

Audio

THE AUTHORITATIVE MAGAZINE ABOUT HIGH FIDELITY • DECEMBER 1977 \$1.00

47425 

Modulation
Distortion
In Speaker Systems

EXCLUSIVE TEST —

Edison Tin-Foil
Phonograph

Wags & Tales —
Oliver Berliner



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THE PIONEER CT-F422.
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**WHEN SOMETHING
WORKS THIS SUCCESSFULLY
MOST PEOPLE WOULDN'T
MESS AROUND WITH IT.**

BUT PIONEER COULDN'T LEAVE WELL ENOUGH ALONE.

WE'VE REPLACED THE WORLD'S BEST SELLING CASSETTE DECK WITH SOMETHING

For the last two years, the CT-F2121 has satisfied more people than any other cassette deck in the world. Because the major difference between it and much more expensive front-loading cassette decks was price. Not performance.

But there remained one highly critical group of people who were never satisfied. Pioneer's engineers. Who were constantly looking for ways to make it even better.

THE DIFFERENCES YOU CAN SEE.

The most obvious improvement over the old 2121 is the new front end of the CT-F4242.

What isn't quite as obvious is the thinking behind it. The new push-button oil-damped door, for instance, doesn't tilt in like the CT-F2121's, or out like others. Instead, it slides neatly up over the lighted tape transport. So it's easier to get your cassette in and out of the deck.

This same kind of thinking went into repositioning the hard Permalloy Solid tape heads. Vertically. Right at your fingertips where you want them. So it's no hassle to keep them free of dust and in good working order.

Pioneer's engineers also put a great deal of thought into features our competitors seem to have given very little thought to. Features like a three-position bias and equalization switch, instead of the more typical two. And a six fin tape drive shaft, instead of the common three, to hold your cassettes more securely.

The point is, you'll see a lot of the new CT-F4242 that you won't see on other modestly priced cassette decks.

But there's more to this deck than meets the eye.

THE DIFFERENCES YOU CAN HEAR.

By far, the most impressive refinements in the new CT-F4242 are the ones you can't see.

Inside, for example, where many cassette decks use small flywheels that can cause wow

and flutter, the flywheel in the new CT-F4242 is massive. (In fact, it's 30% bigger than the 2121's.) Our bigger flywheel reduces wow and flutter even further. So you get cleaner and crisper recordings.

Then there's our new Dolby system.

Practically every decent cassette deck today has some sort of Dolby system that adds clarity to the music by reducing tape hiss. But the Dolby in the CT-F4242 cuts tape hiss enough to produce an incredible signal-to-noise ratio of 52 decibels. A figure comparable to far more expensive equipment.

And although you'll find a multiplex filter switch on many cassette decks, you won't find one on the CT-F4242. It's built-in. Which literally means that you can't make a bad FM recording.

If you're beginning to get the idea that there are vast differences between the CT-F4242 and other decks for anywhere near the same price, you're right.

So visit your Pioneer dealer and listen to the most sophisticated cassette deck ever made for the money. Pioneer's CT-F4242

Once you hear it, you'll be glad Pioneer couldn't leave well enough alone.

High Fidelity Components

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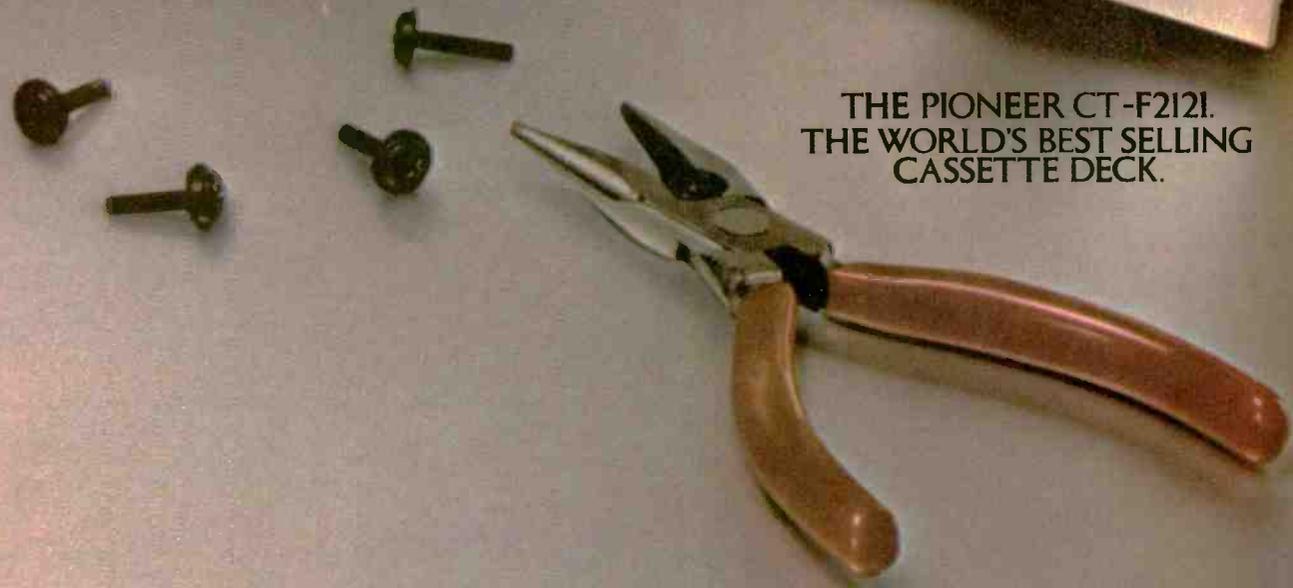
	CT-F2121	CT-F4242
HEADS:	"Permalloy Solid" recording/playback head xl. Ferrite erasing head xl.	"Hard Permalloy Solid" recording/playback head xl. Ferrite erasing head xl.
WOW AND FLUTTER:	No more than 0.12% (WRMS)	No more than 0.08% (WRMS) No more than ±.2% (DIN)
FREQUENCY RESPONSE:	Standard LH tape: 30 to 13,000 Hz (40 to 11,000 Hz ± 3 dB). Chromium type tape: 30 to 16,000 Hz (40 to 12,000 Hz ± 3 dB)	Standard LH tape: 30 to 14,000 Hz (40 to 13,000 Hz ± 3 dB). Ferrichromium type tape: 30 to 16,000 Hz (40 to 15,000 Hz ± 3 dB). Chromium type-tape: 30 to 16,000 Hz (40 to 15,000 Hz ± 3 dB)
SIGNAL-TO-NOISE RATIO:	Dolby OFF: 48 dB (Standard and LH tapes) Dolby ON: 58 dB (over 5 kHz, standard and LH tapes). When chromium type tape is used, signal-to-noise ratio is further improved by 4.5 dB over 5 kHz.	Dolby OFF: more than 52 dB Dolby ON: more than 62 dB (over 5 kHz standard and LH tapes). When chromium type tape is used, signal-to-noise ratio is further improved by 4.5 dB over 5 kHz.

*Walnut veneer wood cabinet optional at extra cost.

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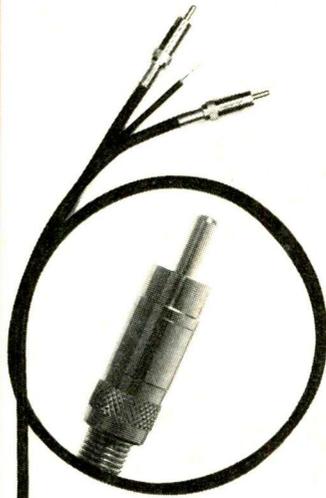


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THE WORLD'S BEST SELLING
CASSETTE DECK.**



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presents

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Gold-ens™



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December 1977

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Editor Eugene Pitts III
Associate Editors: Edward Tatnall Canby, Bert Whyte
Assistant Editor Eugene J. Garvin Jr.
Marketing Director Sanford L. Cahn
Design Frank Moore
Design Assistant Debbie DePietro
Circulation Manager Jean Davis
Advertising Production & Editorial Assistant Gloria Klaiman
Senior Editors: Richard C. Heyser, B. V. Pisha
Contributing Editors: Tom Bingham, Herman Burstein, Geoffrey T. Cook, Leonard Feldman, Joseph Giovanelli, Bascom H. King, C.G. McProud, Dan Morgenstern, George Pontis, Howard A. Roberson, Jon Sank, Donald M. Spoto, Michael Tearson, George W. Tillett, Jon Tiven.
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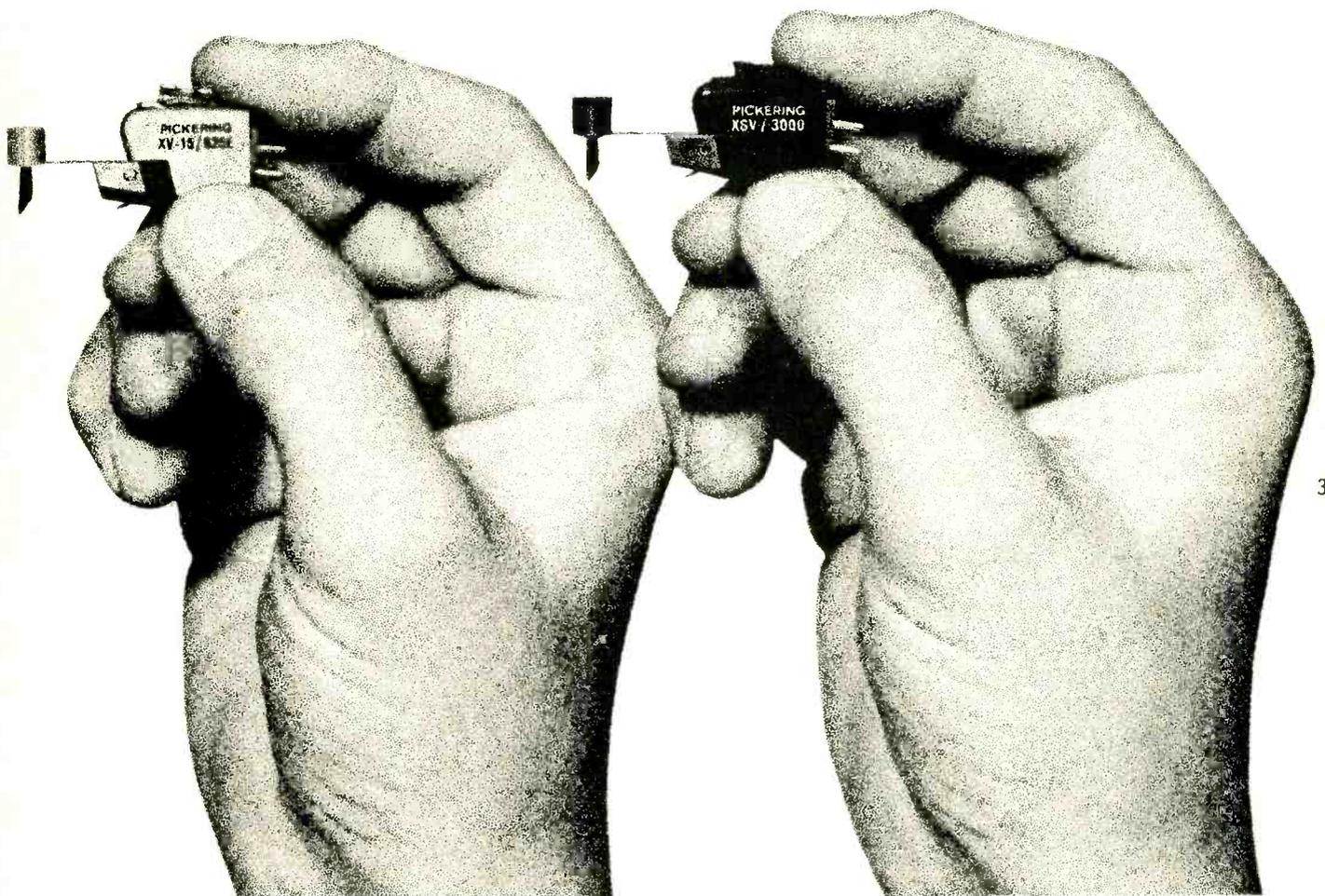
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3

Match one to your equipment

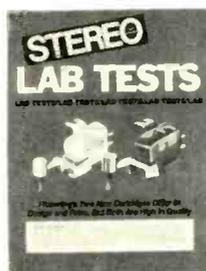
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The summary advice of **Stereo's** Lab Test, in an unusual dual product review, we think brilliantly states our position: "The XV-15/625E offers performance per dollar; the XSV/3000, the higher absolute performance level." That makes both of these cartridges **best buys!**



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Pickering's new XSV/3000 is a remarkable development. It possesses our trademarked Stereohedron Stylus Tip, designed to assure the least record wear and the longest stylus life achievable in these times with a stereo cartridge. Its frequency response is extraordinarily smooth and flat; its channel separation is exceptional; its transient response affords superb definition. It represents a whole new concept of excellence in stereo cartridges.

Read the whole evaluation report. Send for your free copy of the **Stereo** "Lab Test" reprint; write to Pickering & Co., Inc., 101 Sunnyside Blvd., Plainview, N. Y. 11803. Department A

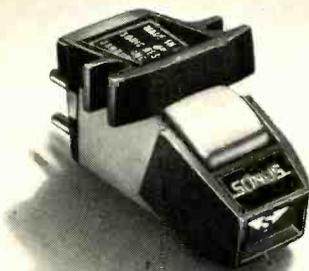
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MORE THAN
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High Definition Phono Cartridges

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Tape guide

Herman Burstein

Cro₂ Pros and Cons

In the six years that chromium dioxide tape has been on the market, there has been a discussion of its pros and cons compared with ferric oxide tapes. Physical as well as magnetic performance have been the subject of debate, particularly the question of abrasiveness.

Recently some new materials, again pro and con, have appeared on the subject. The interested reader can obtain them free of charge by writing to the companies indicated below. While the charge that chrome tape is more abrasive appears to have died down, discussion of other aspects of performance continues. The materials are:

1. *Backgrounder on Headwear*, a paper published by E.I. du Pont de Nemours & Co., Photo Products Department, Magnetic Products Division, Wilmington Delaware 19898. Primarily this refutes the claim that chrome tape is more abrasive than ferric oxide tape.

2. *The Advent Chrome Paper*, published by Advent Corporation, 195 Albany St., Cambridge, Mass 02139. This too defends chrome tape against the charge of abrasiveness, and goes on to other aspects of performance such as drop-outs, uniformity, signal-to-noise ratio, price relative to performance, print-through, modulation noise, etc.

3. *Nakamichi Technical Bulletin 5*, published by Nakamichi Research Inc., 220 Westbury Ave., Carle Place, N.Y. 11514. This deals with past or present claimed failings of chrome tape with respect to abrasiveness, distortion, consistency of performance, headroom, etc.

Poor Erasure

Q: I have a Lafayette RK520 stereo cassette deck which erases poorly. I have to run the tape through the erase five or six times before the erasure is complete. This problem did not occur when I first had the machine. What can I do to troubleshoot the problem?—Tim Mamassia, Baltimore, Md.

A: The trouble might lie in either a defective erase head or in the absence of sufficient oscillator current to power the head. If your recordings are normal—about the same frequency response, recorded level, and distortion problems as before the erase problems arose—it seems unlikely that the oscillator circuit is defective because this circuit supplies the record head as well as the erase head. Check the components (resistors and/or capacitors) leading from the oscillator to the erase head and make sure that they are of proper value. Check the oscillator operating voltages specified in the service manual. If all this checking fails to turn up any suspects, then turn your attention to the erase head and the best check here is by substitution of a new head.

High-Frequency Dropouts

Q: My problem is dropout during playback of the tape on either of two channels (not both at the same time) for about a half second or so, which is especially noticeable on the high frequency portion of recorded material. I am using a Teac 1500U tape deck, Dyna PAT-4 preamp, Dyna 120 power amplifier, an AR turntable, and a Shure V15 phono cartridge. I had the deck checked by Teac, and they claimed that it was the fault of the tape, that is, wearing of the oxide (I use BASF low-noise tape). The dropout occurs at the same point on the tape during successive replays, so I would tend to agree with them. Is it possible that either the preamp or the pickup could be causing the dropout?—R. Sadowsky, Brooklyn, N.Y.

A: I doubt very much that the preamp or cartridge could be the source of your problem. However, there is a slight possibility that on a high signal level the preamp might block causing a brief absence of sound. You can easily check this if you bypass the

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.

AUDIO • December 1977

Everything you'll ever need. The Scott R 376 Receiver.



The Scott R 376 AM/FM Stereo Receiver is our top of the line. It delivers all the power and performance you'll ever need to enjoy records, tapes and broadcasts. Now and tomorrow.

The Scott R 376 provides a full 75 watts minimum continuous RMS power output per channel. Power enough to drive even low efficiency speakers to room-filling volume. Both channels are driven into 8 ohms from 20 Hz to 20 kHz with an incredibly low 0.1% total harmonic distortion.

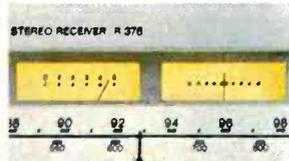
The Scott R 376 has every performance feature you'll ever need, too. Separate channel bass, treble and midrange controls allow you to adjust response to best match your speaker locations, room acoustics and listening taste. Dual tape monitors allow you to operate two tape machines simultaneously. You can record live performances or even copy tape-to-tape while another source is playing.

For three decades, Scott has been satisfying the needs of discerning listeners with the very finest in high fidelity. Today, the R 376, like every Scott receiver, continues this tradition of excellence.

For specifications on our complete line of audio components, contact your nearest Scott dealer, or write H.H. Scott, Inc. Corporate Headquarters, 20 Commerce Way, Woburn, MA 01801. In Canada: Paco Electronics, Ltd., Quebec.



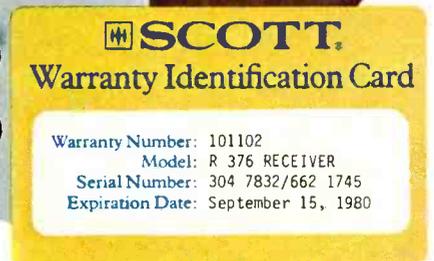
Separate bass, treble and midrange controls



Signal strength and center channel tuning meters



Individual high and low filters.



Scott's unique, gold warranty card. Individualized with your warranty, model and serial numbers, and expiration date. Scott's fully transferable, three-year parts and labor-limited warranty is your assurance of lasting enjoyment

- IM distortion (lower than 0.1%).** Provides cleaner sound and eliminates listening fatigue.
 - Individual low and high filters.** Minimizes turntable rumble, tape hiss, record and broadcast noise.
 - Center channel and signal strength tuning meters** Provides precise tuning and indicates optimum signal strength.
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 - Three position FM de-emphasis switch.** Permits proper reception of domestic, Dolbyized* or European broadcasts.
 - FM Muting.** Silences interstation hiss and prevents the receiver from picking up weak stations.
 - Loudness switch.** Boosts treble and bass at low volume levels.
 - Log-linear volume control with detents.** Spreads out the volume levels over a greater portion of the knob rotation to provide finer control at low to moderate listening levels.
- *Dolby is a registered trademark of Dolby Laboratories

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1. Quantum offers low distortion. You get a true recording of any type of music at high output, with virtually no distortion.

2. Quantum has very high sensitivity. This maximizes output and allows you to effectively capture all signals at a greater level.

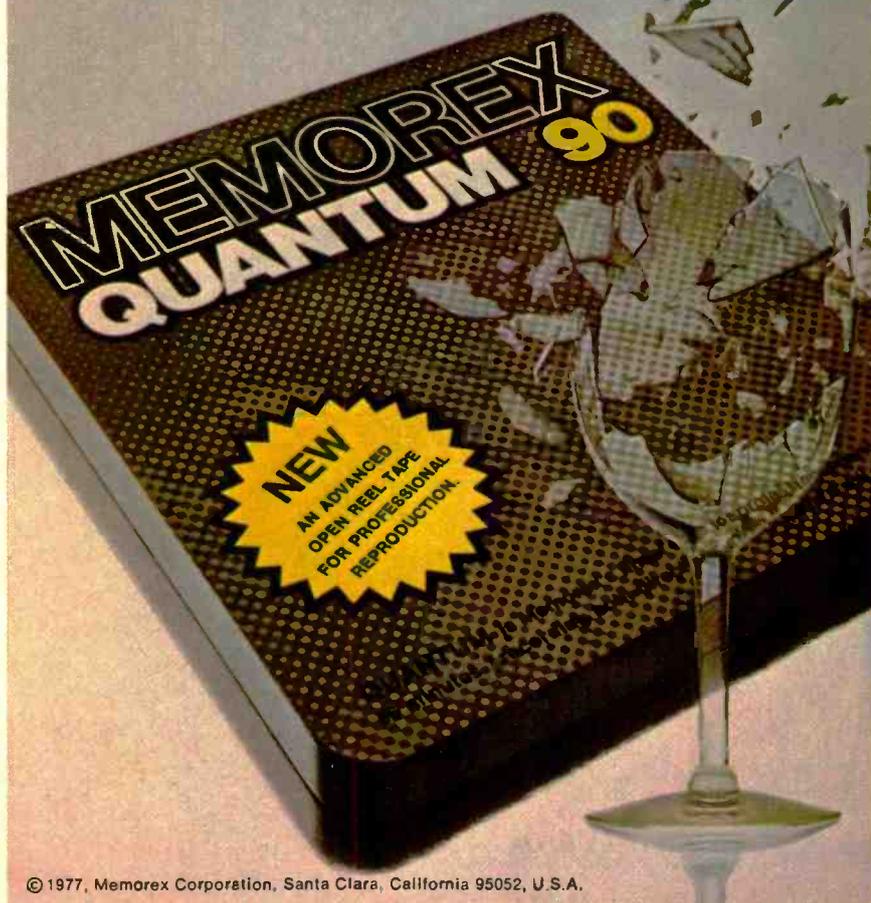
3. Quantum provides an excellent signal-to-noise ratio because its high sensitivity is obtained with no increase in noise level. This means a pure, brilliant sound.

4. Quantum gives you high saturation, resulting in a wide dynamic range and broad recording flexibility.

Quantum achieves improved recording performance while maintaining a high degree of mechanical excellence. With long life, durability, precision edge quality and excellent oxide adhesion.

The best way to hear the Quantum difference is to try it out for yourself. Available in 7" x 1800', 7" x 2400' and 10½" x 3600' reels.

MEMOREX Recording Tape.
Is it live or is it Memorex?



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preamp and feed the tape signal directly into your power amplifier. If the problem remains, this clearly exonerates your preamplifier.

It seems the difficulty probably does lie in the tape you are using or possibly in the electronics of your tape machine. It could be that a high signal level on the tape causes blocking in the deck's playback amplifier. Try playing your tape on another machine and if the dropout remains, then it must be the tape.

Tape Speed Synchronism

Q: Some tapes I recorded abroad at 3¼ ips on an Akai M-9, using a power supply of 220 V at 50 Hz, play back slightly fast on my Akai 250-D, using a power supply of 120 V at 60 Hz. Even when I switch the power supply to 50 Hz the playback is still fast. However, the recordings made on my 250-D play back normally, so this machine seems okay. How can I slow down the playback speed?—Reuben Wilson Jr., Poplar, Mont.

A: Your 250-D tape machine may be fast so that tapes recorded at the correct speed on another machine come out fast on yours. The fact that recordings made on your 250-D machine play back satisfactorily is not proof that the machine speed is accurate. All that is happening is that the speed error in recording is matched by the same error in playback. On the other hand the M-9 tape machine may have been slow while the 250-D is accurate. To tell which machine is at fault, play a commercial prerecorded tape on the 250-D, and if it sounds right, then the 250-D is exonerated.

One thing you can do to make the machine at near the proper speed is to hook the voltage tap on the power supply to the next higher voltage above 120 V. If the machine is hooked to the 150 V position but connected to a 120 V supply, then it will tend to run slow.

Direct Dubbing

Q: When dubbing, is it better to go direct from one tape deck to another, or should one go through the inputs and outputs of a receiver?—Leonard Weiner, Chicago, Ill.

A: The fewer electronic stages a signal goes through the better as this minimizes the chances of additional noise and distortion, along with altered frequency response. Hence it is better to dub directly from one tape deck to another.

AUDIO • December 1977

It's time for everybody else to start playing catch-up. Again.

From the very beginning, experts have acclaimed the performance and feature innovations of Yamaha receivers as nothing less than spectacular.

But now, we've outdone ourselves.

Yamaha is introducing a new line of receivers with such unprecedented performance, it's already changing the course of audio history.

Real Life Rated™ While traditional laboratory measurements provide a good relative indication of receiver performance, they simply don't tell you how a receiver will sound in your living room in actual operation. So Yamaha developed a new standard for evaluating overall receiver performance under real life conditions. It's called **Noise-Distortion Clearance Range (NDCR)**. No other manufacturer specifies anything like it, because no other manufacturer can measure up to it.

We connect our test equipment to the phono input and speaker output terminals, so we can measure the performance of the entire receiver, not just individual component sections like others do. We set the volume control at -20dB, a level you're more likely to listen to than full volume. We measure noise and distortion together, the way you hear them.

On each of our new receivers, Yamaha's Noise-Distortion Clearance Range assures no more than a mere 0.1% combined noise and distortion from 20Hz to 20kHz at any power output from 1/10th watt to full-rated power.

Four receivers, one standard. On each of our four new receivers, Yamaha reduces both THD and IM distortion to new lows—a mere 0.05% from 20Hz to 20kHz into 8 ohms. This is the kind of performance that's hard to come by in even the finest separate components. But it's a single standard of quality that you'll find in each and every new Yamaha receiver. From our CR-620 and CR-820 up to our CR-1020 and CR-2020.

What's more, we challenge you to compare the performance and features of our least expensive model, the CR-620, with anybody else's most

expensive receiver. You'll discover that nobody but Yamaha gives you our incredibly low 0.05% distortion and -92dB phono S/N ratio (from moving magnet phono input to speaker output).

You'll also discover that nobody else starts out with such a variety of unique features. Independent Input and Output Selectors that let you record one source while listening to another. A Signal Quality Meter that indicates both signal strength and multipath. The extra convenience of Twin Headphone Jacks. Or the accurate tonal balance provided at all listening levels by Yamaha's special Variable Loudness Control.

More flexibility. It's consistent with Yamaha's design philosophy that you'll find the same low distortion throughout our new receiver line. Of course, as you look at Yamaha's more expensive models, it's only logical that you'll find the additional flexibility of more power, more functions, and more exclusive Yamaha features.

For example, there's a sophisticated tuner, with unique negative feedback and pilot signal cancellation circuits (patents pending), that makes FM reception up to 18kHz possible for the first time on a receiver. Plus other refinements like a Built-In Moving Coil Head Amp, Fast-Rise/Slow-Decay Power Meters, and Yamaha's own Optimum Tuning System.

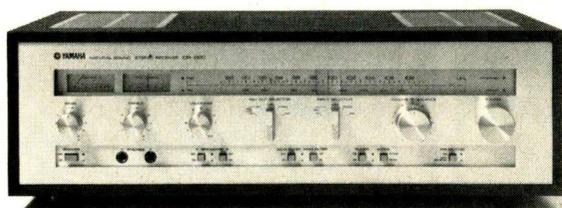
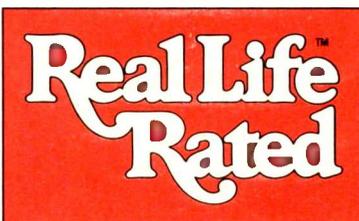
Now's the time to give us a listen. Our new receiver line is another example of the technical innovation and product integrity that is uniquely Yamaha. And your Yamaha Audio Specialty Dealer is an example of uncommon dedication to faithful music reproduction and genuine customer service. It's time you heard them both.

If your Yamaha Audio Specialty Dealer is not listed in the local Yellow Pages, just drop us a line.

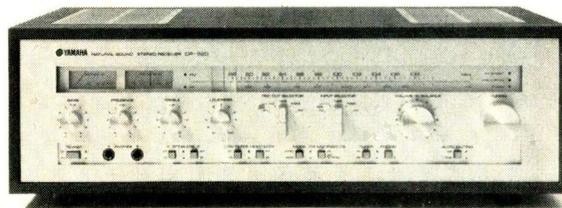


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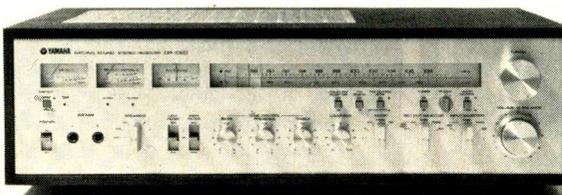
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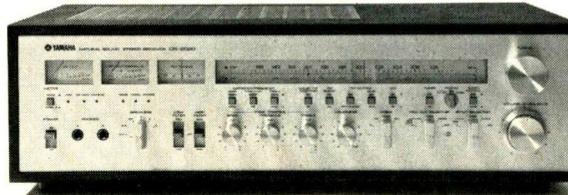
CR-620 0.05% THD 0.05% IM



CR-820 0.05% THD 0.05% IM



CR-1020 0.05% THD 0.05% IM



CR-2020 0.05% THD 0.05% IM

phase 3TM

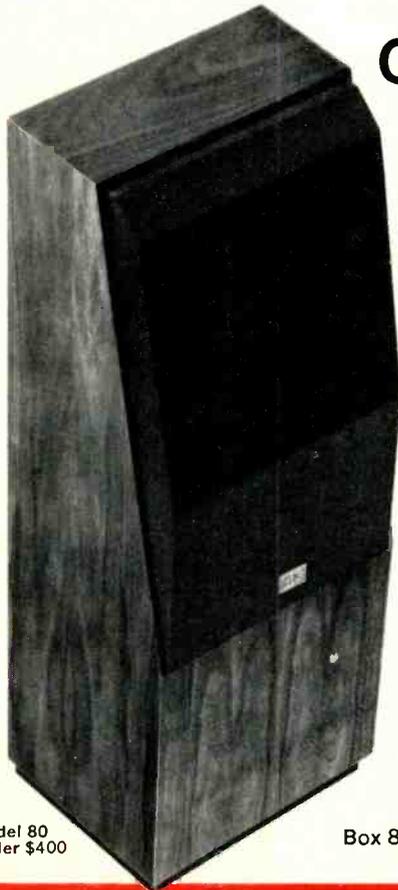
BY DYNACO

For over two years, Dynaco has been investigating the degree to which accuracy can be attained in loudspeaker design. Our selection of a **Phase Coherent** design—where all elements contributing to the sound are precisely in phase—is based on three factors: 1. Computer technology; 2. Advanced instrumentation and testing (the facilities of a complete acoustics laboratory); 3. Controlled listening to all types of music.

Our basic concept—**fidelity to the original**—has been so fully realized that Phase 3 will be your **only** choice if the sound of music live is your reference. Phase 3 is a new expression of Dynaco craftsmanship; a significant contribution to the art of high fidelity.

- Coherent design. Critical step mounting of individual drivers and a special crossover insure all sounds arrive at the ear at the correct time.
- Extremely smooth integrated power and frequency response with low distortion.
- Excellent transient response. Emphasis on clarity and definition. Complex program material remains unmuddied.
- Relatively high efficiency for today's modern, low distortion amplifiers.

Quality is everywhere . . . in the drivers, crossover, cabinet, and finish detailing . . . but especially in the sound.



Coherent Sound

Ask for an in-depth demonstration. Don't be switched. If not available at your dealer, phone Mike Patrick collect at 609/228-3200, or write, Dept. A-12.

DYNACO

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Model 80
under \$400

Tape Set

Q: Assuming that one has only played partly through a reel of tape and will not be able to complete the reel until a day or so later, is it better to rewind the tape or can it be left in the partly played position?—Leonard Weiner, Chicago, Ill.

A: Leaving your tape in a partly played position for a day or so is hardly apt to cause a problem.

Stereo Jack Recording

Q: Can recording be done through the stereophone jack of a receiver if one wants to introduce tone or other adjustments?—Leonard Weiner, Chicago, Ill.

A: I think that, ordinarily, you could record from your receiver's stereophone jack into a tape deck. Depending on the output impedance of this jack, you might have to be careful about the length of cable to the tape deck in order to avoid treble loss. However, I doubt that you are likely to run into this problem.

Tape Dubbing

Q: If I wanted to make a tape of a musical selection which would yield better results, dubbing from a pre-recorded tape or copying a phono disc?—Leonard Weiner, Chicago, Ill.

A: Generally it is preferable to copy from a record rather than a tape since the disc usually has a superior signal-to-noise ratio. Each tape dubbing adds about three dB of noise, and a pre-recorded tape has gone through several stages of dubbing. However, this is better than it used to be owing to the use of the Dolby noise reduction system in making prerecorded tapes.

Tape Pop

Q: When my TEAC tape deck is put into the record mode, an audible pop is recorded on the tape. Is there any way I can eliminate this?—Richard Renfrow, Lakewood, Col.

A: A capacitor of about 0.1 μ F mounted across the switch that puts your machine in the record mode may help. Results may be better if you put a 100-Ohm resistor in series with the capacitor, and place this series combination across the switch. It would be best to consult TEAC if this effort fails.

Introducing the Koss Theory of loudspeaker design and the three new Koss CM speaker systems that prove it.



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Here for the first time is the culmination of a world-wide search for the ultimate in loudspeaker design within the limitations of today's technology and within affordable price restrictions. Indeed it represents a breakthrough in loudspeaker technology of such significance that it heralds the second major revolution in loudspeaker design.

By utilizing a complex series of audio engineering formulas and the precise knowledge of computer science, Koss engineers are now able to derive and produce the optimum system parameters for any loudspeaker. The incredible result of this engineering achievement is the new Koss CM

1010, 1020, and 1030 loudspeaker systems. Each represents the ultimate speaker system available in its price range. And each represents a listening experience you'll have to hear to believe.

Ask your Audio Dealer to let you hear this new, incredibly beautiful, Sound of Koss and to show you how the Koss Theory of loudspeaker design has created a whole new generation of loudspeakers. And if you'd like to have our full-color brochure telling all about the Koss Theory, write for it, c/o Fred Forbes. Once you've heard these revolutionary new loudspeakers, we think you'll agree: hearing is believing.

KOSS® CM LOUDSPEAKER SYSTEMS **hearing is believing**™

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True four-point gimbals centers and pivots tonearm mass where vertical and horizontal axes intersect. The four needle-point pivots are tempered and honed to produce microscopically smooth surfaces. Each pivot is matched to a ball-bearing race only 0.157 inches in diameter.

Unique counterbalance contains two mechanical anti-resonance filters which are specially tuned to absorb parasitic resonances originating in the tonearm cartridge system and chassis.

Cueing descent speed and height are both adjustable, providing complete control of stylus setdown.

Tracking force is applied with a tempered, flat-wound spiral spring, centered around the vertical pivot. Stylus force remains perpendicular to the record even if the turntable is not level.

Straight-line tubular shape provides maximum torsional rigidity and lowest effective mass.

Vertical tonearm control sets and locks tonearm height at any point over an 8 mm range. Tonearm thus parallels record with any cartridge for precise vertical tracking without added mass of spacers.

How to identify the world's finest tonearm.

When one tonearm—among all those available—is described as "the world's finest," some controversy may be anticipated. Fine, we welcome that possibility. There is far too little discussion about tonearms—considering the critical difference they make in how records sound and how long they last.

Simply stated, the tonearm's function is to provide the correct cartridge-to-groove geometry and to allow the stylus to trace the groove contours freely, precisely, and with the lowest practical tracking force.

Dual's engineering approach to tonearm performance makes us feel confident of the outcome of any comparisons.

The basic geometry.

The shape of the Dual tonearm is a straight line from pivot area to tonearm head, the shortest distance between those two important points. Curved tonearms may look sexier, but contribute extra mass, less rigidity and a tendency to lateral imbalance. That's hardly consistent with good engineering.

Every Dual tonearm is mounted in a true, four-point gimbal. The tonearm mass is centered, balanced and pivots precisely where the vertical and horizontal axes intersect.

Identical pairs of low-friction needle-point pivots and miniature ball bearings are used in both axes. The precision and quality control standards applied to their manufacture and assembly are usually found only in aerospace and allied technologies.

Settings for your cartridge.

The vernier-adjustable counterbalance lets you set zero-balance with micrometer-like precision so that tracking force can then be set accurately. A tempered, flat-wound spring applies tracking force directly at the vertical pivot, and this force remains perpendicular to the record even if the turntable

chassis is not level. Anti-skating is applied around the horizontal pivot, directly counter to the skating force, and it adjusts automatically to the varying skating force encountered by the tonearm as it moves across the record.

Another Dual refinement, not available on any other integrated tonearm, is the Vertical Tonearm Control. A vernier height adjustment over an 8mm range allows paralleling the tonearm to the record without cartridge spacers. Tonearm mass remains as low as possible, and mounting and changing cartridges are simplified.

Another Dual exclusive: tuned anti-resonance filters.

The counterbalance contains two specially tuned mechanical filters that absorb parasitic resonances originating in the tonearm/cartridge system and chassis. The result: flawless tracking stability maintained even in the presence of external shock and vibration whether caused by acoustic feedback, record warps or dancing feet.

About all Dual tonearms.

The tonearm shown and described here is part of our higher-priced turntables. But many of its features are found in our lowest-priced model: the four-point gimbal, the straight-line design, and the precise mechanisms for balance, tracking force and anti-skating adjustment.

In fact, we'd be willing to match the performance of our lowest-priced tonearm against anyone else's highest-priced tonearm. But one argument at a time is enough.

Now that you've been "armed" with the facts, we invite you to visit your audio dealer to examine the tonearms you find there—separate and built in—and decide for yourself which one is indeed the finest.

No one can argue with that suggestion.

Dual®



United Audio, 120 So. Columbus Ave., Mt. Vernon, NY 10553

As appearing in all leading audio publications.

Enter No. 15 on Reader Service Card

Dear editor

Radio Remembrances

Dear Sir:

I really enjoyed Mr. Stosich's article in the January, 1977, issue of *Audio*. He is a fellow enthusiast and collector of E.H. Scott radios. This is the first time I have ever seen a thorough discussion into the technical aspects of these receivers. Of course, there are plenty of contemporary articles available, mostly in *Radio News*, but most of them seem to have a "gee whiz" attitude which leads one to think that, perhaps, the reviews were "colored" a bit. On the other hand, the receivers were very advanced for their day and so that attitude may be genuine.

I am currently restoring the tuner and amplifier chassis of a "Berkshire," RCA's entry into the high quality radio field in 1948. Apparently, this was originally a built-in unit as no cabinet for it has survived. At the present time it is operating extremely well on FM, but AM bands (0.50 to 23 MHz) need attention. Did *Audio* ever review this receiver circa 1948?

It is interesting to compare the features and operation of the RCA and its contemporary at E.H. Scott, the Model 800B. It has been my understanding that one or more ex-Scott personnel worked on the design of the "Berkshire."

It would be both interesting and enlightening to hear from any old timers who worked on either the "Berkshire," or on any of the E.H. Scott models as well. Also, members of the Classic Radio Club would like to know of any owners of such radios in your readership, for our mutual benefit.

Bob Fabris
3626 Morrie Dr.
San Jose, CA 95127

Editor's Note: The Equipment Profiles section of *Audio* was initiated in 1952.—E.P.

Editorial Accolades

Dear Sir:

I would like to commend your Contributing Editor of "The Column," Michael Tearson. He has long been a consistent and constructive editor of popular music, and his reviews and

comments are eagerly awaited each month.

Many of us here in the Philadelphia "fringe area" enjoyed him for many years on radio station WMMR, and we were very disappointed to see him leave. Here's hoping that Michael Tearson will continue writing record reviews for *Audio* for a long time to come.

Peter Forte
Tamaqua, Pa.

Nostalgia Buff

Dear Sir:

I am reading your nostalgia articles about old radios with interest. I go back to oatmeal coils, variometers, cat's whiskers, and KDKA (Pittsburgh) on a clear night. Then, everything worked better with a pair of Brandes earphones.

I recently bought a remarkable old Atwater Kent Model 70 (receiver). It is a combination radio, center piece, and flower pot holder for the living room. All of this, plus it works perfectly and brings us the same bad news broadcasts as the modern sets. When I first plugged it in, I expected complete silence . . . or if it did work, I wouldn't have been surprised to hear Ma Perkins, or Vic and Sade. But the set works perfectly, in addition to giving us a lot of needed heat from all the tubes during these Wisconsin winters.

Charles Conrad III
Racine, Wis.

Paraplegic Quandry

Dear Sir:

Where, oh where, can I obtain that Rabid Audiophile Notions Paraplegic 45 Equalizer as listed on page 170 of the *Audio* October Annual Equipment Directory?

Afer perusing this impressive equalizer's extraordinary specifications, I came to the conclusion that I could not live without it as it would be the perfect mate for my Lirpa I Transoceanic receiver.

Excellent issue; keep up the good work.

E. David Lee
Don Mills, Ont.
Canada

Why Bose® speakers may be hard to find this month.

Simply stated, we're selling each of our four Direct/Reflecting® speakers faster than we're making them.

You may ask why we don't make them faster.

We probably could. But we won't. One of the things that separates us from the other guys (besides our unique Direct/Reflecting® speaker designs) is our uncompromising commitment to quality.

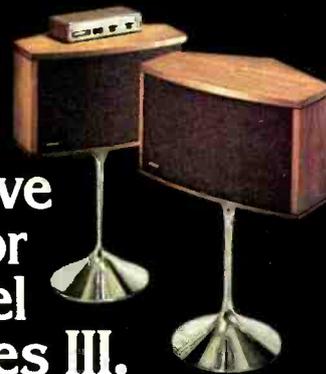
So, if we made Bose speakers faster, they might not be as good.

And then they wouldn't be Bose speakers.

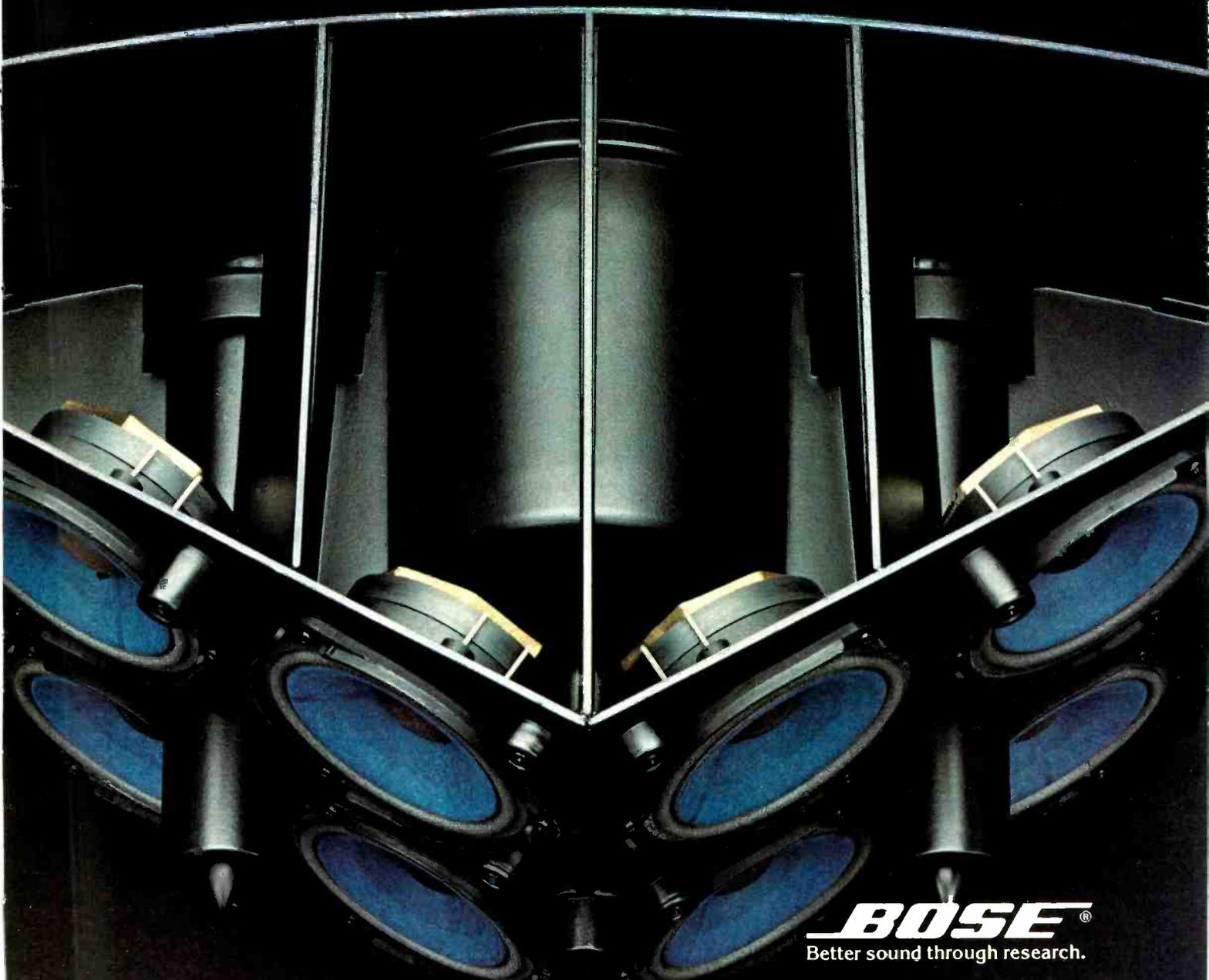
Please be patient with us, and with your Bose dealer.

Whether it's the Model 301, 501, 601 or 901 Series III, Bose speakers are worth the wait.

No other speaker has ever looked like this, no other speaker has ever been built like this. And we believe no other speaker, regardless of size or price, can recreate the impact and feel of live music like the Bose 901 Series III.



It is a speaker unlike any other.



BOSE[®]
Better sound through research.

In one page we cannot begin to describe the 901 Series III and the technology behind it. So we've put together a comprehensive literature package that includes a detailed 16-page color brochure, a 20-page owner's manual, and a copy of Dr. Amar Bose's paper on "Sound Recording and Reproduction," reprinted from Technology Review. To receive this literature, send \$1.00 to Bose, Dept. AU 11, The Mountain, Framingham, Mass. 01701. Patents issued and pending. Cabinets are walnut veneer.

