanding composers in that somewhat painful period, musically, between the late 19th century and beginning of modern sounds. Painful, that is, for a composer who wanted to go beyond big-time late Romantic expression into the unknown; Griffes clearly did (as did Charles Ives). He died young, a frustrated but eloquent talent, caught up in mysticism and impressionistic moods, too soon for the brassy, jazzy days which came just beyond him, a passionate composer, very much heart-on-sleeve but very mixed up as well. Listening, one can almost feel sorry for this tortured exposition of inner feelings; he was 100 per cent genuine and honest in a time when "cheap display" was never easier to get away with.

On this record are three short Griffes mood-poems and a long full-sized Sonata, a really remarkable work and a lot more advanced in its tonal thinking than the passionately Romantic sound would indicate. Susan Starr has caught Griffes to perfection and must be congratulated.

As for Ravel, there is only the Rogé recording (London) of the piano version of *Le Tombeau* and so Miss Starr's adequately done version is useful—but the work is much better known in its orchestral form, though that version omits some of the music heard here.

Technically, Griffes is very nearly impossible to record and Orion has done its best. Not only a violently extended dynamic range, but long passages so mysteriously faint that one loses track of the sense; or one turns up the volume control to help—and then along comes a vast piano explosion to blow the speakers apart! It took me a good many minutes to find a workable level for listening. No amount of "fi" can help in such a situation though, alas, a bit of discreet compression is aesthetically all to the good. Makes for living room listenability. Orion's surfaces are quiet except for too many loud ticks on my copy. Somebody got gravel into the album? I like the piano sound as such. The problem is Griffes himself. Ravel is much more tractable.



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European records

John S. Wright

One of the most important boxed sets of records to be released by Philips is their recording by Alfred Brendel with the London Philharmonic Orchestra, conducted by Bernard Haitink, of the complete **Beethoven Piano Concertos** on 6767 022 (five records). Apparently a very simple and purist microphone technique has been adopted, since the balance is particularly natural and in no way suffers from the bloated over-closeness typical of most concerto recordings. This opinion is augmented by the manner in which the recordings "decode" with Hafler to produce a good surround sound effect. The background noise, while not totally absent, is very subdued with none of the audible effects that often accompany noise-reduction systems. Turning to the music, my particular appreciation of Brendel's Beethoven interpretation has already been expressed in these columns and I find no cause to modify it in this case. Apart from some more unusual cadenzas, the playing is predictable in a manner that provides a sense of security and is well complemented by the reserved orchestral accompaniment.

I suppose that the direct competition to these performances are those of Ashkenazy recording for Decca on SXL6 6594-7. Here we find a more aggressive approach with greater contrast in dialogue between piano and orchestra, epitomized in the opening of the slow movement of the Fourth Concerto. Recording quality is contrastingly heavier, although perhaps more suited to such an interpretation. Of the two recordings, I would not be without either, but if presented with an ultimatum would choose the new Philips. Because of this, I do hope that each concerto will shortly be available on separate records, as the complete box set presents a considerable financial outlay.

Staying with Alfred Brendel and Philips there is a single disc of his performance with the Academy of St. Martin-in-the-Fields (conducted by Neville Marriner) of the *Mozart Concerto No. 22* and the *Rondos in D, K382* and *A, K386* (9500 145). This is rather a

multi-mike presentation for Philips, being close-up although maintaining the piano in balance. I cannot pretend that Brendel's Mozart is as inspiring as his Beethoven, being less delicate both in performance and recording, but for those seeking a modern recording of these works, it is difficult to suggest a superior alternative.

Still staying with Philips and Bernard Haitink, this time conducting the Concertgebouw Orchestra, is a Ravel selection including the popular *Rhapsody Espagnol*. It is a "laid back" presentation maintaining good low frequency performance with extremely high transients. This has somewhat of a "loudness control" effect providing a natural yet also impressive recording, maintaining the acoustic ambience we have customarily come to expect of this force of artistes.