Audio etc.

Edward Tatnall Canby

I couldn't help it. I flipped like a flip-flop circuit. The beginning of the end of electronics? After 75 years? It just could be.

Here's a whole new basic audio technique with absolutely staggering potential, at least in terms of bandwidth, miniaturization, and information-carrying ability—and not an electron in sight. A complete system, so new that it has been shaped up only in the last few years and yet also straight out of present and past practice, to the point where much of its technology will already be second-hand familiar to audio design specialists and hobbyists alike. Lightwave audio!

Light-guide signal transmission, powered by incredibly tiny lasers or LEDs the size of a grain of sand, modulated with a pulsed digital signal—what else?—and transmitted via extremely fine "wires" of glass fiber which, even so, are already being shaped in concentric lateral layers to keep the signal beam cleanly in the center of the glass channel via refraction (and so reduce variable-path blurring). The light signal is finally detected (back into electronic form) via equally tiny, solid-state photo transducers, already familiar enough as variants of the ubiquitous transistor.

There you have the basics. Generation of carrier. Modulation of signal (digitally). Transmission via waveguide glass (your fiber can reach for miles and go around corners any old way). And detection of signal. An old familiar sequence in an utterly new medium. Oh, yes—how about amplification? If you can't amplify your light signal, you are as helpless as we

were back before the vacuum tube. Of course, there is amplification! What else does the very word *LASER* mean? Light amplification by stimulated emission . . . that is the key, No. 1 to the whole new system. The key No. 2 is the wave-guide fiber, now already practical and still under intensive development. Plus the absolutely essential digital technique, which provides the clean-up that allows a

technology). And it is the telephone network for which the entire existing system has been specifically designed—and put into practice. Glass-fiber communications became official and commercial in April of this year in Chicago. Out there, people are actually talking through glass via light, hundreds of them simultaneously.

If, by chance, this is new to you, your mind is probably buzzing with questions (it should be!), and in my space, with my slightly journalistic audio, I can best do no more than get you excited, interested, or at least aware. Is Ma Bell's equipment practical for us, in whole areas of audio from broadcasting to recording and home hi fi?

Of course, it's not practical—not now. Purely visionary. Not in any way systematically developed, for us, or any part of us audio people. Maybe not even thought-about yet, except by small devils like myself who don't have to do the work. Yet even

so, for any half-inventive audio mind the thing should be mind boggling, assuming you know what boggling is.

Developed and yet not developed! Very advanced and already beautiful as telephone technology. I'll have to use that favorite word of the physicist and mathematician—*elegant*. The whole system, as Ma Bell has worked it out, is just marvelously elegant. Elegant, even though there is obviously much work still to be done, because this system is *complete* and coherent, coherent as the very light which pulses it out of the micro-miniature grain-sized lasers and LEDs.

And yet much is obviously irrelevant for us. The phone company's major



M. HALTON

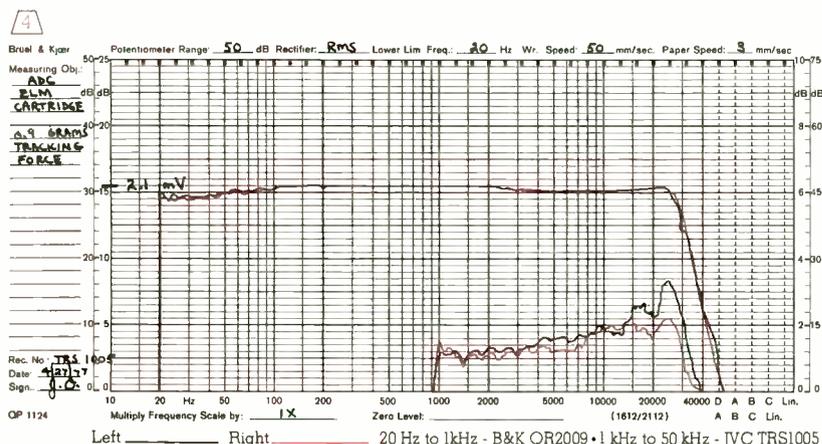
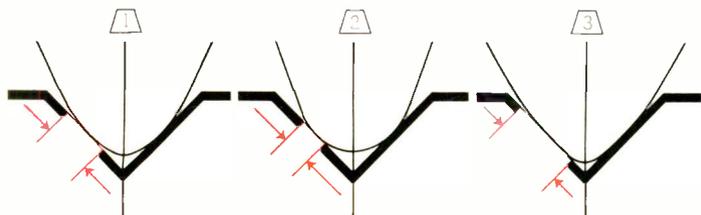
weakened and muddy light signal, full of light noise, to be reconstituted into a new signal as good as the original.

Where It All Began

Now, be sure you understand that all this excitement comes, at the moment, strictly from outside audio as we practice it. The locus of the ferment is, oddly, just where it was when the very first audio of all (i.e. the transmission of sound via electron flow) occurred back in 1876—the telephone. Ma Bell is responsible for the new technique, with assists from such likely sources as the Japanese (who are working on glass fiber

1976: ADC CLAIMS THE XLM MK II SHOWS "NO PERCEIVABLE WEAR OVER THE LIFE OF A RECORD." AND PROVES IT.

1977: ADC CLAIMS THE NEW ZLM WITH THE ĀLIPTIC™ STYLUS HAS EVEN LOWER WEAR AND BETTER PERFORMANCE. AND PROVES IT AGAIN.



Introducing the ADC ZLM cartridge with the ĀLIPTIC ¹ stylus. It's a revolutionary new cartridge design that has taken the state of the art a giant step closer to the state of perfection.

Because of last year's XLM MK II record wear test results, we confirmed our thinking on how to design the perfect stylus tip shape. It combines the better stereo reproduction of the elliptical ² stylus shape with the longer, lower wearing, vertical bearing radius of the Shibata ³ shape. The result is our revolutionary new ĀLIPTIC stylus.

And that's only the beginning. The ĀLIPTIC shape is polished onto a tiny .004" x .008" rectangular nude diamond shank, which has reduced the tip mass of the XLM MK II by an incredible 50%. This tiny stone is mounted on our new, tapered cantilever, which reduces effective tip mass even further.

The XLM MK II tests also proved the importance of tip polish in reducing record wear. So the ZLM is polished with a new, more expensive, more effective patented polishing method.

The ADC XLM MK II has long been known for its uncolored, true sound reproduction. The ZLM goes even further. Sound reproduction is completely open and spatial. And individual instrument placement can now be identified with even greater ease.

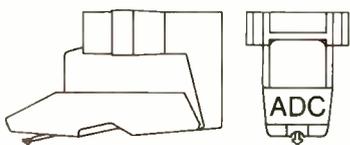
The ZLM tracks between ½ and ¼ grams. Frequency response is ± 1dB to 20kHz and is flat to even higher frequencies; out to 26kHz ± 1½dB.

As you can see, by reducing the tip mass even further, we've come closer to the ultimate in pure sound reproduction. To prove it, every ZLM comes with its own individual frequency response curve ⁴, signed by the ADC technician who tested it.

This means that the ZLM cartridge will reach every sound lying dormant in your records, transmitting them faithfully through your hi-fi system without altering the sound or the health of your records.

Not only do we think the ZLM is one of the most exciting cartridge designs to come along in years, but we can prove it.

Superior performance we can prove.



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CARTRIDGES

Audio Dynamics Corporation
Pickett District Road
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concern, as always, is distance. Their present parameters allow for a glass fiber up to almost a dozen kilometers long with recovery of a useably clean telephone signal—I should say, hundreds of useable signals—that may be fed back into conventional phone channels or passed along to more fiber. Now I can imagine that in special audio applications such as cable TV and large studio wiring complexes, this sort of length could be very important, at a vast saving in cost and size and, of course, in metal. No copper. Just refined sand, of which the supply is rather large and the reserves near-infinite. But wait until you hear about

the size and the bandwidth. There is a lot more to this than convenient miniaturization.

I do not exactly envision five or six miles of light-guide glass inside an average home hi-fi system. To what purpose? Nor do the Ma Bell signal parameters apply to our sorts of audio. Why bother to send almost 700 isolated signals each limited to 4 kHz bandwidth, 'round and 'round through one single tiny hairlike "wire"? That is precisely what Ma Bell is now doing. But look!—and think a bit. What if you limit yourself to a mere 100 separate signals of a correspondingly wider bandwidth? Or if you manage

barely to make do with, say, 50. Or 40, like my favorite future-forecast system, the traveling sound show "Entity I" which a few years ago generated 40 channels of simultaneous sound from 20 individual Ampex tape players. Ha, Entity! Are you there?

The glass wave-guide isn't even the size of a human hair. It is much smaller, if I am right.

The way Ma Bell does it, presently, is to make up a flat half-inch-wide cable of 24 glass fibers in two 12-fiber layers. Sounds very telephonish, doesn't it, and we don't necessarily have to do it that way. Ma Bell, after all, has to cope with manholes and underground conduits and a thousand other gross interferences to transmission efficiency. Do we? Anyhow, the phone company's present cable can carry more than eight thousand completely isolated and separate two-way phone conversations, at the bandwidth already mentioned, 4000 hertz. Please retranslate that for yourself, (a) into wide-range hi-fi signals, just for a breather say 20 to 20K, or if you wish, zero to 50K. And (b), into video channels, wideband and full range for color. Not quite 8000 of them, but quite a few, even so, for one measly little flat tape-like conductor cable, roughly the size of those cable TV conductors they run around the walls of city buildings.

D.c. To Light

Now you see why I flip-flop. *Bandwidth!* That is the overall biggest thing in glass light-guide technology. Bandwidth absolutely beyond belief, because of the very nature of light as a form of matter/energy and a medium for modulated transmission. We think we're pretty good with our advanced electronics, and indeed present civilization depends to an awesome extent on those megahertz and gigahertz devices we get to know so well. But light is the Einsteinian end, the ultimate, as far ahead of the mere electron stream as, say, the electronic switching circuit is ahead of the old-fashioned mechanical flip switch—speaking of flip-flops. Light opens up the same sort of unbelievable "space" as the radio and X-ray telescopes have done, though oppositely.

Let us sum it up. The coherent laser light generator offers an ideal modulation bandwidth of a mere 100 trillion cycles, for anything you want to accomplish. The Editor would never allow me to write that number out in figures—I mean straight figures, not logs. It would take up a paragraph of zeros.



Soundcraftsmen

THE EQUALIZATION LEADER...

WHY? Because WE CARE about HOW an equalizer does its job BEST!

That's why we provide our customers with our exclusive...

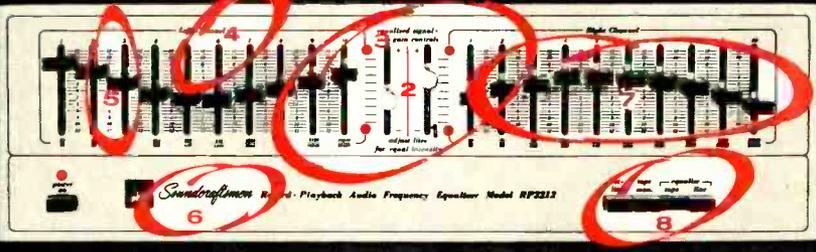
10-POINT "TOTAL-SYSTEM EQUALIZATION"

YOU NEED MORE THAN JUST AN EQUALIZER... FOR OPTIMUM EQUALIZATION BENEFITS, HERE ARE THE TEN ESSENTIAL ELEMENTS YOU NEED:

- 1 YOU NEED VISUAL ZERO-GAIN LEVEL INDICATION:** SOUND-CRAFTSMEN provides combination zero-gain controls with LIGHT EMITTING DIODE indicators to show when exact zero-gain is accomplished. Adjusting the zero-gain controls for equal L.E.D. intensity assures you of input vs. output level matching.
- 2 YOU NEED FULL-SPECTRUM BOOST OR CUT CONTROLLABILITY:** SOUND-CRAFTSMEN'S "zero gain" circuit provides an additional 18 dB control range over the full spectrum 20 to 20,480 Hz on each channel for instantaneous input-output zero-distortion signal matching.
- 3 YOU NEED AUTOMATIC/CONTINUOUS OUTPUT OVERLOAD WARNING SIGNAL:** SOUND-CRAFTSMEN'S 2 top L.E.D.'s glow brightly, (bot-

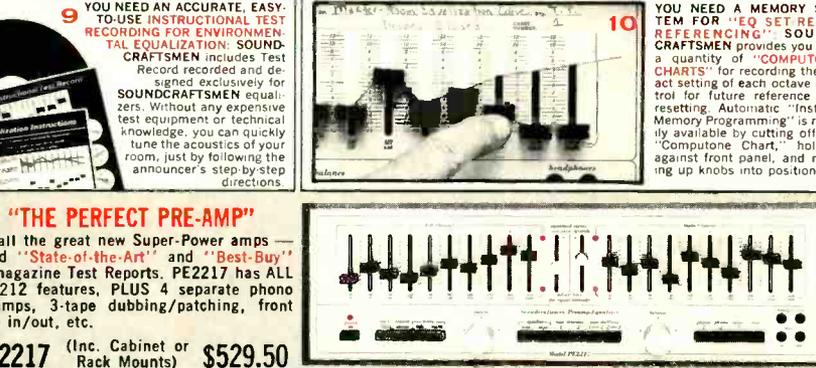
tom L.E.D.'s off), if output voltage is boosted excessively, thus eliminating the danger of distortion and/or damage to related equipment resulting from the high voltages that can be generated by any fine equalizer.

- 4 YOU NEED A POSITIVE METHOD OF READING 1 dB SETTINGS...**
- 5 YOU NEED AT LEAST 24 dB TOTAL CONTROL OF EACH OCTAVE...**
- 6 YOU NEED A UNIT THAT WILL ADD ZERO NOISE AND DISTORTION:** SOUND-CRAFTSMEN'S signal-to-noise and distortion performance figures are far superior to most high fidelity components. SOUND-CRAFTSMEN products are used in professional broadcast and recording systems, assuring you of completely noise-free and distortion-free integration into your system.
- 7 YOU NEED TO BE ABLE TO LOOK AT YOUR ACTUAL "EQ" CURVES.**
- 8 YOU NEED THE ABILITY TO EQUALIZE TAPE RECORDINGS...**



9 YOU NEED AN ACCURATE, EASY-TO-USE INSTRUCTIONAL TEST RECORDING FOR ENVIRONMENTAL EQUALIZATION: SOUND-CRAFTSMEN includes Test Record recorded and designed exclusively for SOUND-CRAFTSMEN equalizers. Without any expensive test equipment or technical knowledge, you can quickly tune the acoustics of your room, just by following the announcer's step-by-step directions.

10 YOU NEED A MEMORY SYSTEM FOR "EQ SET RESET REFERENCING": SOUND-CRAFTSMEN provides you with a quantity of "COMPUTONE CHARTS" for recording the exact setting of each octave control for future reference and resetting. Automatic "Instant-Memory Programming" is readily available by cutting off the "Computone Chart," holding against front panel, and moving up knobs into position.



"THE PERFECT PRE-AMP"

for all the great new Super-Power amps—rated "State-of-the-Art" and "Best-Buy" in magazine Test Reports. PE2217 has ALL RP2212 features, PLUS 4 separate phono preamps, 3-tape dubbing/patching, front tape in/out, etc.

PE2217 (Inc. Cabinet or Rack Mounts) \$529.50

GUARANTEED SPECIFICATIONS

FREQUENCY RESPONSE: ±0.5 dB 20.20,480Hz THD: Less than 1% @ 2 v., Typ: .05% @ 1 v. S/N RATIO: Better than 106 dB @ full output. Better than 96 dB @ 2 v. RMS FILTER TYPE: Toroidal and Ferrite core. INDIVIDUAL OCTAVE-CONTROL RANGE: Minimum ±12 dB (Typ. ±14 dB), each octave centered at 30, 60, 120, 240, 480, 960, 1920, 3840, 7680, and 15,360Hz.

RP2212 (Includes Cabinet or Rack Mounts) \$369.50

RP2204 (Same as 2212, except no LED's) \$329.50

20-12A (Same as 2212, except no LED's and Tape EQ thru rear panel patching) \$299.50

FREE!

THE "WHY'S AND HOW'S OF EQUALIZATION,"

an easy to understand explanation of the relationship of acoustics to your environment. This 6 page booklet also contains many unique ideas on "How the Soundcraftsmen Equalizer can measurably enhance your listening pleasures." "How typical room problems are eliminated by Equalization," and a "10-point self-rated Equalization Evaluation Check-List," plus Specs and Reviews.



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HIGH BIAS.

**These cassette deck
manufacturers are highly biased for SA:**

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KENWOOD · MERITON · NAKAMICHI
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TOSHIBA · UHER · YAMAHA

**And are joined by these
in recommending SA for use in their decks:**

BANG & OLUFSEN · DUAL · FISHER
HARMAN/KARDON · LAFAYETTE
ROYAL SOUND · SANKYO
AND MANY OTHERS.



There's been a quiet revolution going on in the cassette world. □ Leading makers of quality cassette decks have adopted TDK SA as their reference standard tape for high (CrO₂) bias and equalization settings. Why TDK SA? Because TDK SA's advanced tape formulation and super precision cassette mechanism let them (and you) take full advantage of today's advanced cassette deck technology. □ In addition, a growing number of other companies are recommending SA for use with their machines. □ So for the ultimate in cassette sound and performance, load your deck with SA and switch to the "High" or "CrO₂" bias/EQ settings. You'll consistently get less noise, highest saturation and output levels, lowest distortion and the widest dynamic range to let you get the best performance from any quality machine. □ But you needn't believe all this just because we say so. All you have to do is check our references.

 **TDK**[®]

The machine for your machine.

TDK Electronics Corp., 755 Eastgate Blvd., Garden City, N.Y. 11530.
In Canada: Superior Electronics Industries, Ltd.

Enter No. 62 on Reader Service Card

Not all of that bandwidth is available to you via this new phone technology in its present state of practical development. But the jump upwards is so enormous, even so, as to be breath taking. It accounts for those 8000 two-way calls per cable. With inevitable improvements in technology, a much larger part of the total bandwidth will be right there for us to use—if we can use it. Can we? Heaven alone knows! But the thing exists, it is *there*.

Something will be done, without any doubt at all. And it will be you, collectively, who will be doing it.

Before, I quit flip-flopping, a few more answers to fundamental questions. Let me say at once that all credit goes to Ma Bell herself, the main and ultimate source, via my own chief source of inspiration, a detailed and objective article in *Scientific American* (August, 1977) which, without going beyond present telephone use, gives an

admirably detailed account of all phases of this development. It should be your inspirational wave-guide bible for glass technology, at least until something further appears. That won't be long, I expect.

How about the incidentals? How about such mundane things as connectors, switches, and so on? They are already well in hand, along with alternative ways to power the glass fibers and to detect the signals, each with its useful parameters and limitations, each still under development. Take it from beginning to end. The digital coded signal is, of course, now set for phone company needs and ties into the present working system. That coding, too, is widely open to variation for different purposes. It is now 8000 samplings per second and eight binary units, for 256 levels of amplitude, rather modest parameters if I am right. You digital people can get your minds to work on that. Plenty of room to expand. The light sources and the wave guide I have described; both the LED (infra red) and the laser, feed directly into the ends of the fiber. Advantages to both light sources, and both are no more than advanced transistor-like layered-deposit micro-units very much like the structures we know in many sorts of electronics. Similarly, the detectors are solid state and familiar, alternatively at the moment a PIN type junction light detector or a more efficient avalanche-type detector. Because of its narrower, more coherent beam, the laser would seem to be out ahead, and the avalanche-type detector a better bet—but who knows.

That mundane necessity, the connector, would seem to be a tough problem—light beams from the end of one tiny fibre into another. Solved. There is a 0.5 dB loss for each such “splice”—not bad. As for signal loss within the glass fiber, it is now about 5 dB per kilometer, which is not very much per meter, or per inch. Switching—light switching, not electronic—is in the works, though most of ours would probably be in the electronic aspect of signal processing, the easy way for the moment. Digital pulse spreading, the blurring of pulses over distance which was the major unexpected problem in the first long telegraph cables, is a problem now for phone people but relatively minor for short-distance audio. You can have all the pulses you could ever need, like 5×10^8 per second as a starter. Enough?

Well, enough of this—and more later. And keep your eye out for more block busters, like integrated light signal processing within thin films, the light equivalent of the IC. WHERE will it all end? A

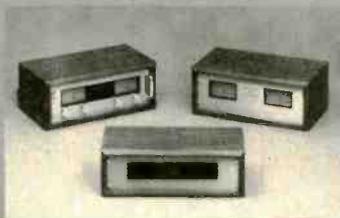
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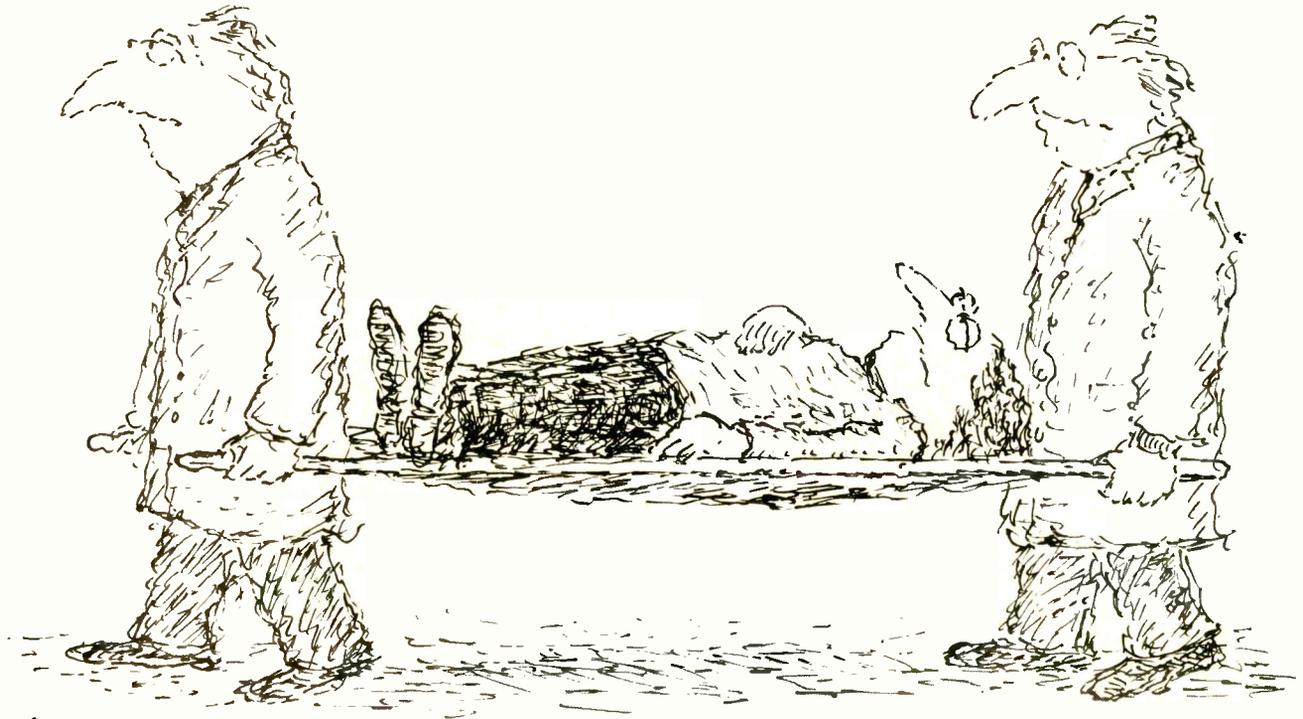
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And I believed it all until I started shopping for a new turntable.

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And, it's been engineered with fewer parts which not only saves money, but improves performance.



Korten

Plug a B·I·C into your system and you have a terrific single play unit, a great changer when you want it, and a precision instrument that's a joy to behold.

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Behind the scenes

Bert Whyte

Back in 1972, I reported on the use of delay lines, specifically the Delta T digital-delay unit, and an acoustical delay line, the Cooper Time Cube, for the synthesis of quadrasonic sound from two-channel stereo sources and the simulation of "concert hall" acoustics in the listening room. Mainly from the standpoint of economics, the Delta T was \$4000 and the Time Cube \$850. I emphasized the use of the Time Cube. I pointed out that no matter how expensive, elaborate, and high in quality a component sound system might be, it could not furnish the psychoacoustic equivalent of the concert hall listening experience without some means of simulating the acoustic ambience of a concert hall in a listening room. The 14-mS and 16-mS delays available from the Time Cube did an excellent job of creating a non-coherent "hall sound" and a convincing illusion of spatial ambience.

In January, 1976, I related how the simulation of "concert hall" acoustics could be improved by feeding the outputs of the Time Cube delay lines into the AKG BX-20 Torsion Transmission Line reverberation unit. The idea was that the 14-mS and 16-mS delays of the Time Cube would approximate the first order reflections (early sound) from the ceiling, walls, and floor, preceding the onset of reverberation and enhance the illusion of a large hall. The BX-20 could provide up to four seconds of reverberation and in combination with the Time Cube do a very effective job of spatial enhancement of stereo material. However, the pair of devices cost over \$4000 and were hardly products for the audio consumer.

New Developments

Since my initial forays into the uses of delay and reverberation in the home listening experience, there has been ongoing interest in these phenomena, and it is evident that the simulation of concert hall acoustics is an idea whose time has come. Thus, in the last few years a number of devices for the generation of delay and reverberation have appeared on the market at an average cost of about \$600. Some models operate on digital principles, and others are analog devices. There

are advantages and drawbacks for both types, and this has a considerable bearing on their acceptance by audio consumers. Since the introduction of these relatively low-cost delay units, many audiophiles have auditioned them and have become positively enthralled with their performance. When they play a favorite classical recording and experience the dramatically increased sense of "liveness" and almost palpable "presence" of the sound afforded by the delay, their reaction is unbridled enthusiasm. For many audiophiles, this enthusiasm never wanes, and their delay unit is a source of unending delight. For other audiophiles, depending on their other system components, certain sonic flaws in the delay units begin to intrude on the overall sound quality.

AKG BX-10



They become aware that there is insufficient echo density . . . not enough multiple reflections with enough amplitude . . . for an accurate simulation of hall ambience. They hear some low level distortions, and most importantly, they hear the illusion-destroying hiss as a result of poor signal-to-noise ratio. Inevitably, some disillusionment creeps in, for while they like the spatial enhancement of the delay systems, they don't want it at the expense of basic audio parameters.

At the same time as the delay units began to appear on the market, another phenomenon was beginning. This was the appearance of what best could be described as "garage" or

"basement" recording studios. Originally set up to record rock groups who couldn't afford professional studio facilities, they soon evolved from strictly amateur operations into a new kind of semi-professional status. This, as presently constituted, is a whole new market entity. It is enjoying mushrooming growth, and many audio manufacturers are specifically catering to them, with many products entirely new on the audio scene. These basement operations kept alive the four-channel tape recorder, and soon specialized models with the all important "sync head" overdub facilities appeared. Here was a new market for small but sophisticated mixing consoles, mikes, stands, booms, mini-synthesizers and other electronic instruments, tape, test instruments, and all the other myriads of paraphernalia used in recording. Lately, many basement operators have upgraded themselves to eight tracks on half inch tape, with dbx noise reduction facilities. Make no mistake . . . these people spend a lot of money, and more and more companies are bringing out products to climb on this bandwagon.

However, it must be emphasized that in spite of this trend, there is a sort of general "break point," a "money barrier" if you will, which precludes the acquisition of equipment beyond a certain price range. Obviously, this includes many professional items, and most unfortunately for the smaller firms, this means the majority of reverberation and delay devices. The EMT gold-foil reverb unit is about \$4500, the EMT reverb plate about \$6000, while the fancy EMT 250 digital reverb is a cool 15 Gs. The Lexicon and Eventide delay units are several thousand dollars. The AKG BX-20 is around \$3200. What to do? Some ambitious types, with time and some money, build their own glass-lined reverb chambers, but they suffer from a fixed reverb time, which may not necessarily be usable for all their recordings. Others try to use tape delay systems, but they have various drawbacks. In desperation, some use cheap springs, but the weird colorations soon drive them (and their clients) berserk. A few try to use some of the audiophile delay units previously described.

The Dahlquist DQ-10. Time...and Time again.

Critics and audiophiles agree — the listening quality of the DQ-10 is unexcelled. What accounts for its superb performance?

Time

Much credit for its smooth coherence must be given to the precise and matched transient characteristics of the live drivers. And, a good deal has been written about the DQ-10 and its extraordinary solution to the problems of time delay or phase distortion. It is not surprising that other high quality speaker designers have followed suit in offering their versions of time delay correction.

...and Time Again

The real "secret" to the unprecedented performance of the DQ-10 lies in Jon Dahlquist's patented method for reducing *diffraction*, a more audible and constructive form of *time* distortion. The separate baffle plate on which each driver

is mounted is dimensioned to minimize diffraction in the frequency band in which it operates. Thus, the effect of the sound we hear is that of a driver mounted in free space, without obstructions or surfaces to distort the original sound source.

It can be said that the DQ-10 eliminates inaccurate reproduction caused by time elements — inertial time delay, and diffraction time delay — distortions that limit the performance of conventional speaker systems.

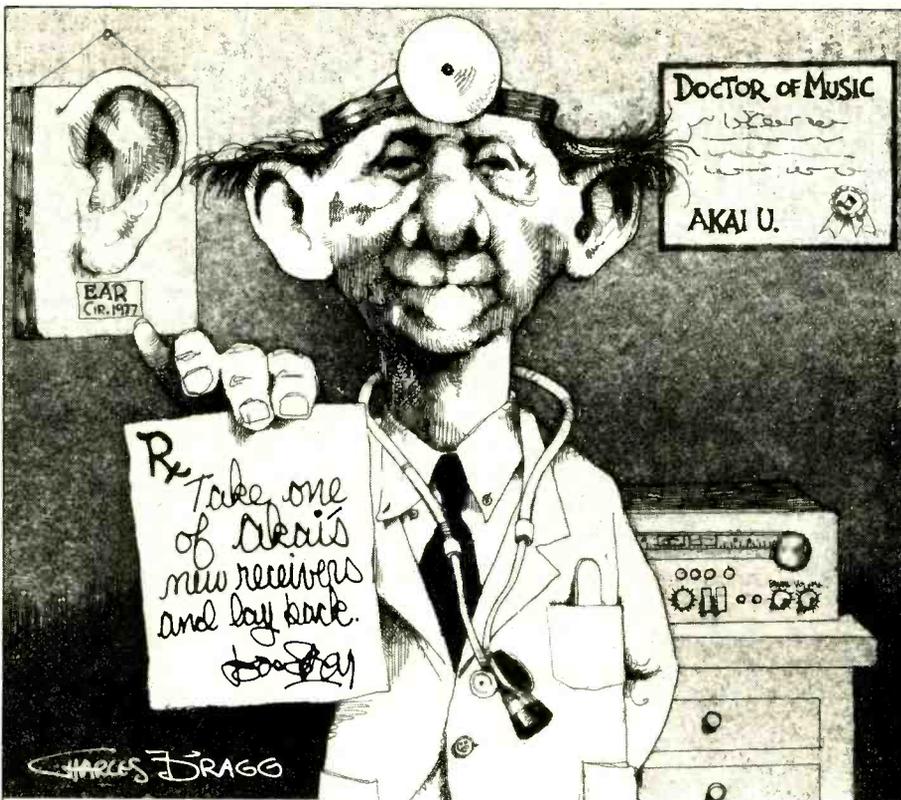
That's why the more critical listener will select the DQ-10. Time and time again.



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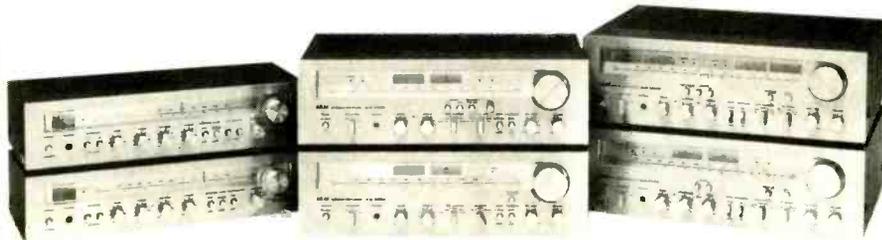
Choose from six power ranges — 15 to 120 watts per channel — with suggested retail prices from \$179.95 to \$629.95. So now, no matter what receiver you want — a good basic unit or a unit with all the features an audiophile demands — AKAI's for you. You can feel confident that dollar for dollar, spec for spec, you're getting the true-to-life sound you expect from the

name AKAI. And a receiver that delivers better tuner sensitivity and less distortion at all volume levels is what a good receiver is all about.

Compare performance, features, design and value at your AKAI dealer. And start hearing what you've been missing.

Model	Watts/ RMS	OHMS	Power Band Width	Total Harmonic Distortion
AA-1115	15	8	40-20,000 Hz	no more than 0.5%
AA-1125	25	8	20-20,000 Hz	no more than 0.3%
AA-1135	35	8	20-20,000 Hz	no more than 0.2%
AA-1150	50	8	20-20,000 Hz	no more than 0.1%
AA-1175	75	8	20-20,000 Hz	no more than 0.08%
AA-1200	120	8	20-20,000 Hz	no more than 0.08%

AKAI



ART COLLECTORS:

For an 18" x 24" reproduction of this Charles Bragg etching suitable for framing, send \$2 to AKAI, Dept. A, P.O. Box 6010, Compton, CA 90224. ATTN: Doctor.

A Reasonable Cost

I have a couple of pieces of equipment, which used singly or in combination, will furnish either an audiophile or a "semi-pro" studio operator with highly satisfactory delay and reverb facilities. One of our great audio pioneers, Rudy Bozak, has introduced the Celeste Model 900 electronic sound delay unit. This is an analog delay system, utilizing Reticon charge-coupled devices, a "bucket brigade" system which affords up to 50 milliseconds of delay and a remix facility for the stereo channels for reverb simulation. A slim 2½ in. high by 17½ in. wide, the unit controls from left to right are *Output* level, with an output of 0.7 volts rms, which is sufficient to drive most pre-amp high level inputs; *Blend*, which is continuously variable from all direct to all delayed sound; *Remix*, which recirculates the delays between the channels for reverb simulation; *High Frequency* restoration, to recreate highs lost in the delay circuit, and the *Delay* control, which is continuously variable from 20 to 50 milliseconds, marked in increments of 3 milliseconds. The Model 900 is a straightforward "no frills" unit, which is characterized by neutrality of audible coloration in the delay section, though there is a small amount in the remix reverb, no audible distortion, and a signal-to-noise ratio which assures quiet operation. One of the advantages of the unit is that it can be used strictly as a delay system if so desired, with no reverb at all. Like most of the delay units on the market, echo density could be improved. I used a setting of "all delayed" on the *Blend* control; the *Remix* control at about 70 per cent, which gives useful reverb with minimum coloration; the *High Frequency* control completely off (I want the attenuation in the delay, which is a characteristic of a concert hall), and I set the delay control at 35 milliseconds, which is just about the fusion limit for the brain . . . beyond this you run the risk of echos. Used in this fashion, the Model 900 does an excellent job of simulating concert hall ambience. The price of the Celeste is \$495. Used by our semi-pro operator, the settings would undoubtedly be different, and while the reverb is quite clean, in many instances longer reverb periods would be desirable . . . so here is the next part of this story.

I noted earlier the availability of the AKG BX-20 reverb unit, a thoroughly satisfactory device, but it costs over \$3200. Well, some bright lads at AKG thought up a way of using the principles of the BX-20, but in a much

While others are reaching for this technology, Sony brings it within your reach.

It takes a sharpened technical sense to deliver innovation at sensible prices.

Who else but Sony could manage it? We know turntables backwards and forwards. As far back as 1966, we were breaking ground: in that year, we applied a slow-speed, servo-controlled motor to turntables.

Today, we present the PS-X7, X6 and X5. Three fully automatic, direct drive turntables that are a direct challenge to the competition.

And the competition will soon find that we've got the features they don't want to face.

The X-tal Lock. X-act speed accuracy.

A traditional servo system doesn't serve you well enough. It can heat up, creating speed drift.

More critically, increased friction between the stylus and record during loud passages can slow the speed into a range where a conventional servo isn't sensitive enough to read. But your conventional ears can.

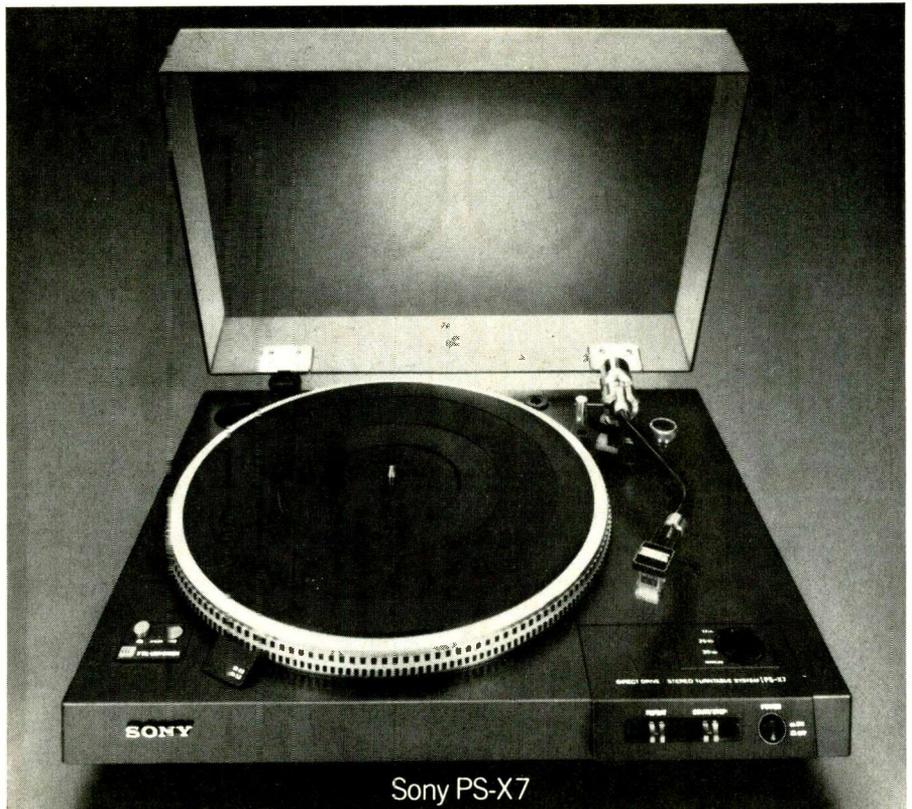
Sony's X-tal Lock system cannot be accused of the above. A quartz generator perfectly regulates the servo, locking in speed *electronically*. It's impervious to temperature, load, or voltage changes.

Our brushless and slot-less is matchless.

Sony's new motor gives brushes the brush. The ring shaped permanent magnet rotor and fixed coil eliminate cogging. The torque is high. The rotation smooth. The start-up, quick.

Sony's Speed Monitoring System. Like millions of tiny State Troopers.

The X-tal Lock system is worth x-actly nothing, unless the right information is relayed to it. Our system uses a precise magnetic pulse signal, recorded on the platter's outer rim.



An 8-pole magnetic pick-up head receives it. Then transmits it to the servo electronics.

Most systems use only one pole. By using 8—and averaging them—we get above average accuracy.

Want functional controls? The case is closed!

Our dust cover lives down to its name. It remains closed, protecting record and machine, allowing immediate access to controls without lifting the cover. (On the X7 and X6, the controls are touch sensitive.)

Underneath the cover, you'll find a safety clutch mechanism to protect the tone arm, should it accidentally be grabbed while in motion.

And on the X7 and X6, an optical sensing system—to automatically return the arm at record's end. (In the X7, a carbon fiber tone arm.)

These turntables are even worth more dead, than alive. Because their cabinets are made from an acoustically dead material. They won't vibrate.

Vibration is also cut by our thick rubber mat, heavy aluminum platter and viscous filled rubber feet. (The X7's mat is filled with the same damping material).

Much has been engineered into these turntables that we haven't mentioned, including lightweight tone arms with a cast aluminum alloy headshell.

So tightly built are they that we didn't even have room for bigger prices.

Cartridges are not included

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smaller, lighter and portable package. This is the BX-10, which measures 17 in. wide X 12 in. high X 19 in. deep and weighs but 47 pounds. Directed at both the professional and semi-pro recording markets, the BX-10 is a much more affordable \$1495. To gild the lily, the AKG engineers even added some features not available on the BX-20. I described the AKG "Torsional Transmission Line" principle a few years ago, but I think it's worthwhile to quote their own description . . . "a helical spring is driven at both ends, in phase to torsional movements, and these mechanical movements are then picked up at both ends again, but out

of phase. Together with the statistical variations of winding and wire diameter of the helical spring, the introduction of reflection points along the spring results in a high degree of diffusion of the signal reflections in both the frequency and time domains, which appear in a similar manner in halls with good acoustics." As noted, the BX-10 is portable, but should not be inclined more than ± 8 degrees. The BX-10 is a two-channel design, with completely independent mechanical and electrical separation, but with provision for mono drive. Input levels can be set for sensitivities from -22 to $+12$ dBm, and output level is a

nominal $+3$ dBm. Each channel has independent decay-time adjustment, high- and low-frequency shelving, and reverb/dry mixing. Each channel has a reverb period of 1.5, 2.5, and 3.5 seconds, switch selectable. The reverb mixing controls for each channel are adjustable from fully counter-clockwise, "dry" (no reverb at all) to fully clockwise for full reverb. S/N ratio is 75



Bozak Celeste

dB rms, and interchannel crosstalk is less than 35 dB with full reverberation.

Taken by itself, the BX-10 furnishes superb clean reverb at the stipulated periods, with a very natural "room" sound. The 3.5 second reverb period should be adequate for most recording situations, except for some "far out," special effects sort of stuff. There are many situations in which the ability to blend various percentages of direct/reverb sound will be most helpful. All well and good, but let us gild the lily again . . . our semi-pro friends can combine the Bozak Celeste Delay unit with the BX-10 for a reverb sound of really outstanding naturalness. By setting the controls on the Celeste for delay only, at about 35 milliseconds, and feeding it into the BX-10, this will approximate those first order reflections, before the onset of reverberation, and produce a sound close to that of a high quality, "purpose built" echo chamber. For slightly over \$2000 for both the Bozak and AKG units, even the "basement boys" can offer a reverb sound of professional quality.

In the home listening situation, admittedly this combination of Bozak delay unit and AKG BX-10 reverb is for the well-heeled audiophile, but *o boy*, what it will do for stereo recordings has to be heard to be believed! Here again, the Bozak delay unit is set for delay only at 35 milliseconds and fed into the BX-10. The BX-10 is set at the 1.5 second reverb position, but even this is really too much reverb for the simulation of concert hall ambience in the average home listening situation. The nifty solution is to set the dry/reverb mix control on the BX-10 to about 35 per cent, and the result is dramatic spatial enhancement of stereo classical music unequalled by anything except the special 16-speaker, computer-controlled system demonstrated by Acoustic Research and not presently available. Thus, for affluent audiophile or quality conscious semi-pros, this Bozak/AGK BX-10 combination is hard to beat! *A*

IOC

The different distortion indicator

26

The Input-Output Comparator (IOC) now available on Crown D-150A and DC-300A amplifiers is a significant departure from traditional overload indicators. The IOC reports all types of overload distortion by telling the user that the output waveform no longer matches the input waveform. The IOC is so sensitive that distortion is reported before it is audible.

In the feedback system used in Crown amplifiers, the input IC is continually comparing input and output waveforms. If there is a difference, indicating a non-linearity in the amplifier, the input IC generates a correction signal.

If the output is distorted from some cause other than overload (for example, crossover distortion) the correction signal will bring the output waveform into compliance with the input.

Overload distortion, however, results from some circuit component operating beyond its linear range. The correction signal cannot change the characteristics of the component, so the input IC continues to generate a large correction signal. This will happen regardless of the kind of

overload—clipping, TIM or protection circuit activation.

The IOC was designed by Crown engineers to take advantage of this behavior, and to use it to report significant information about overload distortion to the user of the amp. The Crown IOC analyzes the correction signal and reports the existence of non-linearities in the output waveform through a front-panel LED.

The IOC is highly sensitive and detects overload distortion that is a great deal less than the .05% THD and IMD ratings of the D-150A and DC-300A. The user is thus notified about overload distortion *before* it is audible. The user also knows that the Crown IOC is reporting distortion of a music waveform, not just a laboratory test signal. Maximum useable gain for the D-150A or DC-300A can be determined by adjusting gain so the front panel LED's stay off, or come on briefly during the highest music peaks.

The IOC is available on all Crown DC-300A and D-150A amps manufactured after October, 1977. Because of its value to any serious music listener, a factory retrofit is available for earlier units.

See your dealer soon for complete information about detecting distortion differently... with Crown.