"Enchanting" is the only word for Andre Previn's rendition of Mendelssohn's *A Midsummer Night's Dream* on EMI ASD 3377. The delicacy combined with immediacy, particularly notable on children's voices and detail with the timpani, is on a par with the Previn/London Symphony Orchestra *Nutcracker* recording (SLS 834). Much of the music is well known and included is the famous *Wedding March*, which could have been hackneyed had it not been for the otherwise excellent qualities of this disc.

In the past I have had cause to praise the engineering of Paul Vavassier when recording in Paris. He possesses the good taste to retain airiness and detail even in complex passages. The new EMI recording of Delibes' Ballet *Coppelia* (SLS 5091) is nearly up to his best in these respects, but some very slight midrange dimness—perhaps associated with the SQ encoding—combined with a rumbly surface in some sections only just places this two-record set out of the highest echelon.

Parker and Bishop produced a recording that is spectacular to the extreme in the Elgar's *Pomp and Circumstance* and Walton's *Coronation Marches* (ASD 3388). Containing as it does, mighty bass, this balance with Sir

Adrian Boult's drive is very stirring, although perhaps it is slightly questionable in terms of ultimate low-end definition.

Not quite so deliberately contrived, but nevertheless a multi-mike presentation showing great skill and expertise, also lies in EMI's recordings of Tchaikovsky's six symphonies on SLS 5099 (seven records). A positive and deliberate interpretation characterizes Rostropovitch's conducting of the London Symphony Orchestra and adequately demonstrates his insight into the composer's intentions, rather than a concentration merely on the cello for which he is so famous. (It seems unfair that one individual should possess such dual talents.) Despite a dryish acoustic, the bass impact has that "wrap-around" quality with a sheen and edge on cymbals and brass that makes parts of these symphonies ideal demonstration material. Just listen, for instance, to the end of the third movement of No. 6. . . . Only a very slightly muddling in the midrange on fortissimo passages provides a marginally tiring effect over long term listening, but I don't expect you are supposed to listen to the whole box set right through non-stop. Again, I hope it will not be too long before these symphonies are available as separate discs.

The last EMI recording to receive a mention this quarter relates more especially to the music, rather than to the recording quality. It is another box set but inseparable, containing as it does Bach's *Christmas Oratorio* (SLS 5098). The artistic line-up speaks for itself: Conducted by Philip Ledger, the Academy of St. Martin-in-the-Fields with the Choir of King's College, Cambridge, is complemented by soloists Ely Armeling, Janet Baker, Robert Tear, and Dietrich Fischer-Dieskau. Fortunately, these soloists are not brought too forward, and the whole recording retains intelligibility with the lightness in texture complemented by a backcloth of ambience (which even decodes fairly well in SQ). The surface of the review set was, however, rather poor, but I have learned that this is not necessarily an indication of the



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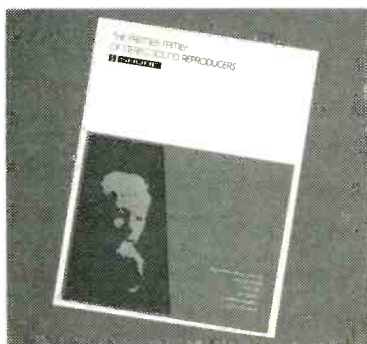
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The Decca Phase 4 label is usually associated with highly contrived, multi-track recordings, made particularly to impress the uninitiated. However, this is not the case in the new recording of Rossini's *La Boutique Fantasque* together with *Suite Rosiniana* played by the Royal Philharmonic Orchestra conducted by Antal Dorati (PFS 4407). Apart from a particular emphasis on precise stereo imaging, albeit of a panned nature, the sound is crisp and clean, especially on the percussion. The engineering delightfully captures the colorful nature of this somewhat frivolous music and can also be thoroughly recommended as a record intended for the general entertainment media.