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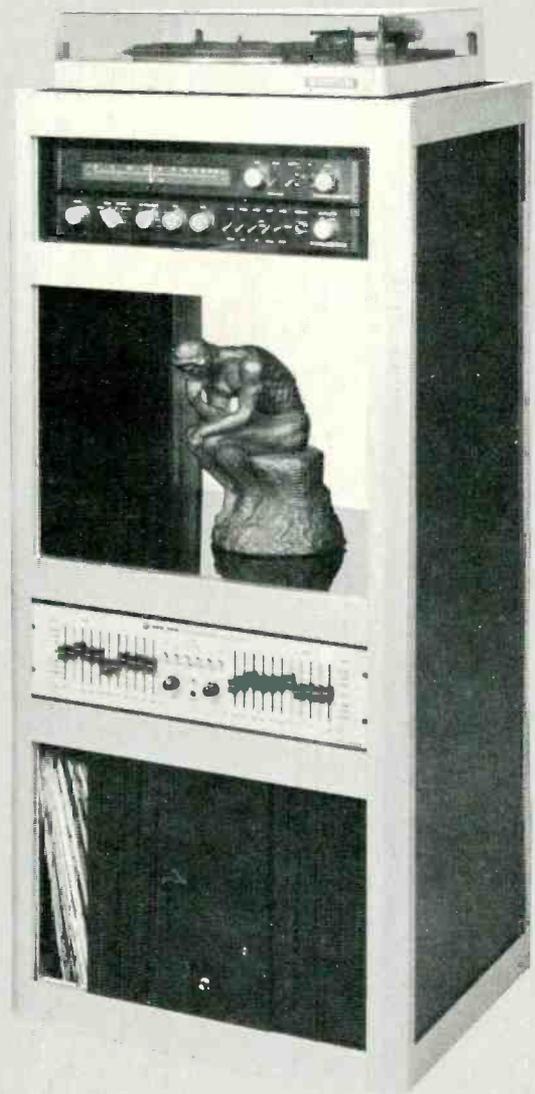
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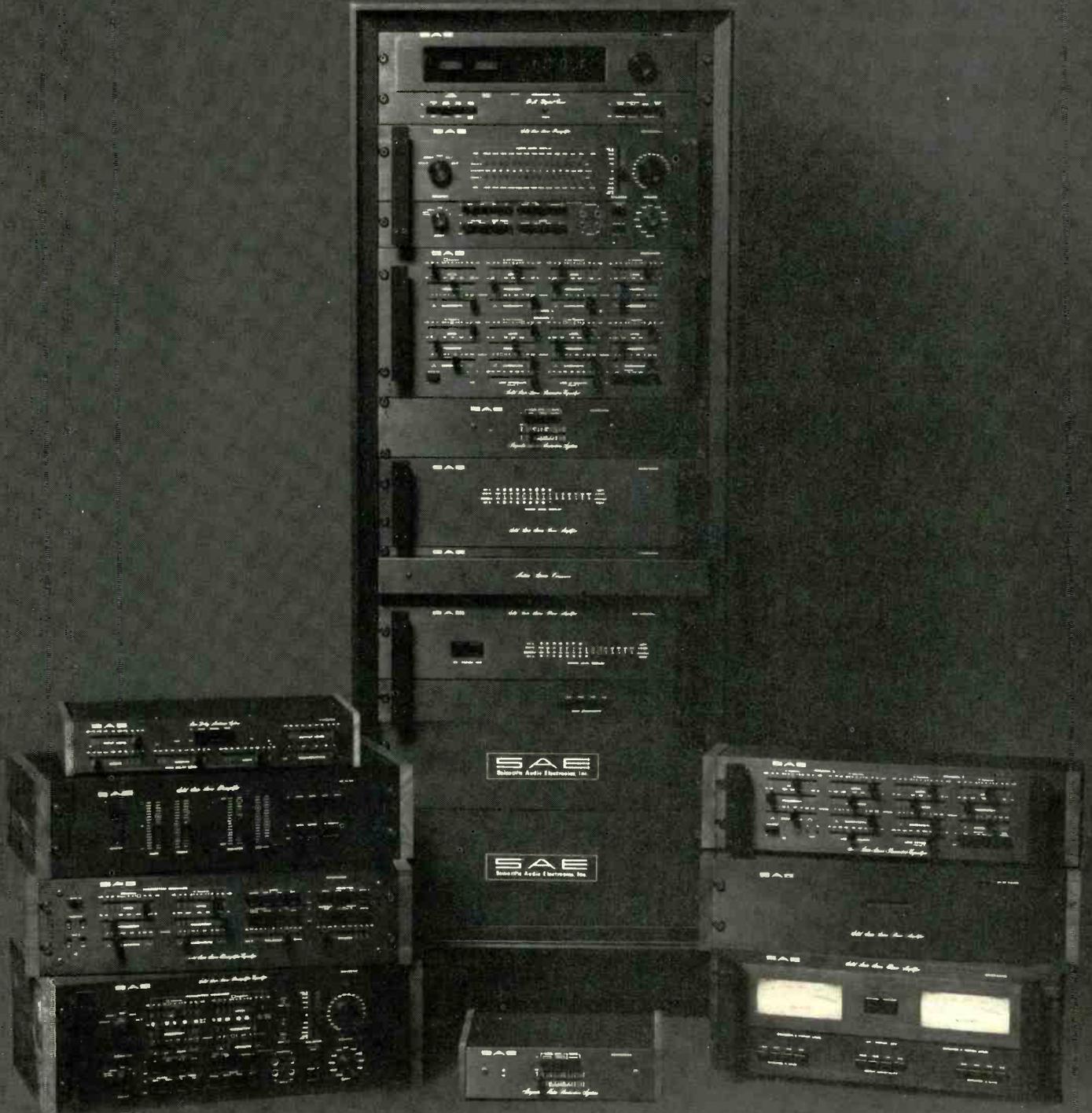
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The Look and



Sound of SAE

What you see here is the result of twelve years of devotion to the development and production of the most revolutionary and highest quality components in the audio industry. This is not the usual self-seeking statement by a biased manufacturer — to prove it, ask anyone who knows SAE.

But, it is not only uniqueness that sets SAE products so far apart from their competitors. It is a goal that SAE established long ago — a goal which states that it is manufacturing excellence as well as design that makes a product truly great.

The following points out the realization of this goal in our product.

AMPLIFIERS

The complete line of SAE Stereo Power Amplifiers is the product of one heritage in both design and construction. The unique, fully complementary design system provides balanced amplification from input to output. This approach yields lower steady state and transient distortion as well as better overload recovery. To realize the full benefits of this unique design approach, every SAE amplifier is built with the same high quality materials throughout. The use of Mil-Spec parts, G-10 glass epoxy boards and hand selected critical components at every level ensures that the superior design results in superior products.

PREAMPLIFIERS

A bold research and development program by our engineering staff has resulted in the introduction of the first integrated circuit (IC) designed specifically for audio applications. Extremely low distortion, low noise characteristics and fast overload recovery have made it ideally suited for preamp applications. To realize the full benefits of this innovative IC, a completely new phono circuit has been developed. This new multi-stage phono circuit requires less gain from each individual stage and results in lower transient distortion, more accurate tracking of the RIAA curve, and also provides much lower interface interaction with the phono cartridge itself. Besides sonic excellence, careful attention has been paid to human engineering — our preamplifiers provide the optimum in signal flow flexibility to complement their sonic excellence.

PARAMETRIC EQUALIZERS

The parametric approach to tone modification stands as a revolutionary advancement in equalizers for consumer products. Our parametric equalizers control not only cut and boost, as in conventional systems, but also bandwidth and center frequency. This unique combination of controls provides for tonal modification never before thought possible.

ASSOCIATED COMPONENTS

These components complement our line of amplifiers, preamps and equalizers. They include a digital readout FM tuner with linear phase IF filters and phase-lock multiplex; an Electronic Crossover for bi-amplification, which will reduce distortion in even the best speaker system; an Impulse Noise Reduction System, the system that takes over where every other noise reduction system leaves off, by providing dramatic reduction of the impulse noises (clicks and pops) that occur in common playback of records; and our new Time Delay Ambience System, to recreate the live performance previously beyond reach in the home environment.

CONCLUSION

As you can see, the goal of advanced design and manufacturing excellence has created the finest audio products in the world. The goal is supported by an ongoing R & D program and by a large modern production facility using the latest techniques in circuit board and mechanical fabrication. With constant supervision of assembly and testing, SAE products offer performance value and consistency — functional, state-of-the-art, and without question, Components for the Connoisseur.

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Audioclinic

Joseph Giovanelli

Voltage & Turntable Speed

Q: When I turn my air conditioner or any other appliance that draws high turn-on voltage, my turntable slows for an instant causing an audible "wow." I talked to an electrician about installing a separate line for my stereo equipment but he said that it would not make any difference. Could an electronic direct-drive turntable system solve the problem?—J.F. Garofalo Jr., Chicago, Ill.

A: I wonder why your electrician says that a separate line would not help to stabilize the operating voltage in your turntable system. Unless the electrical service coming into your home is so poor that it cannot supply constant voltage under heavy transient loads, an extra line run right from the main box should do the trick nicely. If you have a good a.c. VOM meter, measure the voltage at the time the air conditioner goes on. Make this measurement at both the high fidelity system wall outlet, and at the main electrical feed box. If the voltage changes to the same degree at both locations, a separate line will not help. However, if only the wall outlet changes then a separate line will help.

Even a direct-drive turntable must operate within certain voltage limits. When the operating voltage falls below these limits, then the turntable will either slow down considerably or, perhaps, come to a sudden stop. You will have to check with the manufacturer to find the voltage limits of his specific turntable.

The only other answer to your problem is to obtain a constant voltage transformer which is expensive.

Dynamic Expansion on Disc

Q: Is there any way to increase the dynamic range of records electronically?—Thomas M. Lockwood, Duquesne, Pa.

A: The dynamic range of a record can be electronically expanded through use of a device known as an expander. Most amplifiers are fixed gain devices, however, with a dynamic range expander, as the volume of sound increases, the gain in the amplifier also increases. This causes an increase in dynamic contrast beyond what was originally present on the

disc, although it will probably not duplicate the original dynamics present at the time the original master tape was produced.

Phono Motor A.C. Leakage

Q: With the platter and belt removed from my turntable I can detect a small vibration when I gently rotate the motor spindle with my fingers, indicating a slight current affecting the motor. While a DPST switch would eliminate this, is it necessary? Does this "problem" harm the turntable motor in any way?—Dave Watts, Glen Ellyn, Ill.

A: It appears from your description that there is nothing wrong with your turntable. You are feeling either the individual magnetic poles as the armature passes them or, perhaps, some slight leakage from the power line. If it is the latter condition, unplugging the turntable from the wall will eliminate this condition.

However, if it does turn out to be power line leakage, measure between the prongs of the wall plug and the motor case with an ohm-meter to see if there is a low resistance path. Measure this with the motor switch turned on. If the resistance is below one megohm, this can mean excessive powerline leakage which may indicate either a defective line bypass capacitor or a slight short between the motor windings and the case. In the latter case, the turntable motor would have to be replaced.

Filter Capacitors

Q: What is the use or of what value are the filter capacitors in the amplifier power supplies?—Rex Mills, Columbus, O.

A: A power amplifier must operate from a source of pure d.c. voltage, otherwise hum will be heard in the loudspeaker. The amount of hum will depend upon the purity of the d.c. voltage, in other words there must be no variation in the amplitude of the d.c. voltage.

The d.c. current is derived from the 117 V a.c. power line by means of a device known as a "rectifier." The voltage is d.c. but it varies in amplitude up and down many times a second and the purpose of the capacitor

is to remove these rapid fluctuations in voltage.

Because of the large amount of current drawn by solid-state amplifiers, a considerable amount of capacitance is required to smooth out variations in the rectified d.c. voltage. In an effort to use less capacitance and maintain a constant voltage over a longer period of time, some manufacturers use special regulator circuits consisting of Zener diodes and transistors. In such circuits only a small amount of actual filtering, in the form of filters, is required because of the nature of regulator circuits.

dB and Dynamic Range

Q: What is meant by a dynamic range of 120 dB?—Thomas M. Lockwood, Duquesne, Pa.

A: A dynamic range of 120 dB means that there is a 120 dB difference between the lowest and highest volume produced by the performers. This would correspond to a sound range of where the softest components would just be audible and the loudest ones would be on the threshold of pain.

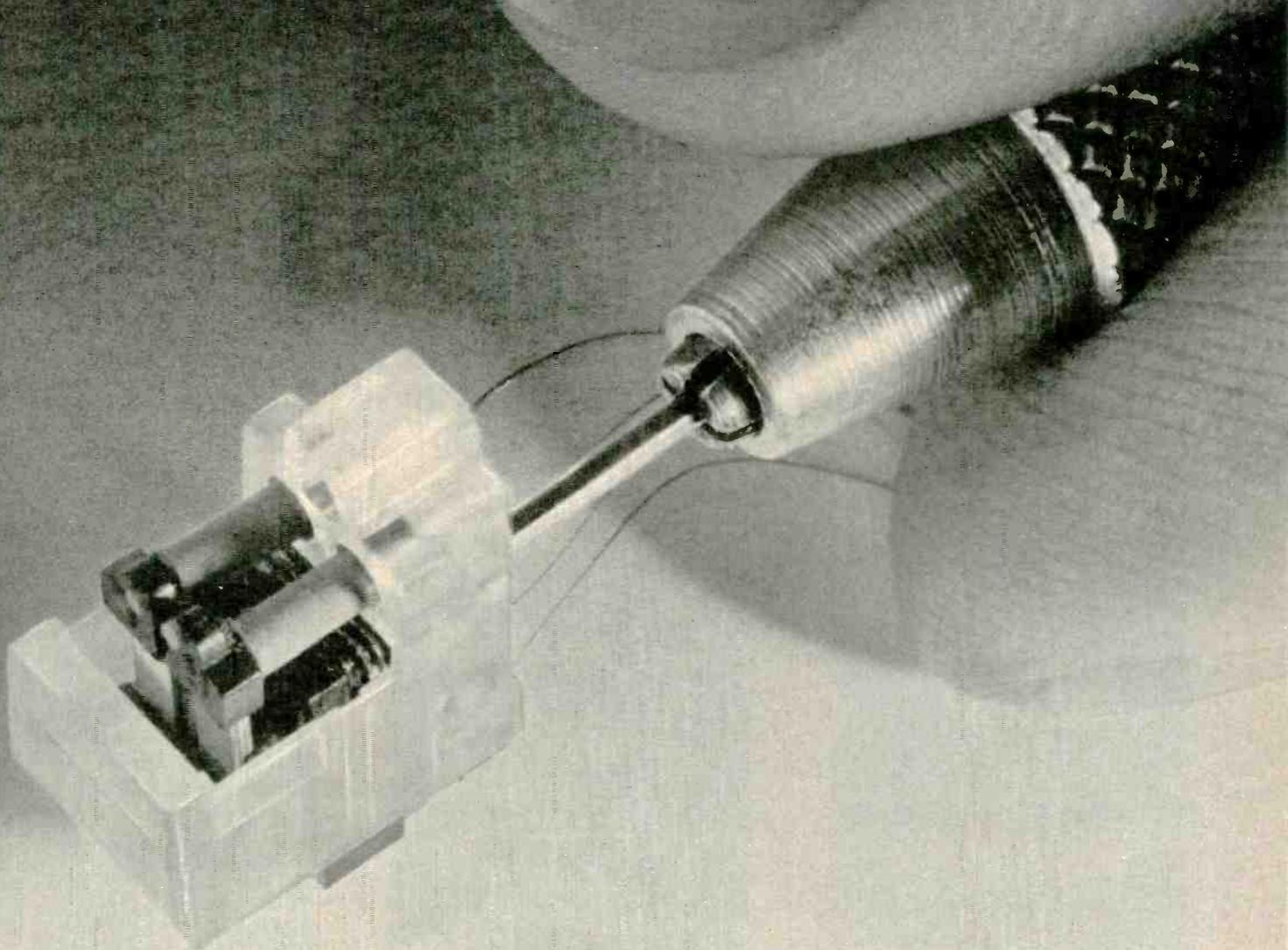
Sound System & Cracking Plaster

Q: I have recently gotten into high-fidelity equipment and have already encountered a big problem. I knew, when choosing my equipment, not to get a powerful system for my small bedroom, but even though this system has been installed for just a short while, I have already noticed cracks in two outside walls of the bedroom, although the two inside walls have no cracks. Is there anything I can do to prevent further cracking?—Jeff McBride, Hickory, N.C.

A: I really doubt that your sound system is powerful enough to crack the outside walls of your bedroom. The cracking is more likely the result of such factors as settling of the house, old plaster work, dampness, or a combination of any or all of these factors.

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.

**Micro-Acoustics invites you to take
a closer look...**



ma[®]
Micro-Acoustics

At Micro-Acoustics, we hand-assemble Because mass production

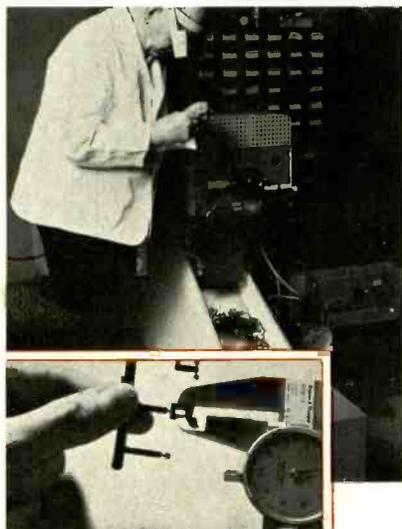
At Micro-Acoustics, we call our stereo cartridges "*The high-end phono cartridge line.*" And we'd like you to know what stands behind this philosophy.

Micro-Acoustics cartridges sound better — and *sell* better — for a very good reason: they're very different from the other phono cartridges on the market.

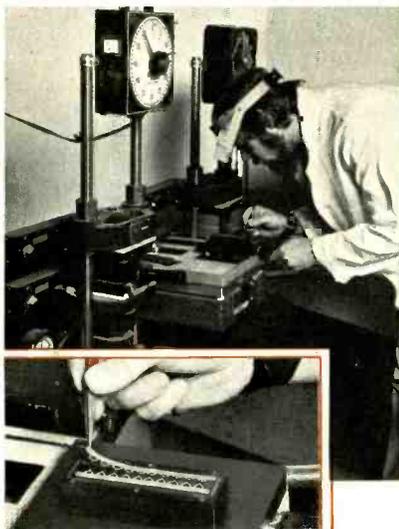
Basically, most stereo cartridges are designed for

mass-production. And they have to be. Because they're engineered and manufactured to *meet a price:* Low enough to fit comfortably into even modestly-priced systems. And low enough in cost to be used as a promotional item in a turntable or system sale.

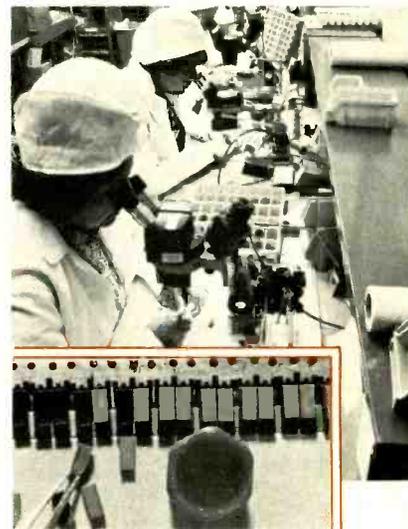
Considering these limitations, some manufacturers have done a remarkable job of achieving acceptable



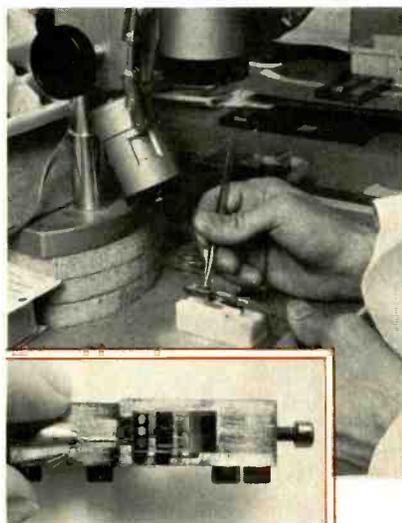
1. Injection-molding station. All plastic parts for Micro-Acoustics cartridges are individually molded in single-cavity molds for maximum uniformity. Frequent sampling and inspection assure that tight tolerances are maintained.



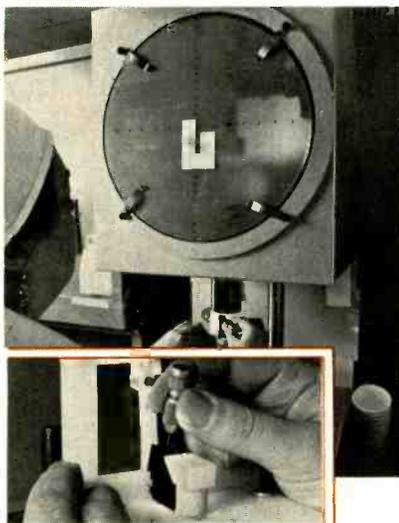
2. Rubber-molding press. Sixteen precision elastomers are employed in all Micro-Acoustics phono cartridges. Each part is individually molded; then inspected and tumbled in refrigerant to remove any excess "flash". The use of multiple elastomers provides greater long-term reliability and consistency than conventional single-bearing cartridge designs.



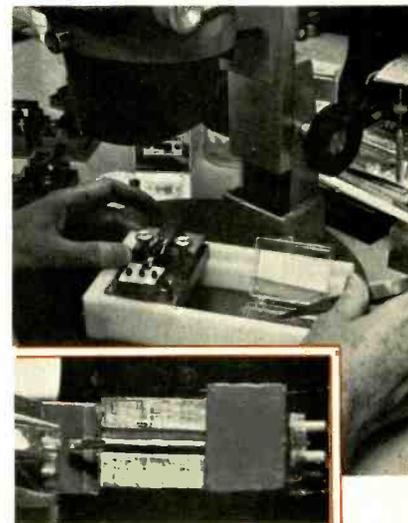
3. Microscopic assembly of damping mechanism. Each elastomeric damper is individually cemented to its own retainer block. Eight dampers are used in each cartridge.



7. Microscopic assembly of complete transduction system. Here, all elastomeric parts are assembled together with transducer elements and positioned by means of three vernier alignment screws.



8. Final vernier adjustment. The three vernier screws are individually set so that the stylus seats symmetrically between the cartridge's twin pivots. Stylus assembly is magnified 20 times on calibrated comparator screen, to assure that all replacement styli will align identically.



9. Microscopic hand assembly of stylus. Using the same procedure employed for Micro-Point™ recording styli, precision polished diamonds are light-beam oriented for mounting in shank and then secured with epoxy to dual-bearing platform. This low-mass, dual-bearing stylus configuration provides superior tracking ability.

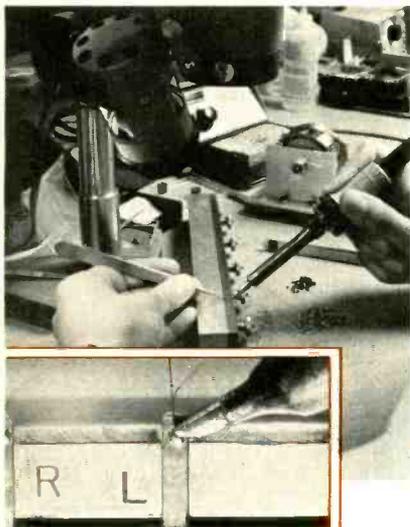
Cover photo: Heart of Micro-Acoustics' patented (Pat. No. 3952171) direct-coupled system, seen with alignment tool making vernier adjustments.

Our precision cartridges one-by-one. Isn't good enough.

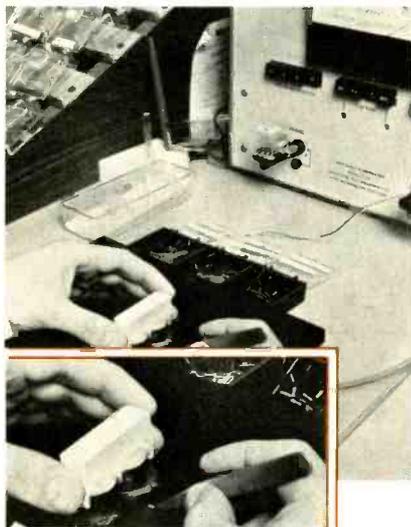
performance levels through automation and other mass-manufacturing techniques.

Problem is, when these manufacturers add *high-end* cartridges to their lines, they're still locked into manufacturing the same basic way. So aside from a change in styli, the differences between other manufacturers' high- and low-end models are primarily cosmetic.

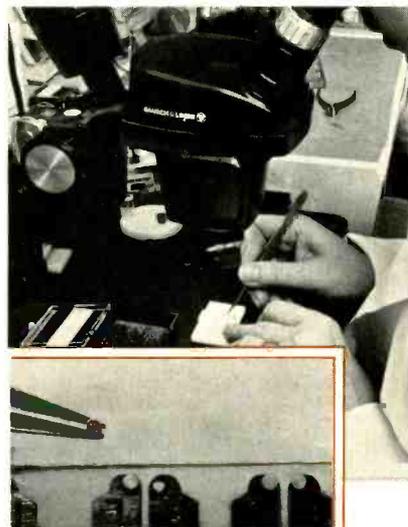
Micro-Acoustics' manufacturing philosophy is quite the opposite: when we design a cartridge, it is to meet *performance* goals. Not budgetary limitations. And the best way is to manufacture a hand-made, precision-crafted product. One that must be assembled under carefully-controlled conditions. Incorporating a number of critical steps which lead to the highest possible performance levels.



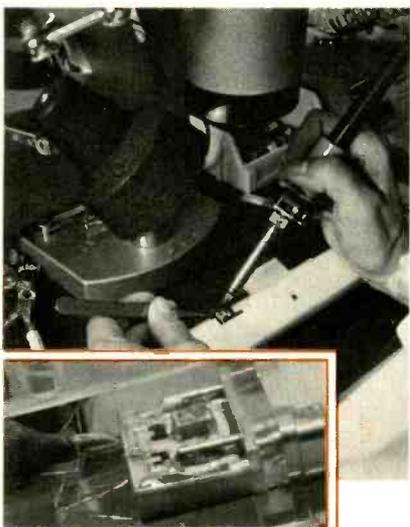
4. Microscopic soldering of transducer leads. Two pieces of pure gold wire are soldered to each electret transducer element (negative and positive poles). Thinner than a human hair, this pure gold wire is totally resistant to oxidation, for long, trouble-free cartridge life.



5. Matching of transducers. Electret transducers are measured for capacitance and sorted into matched pairs. This assures accurate channel balance.



6. Microscopic assembly of pivot dampers. Each transducing element is individually fitted with an elastomeric bearing in which the stylus coupler pivots. This twin independent pivot system assures maximum transient ability.



10. Microscopic assembly of microcircuits. Each cartridge has two individual passive microcircuits whose inputs are directly soldered to gold leads from transducers. These microcircuits assure perfect match with any phono cable-preamp input combination.



11. 100% quality control of all cartridges. All fully-assembled cartridges are individually played on a CBS STR-100 test record, monitored on a dual trace oscilloscope and measured with a VTVM.



12. All areas of cartridge performance are tested. Tests include frequency response, channel separation, output level, tracking and transient ability. Only cartridges that fully meet published specifications are serialized and placed in stock for shipment.

The result. The result of Micro-Acoustics' advanced design and precision manufacturing techniques is a sophisticated phono cartridge line that is non-critical to install and use. Cartridges that deliver maximum performance on manual and automatic turntables. Highly-acclaimed cartridges which work superbly, independent of cable capacity and preamplifier input loading. High-reliability stereo cartridges, with a number of unique features:

1. Ultra-low body weight.

Weighs only a fraction of other manufacturers' high-end cartridges. Helps provide superior tracking of even severely-warped discs.

2. Mechanical dampers.

Configuration of 8 elastomeric damping blocks (only 3 shown in this view) achieves optimum transient ability while cartridge tracks the heaviest groove modulations at low stylus forces.

3. Low-mass stylus. Shaped and polished with the same care as our world-famous Micro-Point™ recording styli.

4. Ultra-lightweight stylus bar. For minimum effective tip mass.

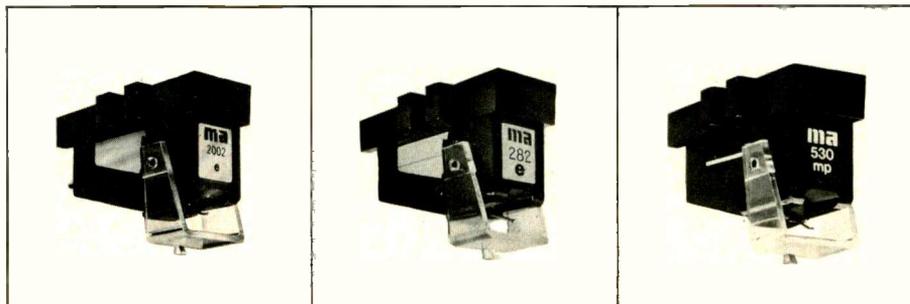
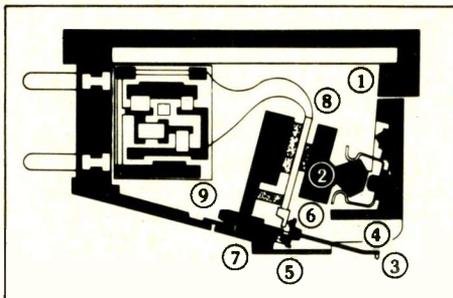
5. Twin pivot/dual bearing resolver. For optimum tracking ability and precise signal resolution. The resolver separates the complex stylus vibrations into left and right channels.

6. Direct coupling of stylus bar to electret. Coupling the stylus bar to the electrets at this point directly transmits the undulations of the groove to the transducers.

7. User-replaceable stylus assembly.

8. Electret transducer. A permanently-polarized dielectric device best described as a low-mass electrostatic equivalent of a magnet. It provides superior response because of inherent linearity from 5Hz to 50kHz.

9. Microcircuit. Passive circuit matches the electret transducer's characteristics to preamplifier phono inputs within 1%. Also, makes output purely resistive, eliminating effect of cable capacitance on frequency response. Resistive output also shunts preamp input, reducing thermal noise.



Specifications*	2002-e	282-e	530-mp
Stylus Configuration** (User replaceable)	.0002 x .0007 elliptical diamond beryllium cantilever	.0002 x .0007 elliptical diamond	Micro-Point™ diamond playback stylus, beryllium cantilever
Frequency Response	5Hz to 20kHz ± 1.5dB	5Hz to 20kHz ± 2dB	5Hz to 20kHz ± 1.25dB†
Tracking Force Range	0.7 to 1.4 grams	.75 to 1.5 grams	0.7 to 1.4 grams
Cartridge Weight	4 grams	5.2 grams	4 grams
Channel Separation	Nominally 30dB at 1kHz 15dB at 10kHz	Nominally 25dB at 1kHz 15dB at 10kHz	Nominally 30dB at 1kHz 15dB at 10kHz
Output Voltage	3.5 mv each channel at 5cm/sec peak recorded velocity	3.5 mv each channel at 5cm/sec peak recorded velocity	3.5 mv each channel at 5cm/sec peak recorded velocity
Load Requirements	10k to 100k (not critical)	10k to 100k (not critical)	10k to 100k (not critical)
Cable Capacity	100pF to 1,500pF (not critical)	100pF to 1,500pF (not critical)	100pF to 1,500pF (not critical)
Suggested List Price	\$119.00	\$89.00	\$200.00

*All measurements made with CBS STR-100 Test Record

**Like our Micro-Point™ recording styli, all Micro-Acoustics playback styli are light-beam oriented under a microscope for optimum relationship between stylus and cantilever.

†Each cartridge supplied with individual frequency response curve.

Warranty: Full 2 years (excluding stylus wear) on all models.

ma[®]
Micro-Acoustics
 Because good tracking isn't enough.

Micro-Acoustics Corporation, 8 Westchester Plaza, Elmsford NY 10523, (914) 592-7627

What's new

Martin Research Plastic Cleaner



Plastic-Glaze is a plastic cleaner and polish widely used in the aerospace and computer industry, which meets military specifications (MIL-C-5547 and MIL-C-1876713 ASG). The four oz. container contains a formulation designed to remove hairline scratches and restore optical clarity to turntable dust covers and tuning scales, plus leaving a protective, high gloss on all plastic surfaces. The cleaner contains no abrasives, and has anti-static ingredients which work to repel dust and electrostatic charges from plastic surfaces. Price: \$2.98.

Enter No. 63 on Reader Service Card

Pro Sound Tester

The Model PS-812 speaker impedance and phase tester matches speakers and amplifiers for best sound and to prevent damage due to overloading, shorts or improper phasing. The unit is calibration-free and works with all types and sizes of speakers. Price: \$36.00.

Enter No. 60 on Reader Service Card

GC Electronics Electronic Chemical Handbook

The 53-page *Electronic Chemical Handbook*, compiled for electronic engineers and technicians, contains detailed descriptions, photographs, uses, applications, and container

specifications for 160 GC Electronics chemicals. The adhesives, cleaners, coatings, PC chemicals, solvents, thinners, and lubricants are used for servicing entertainment, industrial, and military equipment.

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Sonic Systems Loudspeaker

Model Two was designed for the purist with listening area limitations and uses "Bi-Planar"™ dispersion to produce increased depth and perspective. The 7-cu.-ft. enclosure houses a 15-in. cone with a 4 1/2-in. voice coil and 18 1/2-lb. magnet, while frequencies above 800 Hz are handled by two compression drivers with short exponential horn throats. Price: \$2200.00.

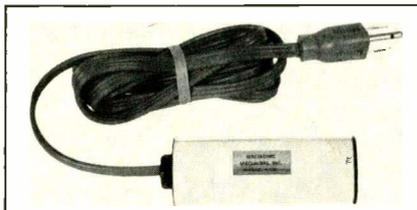
Enter No. 62 on Reader Service Card

Servolinear Speaker

Model SL V11 uses 15-, 12-, and 10-inch woofers, an 8-inch midrange, a 4 1/2-inch squawker, and five piezoelectric supertweeters in a phase-lock servo circuit to produce a claimed frequency response of 20 Hz to 20 kHz ± 2 db. The servo circuit is a constant-impedance, unbalanced bridge, one arm of which is formed by the loudspeaker drivers and the other by the amplifier. The bridge is balanced so long as the diaphragm acts according to the signal coming from the amp, thus the circuit uses "dynamic feedback" to suppress and compensate for mechanical resonances and impedance peaks. Price: \$2000.00.

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Electronic Specialists Suppressor



The line-cord transient suppressor protects equipment from damage by absorbing repeated power surges and transients. It is available with integral power line hash filtering. Price: 2 prong plug/socket \$11.50, and the 3 prong plug/socket \$14.50.

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\$79.50 NOT \$795.00

To most professionals, "Sennheiser" means state-of-the-art microphones for applications where performance — not price — is the main consideration. But while we spent considerable time and talent creating the world's premier microphone line, we haven't neglected price. And our new MD 402 U is proof.

The MD 402 U is a super-cardioid dynamic microphone, ideal for use in many recording, broadcasting and sound reinforcement applications. Its 80-12,500 Hz response and 20dB rejection at 120 degrees insure accurate reproduction and high immunity from feedback. The microphone also features high overload resistance and built-in pop suppression, for superior performance in close miking application. A 200-ohm impedance that directly matches most amp and recorder inputs. Plus an XLR connector, cable, wind-screen and quick-release stand clip

for maximum versatility.

Try the MD 402 U at your dealer today.

It's more microphone than \$79.50* could ever buy before. After all, it's a Sennheiser.



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*Prices, specifications subject to change without notice

Wags and Tales That Started A Revolution

Oliver Berliner

The year 1977 marks the 100th anniversary of the record business . . . actually not of the records as we know today, but rather the start of recording for profit, via Thomas Edison's December, 1877, demonstration of his cylinder phonograph. However, a decade later another invention emerged that revolutionized (pun intended) the recording industry. This was my grandfather's—Emile Berliner—invention of the disc record and player, which he called the *gramophone*, meaning, more or less, sound of words. Alas, my grandfather's terminology is not used in France and the Americas, thus today we call gramophones "phonographs," continuing the misconception that Edison had created the disc when in reality his device was the cylinder which, with the advent of the disc record, was relegated to service as an office dictation machine and was used as such through WW II.

I once shocked a lecture audience by hinting that Edison was of Mexican descent. But consider his middle name, Alva—a very Spanish word. Think, too, that in so very many stories about Edison, his mother and his devotion to her figure prominently. So consider the possibility that the inventor's name was Tomas Alva, and that in historical Spanish tradition he adopted his mother's maiden name as his surname, while Anglicizing his Christian name, resulting in Thomas Alva E. in true Spanish culture and Thomas A. Edison for use in the United States. Think too, how little we know about Tom's father. Why? Imagine how our Latin neighbors would rejoice if they could establish a Spanish heritage for the wizard of Menlo Park.

The Centennial, then, is surely the time to disclose some anecdotes and information about the record industry of today and of yore. Let us begin at the beginning, with the bark that started a revolution, "His Master's Voice."

The world's most famous dog is not Pluto or Lassie—they're not known in nearly as many countries as "Nipper"—but actually lived and was

not the figment of some adman's fertile imagination, as many have thought. He was a mischievous terrier with a considerable amount of bulldog in him, accounting for his broad chest and extraordinary strength. Mark Barraud, a French Huegenot living in England, had acquired the pup when the little nipper, as the British affectionately call their youngsters, was but a few days old. But Mark's children promptly named him Nipper because he was always nipping at their heels. Despite the fact that he was brought home for the kids, Nipper preferred the company of Mark, a theatrical scenic designer who, when called on stage to take a bow, would often find Nipper there sharing the applause, and the noble mutt became somewhat of a local celebrity. Upon Mark's untimely death, Nipper stayed not with the children but went to live with Mark's brother, Francis, an artist of some skill but little renown even though some of his works had hung in the Royal Gallery.

While Emile Berliner or later Eldridge Johnson have often been credited as being Nipper's "master," the dog's true masters were the Barraud brothers, neither of whom ever made recordings for Nipper to listen to. An inquisitive dog, Nipper would, however, sit for long periods of time, one ear raised and his head cocked at an angle, studying whatever it was that attracted his attention. Francis's brother, Phillip, a professional photographer, had captured Nipper on film in such a pose. Francis ultimately disclosed that seeing one of these photos is what gave him the inspiration for the painting which was created in 1893 or 1894; nobody knows for sure. The original painting was Nipper listening to an Edison-Bell Consolidated Phonograph Company cylinder machine, not a gramophone; yet despite this the distributor refused to purchase Barraud's masterpiece. Disappointed, Francis let the painting hang around the studio for more than five years, finally deciding to copyright it by having Phillip take a photograph of it for submission to the Copyright

Office. This was in 1899, and immediately afterwards Barraud found another opportunity to sell it.

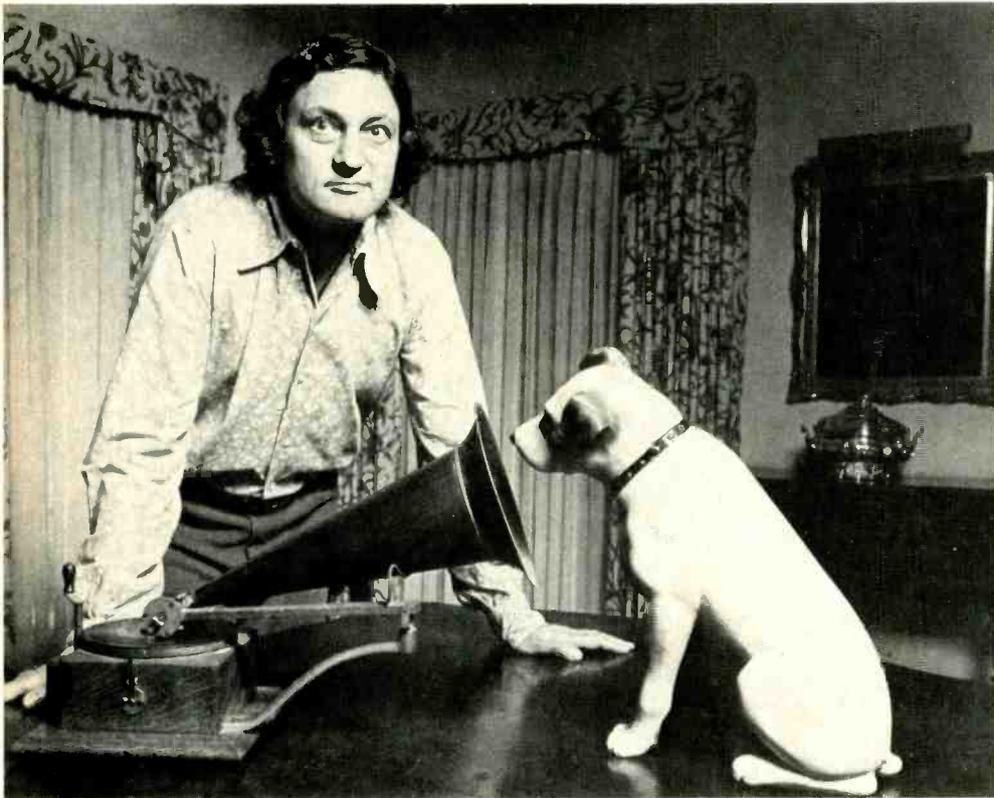
Nipper Is Sold

A friend suggested that the painting might be more saleable if the ugly japanned-black trumpet were replaced, however unauthentic it might be, with one of the smart looking horns used on the new Berliner gramophones. So Francis went to see William Barry Owen, who'd been sent by my grandfather to found British Gramophone. Astutely, Owen advised Barraud that the company was in the disc business, not cylinder, and thus if Francis were able to replace not just the horn but the entire Edison machine with a Berliner disc gramophone. Owen would buy the painting . . . for £50 plus £50 more for the copyright. Interestingly, Barraud had brought with him only one of Phillip's photographs, and not the painting itself to show Owen, but this was more than enough to convince Owen of the design's commercial value.

Nipper was a great hunting dog and a strong adversary who'd think nothing about taking on a dog twice his size. In fact, it was difficult to get the hound to release his hold if he ever sank his teeth into you. In 1893, about the time the painting was created, Francis Barraud moved to Kingston-on-Thames. Nipper died there two years later, in September at age 11, and was buried under a mulberry tree at the back of Mayall's Photographic Works.

On September 18, 1899, exactly five years after Nipper's death, Francis received from William Barry Owen the model he would use to shape the course of history . . . what was to become known as the "trade mark model" Berliner Gramophone, the third in a series of designs created by Emile and the model which introduced Eldridge Johnson's spring-wound motor that made constant cranking unnecessary. Exactly one month later the finished painting was delivered to the Gramophone Company offices and was already titled by the artist, "His Master's Voice."





38 The HMV painting was reproduced immediately via lithographs made by Rembrandt Intaglis Printing Company, and were shown in stores owned by Gramophone Company. Nipper truly rocked the record business, to such a great extent that the company's real name became promptly obscured, and the firm became known as His Master's Voice, as it is today. Though not great art, the painting has majesty and is truly awesome when you consider its contemporary impact and the fact that, even today, it symbolizes the industry almost as much as it does its owners. (In fact, HMV has three owners: Nippon Victor for Japan, no relation to RCA Victor, and EMI for the rest of the world, except for the Americas where it is owned by RCA which now has relatively little interest in HMV but zealously guards against any possibility of losing it.)

When Emile Berliner was visiting his English facility he was exposed to the Nipper painting for the first time, and he immediately carried the idea one step further. Where Owen saw Nipper only as an attention-getter, grandpa envisioned him as a trade mark. So, on July 10, 1900, Nipper joined the ranks of the immortals. British Gramophone, however, was loathe to acknowledge HMV as its trade mark, for they were attached to their design of a "recording angel," but about eight years later

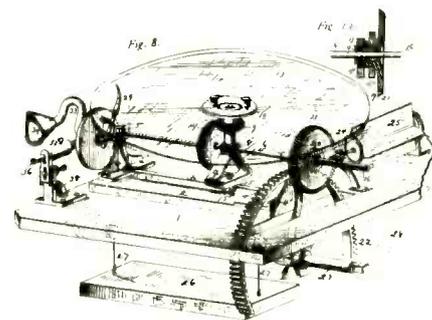
Oliver Berliner stands with the trademark model Berliner Gramophone and a paper maché Nipper. This is one of the sketches that accompanied Emile Berliner's 1877 patent application, and shown is the front of one of the company-owned Gram-O-Phone stores in Montreal, Canada.



they succumbed to the inevitable. Barraud was several times commissioned to paint replicas of his original (minus the cylinder phono beneath the gramophone), but made very little money and lived in obscurity. Recognizing its oversight, the HMV Company instituted a pension for the old gentleman, £250 annually and later increased to £350.

Yesterday and Today

From the time Nipper took the world by storm, the record business has been a strange one. There are today no company-owned stores, whereas in the old days a customer could walk right into HMV's shop and ask what was new on the label. Railroads had no freight classification for records and players, and categorized these items as dynamite, thus charging the highest rates. My father, Edgar, finally persuaded the carriers to regard his products as musical instruments, like pianos. Incidentally, he had the distinction of being president of all three successive Canadian companies . . . Berliner Gramophone, Victor Talking Machine Co., and RCA Victor, from which he resigned in 1929 as did many recordmen who didn't want to work for the Radio Corporation whose goal was



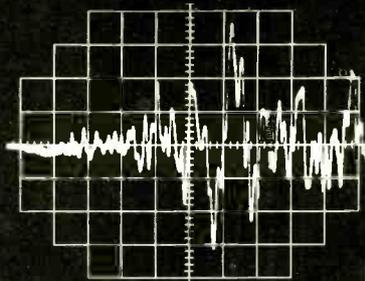
to promote radio using Victor's manufacturing capabilities, distribution . . . and trade mark.

Because of the fact that three-quarters of all single records released and 60 per cent of all pop albums are financial failures, all recording artists today are paid on a royalty basis, with the top stars easily capable of grossing a million dollars annually. Royalties may be anywhere from six to 20 per cent of the suggested retail price of the record. Recording sessions are nothing short of astronomical, but the diskeries don't discourage this because they generally feel that the more that is spent, the better the master recording will be . . . and the recording costs are deductible from the royalties earned by the artists. Nowadays, it is not uncommon for an album which should

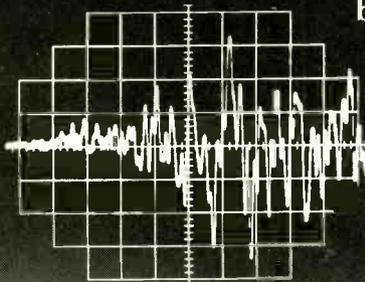
Technics wants you to see what other speakers don't let you hear.

Look at the waveforms. Technics has achieved phase linearity as well as wide frequency response. And that means we've achieved state of the art in high fidelity: virtually a mirror image of music as it was originally played. We call it waveform fidelity. Julian Hirsch, in *June Popular Electronics*, calls the Technics Linear Phase SB-6000A "...one of the better sounding speaker systems we have heard in a long time."

How did we do it? First by conducting exhaustive amplitude/phase studies in acoustically perfect chambers before designing and manufacturing each of the wide frequency/low distortion drivers. Then by developing a unique new phase-controlled crossover network



Live Piano Waveform.



Piano Waveform reproduced by SB-7000A.

that compensates for the time delays caused by the wide range of frequencies in all music. While simultaneously compensating for the different acoustics of the woofer, midrange and tweeter. And finally by aligning each driver unit in the optimum acoustic position for precise linearity.

It's a lot of complicated engineering, but it all adds up to something very simple. Music as it was originally played. Nothing more, nothing less. And that's a lot.

Listen to Technics Linear Phase SB-7000A, SB-6000A and SB-5000A. They're now available for demonstration at selected audio dealers for very selective ears.

Technics Professional Series
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SB-6000A

SB-7000A

SB-5000A



Society ladies and gentlemen dancing to the strains of a waltz played on a Berliner gramophone along the banks of the Rhine in 1911.

that the union is aware that its membership derives considerable employment thusly. Better that they work in this manner than have no work at all, right?

Royalties were not always the rule in the record industry; originally artists were paid a fixed fee, depending upon their stature. Sir Harry Lauder is the one to thank for getting royalties started. The great Scot's HMV contract was up for renewal, and he was in a commanding position. He told the Gramophone Company that if they wanted him to record for them in the future it would have to be on a royalty basis—plus royalties on all the records sold in the past! Nipper howled in pain. They paid, and from that moment on the artist was king.

Neither movies nor television in their respective heydays can match today's phenomenon, the rock *groupie*—the record business equivalent of the Judy Garland fan of yore. By a stroke of good fortune, I have frequent occasion to drive past one of the palatial residences of no less a figure than the late Elvis Presley. Although *his majesty*, even before his recent death, had long ago vacated the premises upon termination of his celebrated matrimonial alliance and had moved his famous hips back to Memphis, his *yesmen* were still ensconced in the Monovale Drive Taj Mahal on that transitional strip between Beverly Hills and Bel Air known as Holmby Hills, the district now presided over by Hugh Hefner. Apparently there to keep the place in good order until a realtor could unload it for Elvis, the *yesmen*

have required six to eight hours to produce to take six to eight weeks instead—sometimes more—and cost \$30,000 to \$75,000 for studio, musicians, arrangers, et al.

Once the late, and not too lamented, David Sarnoff, head of behemoth RCA, had boasted how he would “handle” James C. (for Ceasar, and not without cause) Petrillo, then head of the dreaded American Federation of Musicians, who by the way, never ever shook hands. The outcome of “Davie’s” uncanny prowess was the best deal the musicians had gotten out of the record companies in history. Subsequently, negotiations between the labels and the union have been handled by a trade group called the Recording Industry Association of America, just as is done in the movie industry by the Association of Motion Picture Producers. But unlike AMPP, the RIAA does not have an overpowering compulsion to keep the cost of musicians’ services down. You see, diskeries come out of the woodwork daily with hundreds of low-budget garage operations born, while an equal number fade into oblivion annually. Obviously, if the cost of recording sessions is high, fewer of these upstarts will be able to afford it. Simple, eh?

Unions and Royalties

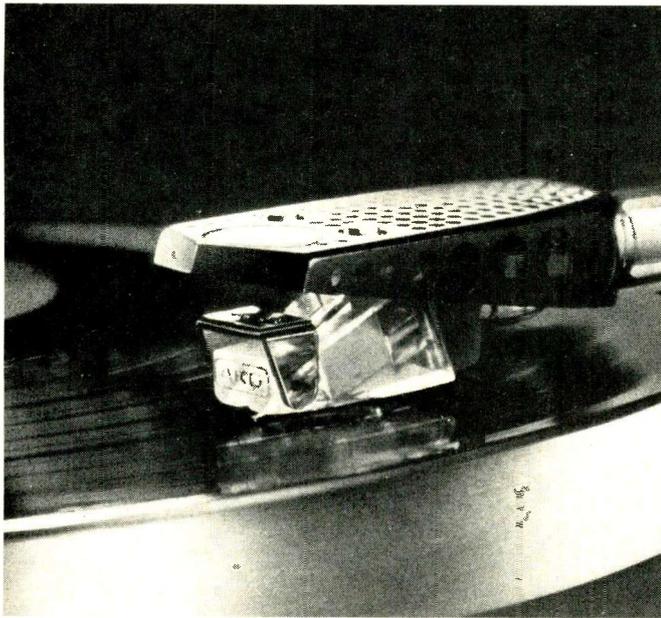
But, you say, the record labels also must pay these exorbitant recording costs (which include \$80.00 to \$150.00 per hour of studio time). They do? Don’t be so sure. While it is true that the cost of musicians, orchestrations,

studio facilities, and “amenities” is paid by the record firm producing these “sessions,” these costs are all charged against the featured artist’s royalties. So, despite the fact that the *artist* is the one who ultimately pays the recording session costs, he is not privileged to have a say in determining the rates he must pay for backup musicians (“sidemen”) and supporting services.

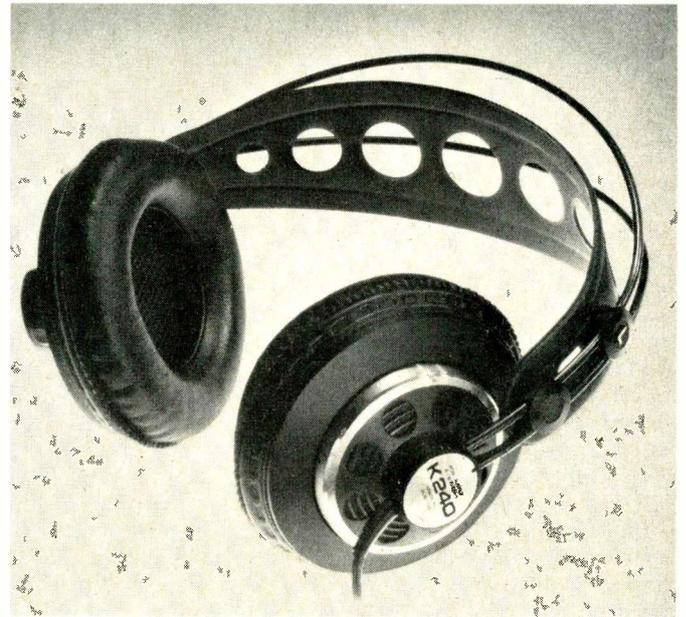
As a consequence of all this, the “bootleg” session has long been on the scene. Here union musicians willingly work at reduced rates without the knowledge of their union because it’s *good* money and nicely supplements their income . . . to say nothing of the fact they are aware that a fledgling producer shouldn’t have to pay the same wage scale as that of a well-established label—especially when the *unknown* was really being forced into contractual requirements that were set for him *in absentia* by the RIAA of which he isn’t even a member (few record labels are). There are various “safe” studios in each of the major union-controlled production centers of America—Hollywood, New York, Nashville, Montreal—whose names are legion wherever bootlegging is known. Despite an occasional “raid” by a union steward, these recording studios are generally left alone, perhaps tacit testimony to the fact

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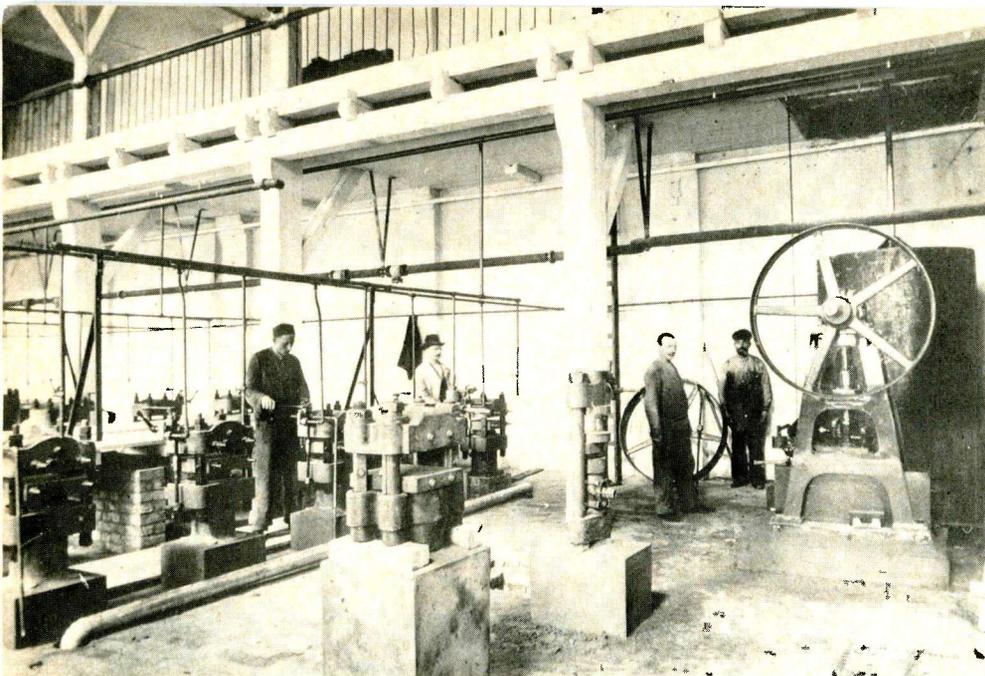
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Four record presses were imported from the United States in 1898 to start production of "Gramophone" records in Hanover, Germany, Berliner's birthplace.

saw no reason to forego the privileges of their rank . . . especially with nobody there to supervise them. Consequently, nearly every night an array of groupies stealthily parked their cars out in front of those massive gates, waiting—often in vain—for a call on the gatehouse intercom that would signal their permission to enter those hallowed grounds.

42

I'd been hopeful of latching onto one of the left-overs from time to time, but scrutiny revealed that virtually all were fat and acned. I asked one girl why she waited day after day. She momentarily stopped peering through the hedge to inform me that she'd been invited in once and it was fantastic. I inquired as to how it could possibly be so great with Presley absent. She indicated that she was quite content to settle for a yesman because this made her feel close to "him." Soon boys began to be present in considerable force, presumably to grab off any girls who didn't meet the entrance requirements. The police had to erect "no littering" signs, probably demanded by the neighbors who had been unsuccessful in getting rid of the groupies under the anti-loitering ordinances.

I've seen them standing outside in the rain at one-thirty in the morning. In good weather they wile away the tedious hours tossing a football back and forth. They congregate in the middle of the street and only with great reluctance will they budge, and then just slightly, to avoid being struck by passing automobiles. I've seen middle-aged women rummaging through the garbage cans, perhaps desirous of finding a pair of discarded undershorts. Now that's the *real* showbiz we all know and love. The record industry has truly come of age.

Promotion and Promotions

Despite the fact that records are the oldest of the professional home entertainment media, the disc business has always been the least sophisticated of them all, particularly in the realm of advertising and promotion. For decades the industry was content to ally itself with its arch-enemy, radio, coupled with some co-op newspaper advertising with selected powerful retailers, as the virtual sole source of promoting its artists and their recordings.

But when Hollywood's fabled Sunset Strip became "hippie haven" a few years back, some *sharpie* decided that a judiciously placed billboard might prove its worth. Today if you're not a diskery, you'll find tough sledding in securing an available billboard along "the Strip." And the degree of puffery and press-agentry knows no bounds, what with spectacular lighting, special display materials, and three-dimensional designs that run the gamut from tasteless to distasteful. Whereas the Nevada casinos used to be Sunset Strip's principal contributors, today all the mafia-men's muscle isn't enough to do battle with the recordmen.

Spurred on by the first bloodletting on the Sunset Strip yet wary of the payola problems of radioland, the diskeries have plunged headlong into the promotional fray. They work actively with concert promoters and rock-nitery operators. They fight to get a new artist on the same program with an established headliner. They buy window space at major record dealers. They make promotional tie-ins with unrelated products, sometimes using records as premiums. They've expanded into motion picture making and teleproduction. Most all record

labels own one or more music publishing companies, often in association with their important recording artists, for they want to pay *themselves* that penny-a-disc royalty that normally goes to the copyright proprietor . . . to say nothing of the performance royalties earned by the writers and publishers when a song is played on the air (live or in recorded form), in nightclubs, arenas, ballrooms, and even in parades up New York's Fifth Avenue.

In fact, the independent music publisher not affiliated with a record label or major artist today couldn't even get himself arrested because the artist and/or his record company want to own the songs they record. Certain major artists won't record a song they don't "have a piece of." Many times they even have the audacity to demand that their names be listed among those of the songwriters.

Diskeries "Peter Principle"

But for all their newfound sophistication, the record companies still lack a knowledge of people. Job hopping is rampant, even in the highest echelons, and the man who's gotten his name in *Billboard* the most times is the one who's thought of first when a position opens up at a label. I recall a couple of guys who were responsible for a privately owned firm's losing a couple of million dollars and going bankrupt in a brief period of time, and within the blink of an eye turning up at an even larger diskery where they immediately proceeded to do the same thing. One of them even thought nothing of listing his earlier catastrophe in his resume when he joined the next firm. Another guy, whose bad judgment helped wreck a



The Luxman 5T50

The Laboratory Reference Series tuner. A very remarkable component—by itself or as part of a complete LRS system.

Although the LUX Laboratory Reference Series was conceived—and introduced—as a completely new concept in systems, we believe you'll find the LRS tuner alone merits special consideration.

At a glance, the 5T50 is strikingly clean and elegant. The tuning display itself is digital, supplemented by what might be considered an advanced touch of nostalgia for the dial of old. One linear dial is calibrated in 1 MHz increments, and another provides for 200 kHz indication. However, instead of a pointer, LED's traverse the dials, giving linear readout of tuned stations.

Electronic tuning and memory.

Tuning is accomplished electronically, by a touch on either of two buttons. Station selection can be switched to either manual or automatic scanning mode, and tuning speed can be adjusted from slow to rapid. A further tuning option is provided through the tuner's C-MOS IC memory system, which stores seven stations in digital code. A touch of the appropriate button provides instant reception, with the station exactly center-tuned.

Tuning accuracy within 0.003 per cent.

Tuning is always exact, no matter how you select the FM station. Using a quartz crystal frequency synthesizer instead of a tuning capacitor and coil assembly, the 5T50 gives a degree of accuracy (within 0.003 per cent) and stability that cannot be found in conventional tuners. The station is received center-tuned and it remains that way—just as accurate and as stable as the FM transmitter frequency itself—which, for reasons of precision, is also referenced to a crystal.

But the utmost in design and performance doesn't stop here. From front end to output terminals, the 5T50 utilizes the best circuitry. For example, dual-gate MOSFET's in the RF amp and mixer. And a buffer circuit—which helps achieve outstanding image, IF and spurious response rejection—follows the crystal oscillator. In the IF section, a ceramic filter plus two pairs of 4-pole block filters provide for excellent

selectivity without sacrificing low distortion characteristics. A double-tuned quadrature detector also keeps distortion low, at the same time protecting against signal overload.

And to assure excellent stereo separation (45 dB at 1kHz and at least 40 dB at high and low frequencies), the multiplex section employs a Phase-Locked-Loop circuit. **Special tuning refinements.**

To help you take advantage of this advanced internal design—which includes a Dolby* decoding circuit for Dolbyized FM broadcasts—we've included a number of advanced external features. So tuner operation is just as precise as performance. For example, a multipath check button lets you detect multipath distortion audibly—no need for an oscilloscope. There's also an antenna attenuator for adjustment if signals are too strong in your reception area. For quick level adjustment when recording Dolbyized broadcasts, a 400-Hz test tone button is provided. The tuner output level is adjustable, along with interstation muting threshold. A digital display provides easy-to-read signal strength indication. And if incoming signals are weak, there's a high blend noise filter to assure low-noise stereo FM.

Other LRS components.

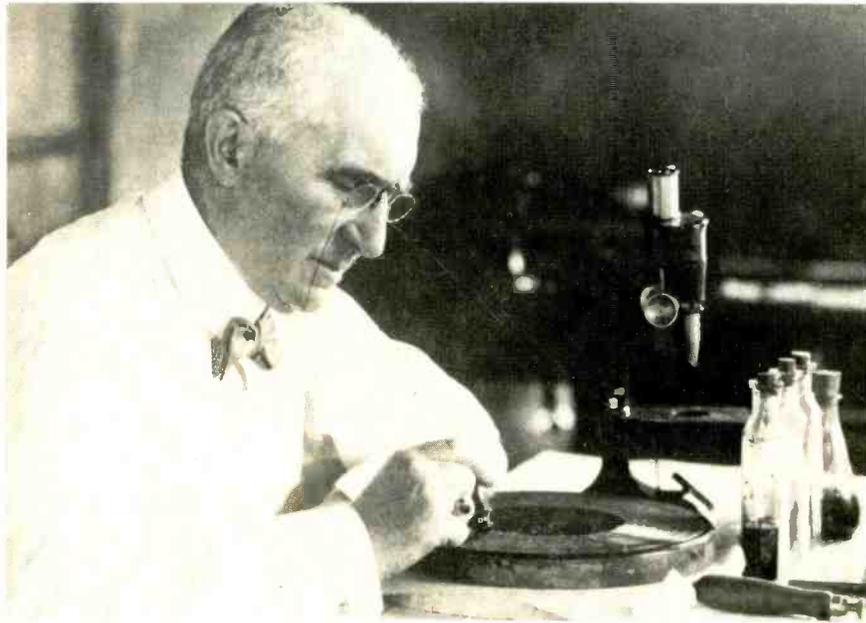
Of course, only you know if you're considering a new tuner at this time, or an entirely new system. If the latter, we'll simply advise you that the LRS system has carried the separates concept to "an extreme." That is, the preamplifiers have no tone controls—these are provided by the LRS graphic equalizer or separate tone control unit. The power amplifiers are available with or without meters—supplemented by a separate LED peak indicator. And if low distortion is important to you, the total harmonic and IM distortion of the LRS power amplifiers at rated power is no more than 0.008 per cent. That's double-0 eight.

However, if a superb tuner is really all that interests you at this time, that's fine. Chances are you'll see and hear it as part of the complete LRS system—where it will look and sound the most impressive. Suggested price: \$1,495.

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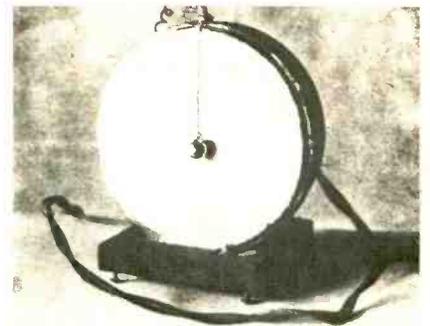


away to manage the artist's own new recording studio. Being merely an equipment operator, the technician suddenly found himself cast not only in the role of a manager and administrator, but a studio designer as well. His first efforts were a total wipeout, but with the artist earning so many millions that the government paid the bulk of his losses in the form of expense write-offs, and the technician (today unemployed) continued to earn tens of thousands of dollars annually, drive a Cadillac, and at the drop of a hat would proudly show you his \$350.00 digital readout wristwatch that he'd bought before they flooded the market at a mere \$50.00. And you thought this sort of thing happened only in the Hollywood movie industry's halcyon days, eh?

label so that he was forced out, had no trouble getting himself an even more prestigious job in a trade association . . . where presumably he couldn't do any harm . . . all because of personal publicity he'd garnered in the "trades."

Then there's the sound technician who'd been earning a couple hundred dollars a week in a small independent recording studio. He had the good fortune to mix a recording session which resulted in a then-penniless artist being skyrocketed to fame and fortune. As a reward, this technician was hired

Emile Berliner examining the grooves on a newly cut disc for imperfections. This year also marks the 100th anniversary of Berliner's invention of the microphone, with the original model of March 4, 1877 at top, while the other is the telephone transmitter which, with the mouthpiece added, saved the Bell System from ruin. The infant Deutsche Gramophone Co. of 1898 with just a few machines and handful of workers.



But, most inexplicable of all was the case of Sal Iannucci . . . so audacious, even by showbiz standards, that NBC's Rowan and Martin couldn't resist taking a poke at one "Salvatore Anuchi" on an episode of their show "Laugh In." Iannucci had been a second-string, resident legal counsel at CBS in New York City. No one in the record industry had ever heard of him and, apparently, few people in broadcasting had either. Incredibly, out of the shadows he suddenly emerged as, of all things, President of Capitol Records. Today, while Salvatore is safely ensconced elsewhere, industry observers are still trying to figure out this miraculous ascendency to "Cap's" helm and what relationship he may



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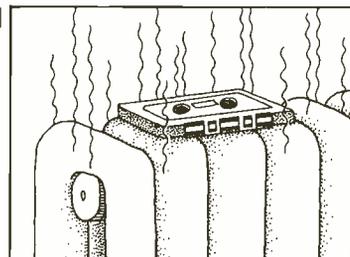
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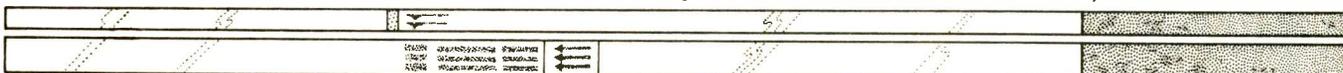


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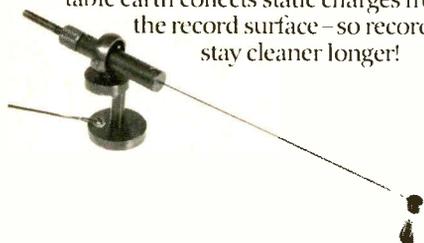


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have had to that diskery's continuing troubles. Interestingly, more than one Capitol bigwig has used his short-lived tenure there as a stepping stone to even greater glory (hopefully, in less volatile atmospheres).

Piracy - Then and Now

Thanks to the advent of magnetic tape and the considerable consumer acceptance of recordings in this form rather than on disc, record piracy has risen to major proportions, siphoning off untold tens of millions of dollars rightfully belonging to the recording artists and their respective record labels, music publishers, and composers. Sophisticated pirates using the finest of equipment secretly stashed in unobtrusive locales, not only avoid the difficulties in copying from disc to disc (most of this having been done in the Phillipines in the not-so-good old days of counterfeiting), but even have brazenly offered to pay royalties to all parties involved. But it must be remembered that these crooks make no investment in the costly recording session, take no risk, because they copy only the *hits*, and spend no money in building the stature of a heretofore unknown artist nor in promoting the sale of his records.

A lot of water has gone under the bridge since the time Eldridge Johnson, with an assist from Emile Berliner, launched the Consolidated Gramophone Company in Camden, New Jersey, soon afterwards to be renamed the Victor Talking Machine Company (incorporated Oct. 13, 1901) in recognition of my grandfather's court victory over a former employee, Frank Seaman, who, in cahoots with a slick lawyer for Columbia Graphophone Co., Phillip Mauro, had used an obscure legal loophole to challenge the inventor's right to manufacture his own records and players. They'd miraculously obtained an injunction preventing grandpa from continuing in business. But Johnson, a top-flight machinist who'd developed the spring-powered turntables used in the trade mark model Berliner Gramophone, persuaded grandpa that he should be allowed to make discs and talking machines until the lawsuit was resolved. He then talked the court into voiding the injunction brought against him.

Emile Berliner won a year later, but was financially ruined, while Johnson was enjoying considerable success not only in filling the demands of the domestic market, but also in furnishing turntables to British Gramophone as well. Victor quickly became the most powerful label in the world, aided in

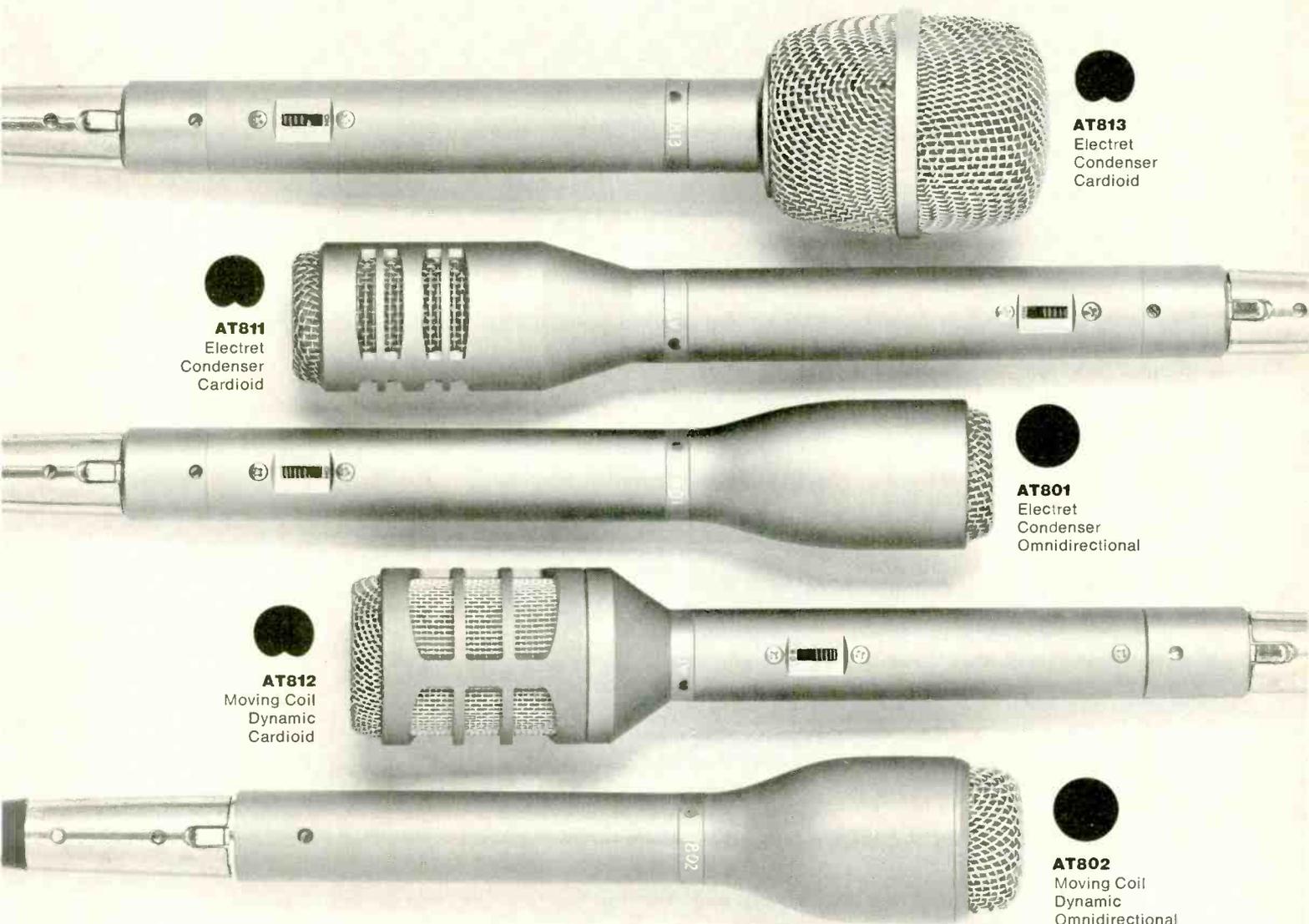
no small way by the use of grandpa's trade mark of the little dog listening to his master's voice on the gramophone. It has truly been stated that, "If Eldridge Johnson be king of Camden, Emile Berliner crowned him so."

Johnson enjoyed his newfound prosperity in regal splendor, particularly aboard his palatial 171-foot yacht, the *Caroline*, reputedly purchased for nearly a half-million dollars in the late 1920s. My father, Edgar, who headed Montreal's Berliner Gramophone, which became part of Victor in 1924, loved to tell of the directors' meetings Mr. Johnson liked to hold on board. One time Mr. Johnson asked the steward (the ship required a crew of 30) to pass out cigars after lunch. But before the men could light up he stopped them, saying he wanted to continue the meeting out on deck and since these cigars were too good to be "wasted" outdoors, he'd have the steward pass out some cheaper cigars. The cheaper ones were Corona Coronas selling in 1927 for \$1.00 each!

Nowadays Victor, owned by RCA since 1929, with said purchase being closely followed by the death of Emile Berliner and nearly that of the stock market as well, is not the supreme leader it once was, Warners and Columbia Records having long ago taken over dominance of the industry. Decca has been swallowed, and dropped, by upstart MCA (Universal Pictures). Other labels, unknown in the days of yore, have risen to prominence such as WEA (Warner-Elektra-Atlantic), and little powerhouses such as A&M and Motown have flexed their new muscles, with a host of other upstarts nipping at their heels.

Perhaps the following anecdote correctly characterizes the record business in a nutshell. Decades ago a number of Canadian Victor officials were visiting British Gramophone. They'd checked out of their hotel and had brought their luggage to the Gramophone Co. offices at Hayes for a final conference prior to catching the boat-train. Realizing they were late and unable to find a taxi, one of the group spied a group of workmen digging a ditch. With a wink at his associates, he sauntered over to the ditch-diggers and, affecting a (phony) British accent, asked, "I say, old chaps, would you mind carrying our bags down to the railway station? We're from His Master's Voice." With this, one of the workmen looked up and exclaimed in a typically British (understated) tone, "Oh, f_____ His Master's Voice!" Whereupon the ditchdiggers proceeded to chase the group down to the station. Enough said. A

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European records

John S. Wright

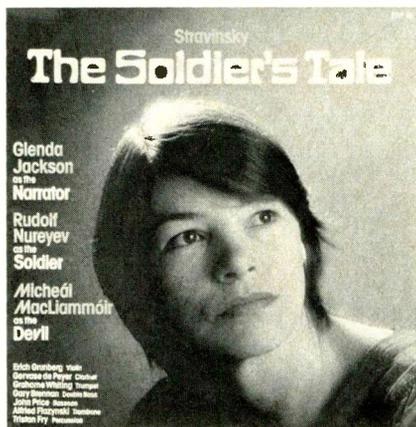
In this British Jubilee year, it is hardly surprising that there has been a number of records of music that could be termed as "patriotic nostalgia." The more important of these releases concerns two recordings of Elgar's *Coronation Ode*. One recording by Bishop & Parker on EMI ASD 3345 couples the Ode to performances of our National Anthem (arranged by Edward Elgar) and *I was Glad When they Said Unto Me* (Parry). Issued in SQ compatible quadraphonic format, the recording made in Kings College Chapel, Cambridge, offers stupendous opportunities for surround sound. In practice, I could only detect a basically front stage arrangement of instrumentalists and soloists with an ambient wash from the rear. In stereo, it was all that we have come to expect from this recording producer and balance engineer, being full blooded and sonorous in a way that is reminiscent on their Elgar oratorio recordings. Albeit in many ways strictly synthetic, the presentation is exciting and likely to please the majority of record collectors, whatever their playback equipment.

In sharp contrast we have a second recording of the *Coronation Ode*, this time coupled with *The Spirit of England* on the RCA label RL 25074 (two discs). This is a more natural balance, being more distant and demanding the finest of ancillary equipment to reap full advantage of its extremely extended range. On large loudspeakers, fundamental organ notes exist at a frequency that can be felt but not heard, whilst the dynamic range is apparent more by observation on meters than by loudness. This, as it should be, is real dynamic range (i.e. a contrast between extremely quiet and occasional peaks—rather than merely plain loud). A direct comparison between this and the EMI recording can easily be made by selecting the finale of *Land of Hope and Glory* (*Pomp and Circumstance*) where the attributes of each recording format are clearly presented. Both are excellent examples of their type, with the EMI disc being a recording suitable for playback even on average equipment, whilst the RCA disc exists more in space with a sense of openness that will only be appreciated on equipment

capable of revealing inner detail and rumble-free low frequencies.

Also on the RCA label comes a selection of popular music by Frederick Delius (*On Hearing the First Cuckoo in Spring*, etc.). Norman del Mar conducts the Bournemouth Sinfonietta on RL 25079 and provides a delicate and sensitive interpretation which is well captured by an equally relaxed recording. In fact, it seems overall that the British produced RCA recordings are becoming a force to contend with. This particular record will not necessarily appeal for demonstration due to its intrinsic lack of the full exploitation of high fidelity equipment, but nevertheless reproduced on state-of-art components a sense of natural ambience is revealed which well justifies the investment.

The music of Malcolm Arnold is among my favorites, not, especially



because they are great works, but that Arnold possesses an intrinsic sense of humor and an ability to poke fun at himself through his own musical clichés. Those who need evidence of this should recall his work for the Hoffnung Music Festivals. EMI has just issued Sir Charles Groves new recording with the Bournemouth Symphony Orchestra of Arnold's *Symphony No. 2* coupled with his *Eight English Dances* (ASD 3353). *The Dances* in particular have a strong similarity to others of his works and in particular have a resemblance to his *Cornish Dances* previously recorded (coupled with *Symphony No. 5*) on EMI ASD 2 878. Indeed both recordings, although at different locations, show great expertise, and it is perhaps more than coinciden-

tal that Nevil Boyling was the balance engineer in both cases. The new record is in SQ format and gains little from it, but can be thoroughly recommended for its weighty and exciting presentation. In spite of this, I still sneakily prefer the earlier record, both musically and technically. In its day it was, and surely still is, one of the finest orchestral recordings of 1973.

On a musically more sober note, Salvatore Accardo has recorded the Bach *Sonatas and Partitas for Solo Violin* on 6703 076 (3 LPs). As a Bach fanatic, I had perhaps an unfair advantage in evaluating the subtleties of interpretation which demonstrate a deep understanding over repeated playings. A masterly performance, coupled to a typically masterly Philips recording which might be found marginally on the bright side by some people. However, since the plentiful sense of ambience seems well balanced, this may just be a characteristic of the particular violin.

Nothing but praise for the Quartetto Italiano again, and nothing but praise for their recording of the Haydn string quartets *The Emperor* and *The Sunrise* (9500 157). The performance is so fresh and animated that I found it quite impossible not to play both sides right through twice, quite glued to the speakers. The recording has even more of that sense of spice and bloom which Philips has achieved with their chamber music, only the slightest reservation lying in some general rumbling noises which might be attributed to traffic. Of all the records in this Quartetto Italiano series, over which I have enthused, surely this is the best so far.

An important new release on the Argo label is that of Stravinsky's *The Soldier's Tale* (ZNF 15). For those unfamiliar with the work, it consists basically of a play, set to music, the story of which involves a soldier's encounter with the Devil. Glenda Jackson is the narrator and Michael MacLiammoir plays the Devil, with the voice of Rudolf Nureyev as the soldier. This is strictly a recording session type production, with Glenda Jackson's voice positioned forward front stage with the action taking place around and behind her. The result in an experience that only could exist in this

THE PLATTER IS THE MOTOR.

Fisher introduces a major advance in audio technology: the linear motor 120 pole, direct drive turntable.

One of the problems in improving direct drive turntable performance is reducing wow & flutter due to cogging action of the motor.

With its limited number of poles (usually 12) and its relatively slow operating speed, most conventional direct drive systems also have an inherent problem of low starting torque.

To solve these problems, Fisher has engineered the linear motor, direct drive system. The new Fisher MT6225.

In effect, the platter becomes the turntable's motor. And Fisher's 120 pole design practically eliminates cogging action, and lowers wow & flutter to a totally inaudible 0.03%.

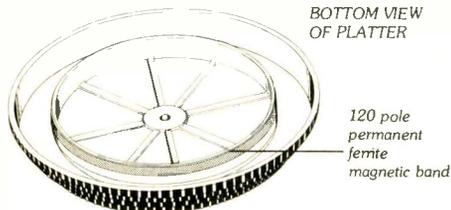
The linear motor direct drive system further reduces turntable rumble to an extremely low -70 dB, far below hearing level.

HOW IT WORKS

A continuous band of ferrite material, containing 120 magnetic poles, is attached to the inside bottom rim of the platter. To start platter rotation, each pole opposes one of the electro-

magnetic drivers on the base top. Each of the 120 poles is attracted or repelled as it passes the driving electro-

magnets for smooth, stable operation.



An electronic sensing device monitors the platter's speed, and acts as a servo-feedback control to maintain

practically perfect speed accuracy. Built-in strobe and pitch controls are provided.

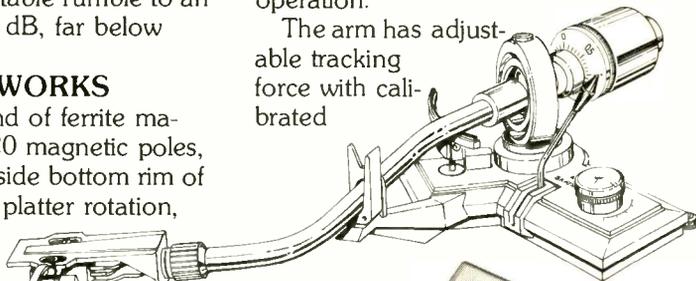
The speed accuracy of the system is independent of line voltage fluctuations.

THE ARM

The Fisher MT6225 is equipped with a professional-type gimbaled tone arm for performance to equal its technically advanced motor design.

The arm accepts all standard cartridges. The auto-return system, which returns the arm to rest at end of a record, is designed with no restraints on its lateral or vertical motion during operation.

The arm has adjustable tracking force with calibrated



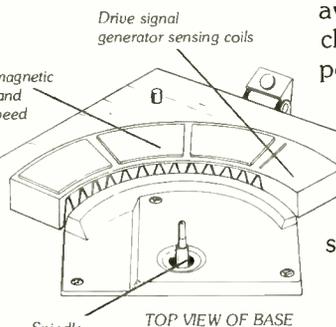
settings from 0.6 to 3.5 grams. There's also precise variable anti-skate, and viscous damped cueing. The MT6225 also has a heavy cast-aluminum platter, and a massive integrated

base to absorb vibration.

In all, there is no other turntable

available that comes closer to the perfect performance... or the ultimate in reliability.

See the new Fisher MT6225 now at fine audio stores and the high fidelity section of department stores.



Motor	Linear Direct Drive
Wow & Flutter	0.03% WRMS
Tracking Force Range	0.6 - 3.5 grams
Rumble	-70 dB (DIN B)
Maximum Tracking Error	± 1.5°
Auto Stop	Yes
Auto Reject	Yes
Cueing	Viscous Damped
Anti-Skate Control	Adjustable
Platter Weight	2.2 lbs.
Speed Selector	33/45 rpm

49



FISHER

The first name in high fidelity

Fisher Corporation,
21314 Lassen St.,
Chatsworth, Calif. 91311



Decca Record Cleaner:



Outperforms all competitors

There are many different brands of turntable-mounting record cleaners, but all are basically the same. They use brushlike materials which, combined with liquids, remove most visible dust and dirt. They do little or nothing about static charges which build up between diamond stylus and vinyl record grooves, resulting in audible pops when discharging. Some dust is always left behind, and dries into hard grit after mixing with liquids. The stylus which could have pushed a few soft dust particles out of the way, must now track hard grit particles like they are part of your record, resulting in distortion and increased stylus wear.

Decca Record Cleaner is the maverick in the crowd. It's the **only** turntable-mounting cleaner using Decca's carbon micro-fiber*: bristles so fine that 1000 of them enter **each** groove, completely removing even the tiniest dust particles. The bristles are incredibly strong and are electrically conductive, as is the cleaner arm: the entire device is grounded to your amplifier chassis. Thus, static charges are **continuously** drained off for lower surface noise and expanded dynamic range. Decca Record Cleaner uses no liquids and thus avoids their potentially damaging effects on records and stylus.

Decca Record Cleaner: Complete dust and static removal without risk of stylus or record wear. Sugg. list \$14.95, complete with mounting hardware.

*Worldwide patents pending
Decca Record Cleaner available at
quality dealers across the U.S.
Sugg. list \$14.95

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recorded format but this is readily and immediately accepted by the listener, in no way spoiling but rather enhancing the appreciation of the work.

I recently gave a rave review to Colin Davis of Beethoven's *Symphony No. 7*. Continuing the series but rather in a reverse order, we now have *Symphony No. 2* coupled to the *Leonore Overture No. 3* on Philips 9500 160. This gets near to completing the set, all of which to my tastes have demonstrated Colin Davis's aptitude to enliven fresh enthusiasm in these popular symphonies. This last release is no exception and the quality of recording more than adequately compliments the performance, being basically a natural rather than brash presentation, if not quite reaching those pinnacles of near perfection achieved in the Concertgebouw series.

With further reference to Philips, Jessie Norman (soprano) is accompanied by Erwin Gage (piano) in the Schumann lieder cycles *Frauenliebe Und Leben* and *Liederkrus* on 9500 110. The pathos encompassed within such music places it in a category apart, and well justifies the observation that "Schumann wrote *lieder* whilst everybody else merely writes songs." As the sleeve notes verify, both works are predominantly in a reflective mood, and as has become almost inevitable is naturally captured at a respectable distance by Philip's ambient microphone techniques. However, the disc cutting level does seem somewhat on the low side.

Karl Munchinger's interpretation of Bach with the Stuttgart Chamber Orchestra has always been controversial. Many listeners find it too mechanical and insufficiently warm in comparison with the more sentimental approach taken by, say, Yehudi Menuhin. However, Munchinger's rather aggressive approach has always appealed to me, and I was delighted to receive a copy of his new recording of *The Musical Offering*, on SXL 6824. This is not the first time that this conductor and orchestra has performed this work for Decca, and I had the opportunity to make direct comparisons of both interpretation and recording against their early stereo release (SXL 2204). The new performance is less whimsical and more poignant, with stronger emphasis on the bass line, more faithfully captured by this new recording which is rather close and less natural from an academic point of view. As a performance intended primarily for the home entertainment media, I would nevertheless not hesitate to choose this latest release from the competitive alternatives.

We have come to associate the Polydor label with light-hearted entertain-

ment in the James Last vein. Out of character, Polydor took a live recording of a concert given by Peggy Lee at the London Palladium (Oyster 2391 287). Usually such recordings suffer badly from the effects of the public address system together with the engineer's inability to avoid oversibilance. This record is quite the exception, with the voice (although close microphoned) clean and well positioned within a big band setting. Turn it up loud, and you're really there! The tracks included are of music that never seems to age, such as *The Folks who Live on the Hill*, *Mac the Knife* and the old favorite, featuring a plucked bass motif—*Fever*. This combination of artist, presentation, and repertoire will be eminent in the Polydor catalogue for many years to come.

A selection of popular pieces from the baroque period is provided by Richard Hickox conducting his orchestra on ZRG 866. Argo seems to be competing with themselves and the Academy of St. Martin-in-the Fields in the way that they have lushly recorded this music, any item of which would adequately fit into a program entitled **Your Hundred Best Tunes**. I found the whole album totally relaxing both musically and technically, and dare I say it, ideally suitable as sophisticated background music.

Finally out of curiosity, I decided to sample a rather unusual record release on the RCA label. I am not particularly interested in the music of films scores, although I greatly admire many of the composers, mainly for their other works. *The Spectacular World of Classic Film Scores* on RL 42005 features some 19 highlights from many famous films, including the introductory fanfares, played by the National Philharmonic Orchestra conducted by Charles Gerhardt. Spectacular, it is indeed! Having rather expected an optical sound track quality, I was more than pleasantly surprised with this full presentation and see from the sleeve notes that the recording engineer was K. Wilkinson, who I assume to be the Kenneth Wilkinson associated with so many fine Decca records. Because of the essentially visual nature of the cinema media, the sound stage is equally presented in cinemascope, providing the sort of demonstration material ideally suited to those who wish to show off hi-fi equipment to the uninitiated. No attempt is made at naturalism, but this is obviously the producer's intention, so as to recall to the listener the impact of the films without their visual counterpart. I highly recommend this disc, particularly to the nostalgic cinema-goer who now tends to stay at home watching TV or listening to his stereo. A

HEAVY.

Heavy technology, Heavy music,
and our Hero — the Heavy.

Demanding music requires audio components with advanced designs, high technology, and the best component parts. A.E.A. has it all. One example is our new power amplifier, The Brute. The Brute weighs in at 72 lbs., half of that weight is the heavy duty power transformer inside. You see, the transformer used in an amplifier makes a decided difference in its sound quality—especially during heavy musical crescendos. So A.E.A. uses a heavy. In the 620 we use a four quadrant bridging output design to dramatically improve the amplifier's slew rate, and to enhance its power handling capability.

To make this Brute feel at home in a system we've added some creature comforts. Like peak-following power output meters, transient LED indicators, and electronic speaker protection circuitry. All this adds up to a true Brute—an amplifier that will provide 325 watts per channel into 8 ohms all day long without the need for forced air fan cooling. (Our

smaller A-610 at 150/150 RMS will do the same for smaller systems.)

What to plug into our Brute — low transient distortion... and our pre-amplifier.

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At A.E.A. quality is no accident. The 520 preamp also uses heavy technology. All 1% tolerance parts throughout. All modular epoxy sealed design. Highest grade, 24k. gold-plated plug-in

interconnections. And all jack-to-printed-circuit board construction for consistent unit to unit excellence. The price of the A-520 is \$590.00 — one quarter the price of our main competitor. We

recommend that you purchase the A-520. It would be hard to design a better preamplifier at any price. We know... we've tried.



On the cutting edge of technology, where nothing matters but the music.

For more information about A.E.A. and their advanced line of audio products, call 305/628-1665 or write direct to the factory. **SPECIFICATIONS:** POWER OUTPUT/325 watts/channel RMS (conforms to FTC rating requirements) both channels operating into 8 ohms (650 at 4 ohms). **FREQUENCY RESPONSE AT RATED POWER:** 5 Hz. to above 40 kHz. **HIGHEST THD.** from 1/4 watt to rated power is 0.08%. **SIGNAL TO NOISE RATIO:** 110 dB. **INPUT SENSITIVITY:** 2.0 volts. **WEIGHT:** 72 pounds. **CIRCUIT DESCRIPTION:** Four quadrant bridging outputs and differential FET input circuitry. **PROTECTION CIRCUIT:** computer logic. **DIMENSIONS:** 19"W x 16 1/4"D x

7"H. **PHYSICAL:** 19" rack mounts with cast alloy handles. **CONTROLS:** Meter sens., power on/of, electronic reset, gain. **METERS:** Large 5" illuminated peak following meters with "ballistometric differential slope peak detector circuitry." **INDICATORS:** LED (light emitting diodes) indicate transient peak overload.

REMOTE: Second line cord switches AC power, plugs into preamplifier and allows the Brute to be switched on from convenience outlet. This circuit is optically isolated from preamplifier and pulls less than 5 ma. from preamp. **PRICE:** With five year "limited warranty," \$1,090.00.