In recent years Decca has been subjected to, perhaps, undue criticism of many of their classical releases, due to a tendency towards brashness and coloration, while in the mid 60s the Decca label symbolized all that was best in the stereo recordings then available. It was, therefore, a great relief to discover a popular work recorded in the older smooth and natural environment—the Tchaikovsky Violin Concerto. Kenneth Wilkinson was the engineer, Kingway Hall the location, and sessions were taken at separate dates during February and April of last year. However, the consistency of sound between movements is indistinguishable, which must imply some careful and deliberate technical adjustments rather than the “hit and miss” approach to which we have almost become completely indoctrinated. For the young violinist Boris Belkin, this second release (SXL 6854) with the New Philharmonia Orchestra conducted by Ashkenazy is to be highly recommended. It is amusing to note that another soloist is getting on the conductors bandwagon.

On a previous occasion, I had cause to especially recommend Richard Bonyngé's recording with the National Philharmonic Orchestra of *Le Cid* and *Les Patineurs* on SXL 6812. Around the same time Decca must have also recorded the complete ballet music from Tchaikovsky's *Swan Lake*, in the same Hall with the same producer. Not surprisingly therefore, we have a similar balance and important attributes of the earlier recording; namely precise imagery and retained dynamic and frequency range (coupled with blended reverberation). The obvious competitors in the field of complete recordings of this work lie in the recent EMI/Previn set, which I did

not entirely like on technical grounds, and the older Melodia recording (SLS 795/3) which still seems fine despite some random phasiness and amateurishly close miking. While this latest release is technically the most superior, I secretly look forward to the day when Philips will record it at the same exemplary standard as they recently did with the *Nutcracker*.

CBS, in their Master Works series, have issued an unusually large batch of boxed sets—so many that (not unreasonably) they were unable to let reviewers have them all. Quite sensibly, they issued a “sampler” disc containing excerpts from each. This record is not available to the public, but does allow me to make some cursory remarks regarding the technical merits



Boris Belkin

Photo: Decca/John Thompson

of two of the various issues. I have previously praised some of the recordings originated by Jean-Claude Malgoire of France as being very clean in a commercial sense, even if strictly incorrect from the purist point of view. On the basis of the sampler, it would seem that his recordings of Handel's *Rinaldo* on 79308 and the *Concerti Grossi* on 79306 are both very promising in these respects and worthy of special attention if you are in the market for these works.

A fairly new name in the world of classical recording is that of Enigma. Their policy is, and I quote, “to have their recordings made in buildings which suit the music . . . rather than in a multi-purpose studio with zero acoustics and artificial echo facilities.

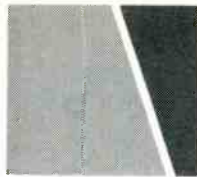
AUDIO • March 1978

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Just before going to press some samples of their latest releases arrived, but not in time for full evaluation. I will therefore refer to these in more detail at a later date, although at this stage I can concur with their philosophy, and to a large extent the results achieved satisfy their intent. Certainly the Enigma label is one to be on the look out for if you share the views expressed here.

We have had some surprisingly good releases from RCA when recording in Europe. A selection of **English Music for Strings**, including Peter Warlock's *Capriol Suite* appears on RL 25071. The enthusiastic playing is accompanied by a sense of bloom and spaciousness, although slightly exaggerated in stereo width. The review pressing was faulty in places, but nevertheless was musically and technically relaxing yet retaining crispness.

On the Erato label is a new recording of the complete Purcell opera *Dido and Aeneas* (ST11 71091). It is an ultra

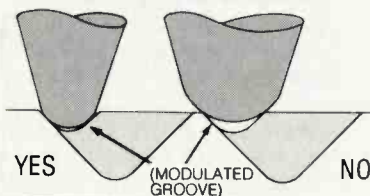


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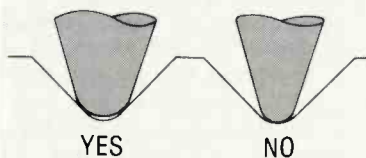
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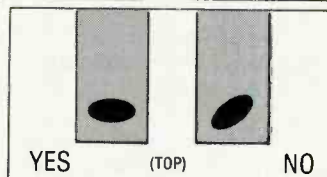
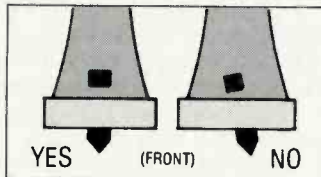