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Frequency modulation distortion [FMD] is a fundamental consequence of the motion of a diaphragm which is radiating sound at more than one frequency. This form of distortion, which is present to greater or lesser degree in all loudspeaker-produced sound, is believed to be a significant cause of the "listener fatigue" which typically results from extended listening to high-fidelity systems. Consequently, if a loudspeaker system is to produce clean, detailed, well-defined sound, FMD must be controlled.

Although human psychoacoustic sensitivity to FMD has yet to be thoroughly measured, guidelines adequate for loudspeaker design have been experimentally estimated. A simple and commensurate quantitative index of FMD is proposed as a useful criterion in the design of high-fidelity loudspeaker systems.

Introduction

Frequency modulation distortion [1, 2], the generation of frequencies anharmonically related to those present in the original sound, is a fundamental consequence of the motion of any diaphragm which is required to radiate simultaneously at more than one frequency.

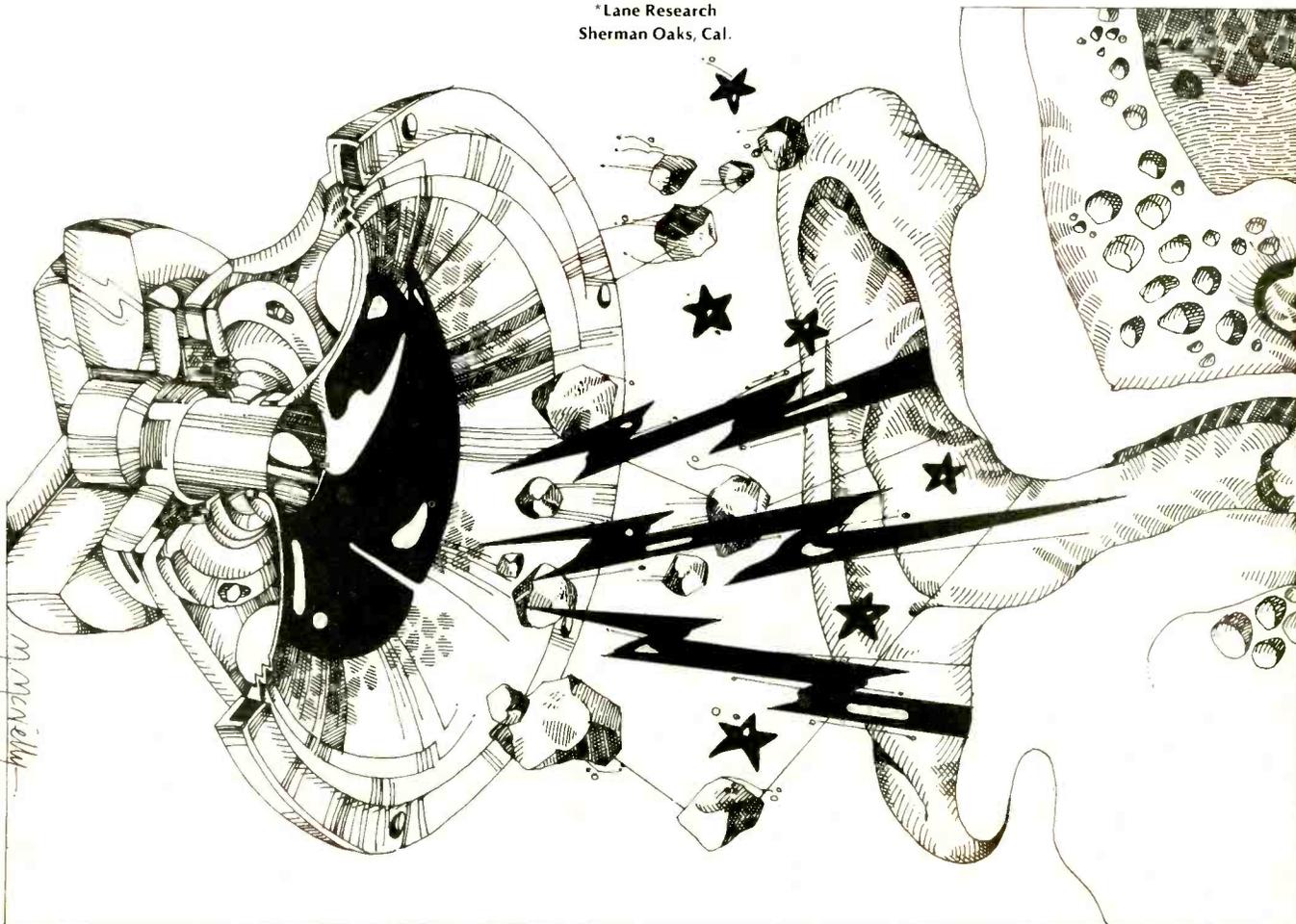
To understand intuitively the physical mechanism which gives rise to FMD, consider a loudspeaker diaphragm simultaneously radiating a high frequency, f_h , and a low frequency, f_l . The diaphragm is periodically moving toward, or away from, the listener with a velocity corresponding to f_l while simultaneously vibrating as required to radiate f_h . Clearly, the higher frequency will experience a periodic frequency shift or modulation, at a rate corresponding to the lower one. FMD is, therefore, simply the consequence of a periodic Doppler shift; hence, this form of distortion is sometimes referred to as Doppler distortion.

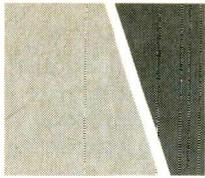
Frequency modulation distortion arises directly from the physical process underlying the production of sound. Unlike most other forms of distortion, nonlinearities are not involved; no degree of technological refinement, other than careful design to limit diaphragm excursion, can control FMD. It follows that if modulation distortion is small, other distortions (which, in contrast with FMD, arise from nonlinearities in the loudspeaker mechanism) will usually be negligible. In this article we will assume, therefore, that amplitude modulation distortion is insignificant; modulation distortion will thus refer specifically to FMD.

Frequency Modulation Distortion in Loudspeakers as a Frequency Design Criteria

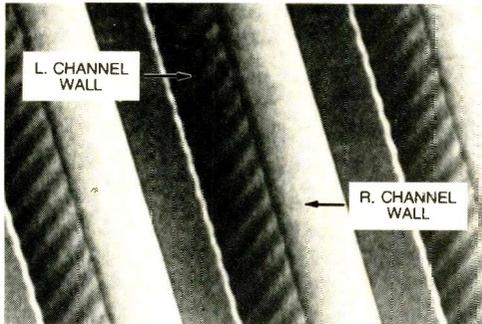
Stephen Kurtin*

* Lane Research
Sherman Oaks, Cal.





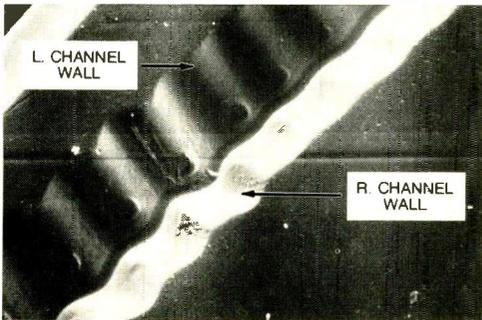
fact: one mistrack damages grooves more than 25...50...even 100 plays.



CBS STR 100 Played 75 Times With a V15 Type III Cartridge

The Optimist's View:

The cartridge that tracked the grooves shown in the top photomicrograph caused no PERCEIVABLE wear after 75 plays. But because these grooves are cut at relatively low velocities and have a continuous 20 kHz signal (only on one channel), they don't present a very challenging test. As a matter of fact, any reasonably good cartridge should produce the same results. However, under greater magnification these same grooves would probably reveal some amount of record wear (although not enough to alter sound quality). That's because record wear is a gradual but constant phenomenon . . . like tire wear every time you drive.

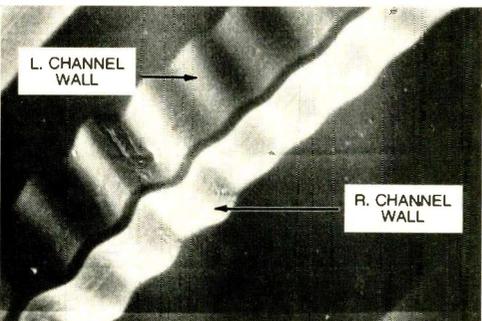


Mistracking Damage
A Commercial Recording After Just One Play With Top-of-the-Line Name Brand Cartridge at 1.0 Gram Tracking Force. Mistracking — Critical Damage.

The Terrible Truth:

The middle photomicrograph shows a record of musical material cut at today's "hotter" velocities after only one play with a well-known competitive cartridge at its rated tracking force. This cartridge mistracked the record. Clearly, critical damage resulted. Notice the deep gouge marks on the groove walls.

A single mistrack can result in MORE damage than 25, 50 or even 100 plays of a record! Continuing our tire analogy, a mistrack is like a blowout. Once your cartridge mistracks a record passage, the damage has been done and that passage will never sound the same. TRACKABILITY is the single most meaningful yardstick by which to measure cartridge performance. That's because TRACKABILITY encompasses virtually every performance factor by which a cartridge is judged . . . including velocity of the recorded signal, frequency, compliance, and effective mass.



The Same Commercial Recording After 50 Plays With Shure V15 Type III Cartridge at 1.0 Gram Tracking Force. Normal (Inaudible) Wear — Excellent Tracking.

The bottom photo shows the same groove played 50 times with a V15 Type III at a record- and stylus-saving force of only one gram. Clearly, there is no cartridge you can buy — for any amount of money — that will protect your record collection more from the damage of mistracking than the Shure V15 Type III.



Shure V15 Type III



Outperforms the best of the rest

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Note that the inherent frequency response of a loudspeaker system, the one specification which is most often published, is essentially irrelevant to our consideration. First aberrations in frequency response are not distortions; no spurious frequencies are generated. Second, if a loudspeaker is properly designed to maintain modulation distortion below a target level at rated acoustic power output, whatever amplitude equalization may be necessary to obtain flat frequency response can be inserted without increasing modulation distortion beyond the design target.

As will be quantified later, modulation distortion increases rapidly with both acoustic power level and fractional spectral bandwidth. Loudspeaker systems therefore emit sound which is contaminated with modulation distortion to an extent which corresponds, at each point in time, to the dynamics of the music being reproduced. As a consequence of the transient nature of modulation distortion, and limited research on its audibility, some authorities have claimed that this form of distortion is of little consequence [3, 4], while others proclaim it to be of great importance [2]. The true significance of

modulation distortion is perhaps best appreciated by comparative listening to loudspeaker systems which generate differing amounts of it. Notwithstanding plausible arguments to the contrary, the research presented in this paper clearly indicates that the amount of modulation distortion typically present in high-fidelity loudspeaker systems is a real, significant, and easily audible deficiency. It follows that a quantitative index describing the amount of FMD to be expected from a loudspeaker system is an important design criterion for loudspeaker systems.

Analysis

Consider a loudspeaker diaphragm driven to peak amplitude x_{pk} by a sinusoidal excitation at frequency f_1 . The displacement, x , of the diaphragm may be written simply as

$$x = x_{pk} \sin 2\pi f_1 t \quad (1)$$

and hence the instantaneous diaphragm velocity is given by

$$v = \dot{x} = 2\pi f_1 x_{pk} \cos 2\pi f_1 t \quad (2)$$

The fractional frequency shift of a higher frequency, f_h , being radiated simultaneously by the same loudspeaker diaphragm is proportional to the ratio of the diaphragm velocity at f_1 to the velocity of sound, c :

$$\frac{\Delta f_h}{f_h} = \frac{v}{c} = \frac{2\pi f_1 x_{pk} \cos 2\pi f_1 t}{c} \quad (3)$$

which implies that the peak absolute frequency deviation, d_{max} , is given by

$$d_{max} = 2\pi f_1 f_h x_{pk} / c \quad (4)$$

That is, f_h will experience a peak instantaneous deviation of d_{max} .

Actually, of course, the deviation is periodic and results in energy being scattered out of the input sinusoid at f_h into sidebands lying at $f_h \pm n f_1$ where n is an integer defined to be the "order" of the sideband. It is possible, therefore, to utilize the mathematical tools routinely applied to the analysis of frequency modulation to derive estimates of the total energy scattered into sidebands, or of the amplitude of each sideband. But such analysis is not necessary for understanding the underlying physical mechanism, nor is it required to obtain a useful index of modulation distortion. Indeed, we propose here that the intuitively obvious quantity d_{max} be considered an appropriate index of modulation distortion. This choice is motivated by the results of the psychoacoustic experiments described below.

Although it is useful to have d_{max} expressed as a function of x_{pk} , cone displacement is not, in and of itself, an acoustically important variable. We will find it generally more valuable to re-express d_{max} as a function of acoustic power output, W_{aoc} .

Intuitively, it is clear that there should be a direct relationship between x_{pk} and W_{aoc} (a loudspeaker is simply a device for moving air; the volume its diaphragm sweeps out per unit time must be the factor which determines power output). In more formal terms, power is simply the product of force times velocity. The relevant force is the radiation resistance term in the equation of motion, namely Rx . For direct radiators over their piston range ($ka < .5$; where k is 2π divided by the acoustic wavelength λ , and a is the radius of the cone), R is proportional to $f^2 S_d$ [5]. We may, therefore, relate the

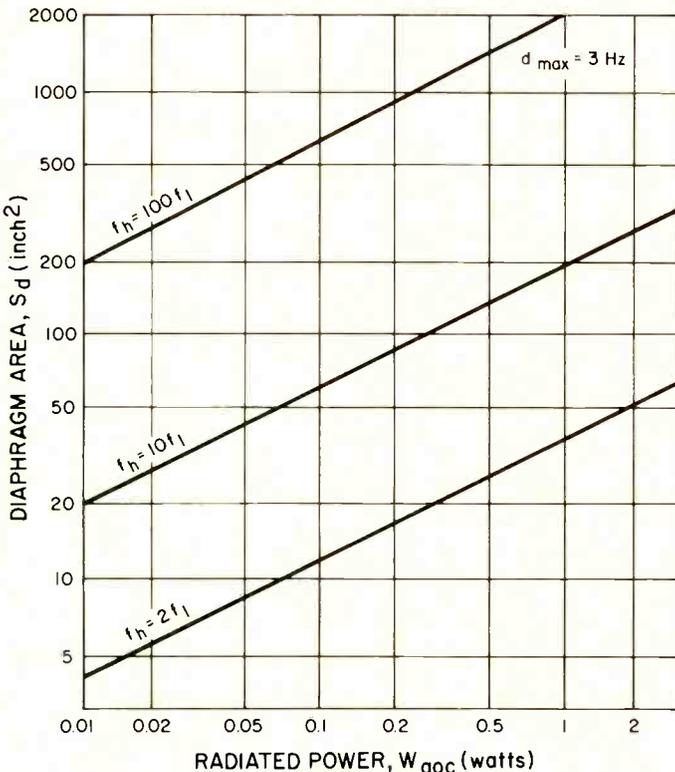


Fig. 1—Equation 7 (see text) relates four significant loudspeaker system design parameters, diaphragm area, fractional bandpass, radiated acoustic power, and peak frequency deviation. Qualitative observations suggest that modulation distortion is inaudible if peak frequency deviation is maintained below 3 Hz. The figure graphically defines the quantitative relationship between diaphragm area (considered as a dependent design variable) and radiated power (considered as an independent design specification) given that peak frequency deviation is to be maintained at less than 3 Hz. The curves are parameterized by the remaining independent variable, fractional bandpass.

acoustic power output of a loudspeaker to its fundamental operating parameters [5, 6, 7]:

$$W_{\text{aoc}} = k^2 f^4 \times x_{\text{pk}}^2 S_d^2 \quad (5)$$

where f is the frequency being radiated at a power level of W_{aoc} (watts) as a result of a diaphragm of area S_d (square inches) undergoing sinusoidal motion with a peak excursion of x_{pk} (inches), and K is 7.63×10^{-6} .

Equation 5 applies explicitly to a direct radiator mounted in a closed box. Were an infinite baffle to be considered, the power output would be a factor of two larger as a consequence of doubling the radiation resistance (energy is radiated from both sides of a speaker mounted in a *true* infinite baffle). Horn enclosures provide a tapered impedance match between the driver diaphragm and its air load, thereby greatly enhancing the acoustic power which is radiated for a given peak displacement. For horns, therefore, a multiplicative (and, in general, frequency dependent) constant [5] should be included on the right side of equation 5.

Of course, if x_{pk} is known or can be measured, we can calculate d_{max} directly from equation 4. The value of equation 5 (or a related equation appropriate to the type of enclosure being considered) is that it allows the speaker designer to calculate basic geometric loudspeaker parameters from an estimate of the required acoustic power and a target maximum allowable modulation distortion index. Solving equation 4 for X_{pk} , substituting that expression in equation 5, and solving the resultant equation for d_{max} we find:

$$d_{\text{max}} = \left(\frac{2\pi}{kc} \right) \left(\frac{f_h}{f_l} \right) \left(\frac{W_{\text{aoc}}^{1/2}}{S_d} \right) \quad (6)$$

From equation 6 it is clear that modulation distortion a) increases as the square root of increasing acoustic power output, b) increases linearly with increasing fractional bandwidth f_h/f_l , that a given radiator is called upon to handle, and c) decreases linearly with increasing area of the radiator. The significance of these simple dependencies will be highlighted below.

For future reference we will rewrite equation 6 with all linear dimensions in inches, power in watts, diaphragm area as the independent quantity, and explicitly for a direct radiator mounted in a box:

$$S_d = 60.5 \left(\frac{f_h}{f_l} \right) \left(\frac{W_{\text{aoc}}^{1/2}}{d_{\text{max}}} \right) \quad (7)$$

Psychoacoustic Considerations

Relatively little definitive study of the human perceptibility of modulation distortion appears in the literature. An interesting audio analog by Klipsch [8] indicates that at modulation rates up to 40 Hz, deviations of as little as 10 Hz peak at 1000 Hz are detectable, and that increasing deviation is distinctly unpleasant. A brief study by Childs [9] indicates the audibility of very low levels of Doppler distortion when pure tones are used as the reference material. In a recent study, Fryer [10] concludes that a few per cent FMD is easily detected by both men and women when listening to a wide range of musical material, and that a few tenths of one per cent can be detected when pure tones, as opposed to music, are the reference material.

In addition to this modest collection of objective measurements, there is a vast collection of subjective commentary which categorizes horn loudspeakers and large electrostatic panels as being "clean and detailed." Conversely, sound reproduced by many three-way acoustic suspension

loudspeaker systems, virtually all of which produce extended frequency response, often lacks detail and is said to be "muddy" or "fatiguing to listen to for extended periods."

To obtain design guidelines firsthand, the author and his associates developed a modulation distortion simulator, the output of which was observed, via high quality headphones, by a panel of four males from 25 to 35 years of age. Results were quite uniform and generally in agreement with the earlier observations of Klipsch, both objectively and subjectively.

The modulation distortion simulator used for these observations was simply a voltage-controlled integrated circuit

Fig. 2—Photograph of one loudspeaker of an experimental stereo pair designed for inaudible modulation distortion. The enclosure is in the shape of a regular, right, decagonal cylinder. The foam grill has been removed from one of the five identical radiating surfaces to show the three electrostatic elements and twelve dynamic drivers located on each of these surfaces.



function generator, driven by an adjustable reference-quality oscillator. The output of this simulator is inherently free of amplitude modulation, although it may have up to a couple of per cent total harmonic distortion as a consequence of the less-than-perfect wave shaping circuitry employed in present-generation integrated circuits of this type.

After several listening sessions, the conclusion was reached that for carrier frequencies between 100 and 4000 Hz, being deviated at rate of 10 to 200 Hz, the critical factor affecting audibility of modulation distortion is the magnitude of the peak deviation. For loud but comfortable listening levels, deviations less than 4 Hz were inaudible; deviations between 4 and 8 Hz were routinely detected; and deviations above 8 Hz were most annoying.

It seems reasonable to surmise that the highest quality high-fidelity loudspeaker systems should be designed to assure that $d_{max} < 3\text{Hz}$, if they are to be free from audible degradation caused by modulation distortion. Using this criterion, equation 7 is plotted as Fig. 1 for several interesting ratios of f_h/f_l .

Alternatively, one could argue that $d_{max} < 3\text{Hz}$ is too stringent a criterion. Perhaps two to five times more modulation distortion could be present without being audible because high-fidelity loudspeakers are used primarily to listen to music, and the ear is apparently less sensitive to FMD in music than in pure tones. The potential deficiencies in this argument are that a) many types of music involve passages in which essentially pure tones are present, and b) human sensitivity to FMD has not yet been thoroughly studied. That is, $d_{max} > 3\text{Hz}$ represents some risk of audible FMD; for $d_{max} < 10\text{Hz}$ this risk probably is not large.

56 Sample Calculations

The most popular "high-quality" loudspeaker systems are three-way, bookshelf-sized, acoustic suspension enclosures typically having a 10-in. woofer, a 5-in. midrange driver, and a 1-in. tweeter. We calculate below the peak cone excursion (using equation 5) and the maximum harmonic distortion index (using equation 7) to be expected from such systems. The calculation, with respect to each driver, states explicitly the assumed crossover frequencies and the peak acoustic power to be radiated at the low-frequency extreme of that driver's bandpass at maximum listening levels:

Woofer:

Frequency range (to 3 dB points): 28Hz-500Hz
 Peak radiated power: 0.5 watt
 Cone area: 63.6 inch²

$$x_{pk} = \frac{(1.3 \times 10^5) \sqrt{0.5}}{(28)^2 (63.6)} = 1.8 \text{ inch}$$

$$d_{max} = (60.5) \left(\frac{500}{28} \right) \left(\frac{\sqrt{0.5}}{63.6} \right) = 12 \text{ Hz}$$

Midrange:

Frequency range (to 3 dB points): 500Hz-5000Hz
 Peak radiated power: 0.5 watt
 Cone area: 16 inch²

$$x_{pk} = \frac{(1.3 \times 10^5) \sqrt{0.5}}{(500)^2 16} = 0.023 \text{ inch}$$

$$d_{max} = (60.5) \left(\frac{5000}{500} \right) \left(\frac{\sqrt{0.5}}{16} \right) = 26 \text{ Hz}$$

Tweeter:

Frequency range (to 3 dB points): 5000Hz-20,000Hz
 Peak radiated power: 0.1 watt
 Cone area: 0.5 inch²

$$x_{pk} = \frac{(1.3 \times 10^5) \sqrt{0.5}}{(5000)^2 (0.5)} = 0.004 \text{ inch}$$

$$d_{max} = (60.5) \left(\frac{20,000}{5,000} \right) \left(\frac{\sqrt{0.1}}{0.5} \right) = 150 \text{ Hz}$$

It is now clear that the listener fatigue, which is so common with bookshelf speakers, is a fundamental consequence of their design, and particularly of the relatively small total diaphragm area utilized. Conversely, the reason that large electrostatic panels, despite their other deficiencies, are uniformly praised as clean, open, and transparent is also evident. The control of modulation distortion requires either very low acoustic output levels, restricted bandwidth per driver, or a substantial radiating area. Given the fact that the required acoustic power is set by the room in which the speakers are resident and the loudness preference of the listener, the choice boils down to either a multiplicity of narrow bandwidth drivers or the utilization of large radiators. Alternatively, horn loading may be employed for the drivers in one or more frequency ranges, thereby increasing the efficiency of that driver and correspondingly diminishing the diaphragm excursion required of the associated driver [2].

Discussion

Utilizing d_{max} as a criterion, the designer of a direct-radiator loudspeaker system is faced with an interesting problem. Let's review the alternatives starting with the tweeter.

Electrodynamic tweeters typically feature very small diaphragm area, to minimize diaphragm mass and to achieve adequate dispersion. A multiple tweeter array is feasible, if expensive, and such an array could cover the entire tweeter bandpass or each tweeter could, if adequate crossovers can be provided at acceptable cost, cover a successive narrow slice of the bandpass. One practical alternative is an electrostatic tweeter array. Once a decision to utilize electrostatic elements is made, a fixed cost for a power supply and input transformer must be incurred; the incremental cost of additional elements is relatively small. (Electrostatic loudspeakers are limited by their construction to extremely small diaphragm excursion; consequently, there is physically no way for an electrostatic element to produce appreciable modulation distortion. Obviously, therefore, the acoustic output power of one such driver is correspondingly limited and additional elements must be added to achieve the desired acoustic output.)

Midrange design considerations are not unlike those mentioned above for tweeters. The area of typical electrodynamic midrange drivers is sufficiently large that, given typical midrange bandwidths and power requirements, a multiple dynamic driver approach is feasible, although electrostatic panels may be preferred for the midrange use as well.

Woofer design is rather different. No reasonably-sized electrostatic can produce significant acoustic power below 50Hz. The woofer of a wide-range system must, therefore, be a dynamic direct radiator or a horn. Horns with fundamental cutoff frequency below 40Hz are necessarily huge, causing the designer who desires flat response to below 30Hz to select direct-radiator dynamic drivers.

Simply restated, the designer of a loudspeaker system who takes care to minimize modulation distortion must provide very appreciable radiating area at all frequencies. So pro-

viding obviously involves costs dramatically beyond those which must be incurred to fabricate a simple three-way bookshelf loudspeaker.

An Experimental System

To test the design criterion proposed herein, the author constructed a two-way stereo loudspeaker system designed to the following specifications:

Woofers

Frequency range (to 3 dB points): 22Hz-1600Hz

Peak radiated power: 1 watt

d_{\max} : 2.5 Hz

$$\text{Cone area} \geq (60.5) \left(\frac{1600}{22} \right) \left(\frac{\sqrt{1}}{2.5} \right) = 1760 \text{ inch}^2$$

Tweeters

Frequency range (to 3 dB points): 1600Hz-20,000Hz

Peak radiated power: 0.6 watt

d_{\max} : 2.5 Hz

$$\text{Diaphragm area} \geq (60.5) \left(\frac{20,000}{1600} \right) \left(\frac{\sqrt{0.6}}{2.5} \right) = 234 \text{ inch}^2$$

Obviously, a single woofer of the enormous diameter required to provide 1760 in² of diaphragm is not suitable for radiating to 2000 Hz. Indeed, it is well known that acoustic radiation from a dynamic driver becomes rather rough and irregular (as a consequence of circumferential "bell" modes within the cone) for all frequencies greater than $f_c = C_c/2\pi a$, where C_c is the speed of sound in the cone and a is the radius of the cone. (Note that f_c is simply that frequency at which the radiated wavelength just "fits around" the outer circumference of the cone.)

Taking C_c to be approximately 2100 ft./sec., and desiring $f_c > 1600$ Hz, we conclude $2a < C_c/\pi f_c = (2100)(12)/1600\pi = 5$ inches. Therefore, drivers of nominally 5 in. diameter, the effective cone diameter of which is typically 4.5 in., are appropriate. The area of each such driver is approximately 16 in²; to meet the design criterion, therefore, at least 110 drivers will be required. For such a woofer array, peak diaphragm displacement is less than 0.15 inch to radiate a 22 Hz signal at one acoustic watt.

The tweeter array is composed of 30 electrostatic elements, each having 10 in² of radiating area. Note that (per equation 5) the peak diaphragm displacement required to radiate 0.6 watt at 1600 Hz is only 1.3×10^{-4} inch! No wonder modulation distortion is controlled.

It is clear that the two-way approach taken stretches woofer response to near its upper limits (the "woofer" is actually an array of midrange drivers), and tweeter response to near the fundamental resonance, at 800 Hz, of the electrostatic elements. An abrupt crossover is, therefore, required. Consequently, an active 1600 Hz crossover with a theoretically optimum [11] third-order Butterworth characteristic was chosen. The low level crossover circuitry includes equalization to compensate for the 12-dB-per-octave roll-off expected, and experienced, below woofer system resonance which, in the experimental sealed enclosure, occurred at approximately 70 Hz. Note that although this approach requires large woofer amplifiers, modulation distortion is caused by diaphragm excursion and the fact that one must push harder, by virtue of the inherent limitations of each small woofer, to achieve the desired excursion is quite irrelevant.

Each column of the experimental stereo pair is in the shape of one-half of a right, regular, decagonal cylinder and contains 60 5-in. dynamic woofers and 15 electrostatic tweeters. The woofer subenclosure has an internal volume of 8.5 cubic feet; it is filled with dacron fluff to assure, insofar as is prac-

ticable, isothermal compressions. Each vertical exterior surface of the enclosure bears a 2x6 woofer array and three tweeter elements. In this manner, nearly ideal dispersion in the horizontal plane is assured. A photograph of one such columnar enclosure, with the foam grill removed from one of the five identical exterior panels, appears as Fig. 2.

Extensive listening tests confirm that, in accordance with its design goals, this speaker produces clean, well-defined sound that is notably free of audible modulation distortion. And, as result of elaborate equalization which is built into the active crossover, the free field frequency response is exceptionally flat from 22Hz to 20,000Hz.

The apparent physical extravagance of this two-way design leads one to reconsider three- or four-way designs. Unfortunately, all that is gained by going to larger woofer drivers and a three- or four-way design is the use of fewer low frequency drivers and a somewhat moderated power requirements with respect to the woofer amplifier. In exchange, the crossover becomes more complex, multiple midrange drivers must be utilized, and additional equalization may be required.

Summary

An easily calculated index of modulation distortion, d_{\max} , has been proposed for use as a criterion in the design of high fidelity loudspeaker systems. This criterion has been shown to be fundamentally related to the physics of sound reproduction and intuitively valid. Experimental observations, while not yet definitive, indicate that a well defined upper bound for d_{\max} of approximately 3 or 4 Hz will assure freedom from audible modulation distortion. An experimental loudspeaker system constructed in accord with the criterion developed herein subjectively confirms its validity. At present, technological and practical considerations dictate that loudspeaker systems designed for low modulation distortion are large and expensive.

Acknowledgement

The author would like to thank R. Small for his extremely helpful advice during the course of this research. The author is also indebted to N. Puckett and E. Kelm for their assistance in the design and testing of much of the electronic apparatus used in this study, including notably the modulation distortion simulator, and various active filters and equalizers. Δ

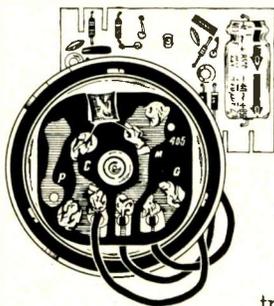
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1. G. L. Beers and H. Belar, "Frequency Modulation Distortion in Loudspeakers," *Proc IRE* 31, 132 (Apr., 1943).
2. Paul W. Klipsch, "Modulation Distortion in Loudspeakers," *JAES* 17, 194 (Apr., 1969); "Part II," *JAES* 18, 29 (Feb., 1970); "Part III," *JAES* 20, 827 (Dec., 1972).
3. E. J. Jordan, "The Design and Use of Moving Coil Loudspeaker Units," *Wireless World* (Nov., 1970).
4. Roy F. Allison, "Doppler Distortion Again," *Audio*, March, 1971, p. 54.
5. H. F. Olson, *Elements of Acoustical Engineering* (Van Nostrand, 1940) or, Leo L. Beranek *Acoustics* (McGraw Hill, 1954).
6. A. N. Thiele, "Loudspeakers in Vented Boxes: Part I," *JAES* 19, 382 (May, 1971); "Part II," 471 (June, 1971); see egn #81, p. 472.
7. Richard H. Small, "Direct-Radiator Loudspeaker System Analysis," *JAES* 20, 383 (June, 1972). See also: "Closed-Box Loudspeaker Systems" "Part I: Analysis" *JAES* 20, 798 (Dec., 1972); "Part II; Synthesis" *JAES* 21, 11 (Jan/Feb, 1973).
8. Paul W. Klipsch, "Subjective Effects of Frequency Modulation Distortion," *JAES* 6, 143 (April, 1958). See also the papers identified in reference #2, above.
9. Roy V. Childs, "Doppler Distortion in Loudspeakers," *Audio*, Aug., 1970, p. 26.
10. P. A. Fryer "Intermodulation Distortion Listening Tests," presented to the Audio Engineering Society Convention, unpublished.
11. J. Robert Ashley and Lawrence M. Henne, "Operational Amplifier Implementation of Ideal Electronic Crossover Networks," *JAES* 19, 7 (Jan., 1971). See also: R. Orban "Comment of Crossover Design" *Audio*, Jan., 1975, p. 8, and J. Robert Ashley and Allan L. Kaminsky, "Active and Passive Filters as Loudspeaker Crossover Networks," *JAES* 19, 494 (June, 1971).

Why you should consider the new Garrard GT35 if you're thinking Dual or B.I.C.

We'll say it straight out. The new Garrard GT35 is the best all-around turntable anywhere near its price. Let's do some direct comparing.

Start with the motor. The Dual 1245 features a fine 8 pole, synchronous motor and the B.I.C. 981, a 24 pole, synchronous unit.



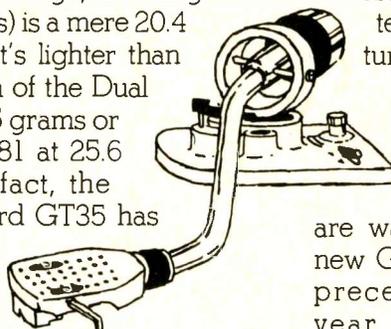
The new Garrard GT35 incorporates a servo-controlled, DC motor.

Servo control provides absolutely steady speed. The motor, (and thus the rotation of the platter), is immune to fluctuations in household voltage or frequency. Len Feldman, writing in *Radio Electronics*, reviewed it as a "significant breakthrough" superior to the "synchronous motor however many poles it might have." The GT35 is the only, belt-driven, single/multiple play turntable in the world with a servo-controlled, DC motor.

Chalk one up for the new Garrard GT35.

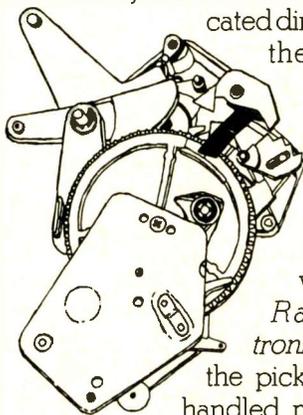
Now for the tonearm. Remember that the delicate stylus, as it traces the groove, bears the full weight of the tonearm. The heavier the tonearm, the greater the wear on the record and stylus. Light is right. The effective mass of the GT35

tonearm (measured with a Shure M95ED cartridge, tracking at 1¼ grams) is a mere 20.4 grams. That's lighter than the tonearm of the Dual 1245 at 27.5 grams or the B.I.C. 981 at 25.6 grams. In fact, the new Garrard GT35 has the lightest tonearm of any single/multiple play turntable.



Chalk up one more for the new Garrard GT35.

The Dual, B.I.C. and Garrard all protect your records as only fully automatic turntables can. And all provide the convenience of multiple play. But only the new GT35 boasts the patented Delglide® system. Unlike the Dual and B.I.C. automatic mechanisms, Delglide is driven by its own belt and is located directly under



the tonearm. Tonearm control is by simple rotary action. It's no wonder that

Radio Electronics said, "... the pick-up arm is handled more gently than could be done by the steadiest of hands." We make

this claim: Delglide is the smoothest and quietest automatic system ever, incorporated in a turntable—of any kind.

That's still another one for the new GT35.

There's more. The Dual 1245 and the B.I.C. 981 are warranted for 2 years. The new Garrard GT35 carries an unprecedented 3 year warranty. That's our way of underscoring its exceptional reliability.

Finally. The price advertised by the manufacturer. Including the base and dust cover, the Dual 1245 is \$240 and the B.I.C. 981, \$237. The price of the new Garrard GT35: just \$200.

The GT35: a "breakthrough" motor, the lightest tonearm, the smoothest and quietest automatic system and a 3 year warranty.

Consider the GT35. If you're thinking Dual, or B.I.C. Or Technics. Or Pioneer. Or Sony. Or...



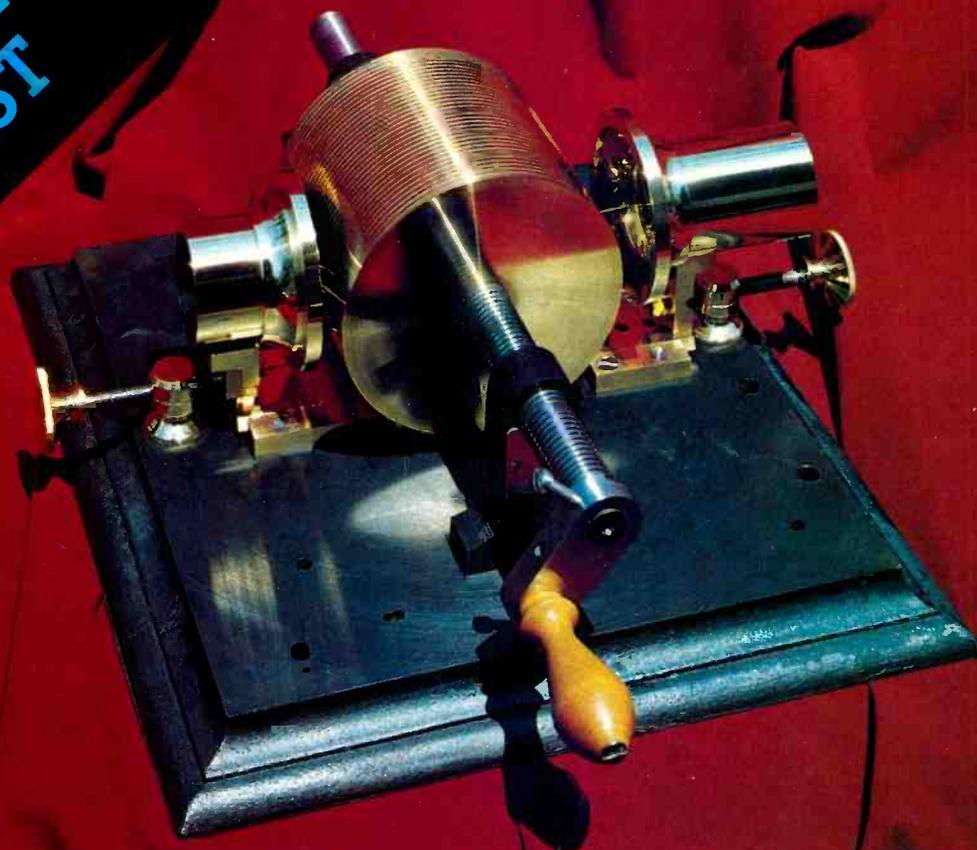
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EXCLUSIVE
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60

Edison Tin-foil Phonograph Complete Sound Recording And Playback System

MANUFACTURER'S SPECIFICATIONS

Speeds: Continuously variable by user, a fixed speed of 60 rpm is recommended.¹

Recording and Playback Time: 32 sec. at 60 rpm.

Motor: Arm muscles.

Drive Method: Direct.

Cylinder: 4.97 in (10.1 cm) diameter.²

Flutter: Improves with practice.

Tracking Error: None, tangential.

Tracking Force: Adjust with enough force to follow undulations in the tin foil without obliterating them.

Recording Medium: 2 mil tin-clad-lead foil (28 per cent tin by weight).³

Groove Density: 10 per inch (3.9 per cm).²

Recording Method: Vertical (hill and dale) with constant groove velocity.

Recording Stylus: Steel, 16 mil radius, conical.⁴

Playback Stylus: Steel, 16 mil radius, conical.⁴

Acoustical Output: Audible to an audience provided considerable force is used when speaking directly into mouthpiece; chest tones are best.⁵

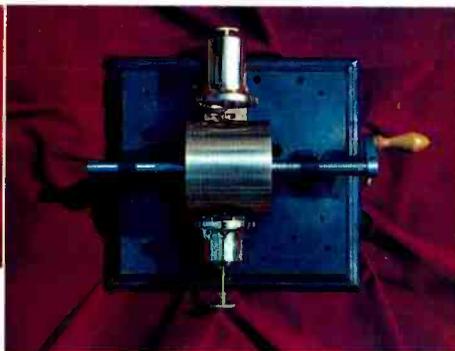
Acoustical Performance: Voice can be recorded and reproduced instantly

with fidelity and distinctness, as can whistles, laughter, songs, and sound effects, including musical sounds.⁵

Dimensions: 14.3 in. (36.4 cm) W with cylinder centered by 10.6 in. (27 cm) D by 5.2 in. (13.2 cm) H with handle down.²

Weight: 15.3 lbs. (6.95 kg).

Price: Variable; must be built from a set of plans available from Edison Laboratories at Menlo Park, N.J.² Materials include bronze, brass, steel, malleable iron. At least 100 hours of a professional machinist's time are required.





In a Class by Themselves

The Nikko Audio professional group of rack-mount design stereo power amplifiers, pre-amps and a remarkable new FM thin-line tuner are truly in a class by themselves.

The Alpha I basic high-power amplifier and Beta I all-FET preamplifier are classics of power and operational ease. Although they have been available for only a few months, they have already garnered critical acclaim.

Following in this tradition is the new Alpha II power amp, with a continuous power output of 110 watts* per channel, with no more than 0.03% THD.

The "rock-steady" Alpha V "Class A" laboratory standard amplifier with AC/DC

selector is shown in matte black. It delivers 100 watts* per channel, with no more than 0.06% THD. Performance is so pure that the Alpha V is the touchstone by which all other amplifiers will be tested.

The matching Beta V high voltage FET preamp, atop the Alpha V, is the last word in performance and reliability. It features 3-position mode switching, 5-tape position controls, adjustable impedance/capacitance controls and subsonic filter.

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*Minimum RMS, per channel, both channels driven into 8 ohms from 20Hz to 20kHz.

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tion and posterity, it would be better to write them down. I have heard that Edison is working on an improved version for production. If this is true, I recommend you wait for the updated model.

Dr. Peter E. Hillman PH.D.
Research Associate,
Dept. of Agricultural Engineering,
Cornell University,
Ithaca, New York 14853.

Manufacturer's Comment¹⁹

We are working on an improved production model of the Edison Tin-Foil Phonograph which should be available by Spring, '78. A single diaphragm is excellent for both recording and playback, and our new phonograph incorporates a single mica diaphragm for both purposes. You must realize that we were anxious to demonstrate the phonograph and to file application with the patent office as soon as possible, without taking time for improvements,²⁰ hence the marked change between this version and our original phonograph.

In addition to a single diaphragm, our new phonograph has a host of improvements.¹ A flywheel has been added to

reduce flutter. The mouth-piece diaphragm assembly swings down for greater clearance than on the original phonograph—hence facilitating ease of wrapping the foil around the cylinder. Also a slot has been added to the cylinder in which to fit the ends of the foil and a wedge holds the ends in place. Lateral screw adjustments of the diaphragm assembly are provided. The stylus is no longer rigidly fastened to the mica diaphragm. Instead, a piece of rubber tubing is placed between the stylus and the mica diaphragm, reducing the metallic noise. Stylus shape has been changed to improve volume and clarity. The mica diaphragm is variably damped, reducing the resonant peaks and raising the frequency response by adding stiffness. Slots have been added to the mouthpiece to reinforce sibilant sounds. Finally, we provide a funnel to greatly increase the volume of playback.

We believe the phonograph does have utility, especially our improved model. We predict that it can be used for letter writing, dictation, books for the blind, education, music, recording the last words of great men, and as music boxes, toys, clocks . . . just to name a few uses.²¹

The Edison Speaking Phonograph Co.

References and Notes

1. Johnson, E. H. (Edison Speaking Phonograph Co.) *Instructions for Management and Operation of Edison's Speaking Phonograph*. Philadelphia, 1878.
2. Edison Laboratories' drawings of original phonograph, 1930. Copies entitled, *Build the Edison Tin-Foil Phonograph*, are available at \$2.25 each from Eastern National Park and Monument Association, Edison National Historic Site, P.O. Box 126, Orange, N.J. 07051.
3. The type of foil used on the original phonograph was surmised from the oldest documented tin foil sample (#14281) at the Edison National Historic Site. This sample had been used on the first phonograph exhibited in Nashville, Tenn. on June 18, 1878. The relative content of tin and lead was calculated from a density measurement of this sample. Apparently this sample is a sandwich of tin with a lead center. A note from *Mining World*, July 6, 1906; reads, "Tin-foil is supposed to contain more tin than other metal, but this is not so. The Crookes method of manufacturing tin-foil is by rolling plates of lead coated with tin." I am still trying to find out when tin foil was first manufactured by the Crookes method.
4. Stylus shape is not clearly depicted in the drawings of the phonograph (reference 2). Visual examination of the original at the Edison National Historic Site revealed the recording and playback styli are conical.
5. Advertising handbill for an exhibition of Edison's phonograph in July, 1878.
6. U.S. Patent No. 200,521 granted February 19, 1878.
7. *Scientific American*, "The Talking Phonograph." 37:384, 1877.
8. Josephson, M. *Edison: A Biography*, New York, McGraw Hill, Inc. 1959.
9. I am greatly indebted to the Edison National Historic Site and its staff for allowing me to examine archival material crucial to this study. Not only is the original phonograph displayed there, but also models of his other famous inventions, his books, and his tools. It is well worth a visit. I am also indebted to Sam Baughman for advice and supervision while constructing the phonograph replica for this review.
10. Read, O. and W. J. Welch. *From Tin Foil to Stereo*, Indianapolis, Howard W. Sam & Co., Inc., (2nd ed.) 1976.
11. Young, J. L., *Edison and His Phonograph*. 1890. Reprinted by *Talking Machine Review*, Bournemouth, England. Mouth glue is either a gelatin glue or saliva (*Oxford English Dictionary*, 1933). I found that transparent tape placed at the edges of the overlapping foil works nicely.
12. Samples of tin-clad-lead foil (40 per cent tin by weight) and pure tin foil were obtained courtesy of Revere Copper and Brass, Inc., Foil Division, Brooklyn, N.Y. 11222.
13. I used a commercial heavy-duty aluminum foil. Aluminum probably was not sold as a foil in 1877 because tin foil worked as well for wrapping and wasn't nearly as expensive. Until Halls' electrolysis method for reducing aluminum in 1888, aluminum rivaled gold in price.
14. Lyman, T. (ed.) *Metals Handbook*. Vol. 1. *Properties and Selection of Metals*. Novelty, Ohio. American Society of Metals, (8th ed.) 1961.
15. A Nicolet Scientific Corp. Ubiquitous Spectrum Analyzer Model UA500A was used for this test. I thank Dr. Cornelis Drost for his aid in measuring the frequency response and signal-to-noise ratios.
16. The frequency response of the phonograph is reminiscent of a steel diaphragm earphone (Olson, H. F. *Modern Sound Reproduction*. New York, Van Nostrand Reinhold Co., 1972, p. 58.).
17. Kinsler, L. E. and A. R. Frey. *Fundamentals of Acoustics*. New York, John Wiley & Sons, Inc. (2nd ed.) 1962.
18. A notch filter was used to determine the per cent contribution of the distortion to the fundamental.
19. This section is strictly my imagination of how Edison might reply to my equipment review. I assume sole responsibility for its content.
20. Elisha Gray just missed the valuable telephone patent by arriving two hours later than Alexander Bell at the U.S. Patent Office on February 14, 1876 (reference 8).
21. Edison, T. A., "The Phonograph and Its Future." *North American Review*. 126: 527-536. 1878.

HOW NOT TO RUIN YOUR RECORDS

PART I

Don't "play" over micro-dust

THE PROBLEM:

The greatest cause of record degeneration is micro-dust. All records possess a static charge which attracts a very fine, virtually invisible micro-dust from room air. A record may "look clean" but contain a fine coating of micro-dust. When you play over this coating, even at one gram of stylus pressure, you grind the micro-dust into the record walls, often forever. Your record then gets "noisy."

COMMON ERRORS:

Most record cleaners are "pushers", and simply line up dirt without removing it from the disc. Skating a pusher off the record *only* spreads micro-dust into a tangent line of danger. Extra arm devices and all cloths are too coarse to do anything but pass over micro-dust—or gently spread it out.

AN ANSWER FROM RESEARCH:

The exclusive Discwasher System removes micro-dust better than any other method.

1. The slanted pile lifts up rather than lines up debris. The pile fibers are fixed in the fabric better than any other record cleaner, and "track" record grooves rather than scrape them (see figure 1).
2. Alternating "open rows" of highly absorbent backing *hold* micro-dust taken off the record, and demonstrate Discwasher's effectiveness over long term use (see figure 2).
3. The inherently safe D3 fluid delivery system and capillary fluid removal allows the most researched record cleaner to be the world's best.



Fig. 1 Line of micro-dust removed from a "clean" record.

UNRETOUCHED PHOTOS
OF DISCWASHER BRUSH



Fig. 2 Accumulated micro-dust from long, effective use of the Discwasher System.



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You've been putting up with compromises all these years, but now you're ready for the ultimate.

You deserve a Citation.



Citation 16a Power Amplifier. 150W min.RMS per channel into 8 ohms from 20Hz to 20kHz, with less than 0.05% THD Twin Powered. Frequency response from below 4Hz to beyond 120kHz + 0, -3dB.

Citation 16s Power Amplifier (not shown). Professional version, without instant-reading LED displays.



Citation 19 Power Amplifier. 100W min. RMS per channel into 8 ohms from 20Hz to 20kHz, with less than 0.08% THD. Frequency response from below 5Hz to beyond 140kHz, -3dB.



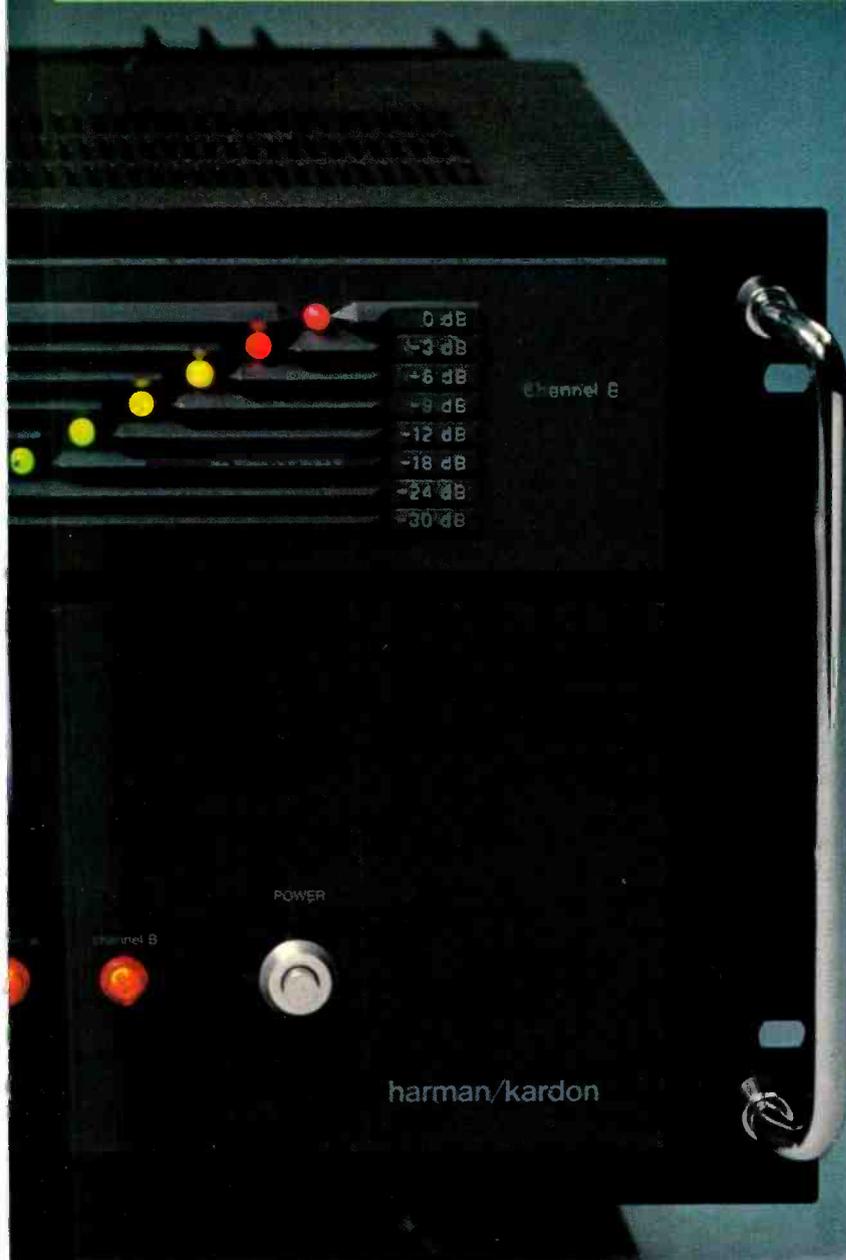
Citation 17s Preamp. Same performance specifications as Citation 17, without active equalizer.



Citation 17 Preamp. Frequency response from below 3Hz to beyond 270,000Hz, -3dB. Less than 0.001% THD, phono preamp less than 0.002% THD.



Citation 18 FM Tuner. 50dB Quieting Sensitivity, better than 17 dBf. Audio frequency response, 10Hz-50kHz. Patented Quieting Meter.



You've spent a long time developing your listening sense. To the point where what's super for most people, for you is just compromise.

You're ready for the ultimate. Which we call Citation.



The Citations you see here are brand-new. Designed to new understandings.

New understandings about transient intermodulation distortion (TIM). About crossover distortion. About FM signal processing and phono preamp design.

The new Citations answer these concerns with features like fast slew rate, low-level negative feedback, discrete components in place of integrated circuits, extended Class A operation, an FM external processor loop, and phono equalization to within ± 0.25 dB of the RIAA curve.

In addition, they all feature the ultrawideband design pioneered by our first state-of-the-art Citations in 1953. Ultrawideband design extends flat frequency response well beyond the conventional 20-20,000Hz range to insure phase linearity and outstanding transient response.

The benefit is an incredibly open, accurate sound. The spacious stereo imaging and the far greater musical detail you've been longing to hear.

Citation components are in use throughout the world. By professionals in their reference systems, by rock bands on stage, and by symphony orchestras in their listening facilities. And their reliability is legend.

The new Harman Kardon Citations.

As close to the ideal in sound reproduction as any components have ever come. Some even say closer.

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harman/kardon
wide,
open sound

Equipment profiles



McIntosh Model C-32 Stereo Preamplifier/Control

MANUFACTURER'S SPECIFICATIONS
Rated Output: Main, 2.5 V; Tape, 250 mV.

Output Impedance: 220 ohms designed to operate into 5,000 ohms or greater.

Frequency Response: 20 Hz to 20,000 Hz, +0, -0.5 dB; with equalizer out, 10 Hz to 100,000 Hz, +0, -1.0 dB.

Harmonic Distortion: 0.05 per cent maximum at rated output level, 20 Hz to 20 kHz.

Hum & Noise: Phono 1 & 2, 80 dB below 10 mV input, unweighted (90 dB IHF weighted); AUX, Tuner, Tape 1, 2,

and 3, 90 dB unweighted (100 dB IHF weighted).

Input Sensitivity: AUX, Tuner, Tape 1, 2, & 3, 250 mV @ 50 kilohms; Phono 1 & 2, 2.0 mV into 47 kilohms, 65 pF.

Program Equalizer Center Frequencies: 30 Hz, 150 Hz, 500 Hz, 1.5 kHz, and 10 kHz.

Equalizer Range: ± 12 dB at each center frequency.

High & Low Cut Filters: 12 dB/octave above 7 kHz and below 50 Hz.

Voltage Gain: All controls flat, Phono to Main outputs, 62 dB; Phono to Tape Out, 42 dB; High Level Inputs to Main Outputs, 20 dB.

Monitor, Headphone & Line Output: 12 W/ch., 8 ohms, 20 Hz to 20 kHz, 0.1 per cent THD, or 5.0 V rms into 600 ohm line.

General Specifications

Dimensions: Front Panel, 16 in. (40.6 cm) x 5 $\frac{1}{16}$ in. (13.81 cm); Chassis, 15 in. (38.1 cm) x 5 in. (12.7 cm) x 13 in. (33 cm) D.

Knob Clearance Required in Front of Mounting Panel: 1 $\frac{1}{2}$ in. (3.81 cm).

Weight: 26 lbs. (11.8 kg).

Power Requirements: 120 V, 50/60 Hz, 25 to 85 watts.

Price: \$1500.00.

Devotees of McIntosh equipment have long maintained that if some of the products designed and produced by that respected company endure unusually long life and currency, it is simply because they were "ahead of their time" in the first place. Detractors, on the other hand, accuse McIntosh Laboratory of being "behind the times" and of "not keeping up with the state-of-the-art." Both camps should be totally delighted with Mac's latest component, the Model C-32 Preamplifier. It is a totally new design so flexible in its operating capabilities that a complete description of it would require more pages than are contained in this entire issue of

Audio. We have had the unit in our lab for the better part of a month now—and are still finding new applications for it each day. Here, we predict, is a preamp unit that will become a classic in its own time—along with other Mac products that seem to endure while others come and go.

The front panel of the C-32 immediately identifies its maker as McIntosh and consists of their familiar "black glass" face, with gold lettering and gold end-caps. Much of the surrounding gold nomenclature lights up magically in a soft green color when the power *On/Off* pushbutton (colored red for immediate identification) is depressed. A pair of

Remember the plug-in-shell?

Thorens Isotrack Series Turntables proudly introduce the Plug-In Arm.

Thorens introduces an exciting new tonearm design to complement its highly sophisticated, new manual turntable series. Thorens has eliminated the headshell and its collar connection by incorporating the headshell and tonearm rod in a straight tubular design only 7.5 grams in effective tonearm mass. This reduction in mass (up to 50% that of other tonearms) reduces the inertial forces that affect stylus pressure. Tracking is improved, distortion lowered and stylus and record life are extended. Thorens Isotrack tonearm assures optimum performance with the newest, light weight, high-compliance pick-up cartridges.

tion of the belt-driven 16-pole synchronous motor is a tribute to Thorens traditionally advanced engineering. The natural elasticity of the belt filters motor vibrations from reaching the platter, and therefore, the pick-up stylus. In more than twenty years of continuous development, and the manufacture of nearly one-million Thorens turntables, Thorens has brought its belt-drive design to a level of technical perfection not approached by *any other drive system known today.*

Thorens Isotrack turntables featuring the "mini-mass" tonearm—now at your Thorens Isotrack series Dealer, or for further details write:

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—The high-speed stability and silent opera-

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West: 7301 East Evans Road,
Scottsdale, Ariz. 85260



Pictured Above: Top Right—TD-126C • Lower Right—TD-145C
Lower Left—TD-166C • Top Left—TD-160C

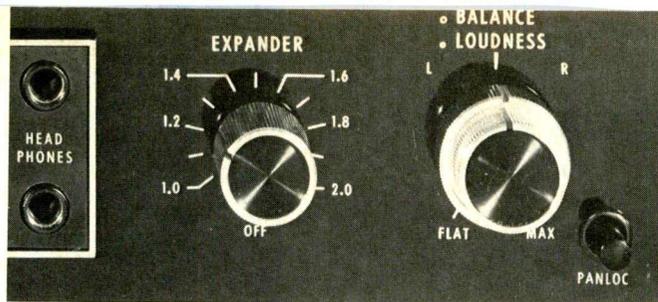


Fig. 1—Close-up view of the expander control.

selector controls at the left are identified as *Listen* and *Record* and make it possible to listen to any connected program source while supplying any other (or the same) program source to any of the three tape-out circuits. Since the *Listen* and *Record* busses are completely independent, it is also possible to connect a tape recorder to the *Listen* program line by making a few simple patch cord connections at the rear of the unit. A mode selector switch, adjacent to the *Listen* selector, has positions for *L* to *L+R*, *R* to *L+R*, *Stereo*, *Stereo Reverse*, *Mono (L+R)*, *L+R to L*, and *L+R to R* and affects only program sources selected by the *Listen* control.

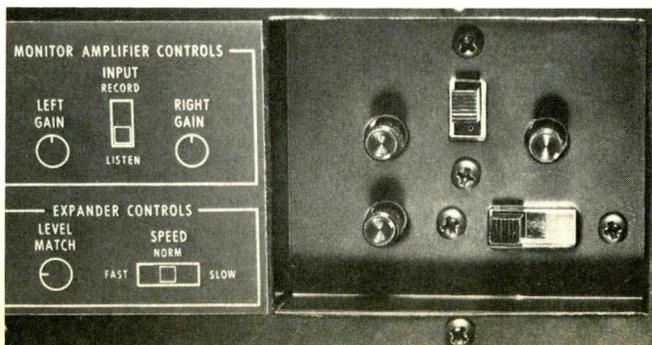
The First Surprise

Five controls along the top of the panel represent a five-band (two octaves per band) built-in equalizer and adjust center frequencies indicated by ± 12 dB. To their right is the master volume control while just below are a pair of dual concentric controls which handle channel balance and loudness compensation. The loudness control operates completely independently of the volume control (as a true loudness control should) and can be set to desired Fletcher-Munson "equal loudness" curves regardless of the position of the volume control. This arrangement permits the user to introduce the correct amount of compensation regardless of program source levels, speaker efficiency, or listening room dimensions.

The Second Big Surprise

Coming around clockwise to the last rotary control on the panel, we discovered a knob identified as *Expander*. Yes, the Mac C-32 has a built-in linear expander which can be set for dB expansion ratios of anywhere from 1.0 (no expansion) to 2.0 (see Fig. 1). More about this expander circuit presently. Eight pushbuttons (including the red-colored *On/Off* switch) are framed in an area along the lower section of the panel, along with *Tape 3* in and out phone jacks and twin headphone jacks. The latter are not simply paralleled for dual headphone listening. The upper headphone jack is used to feed electrostatic headphones which generally require more power than dynamic types. It is fed directly by (and here comes a third surprise) a 12-watt per channel full-range monitor amplifier built into the C-32. The lower phone jack is intended for feeding low impedance dynamic phones and is

Fig. 2—Close-up of controls and switches on the top surface.



fed by the monitor amplifier through an appropriate matching network.

The monitor amplifier can also be used to drive speakers directly and program sources applied to the monitor amp may be selected from either the *Listen* buss or the *Record* buss by means of a switch located on the top surface of the preamp (see Fig. 2). Beside the input switch are separate gain controls which adjust the monitor amplifier output level. Additional controls located in this area determine the level at which the expander makes its transition from "downward" to "upward" expansion and the attack time constant associated with the expansion circuit. Certain types of program material are reproduced more effectively with a slower attack time than others, and three speeds of expansion (slow, normal, and fast) are provided by means of a three-position slide switch.

Since the *Listen* and *Record* selectors have only a single *Phono* setting, the first of the remaining pushbuttons is used to switch from *Phono 1* to *Phono 2*. The next button is a record monitor switch (which tape monitor circuit is monitored depends upon the setting of the *Listen* or *Record* selectors). This is followed by an *Equalization* switch (which either bypasses or introduces the five-band equalizer), low- and high-cut filter buttons, and two output selectors which connect the *Listen* program to either or both pairs of additional output jacks (over and above the main output jacks) and can be used to feed program material to additional power amplifiers feeding remote speaker installations. These buttons also serve to turn remote speakers on and off if an optional remote control SCR relay is connected to an appropriate socket on the rear panel of the C-32.

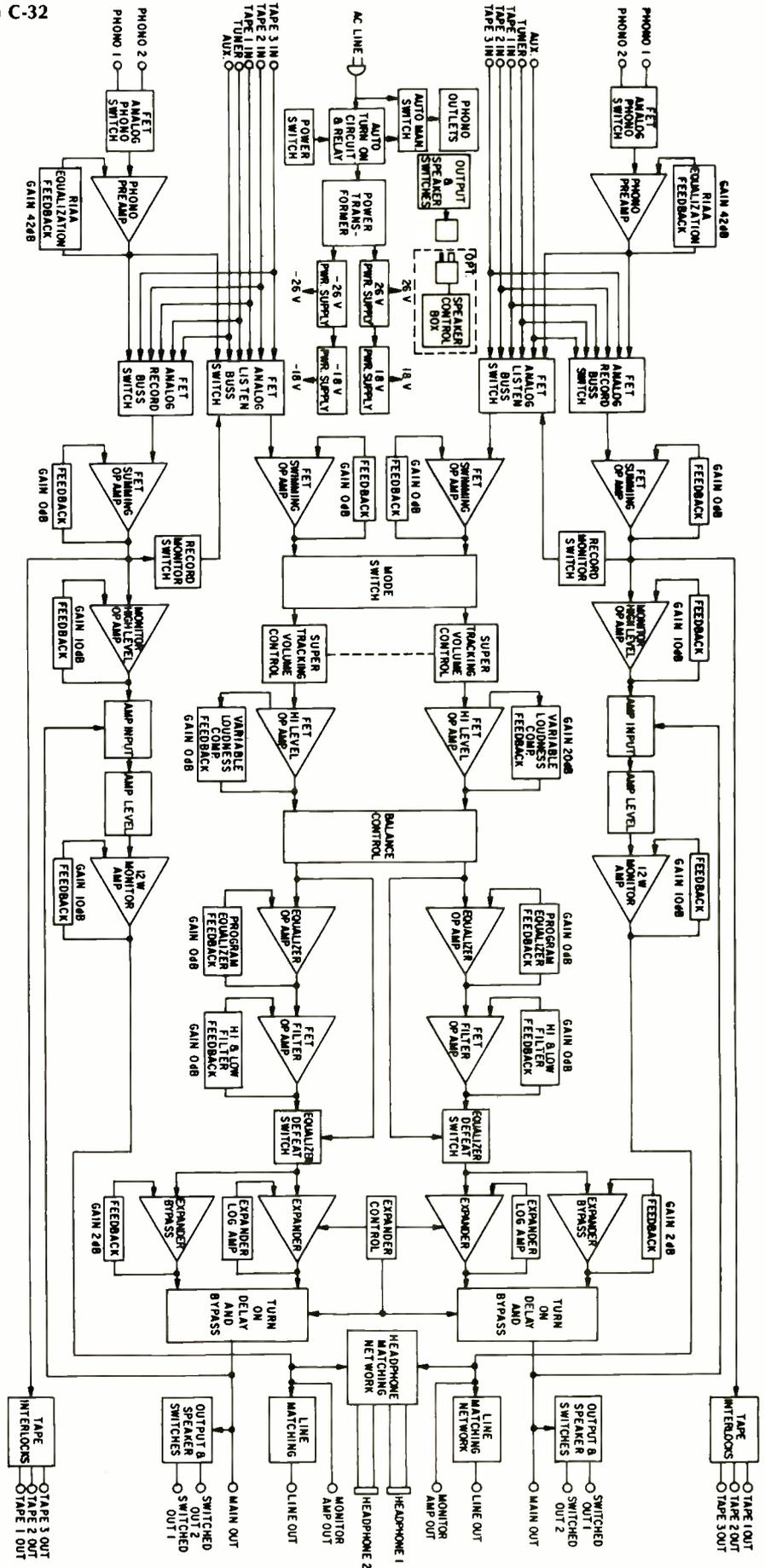
As for the rear panel, there are a few surprises to be found here as well. There are, for example, those familiar spring-loaded speaker terminals at the lower right which are used for connecting a pair of speakers directly to this unit. If you think about the *Listen* and *Record* buss arrangement for a moment, you will realize that these speakers could serve as the "rear channels" in a quadraphonic system, or even to provide "ambience" channels when using an audio time-delay unit, since the feed to such a time-delay unit could come from one of the *Tape Out* circuits and the return could be fed to the alternate buss and extracted via the monitor amplifier. In that way, a second stereo power amp would not be required for these arrangements.

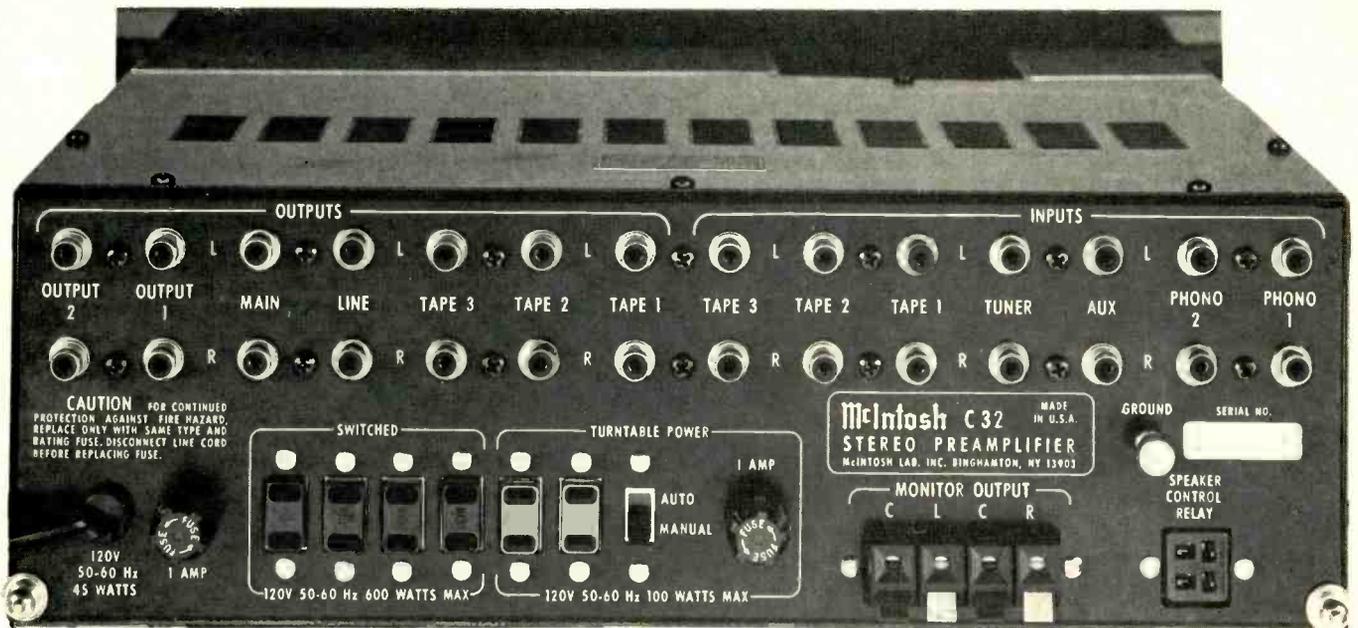
All of the program source input jacks, the three sets of tape-out jacks and the main and extra sets of output jacks are neatly arranged along the top of the rear panel while below are four sets of switched a.c. receptacles plus an additional pair identified as *Turntable Power* and colored green. Associated with these latter receptacles is a slide switch which, when placed in the *Auto* position, permits your entire system to be turned off and on whenever your turntable is activated. A sensing system associated with these receptacles detects the fact that current is being drawn by the turntable and turns on the C-32 (as well as anything else connected to its other switched receptacles) so long as the front panel power switch is left in the *Off* position. A separate fuse protects these receptacles (which can supply no more than 100 watts) while a main line fuse is located near the power cord at the lower left of the rear panel. A ground terminal, located near the phono inputs and the speaker control relay socket at the lower right completes the rear panel layout.

Internal Construction and Circuit Highlights

The views of the underside and top side of the C-32 chassis clearly disclose the flawless workmanship and layout for which McIntosh products have become famous. Flat-ribbon multiple conductor cables can be seen used as interconnecting cables between the various p.c. board assemblies, while

Fig. 3—Block diagram of the McIntosh C-32 Preamplifier/Control.





all conventional point-to-point wiring is carefully harnessed and methodically routed. A block diagram of the C-32 circuitry is reproduced in Fig. 3. Each phono preamp circuit uses four low-noise transistors arranged in a low-impedance configuration. To achieve low noise, a 68-ohm feedback termination is used. All program source input switching is done electronically, using FET analog switches. The mechanical *Listen* and *Record* front panel switches are single-deck units that simply switch low d.c. voltages which turn the FET analog switches on or off. The master volume control is a step attenuator, and since the switch commutator touches only contact pads, rather than the actual resistance elements, tracking accuracy (spec'd at within 1 dB over its entire range) is not degraded with continued use. Loudness, equalizer, and band pass filters are all constructed using ion-implanted, junction field-effect op-amps. The logarithmic expander is capable of being switched only into the *Listen* program line. Signals from the equalizer circuit are applied to a voltage controlled amplifier which operates as a variable gain block, and control voltages for this VCA are developed from a sample taken from the output of the equalizer. Electronic processing of this sample includes band shaping, logarithmic amplification, full wave rectification, level setting, expansion ratio regulation, attack timing, level setting, and d.c. amplification. The resulting voltage controls the gain of the VCA to cause logarithmic gain reduction below set level and logarithmic

expansion above that level. A switched bypass link provides a program path around the expander, maintaining a constant signal level regardless of whether the expander is in or out of the circuit.

To minimize hum pickup, the C-32 power transformer is triple shielded (copper strap, silicon steel strap, and steel outer shell). Transformer output voltage is fed to a full wave bridge with 5000 mF filter capacitors to provide ± 24 volts d.c. for powering the monitor amplifier. The ± 18 volts needed for low level and op amp stages is derived from the 24 volt supply and controlled with integrated circuit voltage regulators. A relay, time controlled by a transistor switch, connects the output of the preamplifier to the output jacks. Transistor switch control is derived from a long time constant, capacitor-charging network which turns on the relay approximately two seconds after the unit is turned on. The same circuit has a short turn-off time constant, which turns off the relay before the preamplifier's main power supply has had a chance to discharge.

Measurements

Phono equalization was accurate to within 0.2 dB from 30 Hz to 20,000 Hz. Below 15 Hz, a sub-sonic filter rolls off all program sources and is independent of the RIAA equalization. This additional roll-off, though not part of the phono circuitry, tends to reduce response at sub-sonic frequencies

Fig. 4— Harmonic and intermodulation distortion characteristics for the main output.

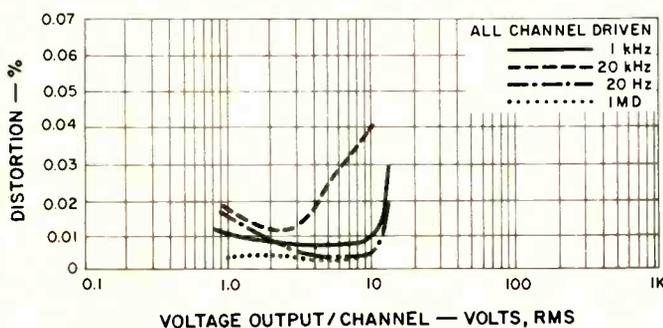
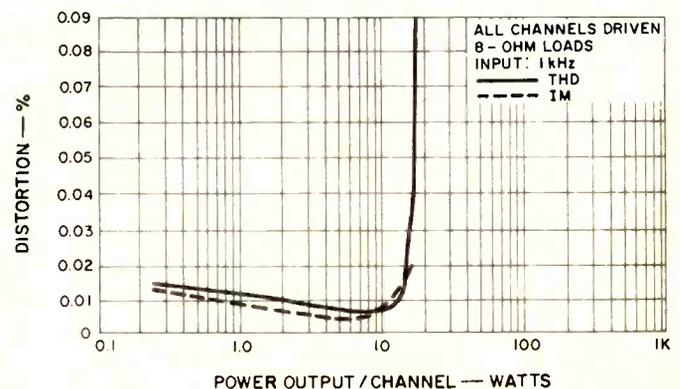


Fig. 5— Harmonic and intermodulation distortion characteristics for the line/monitor output.



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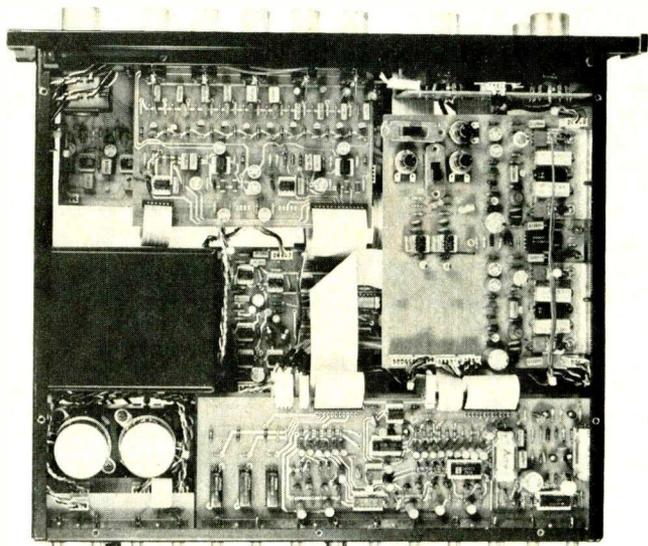
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somewhat in the manner required by the newly adopted revised RIAA response curve which calls for a roll-off beginning at around 30 Hz. We measured an input sensitivity for phono, for 2.5 volts rated output from the main outputs, of 2.3 mV, and phono overload (at 1 kHz) occurred with a 100 mV input signal—adequate for just about any cartridge tracking any disc we know of. Harmonic distortion in phono (measured at the output) was well below 0.02 per cent for any frequency from 20 Hz to 10 kHz, rising slightly to 0.03 per cent at 20 kHz. Signal-to-hum and noise in phono measured 78 dB referred to actual input sensitivity (nearly 91 dB referred to 10 mV as compared with McIntosh's limit spec of 80 dB) and 82 dB when using an "A" weighting network but still referred to actual 2.3 mV input. Translated to a 10 mV reference, the weighted S/N becomes nearly 95 dB as opposed to the 90 dB limit specified by the manufacturer. No matter what reference level you choose to use, these are excellent S/N figures for any phono preamp.

Frequency response using the high level inputs was within 0.25 dB from 20 Hz to 20 kHz and within 1 dB from 10 Hz to 100 kHz. Figure 4 is a plot of output voltage versus harmonic



of 0.023 per cent at 20 kHz. In terms of FTC power disclosure requirements, the power amplifier section of this unit might well have carried a power rating of 14 watts per channel, while power band might have been specified as extending all the way from below 10 Hz to 55 kHz for the existing power rating of 12 watts and the rated THD level of 0.1 per cent! If anyone ever doubted the conservatism of McIntosh specifications (or, as they prefer to call them, "performance limits"), these reported readings and measurements should certainly dispel those doubts.

Turning our attention to some of the front panel control features, we next examined the way in which the equalizer controls performed. The sequential stored 'scope sweeps of Fig. 7 were made by running 10 separate traces or sweeps, from 20 Hz to 20 kHz, each sweep made with either maximum attenuation or maximum boost of a single one of the five available band controls of the equalizer section. Center frequencies of each control corresponded very closely with specified frequencies and maximum boost or cut in each case was almost precisely the 12 dB specified. Needless to say, with overall response adjustment capability such as this,

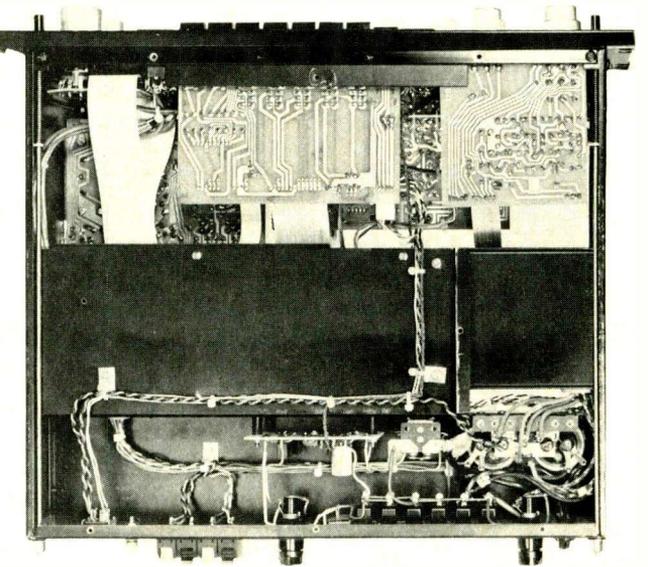
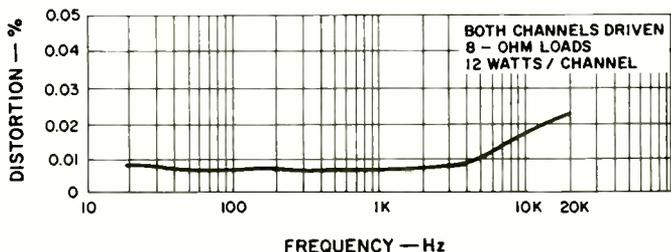


Fig. 6—Distortion vs. frequency for the line/monitor output.



and IM distortion, measured at the Main output terminals. Maximum output before clipping measured between 10 and 12 volts depending upon the frequency used and, at rated output (with equalization and expander circuits bypassed), THD measured 0.007 per cent at 1 kHz, 0.01 per cent at 20 Hz and 0.012 per cent at 20 kHz. IM distortion measured a very low 0.003 per cent at any output voltage (equivalent) level up to 10 volts.

Measurements were repeated using the speaker output terminals to include the monitor power amplifier in the signal path. At 12 watts output per channel (both channels driven, 8 ohm loads), with a 1-kHz test signal, THD measured 0.0075 per cent, while IM distortion was 0.01 per cent. These results, as well as those obtained at lower and higher power output levels, are plotted in Fig. 5. Rated (limit) distortion of 0.1 per cent was reached when the amplifier delivered 16 watts per channel under the same driving and test signal conditions.

Introducing the expander into the circuit tended to increase THD slightly, but even then harmonic distortion remained well below McIntosh's published limit, with typical readings of 0.018 per cent at the 12-watt output level from the monitor amplifier. Figure 6 is a plot of harmonic distortion versus frequency at the 12-watt-per-channel output level, as measured at the speaker terminals of the C-32 with 8 ohm resistive loads connected. Distortion remained below 0.01 per cent up to around 5 kHz, increasing gradually to a maximum



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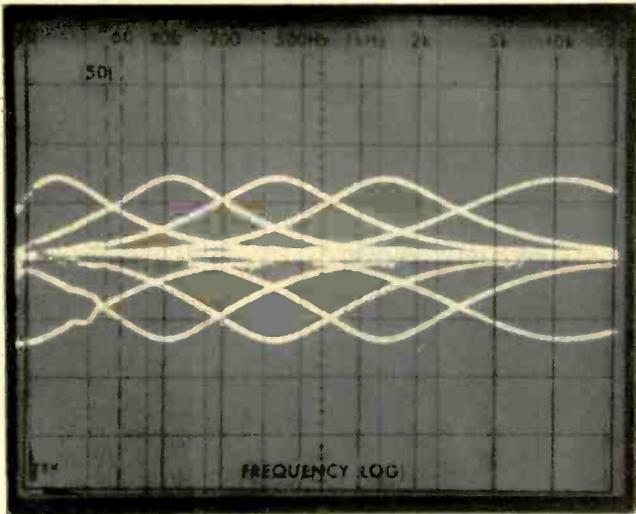


Fig. 7—Control range of the five EQ controls.

there is no need for conventional bass, treble, or even mid-range tone controls on this unit.

The response of the high- and low-cut filters was plotted using our spectrum analyzer/storage scope combination, and it is interesting to note that the action of the permanent sub-sonic filter is clearly discernible even in the "flat response" position with the low-cut filter out of the circuit. To illustrate this action, the 20-Hz low limit of our sweep was deliberately offset slightly, since at 20 Hz the sub-sonic filter has no effect.

Examples of the loudness compensation curves available through the use of the separate loudness control were plotted for the 'scope photo of Fig. 9. All of these curves were made for an arbitrary setting of the volume control which, as we mentioned earlier, is totally unrelated to the loudness-contour control. While this arrangement permits the user to properly utilize loudness compensation at any listening level, the method of use is somewhat different from that which most audio equipment users are accustomed to and a bit of explanatory material in the owner's manual might prove

Fig. 8—Response of the low- and high-cut filters.

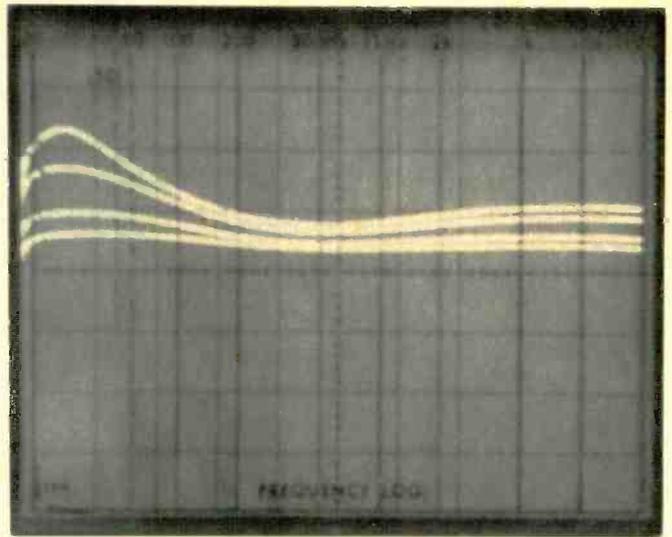
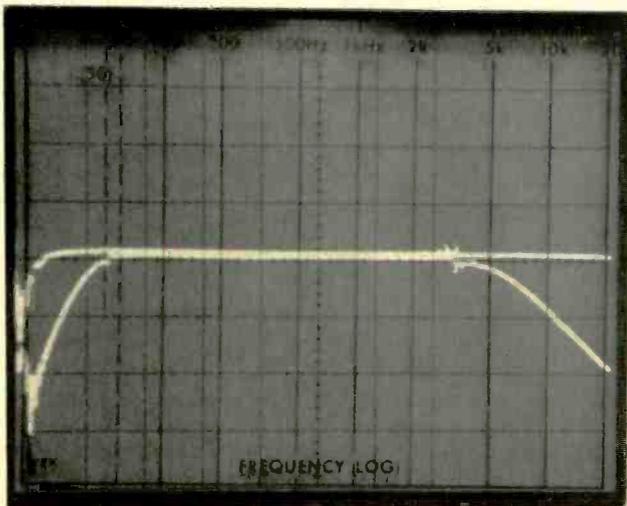
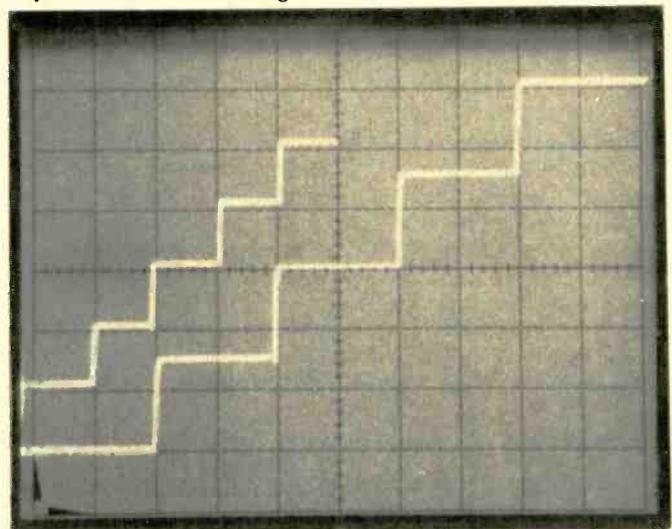


Fig. 9—Loudness compensation response curves.

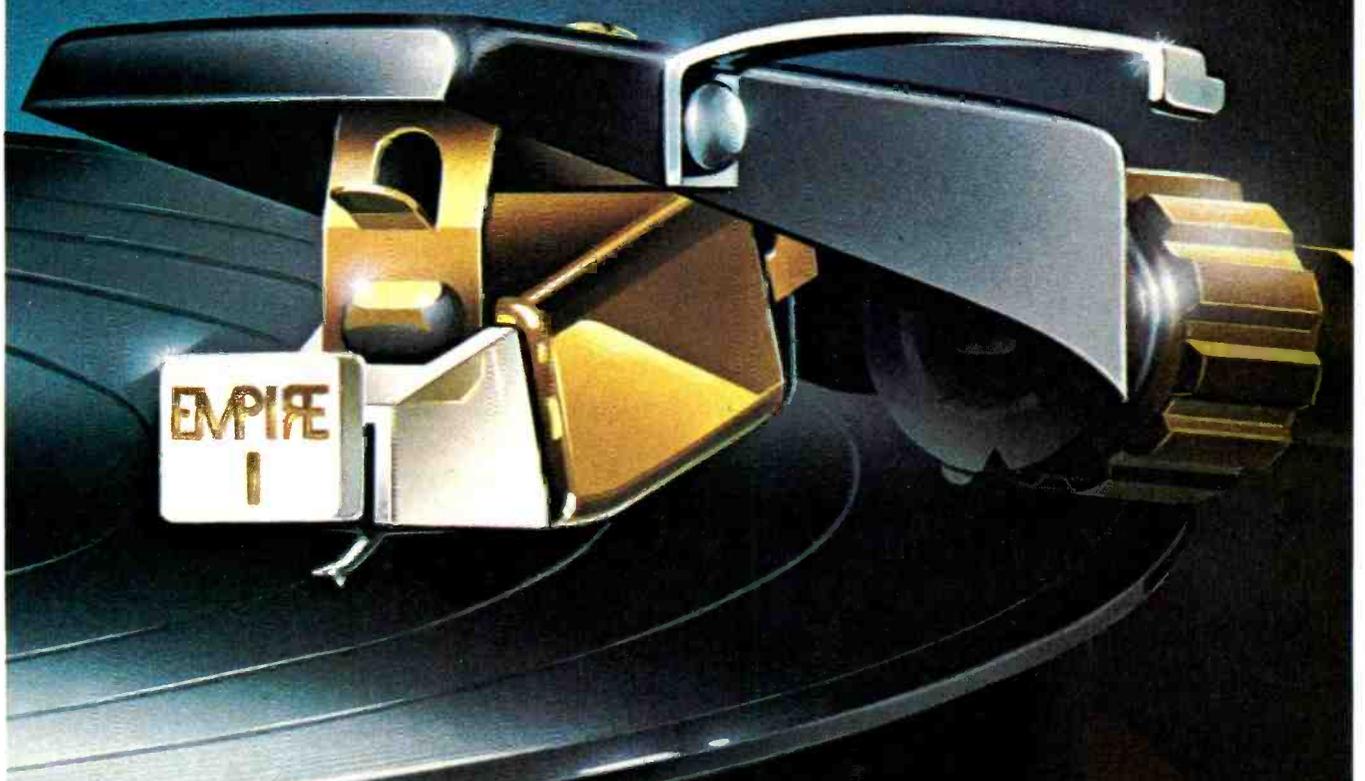
helpful. As matters stand, the user is left pretty much on his own when it comes to setting up this control.

While the action of a linear expander is probably familiar to most readers and has been verbally explained earlier, we sought nevertheless to present the action of the C-32 expander in a more graphic way. After some experimentation (and thanks to the flexibility of our Tektronix 5L4N spectrum analyzer), we devised a technique which resulted in the scope displays shown in Fig. 10. The 5L4N analyzer can be set so that it is responsive only to a single frequency (in this case, 1 kHz), even though the horizontal sweep on the scope display moves across the screen. Having tuned the analyzer to 1 kHz, we fed a signal of that frequency into one of the high level inputs of the C-32 and applied the output to the vertical input of the analyzer. A very slow sweep was initiated, and after each horizontal division was traversed, we increased the signal input level by 10 dB for a total of 40 dB of amplitude change. The "steps" formed by the leftmost trace show this 10 dB progression, since during this first pass the expander control was in the off position and the preamplifier operated

Fig. 10—Left display shows 10 dB steps of increasing amplitude without expansion. In right hand display, with expander set to 1.5, the downward and upward expansion of the same signals.



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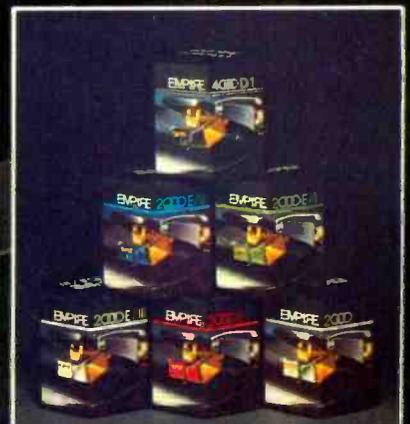
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in a perfectly linear fashion. Next, we turned on the expander control and set it to 1.5 linear expansion. Starting at the same signal input level as before, we once again began a 'scope sweep, only this time we allowed each level to remain constant for two horizontal divisions, so that the second display would not overlap and confuse the first one. As you can see, each 10 dB of amplitude increase now resulted in a 15 dB increase as seen at the output of the C-32 (each vertical division on the analyzer's scope face equals 10 dB of amplitude change). Thus, at low signal levels, the output has been "downward" expanded (it is lower in amplitude than it would have been with the expander out of the circuit), while at levels above the "level match" setting (mid-screen, vertically), outputs become progressively greater than those in the earlier display. Note that each successive increase of 10 dB in input level resulted in almost precisely a 15-dB increase in output level. (Thus, $15 \text{ dB}/10 \text{ dB} = 1.5$, the ratio of expansion selected by means of the front panel control.) Putting it another way, a "program" having only 40 dB of dynamic range has been expanded to 60 dB of audible dynamic range.