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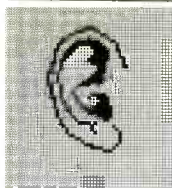
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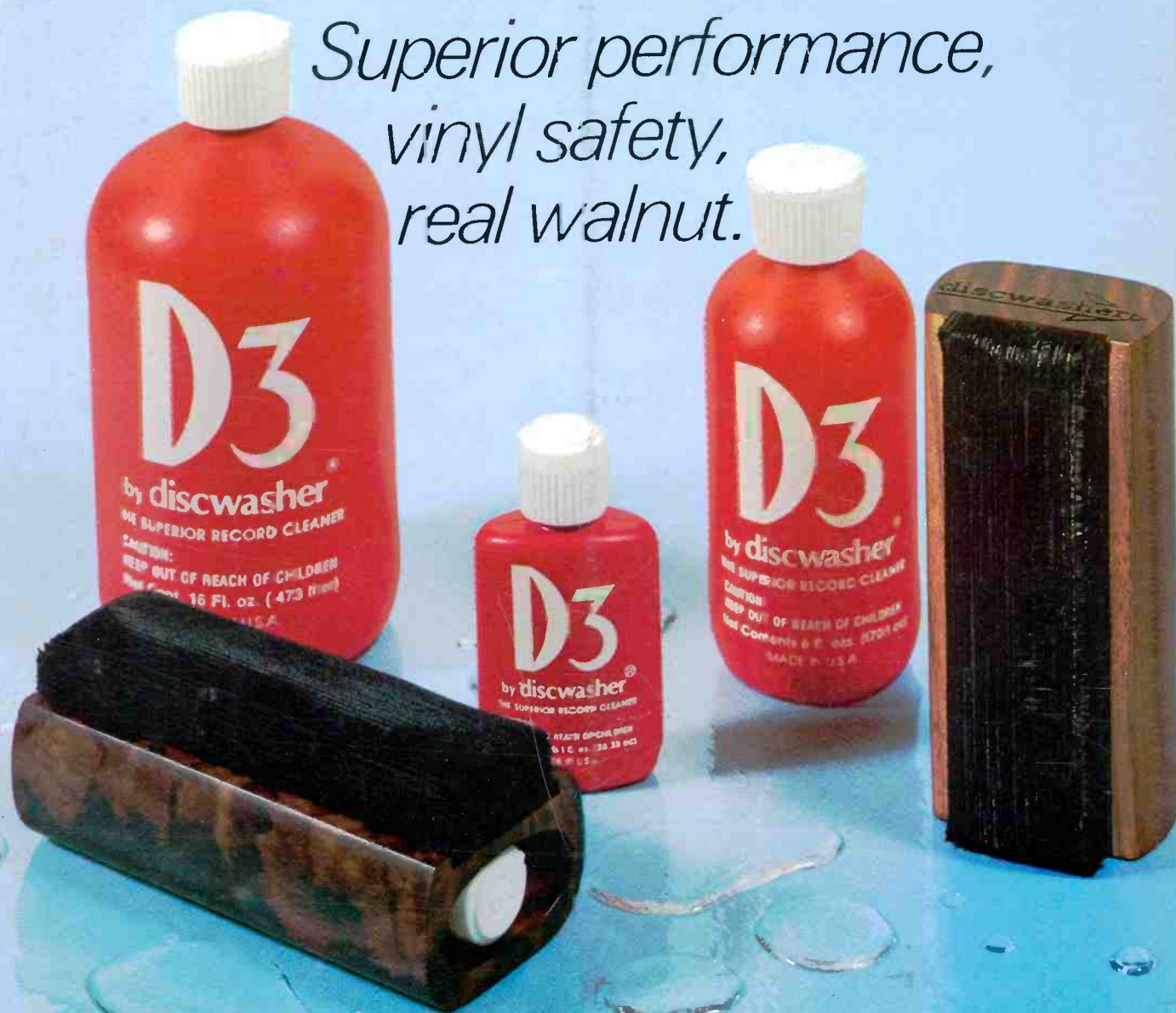
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