The attack time selected for this display was "normal." Had we chosen the Slow attack time available, we would have observed a slight "rounding" of the rising or leading edge of each "step," indicating a slight time lag in the action of the expander. Using the "fast" setting would have resulted in even sharper "corners" for each of the expanded steps than those recorded.

Speaking of attack time of expanders, should you ever have occasion to measure the C-32 you will find that with the expander "in circuit" any attempts to measure IM distortion will be rather meaningless, and readings are likely to be

higher than you would expect. Such readings do not actually represent IM distortion (which is normally defined as sum-and-difference products between the 60 Hz and 7000 Hz tones that make up the IM test signal), but rather the emergence of slightly time-delayed low frequency 60 Hz components which the expander circuit cannot "track" instantaneously. In actual listening tests, these odd results do not show up as audible IM distortion which, as we have said, they are not.

Listening and Use Tests

Even if one ignores all those extra circuits and simply hooks up the McIntosh C-32 as a straight phono preamp/control unit, its superior listening qualities are immediately apparent. Apparently bowing somewhat to the "wideband" school of audio enthusiasts, McIntosh engineers have seen fit not to roll off response above 20 kHz in this unit (though, in previous products they have maintained that response beyond that audible limit contributed nothing to purity or accuracy of sound). Whether because of this extended response or because of the obviously excellent overall stage-by-stage design, the sound quality reproduced using this preamplifier is as good as anything we have heard to date—*regardless of price*. When you consider the fact that one is really dealing with what might well have been *four* products here (a high-quality preamp/control unit, a five-band equalizer, a linear expander and, yes, a moderately powered high-quality stereo power amplifier), the suggested retail price of \$1500.00 doesn't seem high at all. In fact, all things considered it's quite a bargain! Leonard Feldman

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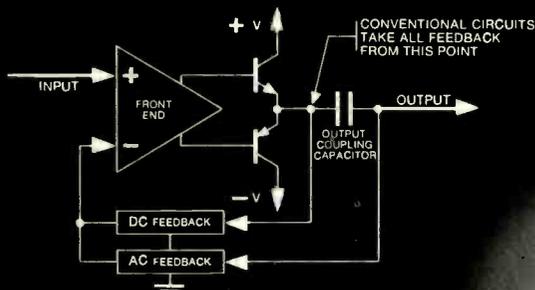
It's specs may look great, but in your system a preamp may lose bass. The reason—an output coupling capacitor that is too small for its load. Mylar capacitors, which are used by some manufacturers because of their excellent electrical characteristics, unfortunately are very limited in size. Connect them to some power amplifiers, and you'll wonder where the bass went. The alternative is electrolytics. Their high capacitance maintains the low end, but their complex changing impedance characteristics degrade fidelity.

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you won't find a specification for Quartz-Locked or the Sentry Circuit. That's the trouble with specs. Some things just can't be measured.

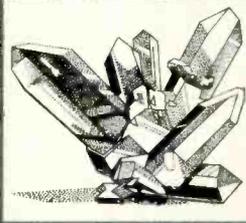
We suggest, then, you forget specifications and listen to Quartz-Locked FM at your Onkyo dealer. Onkyo has it in component tuners and receivers. After you hear Quartz-Locked, you won't care about specifications.

That's what Onkyo is all about. Listening. That's why only Onkyo has Quartz-Locked tuning. See your Onkyo dealer or write for information and test reports on the Quartz-Locked system.

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Quartz Crystal



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Thorens TD-126C Turntable

MANUFACTURER'S SPECIFICATIONS

Speeds: 33 $\frac{1}{3}$, 45, and 78 rpm.

Wow & Flutter: Less than 0.04 per cent
DIN 45-507.

Rumble: 70 dB, DIN B.

Variable Speed Range: ± 6 per cent.

Dimensions: 19 $\frac{1}{8}$ in. (50.5 cm) W

x 15 $\frac{1}{2}$ in. (39.37 cm) D

x 6 $\frac{1}{16}$ in. (16.99 cm) H.

Weight: 34 lbs. (15.3 kg).

Price: \$625.00. Addi-

tional plug-in arms,

\$17.50 each.



84

The reputation of Swiss precision engineering is certainly substantiated by the current high-end Thorens TD-126C turntable. Its modern appearance is cosmetically superior to all previous Thorens turntable styles.

The TD-126C turntable consists of an electronic, three-speed, belt-driven turntable with a newly designed, very low-mass plug-in tonearm, which they term "Isotrack." The platter, weighing 7.1 lbs., is belt-driven by a 16-pole synchronous motor that is powered via a Wein bridge oscillator. The oscillator is unaffected by the variations in power line voltage or frequency. The three available speeds (33 $\frac{1}{3}$, 45, 78 rpm) are obtained by a change in the frequency of the oscillator. For example, to obtain the usual 33 $\frac{1}{3}$ rpm speed, the oscillator frequency is changed to 28 Hz for a motor speed of 210 rpm which, through the belt drive system, converts to 33 $\frac{1}{3}$ rpm. The low motor speed helps reduce the rumble in the audio range.

The Isotrack plug-in tonearm is rather unique. To overcome the ever-present tonearm effective mass, Thorens has reduced the mass of the head shell and moved the shell's screw collar closer to the pivots, thus moving the mass closer to the pivots. With the mass of the tonearm decreased, the mass of the counterweight is now correspondingly decreased. The end result is a reduction in the "effective" tonearm mass of about 50 per cent. The plug-in unit consists of a rigid, lightweight aluminum tube that has a simple plastic holder to which the cartridge is attached at one end and a plug with screw collar at the opposite end. When attached to the rest of the arm via the four-pin socket at the rear portion of the arm assembly, the total tonearm length is nine inches. The rear portion of the arm assembly contains the counterweight, tracking force adjustment, magnetic anti-skating adjustment,

and the arm pivots. The rigid aluminum tube with its head shell has an average weight of 14.32 grams \pm 180 milligrams and is available separately for installation of additional cartridges.

The anti-skating force is produced without any additional friction by means of a magnetic field. The dial is calibrated for an optimum anti-skating force in modulated (recorded) grooves under real playing conditions. Anti-skating adjustments are available for playing a dry or wet record, with either an elliptical or a spherical stylus.

The tracking force is adjusted with the stylus tracking force dial located on the arm. With the tracking force properly adjusted, the Isotrack tonearm has been designed to exhibit a slight tilt in the tonearm tube while the stylus is on the record. The degree of tilt will vary between 1° and 2°, depending on the physical dimensions of the cartridge body. The purpose of the slight tilt in the tonearm tube is to improve the tracking of warped records. The wedge-shaped mounting platform in the head assembly adjusts the cartridge body so that it is parallel to the record surface. The vertical tracking angle will be maintained at the proper angle—20° for the newer cartridges and 15° for the older cartridges.

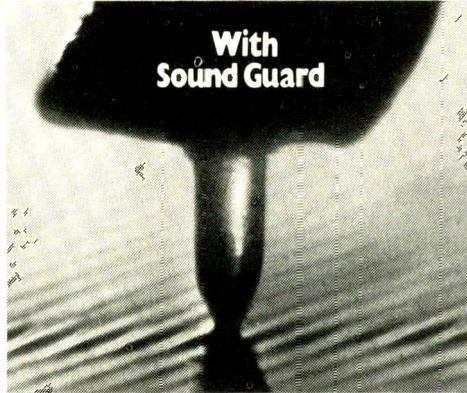
The base is isolated from the platter and tonearm by a highly damped, three-point, floating spring suspension. In this suspension system, the center of mass is located equidistant from the three spring positions, thus eliminating the need for chassis leveling adjustments.

All the operating controls on the Thorens TD-126C turntable are located across the front surface of the base. The knob at the extreme left turns on the power. The three flat, touch switches next to the power switch select the speed by a light pressure on the plate representing the desired speed.

Before Sound Guard[®], you only played a record in mint condition once.



Magnification shows the record vinyl wearing away.



Same magnification shows no record wear.

You can see how the picture has changed.

Independent tests* show that records treated regularly with Sound Guard preservative keep the same full amplitude at all frequencies, the same absence of surface noise and harmonic distortion as records played just once in mint condition.

With its patented dry-lubricant film, Sound Guard

preservative maintains sound fidelity by reducing record wear. And with its built-in, permanent anti-static property, it resists dust accumulation.

And now, two new Sound Guard products:

1. Sound Guard[™] record cleaner, developed from extensive research into record cleaning problems and

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2. Sound Guard[™]

Total Record Care System puts Sound Guard record preservative and Sound Guard record cleaner in one package—for the best possible total care for all of your records.

Available in audio and record outlets.

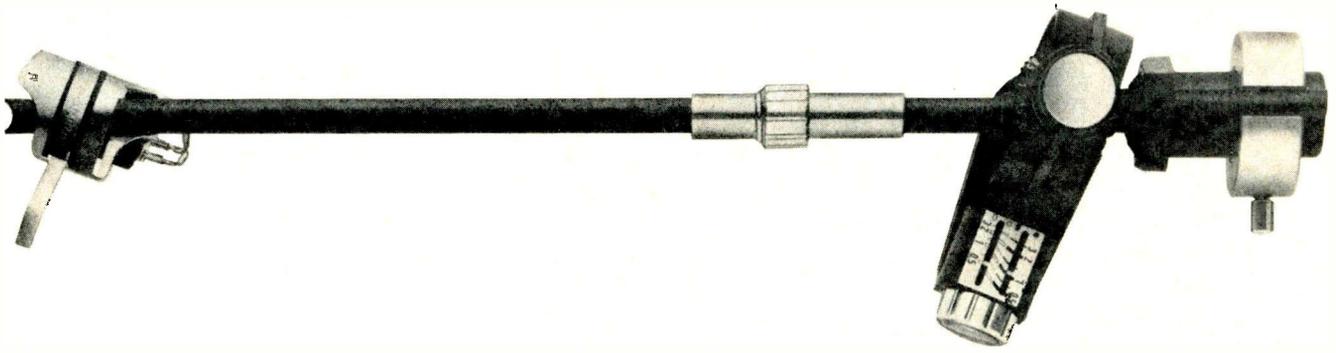
*Tests available on request.



Sound Guard[®] keeps your good sounds sounding good.



Sound Guard preservative—Sound Guard cleaner—Sound Guard Total Record Care System
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The edge of the switch is illuminated when it is activated. The stroboscope window is located next to the speed selector touch switches, followed by a speed vernier knob that is used to accurately adjust the platter speed. It is worth noting that when one speed is accurately set with the vernier speed control knob, the remaining speeds are also accurately set. To the right of the vernier speed control knob is the mode selector knob. This knob, marked with three positions (ML, L, 0), provides a choice of tonearm lift and motor shut-off at the end of the record, tonearm lift but turntable continuing to rotate at the end of the record, and a fully manual operation, respectively. The three flat, touch switches on the extreme right control the action of the tonearm. The touch switch next to the mode knob raises the tonearm but the platter does not turn; the next touch switch starts the platter rotating but does not lower the arm; the third touch switch, when pressed, lowers the tonearm and starts the platter rotating if it wasn't already rotating. When the unit is first turned on, the 33 $\frac{1}{3}$ rpm touch switch and the third touch switch from the right are both illuminated, indicating that the turntable is now ready to play 33 $\frac{1}{3}$ rpm records, the tonearm is lifted up, and the platter is not turning. After automatic play is completed, when the arm reaches the record runout groove, the Thorens TD-126C turntable has an electronic sensing circuit that detects the arm in the run-out groove, activates the arm lift circuit, raises the arm and, if so programmed, turns the motor off.

Measurements

The Thorens TD-126C turntable was tested with an Empire 2000Z cartridge installed in the plug-in Isotrack tonearm. Room temperature was 79°F (26.1°C) and the relative humidity was 54 per cent. Mounting the cartridge on this arm is not as easily done as it is on the conventional arm. A special jig, which is also the case for the plug-in arm, is required. The instructions for mounting a cartridge in the accompanying manual leave much to be desired. The importer for all Thorens turntables, Elpa Marketing Industries, Inc., New Hyde Park, New York 11040, has issued a supplementary pick-up cartridge mounting instruction sheet to replace the instructions in the manual. However, we found the plastic storage box for the plug-in arm that doubles as an optical alignment gauge for mounting the cartridge is in need of four additional slits for a greater accuracy in setting the stylus overhang. The final slots now measure 2 mm wide, much too wide for a standard size 40 sewing thread to remain secure. We suggest that slits wide enough for a standard size 40 sewing thread be made in the center of the present 2 mm slots. The slits would also serve to hold the thread in place via friction while the cartridge is being positioned. The 2 mm slots also appear to be too wide for precision setting of the stylus overhang.

After the stylus overhang was accurately positioned and the arm properly balanced, the weighted peak wow and flutter was measured as +0.053 per cent (0.038 per cent rms),

as measured with the 3M Company Model 8160-01 Audio Flutter Meter. Lateral unweighted rumble measured -40 dB. Certainly, even through a super low frequency speaker such as the Janis subwoofer, rumble is inaudible. Arm-cartridge resonance, with the high compliance Empire 2000Z cartridge, is well-damped at 7.5 Hz with an amplitude of about 1.25 dB. The capacitance of the tonearm wiring measured 189.5 picofarads per side.

The vernier speed range was +9 to -7.8 per cent at 33 $\frac{1}{3}$ rpm, +8 to -8.4 per cent at 45 rpm, and +7.8 to -8.2 per cent at 78 rpm. All platter speeds were constant when the line voltage was varied from 95 to 135 volts a.c.

The tracking force calibrations were found to be quite accurate when checked against analytical balance weights, in the 0.5- to 3-gram range.

Anti-skating calibration was correct as indicated on the dial when equal to the tracking force, using the Empire 2000Z cartridge. At a recent technical meeting at the Stanton Laboratories, chief engineer George Alexandrovitch's newest scanning electron microscope pictures give dramatic evidence that anti-skating is a very positive factor in ensuring equal tracking force so that one groove wall is not worn inordinately. Cueing was reasonably good, despite the influence of the anti-skating setting.

To check the interchangeable arm feature, we took a spare arm mounted with a Shure V15 Type III cartridge, and replaced the original arm. The readjustment of arm level and balance proved to be very quick and easy. However, we performed no tests on this arm-cartridge combination.

Performance Evaluation

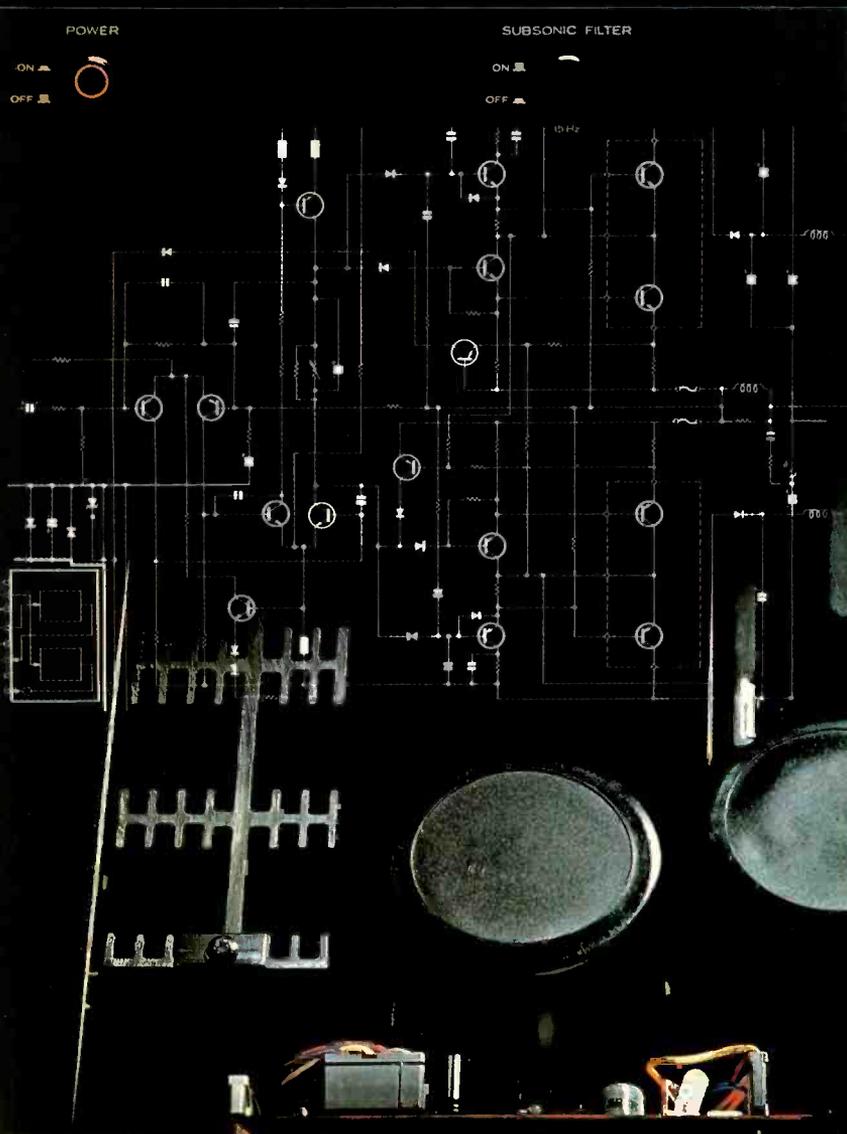
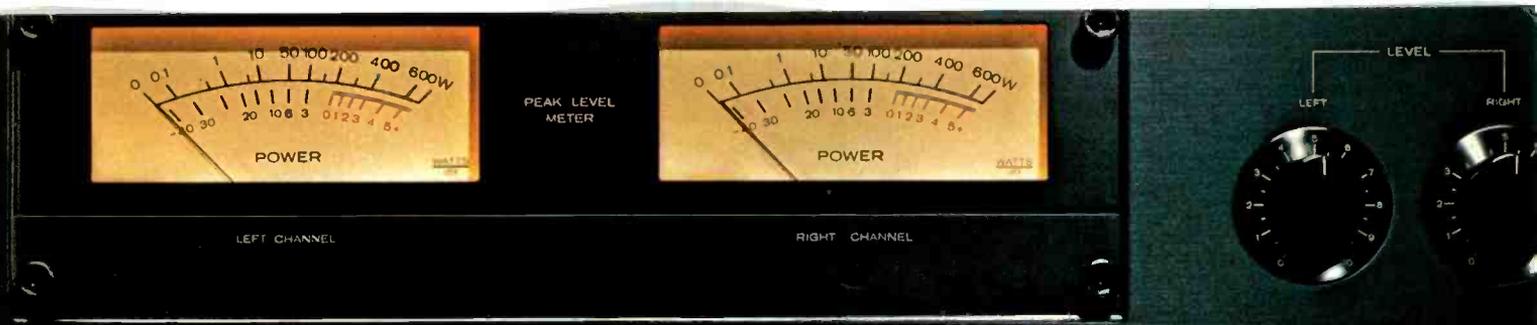
This is one of the best belt-driven, semi-automatic turntables we have ever used, equal to or better than all but the best high-end, state-of-the-art direct-drive turntables. This is certainly true of the measured flutter and rumble data. The ability to track warped records is, in our experience, on par with the better radial arms, and we feel this is due to the very low tonearm mass.

One of the unique features offered, particularly in 1977, is the 78-rpm speed, which should appeal to all collectors of these records. As all 78-rpm, acoustic record collectors know, no records were cut at 78 rpm. The speed varied with the individual record companies, from about 65 rpm to over 87 rpm. The speed variations available on the Thorens TD-126C turntable will permit the serious 78-rpm record collector to play almost all of these records at the correct speed.

When starting the Thorens TD-126C turntable, there is a brief time delay before the platter starts rotating which is normal for this turntable.

For those audiophiles who are in the market for a turntable of this caliber with its unique features, we recommend they seriously consider the Thorens TD-126C. The modern design and styling coupled with engineering excellence will certainly provide a superior means of record reproduction. *B. V. Pisha*

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Dynaharmony

- RMS output power per channel**
(both channels driven into 8 ohms
20Hz - 20,000Hz 0.1%THD) **200 watts**
- Transient Music Power**
(within rated distortion) **400 watts**
- Frequency Response** **5-80,000Hz (+0, -1dB)**
- S/N Ratio**
(IHF, A Network) **110 dB**

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Hitachi's Class G is one of the most incredible cost/performance amplifiers ever created.

It is about three times as efficient as the conventional Class B amplifier. And it looks as sophisticated as it sounds.

Simply expressed, Class G is two amps in one. During the musical "downs" and "averages" the primary amp works on the low-voltage amplifier. But let one of those musical peaks come along and the standby

high-voltage amplifier cuts in for clear, powerful sound without clipping distortion.

Technically the standby amp consists of additional power transistors which are activated only when the signal peak demands it. But practically it means we can offer more usable power at a lower price.

Or in other words you're not only getting a little extra, you're getting about twice the amplification for the price of one amplifier.



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Tannoy Model Berkeley Speaker System

MANUFACTURER'S SPECIFICATIONS

Speakers: One 15 in. woofer mounted in a ducted port enclosure, and a two-in. concentrically mounted compression driver.

Frequency Response: 35-20,000 Hz.

Crossover: 1000 Hz.

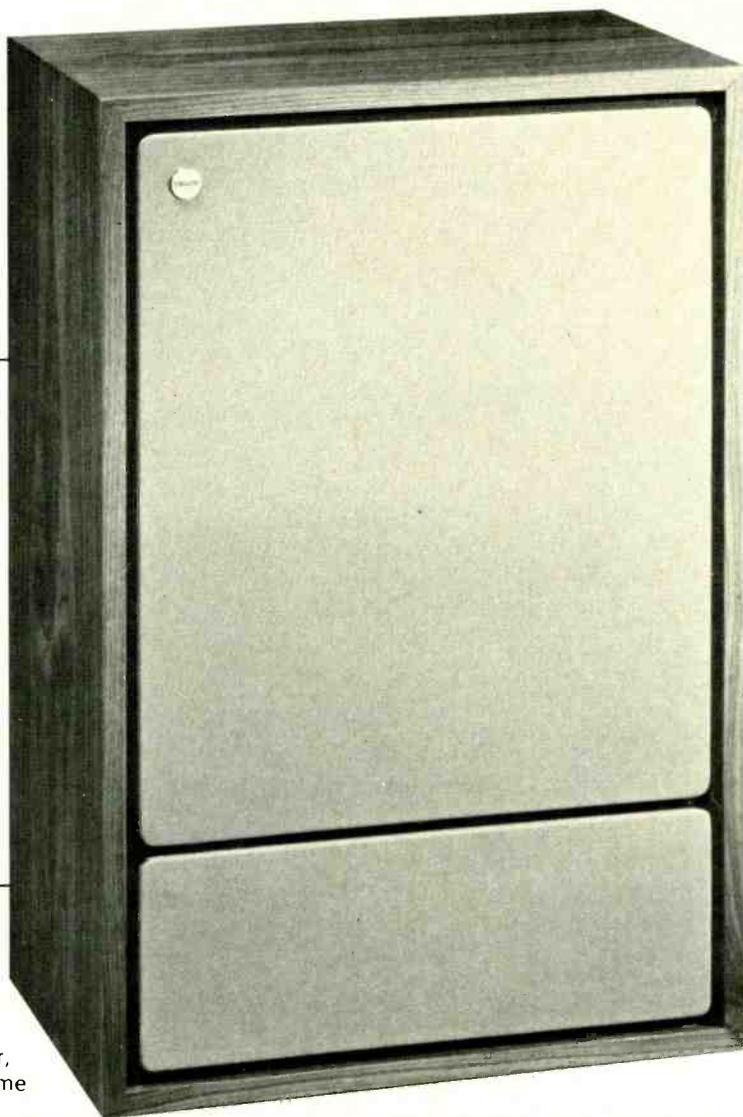
Impedance: 8 ohms nominal.

Power Handling: 85 watts continuous program material.

Dimensions: 33 in. (83.8 cm) x 21 in. (53.3 cm) x 12 in. (30.5 cm.).

Weight: 90 lbs. (40.8 kg).

Price: \$480.00.



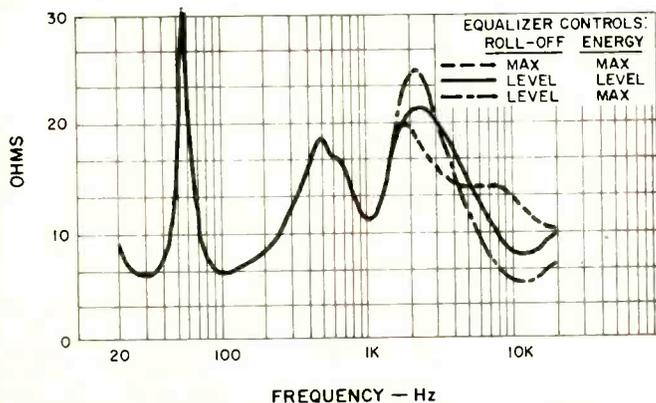
Tannoy is an old and respected name in the field of high quality sound reproduction. Made in England, the Berkeley is a substantial sized two-way loudspeaker system in the Tannoy line which uses their unique direct radiator bass unit and high-frequency compression driver, both located concentrically within the same frame and magnet assembly.

In this ducted port system, the low frequency radiator is 15 inches (381 mm) in diameter and carries the frequency range from 35 Hz to the crossover at 1 kHz. The coaxially mounted 2 inch (51 mm) compression driver then takes over from 1 kHz upward.

The system is large and of substantial mass, but tastefully accented so that it does not overwhelm normal living room decor. The enclosure is finished in oiled walnut with two removable brown cloth covered grilles. The upper, and larger, grille covers the loudspeaker cone and, while removable, need not be removed by the user. The lower grille covers two switched equalizer controls. These controls are intended to allow for minor higher frequency adjustments which a user might set to suit his particular tastes in music reproduction.

Connection is made to spring loaded terminals mounted in a recessed cavity on the rear of the enclosure, and connectors and controls are legibly marked and should offer no problems for even the most inexperienced user of audio equipment. In addition, Tannoy provides an excellent technical manual with each loudspeaker system which thoughtfully discusses system hookup and maintenance.

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



Technical Measurements

The Tannoy "Berkeley" Integrated Loudspeaker system is provided with two equalization controls located on the front baffle. These are labeled *Roll-off* and *Energy* and can be used to compensate the response at the higher frequency portion of the spectrum. There are four positions of *Roll-off* and five positions of *Energy*, giving 20 possible combinations. As is common with equalizer controls, the loudspeaker terminal impedance is influenced by this adjustment. All 20 com-

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HIGH FIDELITY MAGAZINE*

If you're not yet convinced that Sansui receivers stand in a class by themselves, we'll try a different approach. Read what the editors say. After all, they're the experts.

"Here is yet another receiver in what we have come to think of as the Sansui tradition: solid, well thought-out...delivering performance right up there with the best...."

"Some 'extras' are immediately apparent when you lay an inquiring finger on the controls. The tone knobs are stepped...and include a MIDRANGE as well as the usual BASS and TREBLE...two phono inputs...mono mike input with its own mixing level control...There also is output-power metering...One special feature of the 7070 is its provision for outboard decoding of Dolby** FM broadcasts.

"The amplifier section is rated at 18dBW (60 watts) per channel and actually will pump out 1/2dB (10 watts) more before exceeding the distortion rating at any audio frequency. More impressive, harmonic distortion is far below Sansui's 0.3% rating at all tested power levels.... Intermodulation too is low...."

"...if your expectations are high, there's very little about the 7070 that we think might disappoint you. Feel and finish of the parts is excellent, as we have come to expect of Sansui. The capable amplifier section has enough power for use with two pairs of speakers...the tuner section is among the best; the ancillary functions...are comprehensive and efficient. All in all, a fine value for the money."

See your local franchised Sansui dealer for a demonstration of the beautifully styled 7070, one of the only mid-powered receivers that offers twin power meters. You'll find that the experts are right. Musical quality is excellent and a finer value can't be found. It is what you've come to expect from Sansui.

A whole new world of musical pleasure.

*High Fidelity Magazine, Dec. '76 **Trademark of Dolby Laboratories, Inc. Simulated woodgrain cabinet.

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SANSUI ELECTRONICS CORP.

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Sansui



What's 3 years of a man's life worth?

That's what you're looking at. Three years. Because that's how long it took our Katsuzo Hiramatsu to develop the Mitsubishi Logic Control Turntable at the right.

Hiramatsu, you see, didn't just invent a better turntable. He actually created a whole new state of the art. Starting from the ground up. Probing areas that few people had ever looked into before.

First, he investigated basic audio performance. He learned that, with the exception of the cartridge, the tone arm has more influence on sound quality than any other component in a turntable.

So he researched tone arm materials and configurations until he discovered the ideal combination: A tubular stainless steel tone arm isolated from the counterweight by butyl rubber. Thus completely eliminating a phenomenon that plagues nearly all other turntables: counterweight-induced resonance in the 150 Hz range.

Next, he looked at drive systems for the turntable's heavy platter. Here, too, he utilized another ideal combination. A frequency-generator control system for accurate speed — combined with a high-torque, direct-drive motor for fast start-up and virtually undetectable speed fall-off under load. And because the motor operates at 33.3 or 45 rpm instead of the conventional 1500 rpm, vibration is almost nonexistent.

Finally, even the turntable mat came under Hiramatsu's scrutiny. He discovered that the mat has a considerable effect on low-frequency response. And he adjusted thickness, density, and compliance for optimum matching with the low-frequency characteristics of the tone arm.

So, even without the logic control system, Katsuzo Hiramatsu's new turntable would be a superb instrument.

But with the electronic logic control system for automatic speed selection and tone arm operation, it becomes a foolproof instrument as well.

And you should hear it for yourself. You should hear it through our equally impressive Mitsubishi dual-monaural power amplifier and preamplifier, driving one of our five available Mitsubishi high-performance speaker systems.

Your dealer will be happy to audition them for you anytime you ask.

And if you ask that he put a dollar figure on Hiramatsu's efforts, he will tell you that the Mitsubishi DP-EC1 Logic Control Turntable carries a price tag triple that of some lesser turntables.

Which, when you consider what went into it, probably makes the DP-EC1 one of the greatest bargains in the store.

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AUDIO SYSTEMS

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STEREO TURBO MOTOR

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VOLUME
TONE
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AUTO REVERSE

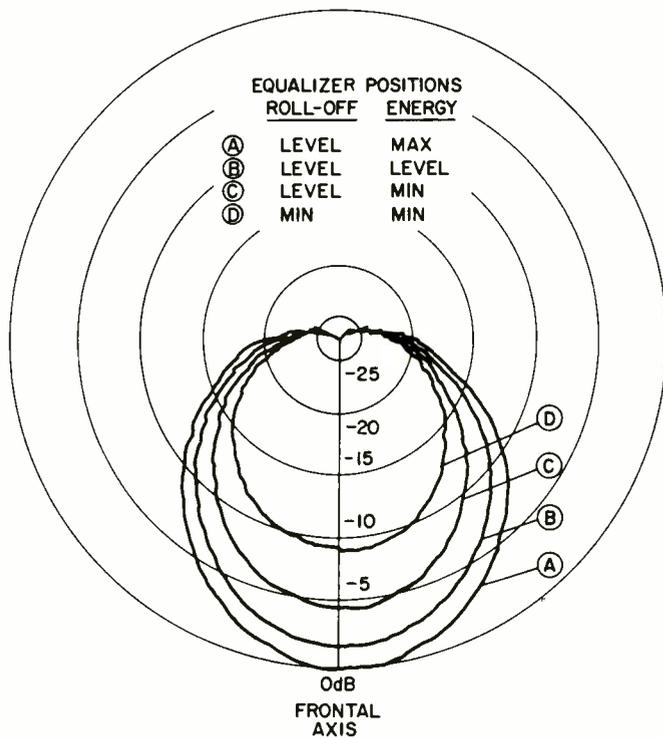
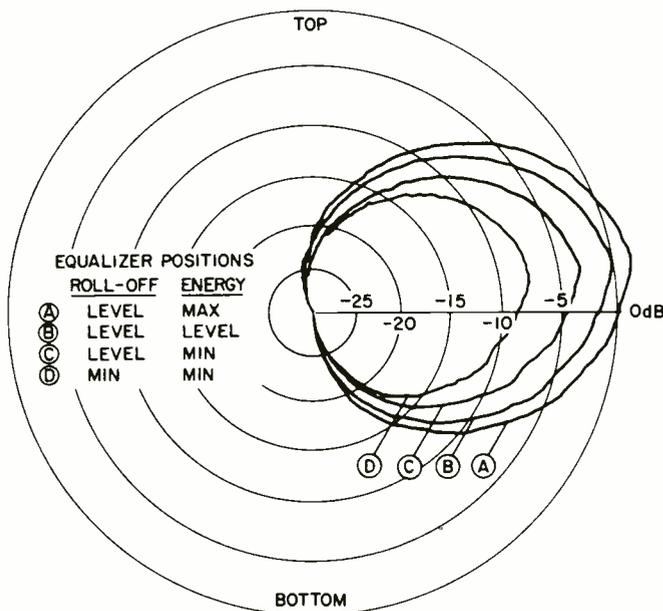


Fig. 6—Horizontal energy response.

Fig. 7—Vertical polar energy response.



minimum phase in its response. Another unusual property is that the first sound which reaches the listener's ear is that of the woofer, which occurs 0.39 milliseconds prior to the first tweeter sound.

The results of the three-meter room test, shown in Fig. 5, tends to verify the earlier listening impression of a strong middle and upper register with the extreme top end somewhat down in level. Both equalizers were adjusted to the "level" condition for this room test and the Tannoy was placed flat against a wall.

The polar energy response for four combinations of equalizer position is shown for azimuth in Fig. 6 and elevation in Fig. 7. This speaker system has a very smooth angular dispersion of sound. The smooth vertical response does, in fact, seem to account for the diffraction dips in the room response of Fig. 5 compared to the rather smooth anechoic response of Fig. 3. Although the Tannoy was placed on a rug surface, it is evident that enough sound can reflect off the floor to cause interaction with the direct air path sound to a listener's ear. While it may not be practical to raise this speaker system off the floor due to its substantial size and weight, these tests do show that large objects which can reflect sound should be kept away from the vicinity of the front of the enclosure, and these speakers should definitely be kept away from overhead projecting surfaces. A small benefit in spectral balance can be obtained by rotating the speakers toward the listening area.

Harmonic distortion for the tones E_1 (41.2 Hz), A_2 (110 Hz), and A_4 (440 Hz) is shown in Fig. 8, and it is a bit higher than I would like to see in a system which is intended for the very highest sound reproduction, particularly at the lower frequencies. However, the uniform increase of distortion with increasing sound pressure will make this less noticeable than would a sharp increase at some power level. The subjective "mud" in program material may thus be lower than indicated by these measurements.

Intermodulation distortion of 440 Hz by 41.2 Hz is shown in Fig. 9. The two tones are mixed in equal amplitude and the crossmodulation of the higher tone is plotted as a percentage of the higher tone. Unlike the harmonic distortion, intermodulation distortion in the Tannoy is quite low right up to the very highest sound levels. Most of this intermodulation consists of amplitude modulation of 440 Hz by the 41.2 Hz bass tone. At both one watt and 100 watt average levels, the phase modulation is three degrees peak to peak and climbs to 10 degrees peak to peak at 60 watts average. There is an average offset of cone position due to the low frequency tone which causes a time delay of the higher tone by an amount corresponding to about 10 microseconds. All loudspeakers have this to some extent and the subjective correlative is a spatial smearing of the reproduced sound image. In the Tannoy the extent of this delay is low enough to be negligible.

The ability to handle complicated program dynamics is measured by mixing Gaussian band-limited noise with a single frequency tone and measuring the spectral smear which is produced on this tone by the noise. In this crescendo test, the Tannoy scores moderately well, causing a drop of tonal energy by 0.5 dB at a combined 12.5 watt peak signal plus noise, and 0.7 dB at 253 watt peak levels for a tone of 440 Hz. Large orchestral peaks should therefore be handled well with little image smear due to random bursts of sound level.

The Tannoy shows a very slight drop of acoustic transfer gain with increasing drive level. Relative to a drive of 0.1 watt, the acoustic output at 30 watt average for tone burst less than one second in duration is approximately 0.4 dB less than would be expected based on the drive level. This should cause a very slight reduction in subjective program dynamics; that is, the sound pressure does not exactly increase in direct

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Every TEAC cassette deck from the least expensive to the most expensive is built to last a long, long time. That's been true since the first TEAC was built more than 25 years ago.

A-103 Specifications:

Wow & Flutter:
0.10% (NAB weighted)
Signal-to-noise ratio:
50dB (without Dolby)
55dB (with Dolby at 1kHz)
60dB (with Dolby over 5kHz)
Frequency Response:
30-14,000Hz (CrO₂/FeCr)
30-11,000Hz (Normal)

Take the new A-103, one of the least expensive TEAC's you can buy.

Despite its low price, the A-103 is manufactured to the same tolerances as decks costing three times as much. And, where most decks have a maze of hand-wired switches, harnesses and boards inside, the A-103 boasts an innovative design which replaces all that with a single circuit board directly coupled to the front control panel.

A-640 Specifications:

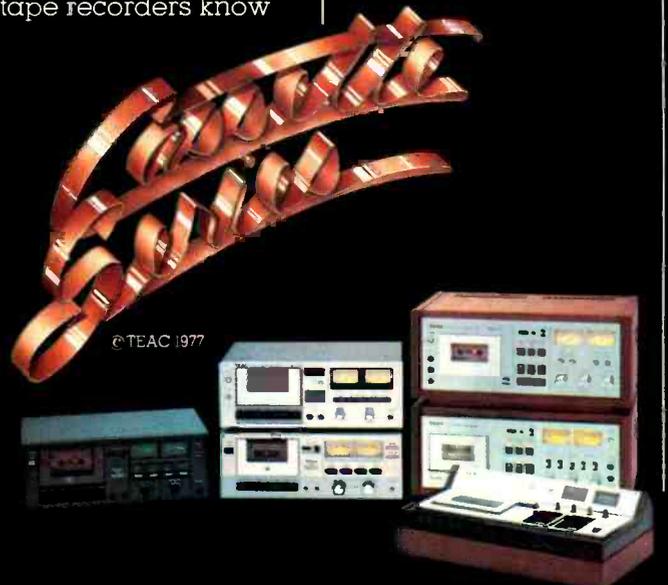
Wow & Flutter:
0.06% (NAB weighted)
Signal-to-noise ratio:
57dB (without Dolby)
62dB (with Dolby at 1kHz)
67dB (with Dolby over 5kHz)
Frequency Response:
30-16,000Hz (CrO₂)
30-14,000Hz (Normal)

TEAC's more expensive A-640 brings engineering sophistication to a new high with plug-in circuit boards, two motors and electronically operated push buttons for feather-touch, maintenance-free reliability. People who work with tape recorders know

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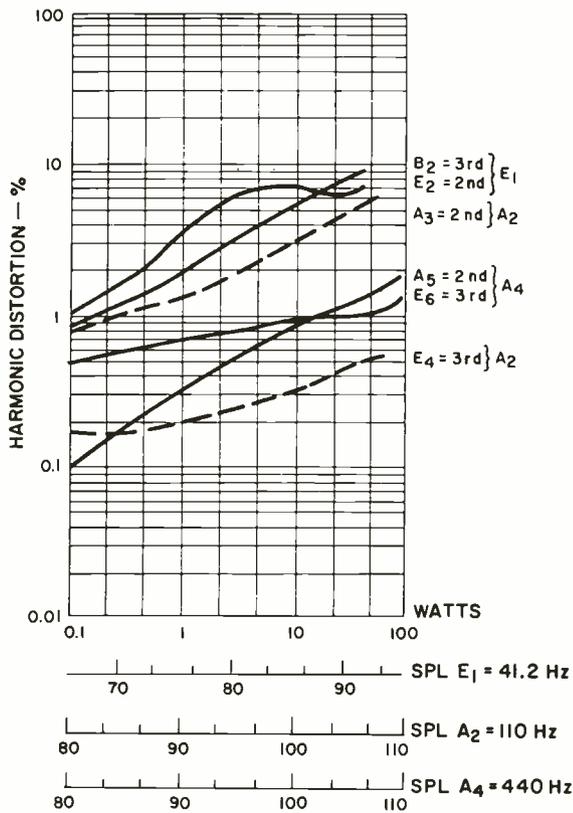


Fig. 8—Harmonic distortion for tones E_1 (41.2 Hz), A_2 (110 Hz), and A_4 (440 Hz).

96

proportion to drive level. In the case of the Tannoy, the subjective softening of dynamics is extremely low. Even more important is the fact that test tones of 60 Hz, 110 Hz, 262 Hz, and 440 Hz show exactly the same behavior. This means that while there may be a small reduction in dynamics, every tone is equally reduced and we can expect there will be no change of timbre with program dynamics.

The result of the energy-time test is shown in Fig. 10. The sound pressure remains within 20 dB of the peak arrival for a period of time slightly greater than 1 millisecond. The pressure wave from the woofer actually arrives 0.39 milliseconds before the first pressure component from the tweeter. The energy due to the woofer begins at 3.22

milliseconds, for a one-meter microphone to enclosure spacing, while the first tweeter component arrives at 3.61 milliseconds and peaks at 3.69 milliseconds. A multiplicity of later energy arrivals mars what might otherwise have been an excellent transient response.

Listening Test

Tannoy provides a good description for recommended loudspeaker placement, so I followed their recommendations closely. I did find that it was necessary to pull the systems forward and away from any back wall so as to minimize an upper-bass heaviness. After extended listening, I found that I preferred the *Roll-off* in its "level" position and the *Energy* at the "minus 1" position.

This system is very efficient and can both clear sinuses and break leashes with very little effort from a powerful amplifier such as the Marantz 510 which I use. My overall impression was that the sound is similar to that of the Nakamichi Monitor system. There is no *super* low bass, a good balanced midrange with some emphasis, and the extreme tops are

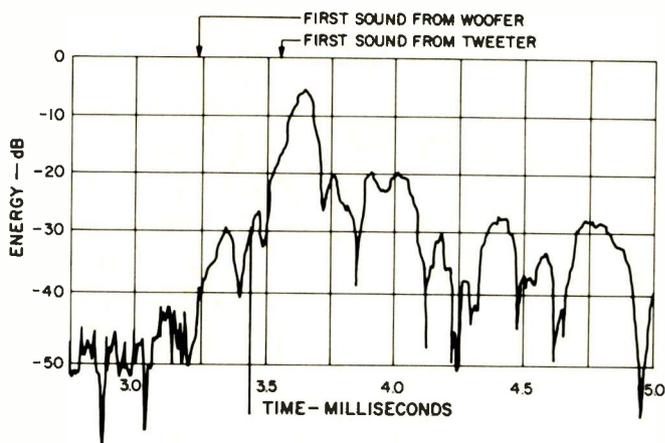


Fig. 10—Energy-time measurement at one meter on-axis.

somewhat down. There is good articulation of transients, and this is one of the few loudspeakers which I believe does a good job of reproducing piano, a difficult instrument.

There is an emphasis of the upper range of pitch components which gives a bit of the so-called "West Coast" sound. As a result female vocals come through with a lot of punch.

Tannoy is correct in stating that the speakers should be angled toward the listener's position. When this is done there is a good lateralization of the stereo image with a moderately good sense of depth. Not absolutely perfect, but a lot better than most.

There are two accessories which would make this Tannoy an outstanding performer. The first is a sub-woofer. The Tannoy just does not have the extreme bottom end to match the quality of its mid and top ranges.

The second goodie would be an equalizer to pull down the 1 to 5 kHz range just a bit. I felt that bright program material could benefit from this adjustment, which is just not properly available with the equalizers that are provided. However, in sum, I liked the sound of this system. *Richard C. Heyser*

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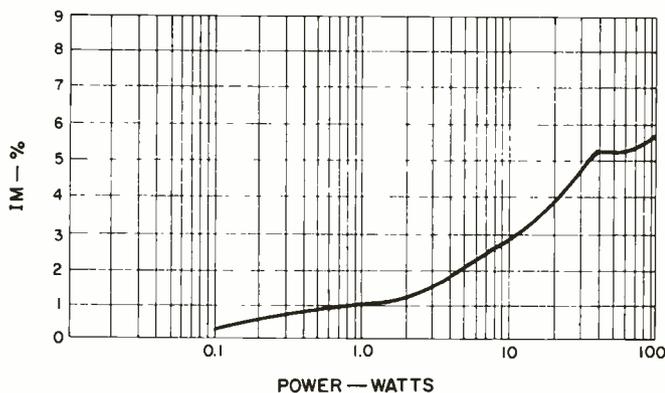


Fig. 9—IM distortion on A_4 (440 Hz) when E_1 (41.2 Hz) and A_4 are mixed one-to-one.

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matched walnut veneer enclosures

It's important to be earnest — about speakers, that is. Because we know that your speakers are the most important, and final, link in your high fidelity component system. And we know that to make truly great speakers has long been the greatest challenge to audio engineers.

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To develop the Leak 3000 Series, Leak engineers created a distortion-free listening system: free from harmonic and intermodulation distortion, free from time delay and Doppler distortion and free from delayed resonance. Our engineers then electronically introduced varying degrees of each form of distortion, separately.

A large number of listeners, including many "golden ears," determined when distortion was audible and when it was objectionable. These results were fed into a computer which then generated the

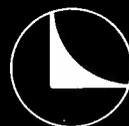
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 **LEAK**



Empire Model 698 Turntable

MANUFACTURER'S SPECIFICATIONS

Speeds: 33-1/3 & 45 rpm.

Type of Motor: Hysteresis Synchronous.

Drive System: Belt.

Wow and Flutter: 0.04 per cent, weighted.

Rumble: 68 dB below 3.54 cm/sec @ 1 kHz, ARLL method.

Speed Accuracy: 0.25 per cent.

Tracking Error: 1.5°.

Track Force Range:

0 to 4 grams.

Dimensions: 8 3/16 in. (20.8 cm) H x 17 1/2 in. (44.5 cm) W x 15 1/8 in. (38.4 cm) D.

Weight: 15 1/8 lbs. (13.6 kg).

Price: \$400.00.

98

The Empire 698 is an updated version of the well-known Model 598 Troubador, reviewed in *Audio* in December 1970. The new model still has the same basic features such as the massive platter and belt-drive system, but it now boasts a newly designed tonearm with anti-skating control. There are a number of other refinements such as a photo-cell activated automatic arm lift and nifty touch contacts to initiate cueing. There are two of these contacts, one to raise the arm and the other one to lower it, using a d.c. solenoid in conjunction with an amplifier. Next to the contacts, on the right, is an *On/Off* switch; when the power is on, one of the contacts is illuminated as well as the plastic arm rest. The tonearm is made of lightweight tubular aluminum, nine inches long with a specially decoupled counterweight. There are 32 jeweled bearings, and friction in both modes is claimed to be less than 0.001 grams. The stylus force device uses the well-proven clock-spring method, and the calibrated dial is on the left hand side of the pivot. The anti-skating control also employs a spring, and the dial is mounted on top of the pivot assembly.

The dynamically balanced platter, which weighs over seven pounds, is two inches deep and so acts like a heavy flywheel. Most of it is below the surface of the top plate and a 12 inch "dress ring" is fixed to its perimeter so at first glance it looks like a conventional turntable. The platter shaft is made of stainless steel, which has been through an aging process, and it turns in twin oilite, self-lubricating bearings. A belt-drive, which is ground to a precision tolerance of only

0.0001 inches in thickness, couples the platter to the motor. The motor is a hysteresis synchronous type with a dual diameter drive spindle (we'll come back to that later). It is mounted on rubber suspension grommets in the front left corner, while a tripod structure holds the platter bearings at the center and the tonearm base at the end of one of the legs. Each leg is suspended by a spring and dashpot combination to isolate it from the base. Connections from the photo-sensor and solenoid (which is an integral part of the arm) terminate in plugs which go into the appropriate sockets underneath. (The arm is packaged separately.) Phono connections terminate in a socket under the base and two sets of cables are supplied—one being low capacitance types suitable for CD-4 cartridges, and the other having the more or less standard 250 pF capacity.

Although the top platter is embellished with strobe markings, no illumination is provided. This brings us to the method of speed change which is similar to that used by the original 598. The cover on the left has to be removed, and the belt moved up or down to the other position on the drive spindle. It is very easy to do but even so, it is not nearly as convenient as a push-button switch. Also, under the cover is a small knob which gives a small speed variation by changing the axis of the motor shaft. The construction and mechanical design of the unit, which includes the tonearm, is really superb. Styling is clean and uncluttered, and the gold finish makes a most pleasing contrast with the light walnut base. The dustcover uses friction-type hinges and is installed by simply placing it

The most popular way to clean records isn't the best.

It's popular to believe that buying the best known label or spending considerably more money will get you the best product. Nowadays that isn't true.

More often than not, the best product combines quality *and* value. The new Record Conditioner by Fidelitone is a case in point.

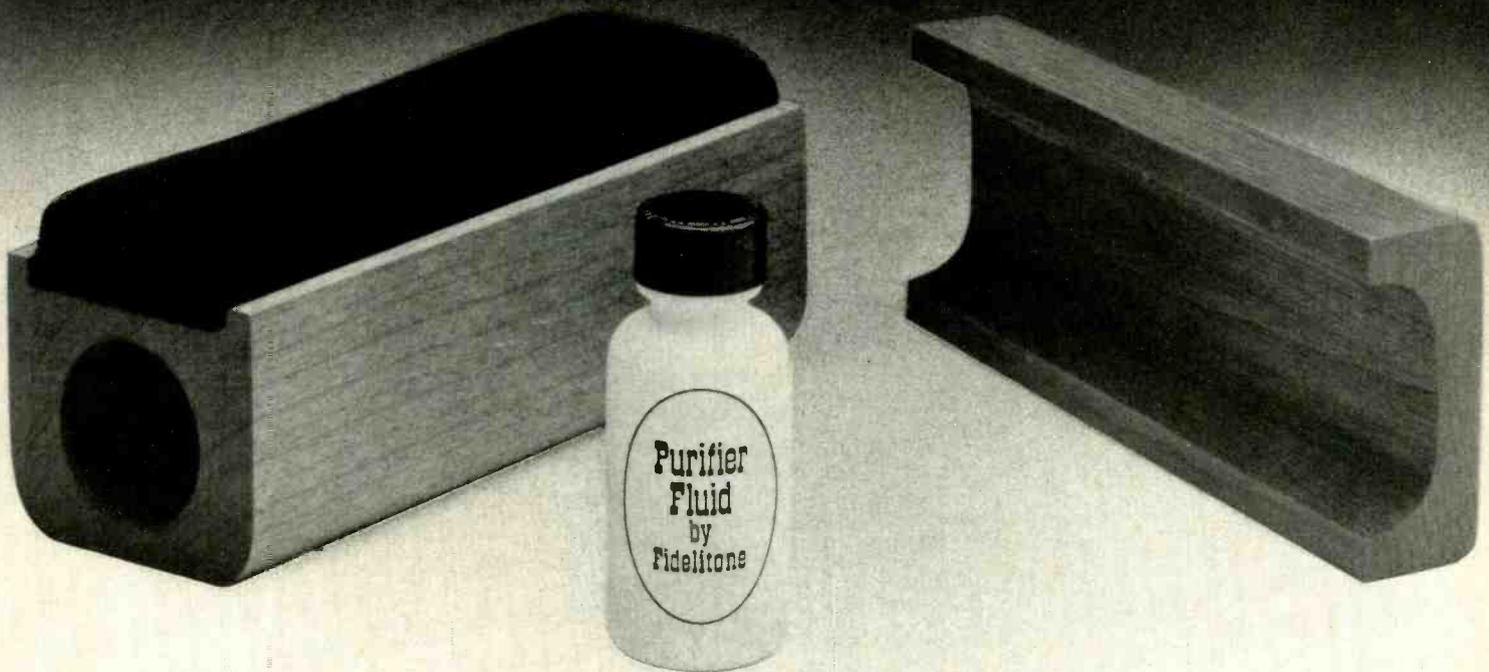
It has a more effective cleaning fluid, The Purifier Fluid, that leaves no residue, reduces static charge and increases output sensitivity.

The Record Conditioner has a unique unidirectional pile pad with an exclusive cherry wood handle that's contoured not to slip or roll in your hand. And there's a matching cherry holder that won't cost you extra.

Speaking of value, Record Conditioner costs surprisingly less than the most popular brand.

Ask your hi-fi or music dealer for Record Conditioner with Purifier Fluid by Fidelitone.

Keeping your records clean is worth spending some money. But why spend more than the product is worth?



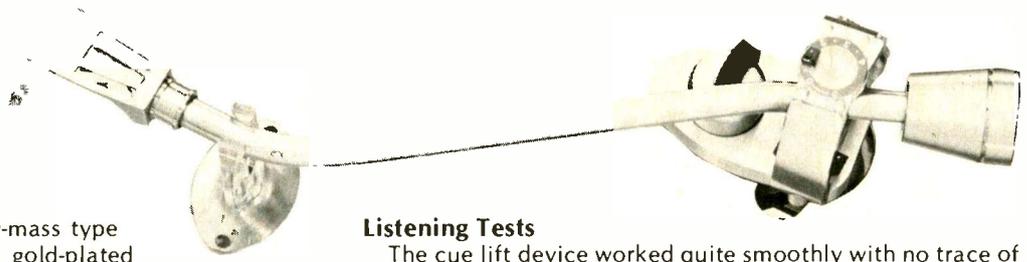
Record Conditioner with Purifier Fluid by Fidelitone

Fidelitone, Inc., 207 North Woodwork Lane, Palatine, Ill. 60067 Fidelitone Products are available in Canada.

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so that the U-shaped hinges fit over the bearings located at the top of the rear panel.



Measurements

The cartridge shell is a low-mass type with the leads terminating in gold-plated printed circuit, toil-type connections. For these tests, a Goldring 900 SE cartridge was selected and the arm was balanced in the usual manner. Both the tracking force and the anti-skating dials were set to 1.5 grams, which turned out to be slightly greater than optimum.

Instead of measuring wow and flutter first, as I usually do, I decided to see what speed variation could be obtained with the axis tilting system . . . it clocked in at +4.5 per cent and -0.3 per cent. In other words, it was almost "on the nose," and there was very little margin on the minus side. Subsequent tests over a long period showed that the speed remained absolutely constant once it was set. Wow and flutter came out at 0.04 per cent DIN, exactly as claimed, and rumble measured -68 dB using the ARLI weighting. Tracking error was within the 0.5 degrees per inch, standard for this type of arm, and both vertical and horizontal tracking friction were too low to measure with any accuracy, but I have no reason to doubt the specified figure of 10 mg.

Tonearm resonance with the Goldring cartridge was at 7 Hz, showing a rise of only two dB. Both the tracking force and anti-skating dial calibrations were as accurate as my standard, which means they were within one or two per cent at most.

Listening Tests

The cue lift device worked quite smoothly with no trace of annoying sideplay—you could really cue with it! However, the platform could be longer as it does not support the arm as far as it could, so there is the possibility that it could swing free with disastrous results. The arm permitted tracking to less than a gram with the 900 SE cartridge, and because of the arrangement of pistons and springs used for isolation there was no problem with acoustic feedback.

How about the speed change method? This is somewhat of an anachronism on such a beautifully engineered unit, although it is quite easy to cope with. The only 45 rpm discs I play these days are the direct-to-disc recordings made by Crystal Clear, and I imagine few readers of *Audio* bother much with commercial 45 rpm records these days.

Summing up, then, the Empire 698 is well-engineered, a solidly constructed unit capable of years of trouble-free operation. The accurate cueing facility plus the fast speed torque (full speed is reached in less than one-third of a revolution) would commend it to recording studios and broadcast stations in particular. Another strong plus feature is the tonearm with its jeweled bearings, not forgetting the freedom from acoustic feedback. All this adds up to a fine turntable.

George W. Tillett

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Z's 1 to 4 are the four passive components which interconnect the current dumpers, (the output transistors which supply the power), to the small high quality amplifier which provides the error signal, so that when the above condition is met the current in the load, the loudspeaker, is independent of the current in the dumpers and hence distortion is solely dependent on the quality of the error amplifier, which because it is small can be very good.

Wonderful indeed.

For further details on current dumping and other Quad products write to Dept. A

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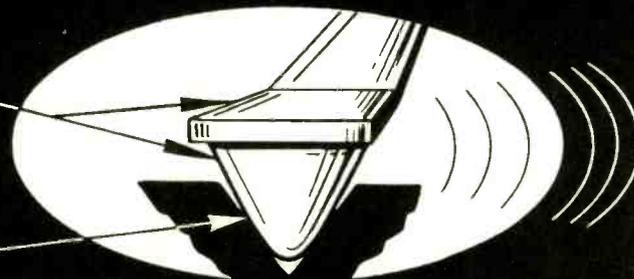
* Elektor Electronics Magazine No. 8. Dec. 1975

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How to make a STUNNING IMPROVEMENT in Your present SOUND SYSTEM for PRACTICALLY NOTHING!

UNIQUE BONDING—
MICRO TIP TO
TAPERED CANTILEVER
YIELDS LOWEST MASS

PARABOLIC
(SHIBATA-TYPE)
TIP FOR MAXIMUM
GROOVE CONTACT



The New **Walco**
**EXTENDED
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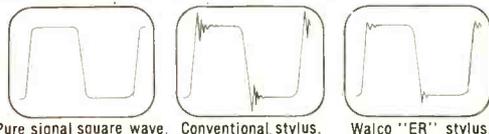
INTRODUCING A NEW AUDIO COMPONENT

Now there is a new audio component you can buy, to make a fantastic improvement in the phono cartridge you are now using. It's the Walco "ER" Extended Range Replacement Stylus assembly, designed to fit into your present cartridge just like the original. The dramatic difference is a reduction in tip mass—for the lowest tip mass of any stylus.

What can you expect? A remarkable number of improvements that all add up to total better sound. Immediately you notice that records are clearer, purer, more listenable than ever before. The sound is more "open," and more effortless. There is less harshness, so you can listen longer without suffering from "distortion fatigue".

Why The Walco "ER" Is Better Than Your Original

Look at the illustration below. The one on the right is the Walco "ER" Replacement Stylus Assembly fitted into one of the most popular and most expensive cartridges you can buy. The center illustration is that same cartridge with its original stylus.



You don't have to be an engineer to know that the one on the right is closer to the pure square wave: more accurate, less distorted, a noticeable improvement in reproduction. The difference is lower mass at the stylus tip.

Any stereo or four-channel cartridge can be improved by reducing the effective mass at the tip. But until now the diamond tip had to be the size it is, so it could stick up through a hole in the cantilever (arm) where it is cemented in place.

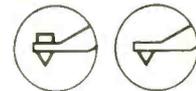
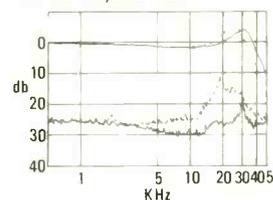
Walco Achieves An Engineering Breakthrough.

But now Walco Electronics has perfected a way to reduce the size and mass of the diamond tip more than 32%! This technological breakthrough is available as a replacement stylus for top quality magnetic cartridges . . . whether two or four-channel.

In the new assembly method, a tiny, naked diamond—at least 60% smaller than ever before—is bonded to the underside of the cantilever only. No mounting hole needs to be drilled, so a lighter and smaller arm can be used, for full compliance with greater strength. The net result is the lowest total tip mass of any stylus!

The unique tip mounting method plus lower tip mass, also permits the center of gravity of motion, between stylus and fulcrum to be held closer to the centerline—extending high frequency response to an amazing 50,000 Hz! Channel separation (distance between up-

per and lower curves in graph illustration) is greatly improved, and dramatically increased to 20 db even out to 40,000 Hz!



All other stylus tips. New Walco "ER" lowest mass tip.

Walco "ER" response (solid line) is flatter, more extended, has better separation than original stylus in same cartridge!

TESTED AND PROVEN

LEN FELDMAN REPORT — MAR. 77

"Walco has managed to come up with a line of replacement styli which not only can be purchased without the user's fear of degraded cartridge performance but which can actually result in improved record reproduction."

TYPICAL EXCERPTS— from among hundreds of endorsements received.

"The results were quite surprising — Noticeably (by its absence) is less surface noise. A fuller type of response from both stereo and older mono discs. Together with evident reduced distortion."

"I have used the WALCO "ER" styli in a number of fine cartridges to check our test pressings against our master tapes. The quality of your company's styli are audibly superior to the original manufacturer when they were brand new."

"As a composer of classical music, my turntable gets very heavy use. The WALCO "ER" needle provides better high end response, transient response, and a more vivid image."

"Again let me say I am delighted — your stylus performs better. Yes it outperforms the ADC-XLM-MK11 Cartridge, and I have had 2 of them complete with styli."

A Stunning Advance in Sound Reproduction.

You can only improve your present cartridge, no matter how good it is now, with the Walco "ER" Lowest Mass Stylus. It's guaranteed to fit perfectly, and you can install it easily as any replacement. It is warranted for two years. Yet it costs no more — and probably less — than a conventional elliptical replacement from the original manufacturer.

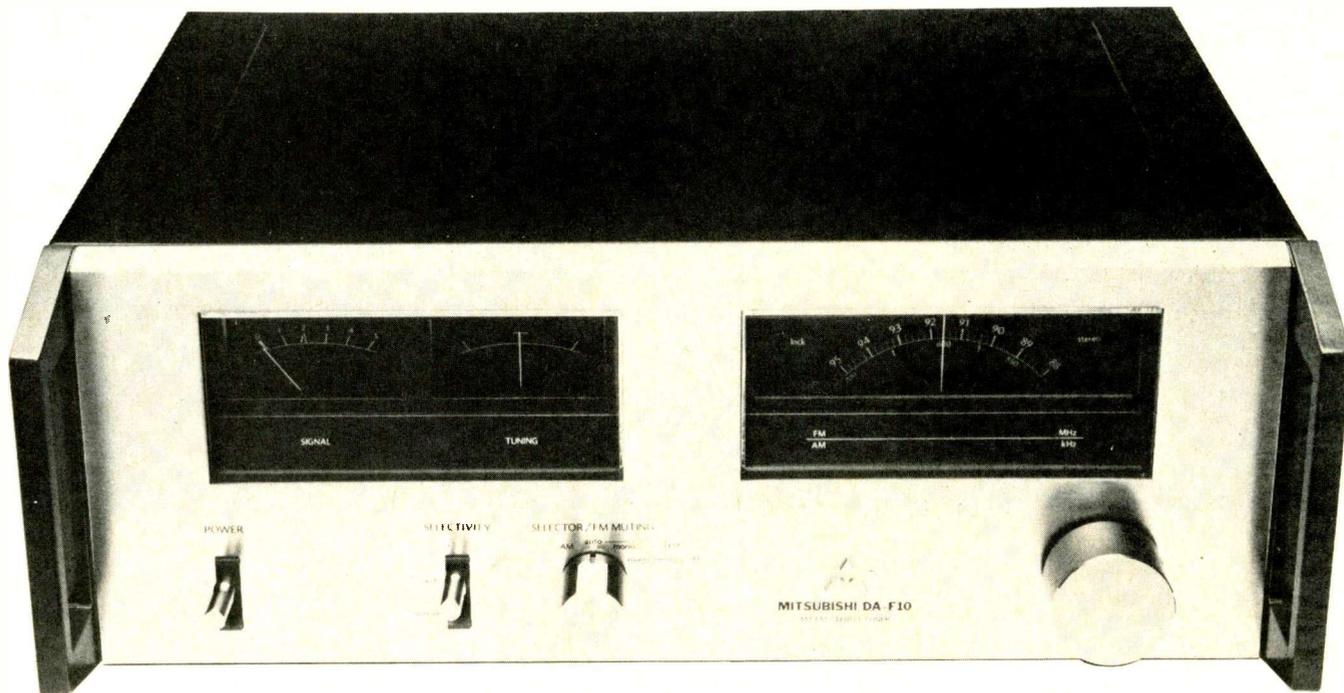
Send for complete list of cartridges for which units are presently available. Or ask your dealer. The Walco "ER" Replacement Stylus is available from fine Audio and Record shops nationwide.

Specific data regarding cartridges used in these tests, test records and other information, will be sent on request. WRITE TODAY FOR FREE BROCHURE.

*Complete report on request.

Walco ELECTRONICS

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Mitsubishi Model DA-F10 AM/FM Stereo Tuner

MANUFACTURER'S SPECIFICATIONS

FM Tuner Section

Usable Sensitivity: Mono, $2.5 \mu\text{V}$ (13.2 dBf); Stereo, $7.8 \mu\text{V}$ (23.0 dBf).

50-dB Quieting: Mono, $5.5 \mu\text{V}$ (20.0 dBf); Stereo, $55 \mu\text{V}$ (40 dBf).

Signal-to-Noise Ratio: Mono, 75 dB; Stereo, 70 dB.

THD: Mono, 0.06 per cent wide; 0.2 per cent narrow (1 kHz); Stereo, 0.1 per cent wide, 0.5 per cent narrow (1 kHz).

Capture Ratio: 0.8 dB wide, 1.5 dB narrow.

Selectivity: 45 dB wide, 75 dB narrow.

I.F. Rejection: 80 dB.

Image Rejection: 75 dB.

Spurious Rejection: 90 dB.

AM Suppression: 55 dB wide, 50 dB narrow.

Frequency Response: 30 Hz to 15 kHz, ± 1.0 dB.

Stereo Separation: Wide, 45 dB @ 1 kHz, 40 dB @ 10 kHz; Narrow, 35 dB @ 1 kHz, 30 dB @ 10 kHz.

Sub-Carrier Rejection: 60 dB.

SCA Rejection: 70 dB.

Muting Level: 23 dBf.

Output Level: Fixed, 450 mV; Variable, 0-1.2 V.

AM Tuner Section

Usable Sensitivity: 45 dB (bar antenna).

Selectivity: 25 dB.

THD: 1.0 per cent.

S/N: 50 dB.

Image Rejection: 40 dB.

I.F. Rejection: 70 dB.

Spurious Rejection: 60 dB.

Output Level: Fixed, 150 mV; Variable, 0 to 400 mV.

General Specifications

Dimensions: $16\frac{3}{4}$ in. (42.5 cm)W x $6\frac{3}{4}$ in. (17.1 cm) H x $10\frac{1}{8}$ in. (26.4 cm) D.

Weight: $16\frac{1}{2}$ lbs. (7.5 kg).

Power Consumption: 18 W.

Price: \$260.00.

102

Part of the joy that comes from evaluating new audio products occurs when, every now and again, we run into an unexpectedly fine product at an unusually low price—with no forewarning. That is exactly the sort of thing that happened when we unpacked and began measuring the Mitsubishi Model DA-F10 tuner. From the moment we removed the little unit from its carton we sensed that here was a different sort of tuner. The tuning dial treatment was the first thing that attracted our attention. Instead of the usual long, linear dial scale, frequencies are printed on a circular wheel only part of which is visible in the dial area window. Turning the tuning knob at the lower right provides vernier rotation of this dial wheel, which is calibrated linearly (or should I say circularly) at every MHz. The dial pointer itself is really just a stationary graticule marker. Clearly, if this dial wheel were extended to its full perimeter length, it would be quite long indeed, and therefore very precise tuning is made possible with this novel arrangement. If you've seen any of those "nostalgia" radios around (which, I believe are replicas of vintage-20s Philco "cathedral" cabinet sets), the similarity of tuning method is immediately apparent. But make no mistake—this is no archaic tuner. It is, in fact, extremely advanced for its low price. To either side of the "dial-wheel" are indicator lights—one to

show stereo reception, the other identified as "lock" which comes on when stations (FM) have been properly centered using the center-of-channel meter located in a matching window at the left of the panel along with the signal strength meter.

Controls along the bottom of the panel include a toggle-type power *On/Off* switch, a selectivity selector switch with positions for wide and narrow i.f. bandwidth, a selector switch with positions for AM, auto FM, mono FM, and mono FM with muting defeated. This switching arrangement makes it impossible to tune to a stereo FM station without interstation muting, but that is not as serious as it might seem since, as we later learned, muting threshold is fixed at around $8.0 \mu\text{V}$ (23.3 dBf), and any stereo signals likely to be received at lower signal strengths than that would be unlistenable because of high noise content anyway. The aforementioned tuning knob at the lower right of the front panel completes the layout.

The rear panel of the Mitsubishi DA-F10 is equipped with the usual 75-ohm and 300-ohm antenna terminals for FM, and ground and hot AM external antenna terminals. A cable clamp beneath the 75-ohm terminal retains the coaxial transmission line in place and grounds its shield when that



The world's finest audiophile recorder has become even finer

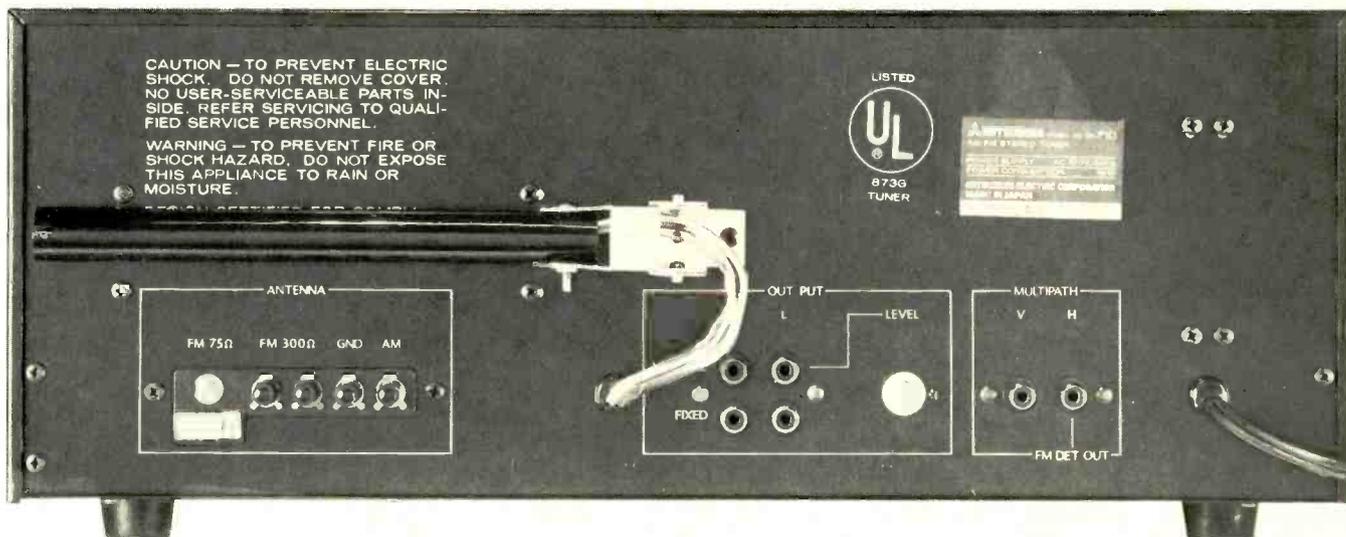
With its large professional VU meters using LED peak overload indicators, its full electronic logic control of tape motion and its precision tape cutter and splicer, the new B77 stereo tape recorder sets new standards of convenience for the discriminating recordist.

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type of lead-in cable is used. A pivotable AM ferrite-bar antenna is located near the two sets of output jacks—one pair providing fixed level, the other variable by means of an adjacent screwdriver control which enables the user to set tuner output levels to match other program sources fed to the amplifier or preamplifier in the system. Vertical and horizontal 'scope output jacks are also provided, the latter also serving as a detector output for connection to any form of four-channel adaptor that is likely to appear on the market in the future.

Although no schematic diagram was supplied with our sample, examination of the internal layout of the chassis disclosed a neatly constructed separate front end, which utilizes a four-gang FM tuning capacitor and a three-gang AM (yes, we said three-gang) tuning capacitor, and extensive interstage shielding. The main tuner board (i.f., multiplex, AM, and audio sections) is a model of neat r.f. layout, and each and every part is identified by legible, schematic-symbol silk screening. In evidence was a six-pole, linear phase, 10.7-MHz i.f. filter block in the final section of the FM-i.f. stages and a pair of low-pass filter blocks in the multiplex decoder section for subcarrier product suppression and a phase-lock loop circuit in the multiplex section. Total solid-state complement includes five ICs, 38 transistors, and 19 diodes.

Laboratory Measurements

As we noted in describing the front-panel controls, this tuner has two bandwidth ranges in the FM i.f. section. The wide-band position is intended for use when ultra-low distortion

reception is desired and when stations are not too close to each other on the dial to cause interference, since wide bandwidth must necessarily sacrifice adjacent and alternate channel selectivity to some degree. Since many of the measurements one would normally make on an FM tuner are affected by the bandwidth setting, it was necessary to repeat most of the significant measurements for each bandwidth switch setting. Figure 1 shows quieting and 1-kHz distortion as a function of signal strength, for both mono and stereo reception. For this narrow bandwidth setting, selectivity was 76 dB (alternate channel) while adjacent channel rejection was only 9 dB. Though S/N for mono and stereo remained the same for both bandwidth settings (84 dB mono; 71 dB stereo), distortion, as might be expected, was considerably higher than the figures we later obtained in the wide band position, namely 0.12 per cent for mono and 0.32 per cent for stereo. Switching to the wide-band position, selectivity decreases to 45 dB (alternate channel), but, as can be seen in Fig. 2, distortion almost reaches the "vanishing point" with readings of 0.055 per cent in mono and 0.06 per cent in stereo. Both readings may well be influenced by whatever residual distortion components exist in our FM signal generator setup!

Figure 3 includes multiple plots of distortion versus audio frequency, for mono and stereo, and for both bandwidth settings. In the wide-band position, even 6 kHz THD in stereo was a very low 0.2 per cent, and there was no evidence of sub-carrier product leakage when this reading was taken.

Best mono usable sensitivity was obtained in the narrow position, with a reading of 2.5 μ V (13.2 dBf) as claimed. In

Fig. 1—Mono and stereo quieting and distortion characteristics for the Mitsubishi DA-F10 tuner FM section in the *Narrow* i.f. position.

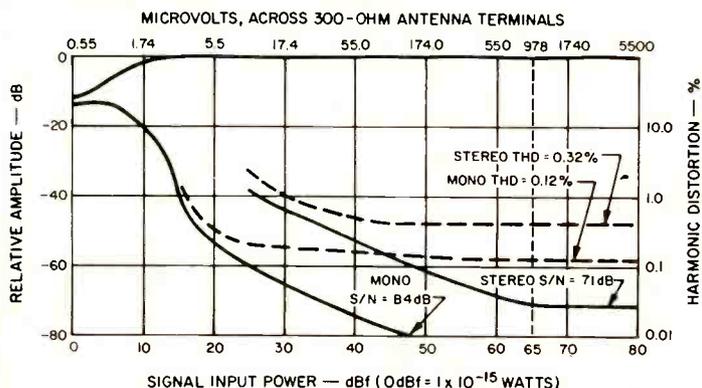
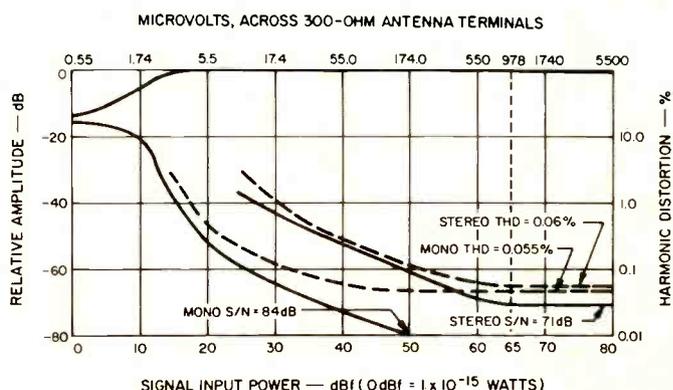


Fig. 2—Mono and stereo quieting and distortion characteristics in the *Wide* i.f. position.



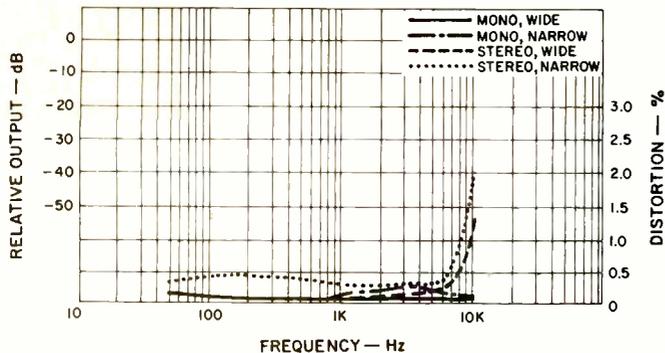


Fig. 3—Distortion vs. frequency.

stereo, the usable sensitivity was limited by the stereo switching threshold which occurs at $8.0 \mu\text{V}$ (23.3 dBf) in the case of the "narrow" setting ($10.0 \mu\text{V}$ or 25.2 dBf for the wide band position). The 50-dB quieting reading was the same for both bandwidth positions, $3.8 \mu\text{V}$ (16.8 dBf) for mono and $48 \mu\text{V}$ (38.8 dBf) for stereo—rather high in view of the other quieting parameters measured. Muting threshold was set to the same $8.0 \mu\text{V}$, as was the stereo threshold. Capture ratio measured 1.4 dB in the wide i.f. setting and 0.9 dB in the narrow setting. The i.f. and image rejection ratios were 87 dB and 92 dB respectively, regardless of bandwidth settings.

As might be expected, stereo separation was materially affected by the bandwidth settings. In Fig. 4 we have plotted desired and undesired (cross-talk) response (including the built-in 75-microsecond de-emphasis characteristic) for each of the bandwidth settings. Desired channel output (upper trace) remains the same, of course, but when the narrow bandwidth setting was used, high frequency separation suffered (higher branch of the lower traces), decreasing to some 37 dB at 10 kHz as compared with an amazing 48 dB at that frequency when the wide-band mode was used. The low-frequency stereo separation exhibited a peculiar characteristic which we have never encountered previously, decreasing to 28 dB at 100 Hz for no apparent reason regardless of which bandwidth position was used. For practical listening purposes, however, 28 dB is quite adequate separation at such

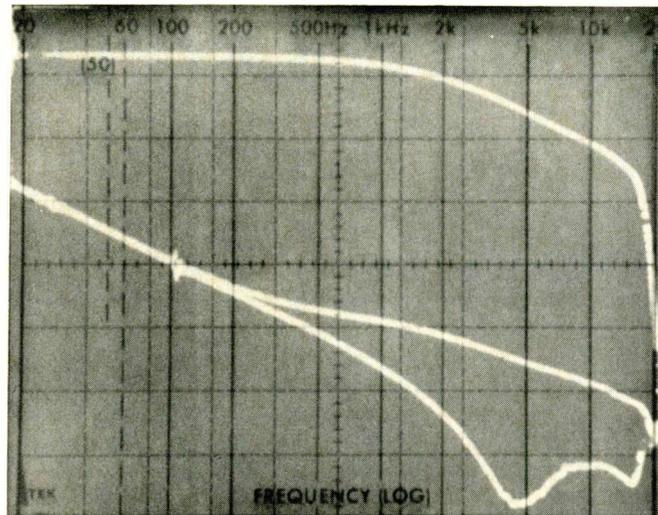


Fig. 4—Stereo separation vs. frequency. Upper trace is the desired output; lower traces show crosstalk to opposite channel with poorer high frequency separation in the Narrow i.f. setting.

low frequencies. Overall frequency response was flat with 0.1 dB from 30 Hz to 10 kHz, with a 1.5 dB roll-off at 15 kHz caused, in part, by the action of the very effective carrier suppression filters in the multiplex decoder section.

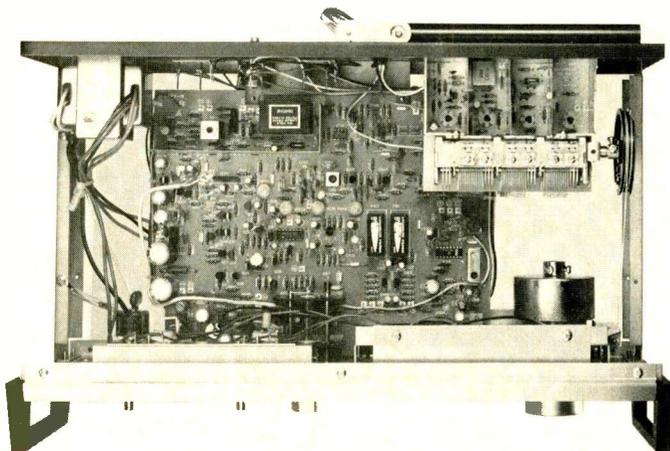
The AM section of the tuner benefitted from the use of a somewhat more elaborate circuit than one normally finds in a tuner in this price category (or even in many higher priced tuners, for that matter) and had an ultimate signal-to-noise ratio of 51 dB, i.f. rejection of 70 dB as claimed, image rejection of 42 dB and a total harmonic distortion (at 30 per cent modulation) of 0.8 per cent. Using the internal antenna, sensitivity was $200 \mu\text{V}/\text{meter}$. Selectivity was exactly 25 dB as claimed.

Use and Listening Tests

When the DA-F10 was used in the narrow-band setting, it delivered good FM reception which was indistinguishable from that of other tuners in this price range. It was only when we switched to the wide position (happily, there are some sections of our local FM dial that permitted us to use this bandwidth) that the tuner really comes into its own. There is a clarity and openness of sound that is too good to believe. We have, of course, heard many other tuners which do as well or better, but these were generally in the over-\$400.00 category and if we seem overly rapturous about this "sleeper" entry from Mitsubishi, it is simply because we are amazed at how much FM tuner value that company has been able to offer for this low, low price. While we were at first disturbed by the incorporation of the "lock" tuning feature (AFC by any other name is still AFC in our book), we can report that this feature is not too strong to prevent us from tuning to weak signals located near stronger ones and, even more important, in our sample at least, the "locked" setting corresponded perfectly with exact center-of-channel meter centering, and meter centering, in turn, corresponded precisely with the lowest-distortion tuning point. If one is going to feature AFC in an FM tuner these days, at least this one does not get in the way of proper tuning and proper reception. As a relative newcomer to the audio market, the name Mitsubishi may not be the easiest to pronounce, but I suspect that it will be one which will become very familiar if other products in their line are as value laden as this one.

Leonard Feldman

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Annual Directory Addenda

Amplifiers

MANUFACTURER	Model	Ave. wdgts./Chan. into 8 ohms		Freq. respon. at rated power.		Highest THD from 1/4 W to rated power, %		S/N, "A" wdg. phono re. 10 mv, dB		Phono sens., mv, phono 1 / phono 2		Phono overload, mv, phono 1 / phono 2		Mike input sens., mv		High level sens., V		Headphone output level, V		Headphone load Z, ohms		Minimum Speaker Z, ohms		Damping factor at 1 kHz		Dimensions, inches, W X D X H		Weight, lbs.		Price, \$		Notes
		1-100	0.05	0.025	100																											
Bryston	2B	50	1-100	0.05	0.025	100													100	19x10 x3 1/2	25	495 00									Slowing rate. 60 V per mSec	
	3B	100	1-100	0.05	0.025	100													100	19x9 x5 1/4	35	785 00									As above	
	4B	200	1-100	0.05	0.025	100													100	19x13 1/2 x5 1/4	50	1250 00									As above	
Dunlap Clarke	1000(B)	250	20-20	0.15	0.10							1.75						2	400	19x16 x7	80	1500 00									500 W/ch into 4 ohms	
	500(B)	175	20-20	0.15	0.10							1.25						2	400	19x12 x7	50	980 00									300 W/ch into 4 ohms	
	250(b)	125	20-20	0.15	0.10							1.05						2	300	19x10 x7	35	675 00									200 W/ch into 4 ohms	
Radio Shack	SA-1000A	25	20-70	0.5		60	3	150			0.15							8		15 1/4 x 11 1/2 x4 3/4		169 95										
	SA-2000	55	20-20	0.5		60	2.5	160			0.15							8		16x12 x4 3/4		269 95										
Technics	SU-8080	72	20-20	0.02	0.02	100	2.5/2.5	280/280			0.2								70	17 1/4 x 14 1/4 x5 5/8	30	449 95									Subsonic filter, switchbl phono input res & cap	
	SU-8600	73	20-20	0.08	0.08	87	2/2	200/200			0.15								50	19 1/4 x 13 7/8 x7 1/4	32	349 95								12 dB/oct low/high filter		
	SU-7700	50	20-20	0.08	0.08	90	2.5	150			0.15								50	18x13 7/8 x5 3/4	24	249 95								2-way tape dubbing		
	SU-7300	41	20-20	0.08	0.08	90	2.5	150			0.15								40	17 1/4 x 13 1/4 x5 1/4	20	199 95								Direct reading meters, sharp-cut subsonic filter		
	SE-9060(B)	70	20-20	0.02	0.02						1.0									70	19x14 1/4 x4	25 1/2	399 95								Rack mount, d c design w/low switching distortion	
	SE-9600P(B)	110	20-20	0.08	0.08						1.0									100	19x16 1/4 x7 1/4	53 3/4	799 95									

Preamplifiers

MANUFACTURER	Model	Frequency response, Hz to kHz ± dB		Rated output, V		% THD at rated output		% IM at rated output		S/N, "A" wdg. phono re. 10 mv input, dB		Phono sens., mv, phono 1 / phono 2		Phono overload, mv, phono 1 / phono 2		Mike input sens., mv		High level sens., V		Tape monitor Z, ohms		Tape monitor output, V		Dimensions, inches, W X H X D		Weight, net, lbs.		Price, \$		Notes
		10-200 ± 1.5	10-200 ± 1.5	5	0.005	0.005	95	1.0/0.1	200/10																					
Dunlap Clarke	M-10	10-200 ± 1.5	5	0.005	0.005	95	1.0/0.1	200/10			0.5	330	2.5	19x12 x3	20	675 00													Moving coil input	
	M-5	10-200 ± 1.5	5	0.005	0.005	95	1.0/0.1	200/10			0.5	330	2.5	19x12 x3		550 00													As above, less moving-coil input	
Hegeman	Hip Probe	2-350 ± 1	0.001 0.004			76		500/2000													6x1 1/2 x2 3/4	1	160 00						\$135.00 bat pwr'd Mounts at turntable acts as interface bet cart & preamp	
	HPR	2-350 ± 1	1.0	0.02	0.025	76	3.0	80													8 1/2 x 1 1/2 x2 3/4	1 1/2	270 00					Mounts at turntable		
	Heu	2-350 ± 1	3.0	0.02	0.025								0.5								10 1/4 x 3 1/2 x5 1/2	3	375.00					Power tap to drive HPR		
Technics	SU-9600Q	2-100 +0 -3	1	0.02	0.02	87	Adj *	Adj **			0.1	600	0.1	19x7 3/4 x16 1/4	53 3/4	629 95												*2/1-3 **900/450-1350 Two-way tape dub. 18 dB oct filters Rack mountable		
	SU-9070	d c -100 +0 -1	1	0.004	0.004	100	2.5/2.5	350/350			0.15		0.15	19x4 x14 1/2	16	399 95												Rack-mount d c preamp w/3-way dubbing and subsonic filter		

Tuners

MANUFACTURER	Model	Mono IHF Sensitivity, μV (dB)	Stereo IHF Sensitivity, μV (dB)	Capture Ratio, dB	Ali. Char. Select., dB	AM Supp., dB	Mono Signal Strength for 50 dB Quieting, μV (dB)	Stereo Signal Strength for 50 dB Quieting, μV (dB)	Separation, dB, 1 kHz	Separation, dB, 10 kHz	THD mono stereo, 100% modulation	S/N, max., dB mono stereo	De-emphasis, μs	Dimensions, inches WxHxD (to nearest 1/4 inch)	Net Weight, lbs.	Price, \$	Notes
Radio Shack	TM-1000	2 0	2 0	65				35	0 6/0 8	65	75	15 1/4 x 11 1/2 x 4 3/4	169 95				
Technics	ST-9030	1 2 * (12 B)	0 8	90	58	2 2 * (14 B)	22 * (3 8 1)	50	40	0 08/0 08	80	75	19x4 x 14 1/2	16	399 95	* at 75 μV Rack mntg sep wide and narrow band 1 F sections	
	ST-8080	1 9 (10 B)	1 0	85	55	2 6 (13.6)	28 4 (34 3)	45	35	0 15/0 3	75	75	17 3/4 x 5 1/2 x 14 1/2	18 1/2	249 95		
	ST-8600	1 9 (10 B)	1 0	85	55	2 6 (13.6)	28 4 (34 3)	45	35	0 15/0 25	80/72	75	19 1/4 x 14 x 7 1/4	31 3/4	329 95	Bit in pink noise generator, 2-step muting, direct FM-to-tape recording	
	ST-7300	2 0 (11 2)	1 0	75	55	3 0 (14 B)	45 (38 3)	45	35	0 2/0 4	75/70	75	17 1/4 x 5 3/4 x 12 1/2	14	179 95		

*F with model indicates FM only.
 **K indicates kit price.
 ***W indicates wired price.

Single-Play Turntables & Tonearms

MANUFACTURER	Model	Speeds—see code	Wow & Flutter, % 33 1/2, DIN 45-507	Rumble, μg , DIN 45-539	Motor type	Speed accuracy, $\pm\%$	Drive system	Speed Adjustment Range, $\pm\%$	Dimensions, inches	Built-in strobe light?	Model, if separate arm	Overall arm length, inches	Pivot-stylus dist., inches	Vertical bearing type	Lateral bearing type	Max. track error, deg./in.	Anti-skate adjustment?	Tracking Force Range, gms	Solid w base and cover?	Damped cuping?	Price	Notes
Ariston (Roth Sindell)	RD 11E	B	0 04	72	d c Servo	Belt	4	17x14x6	Yes		11	9	Needle	1 5	Yes	0-3	Yes	Yes	Yes	349 95	Autostop	
Fons (Roth/Sindell)	MARK 1	F	0 03	70	d c Servo	Belt	*	17x14x6	No		11	9	Gut	Ptfe	1 5	Yes	0-3		Yes		315 00	*29-100 rpm
	Orphan																		Yes		150 00	
Gale Electronics	GT2102	F	0 01	75	d c brushless	direct															1975 00	
Radio Shack	LAB-400	B	0 03	63	d c	Direct	5	17 3/4 x 14 x 5 3/4	Yes		11 1/4	8 3/4			Yes	1/2-4	Yes	yes	yes	199 95		
	LAB-300	B	0 10	60	4-Pole Sync	Belt		17 3/4 x 14 x 7 1/4	No			8 1/2			Yes	3/4-4	Yes	yes	yes	159 95		
	LAB-110	A			4-Pole Sync	Rim									Yes	1 1/2-4	Yes	yes	yes	69 95		
Technics	SP-10 Mk II	A	0 025	73		direct	0 002	14 1/2 x 14 1/2 x 4	yes									no			699 95	Quartz controlled, full-spd in 0.25 sec
	SL-1000 Mk II	A	0 025	73		direct	0 002	14 1/2 x 14 1/2 x 4	yes									yes			1300 00	Titanium nitride arm w/var damping adj
	SL-1300 Mk II	B	0 025	73	d c Servo	direct	9 9		yes			9 1/4	gimbal susp	yes	0-3	yes	yes	yes	yes	399 95	Quartz phase-locked spd. cont., dual susp. system	
	SL-1400 Mk II	B	0 025	73	d c Servo	direct	9 9		yes			9 1/4	gimbal susp	yes	0-3	yes	yes	yes	yes	369 95		
	SL-1500 Mk II	B	0 025	73	d c Servo	direct	9 9		yes			9 1/4	gimbal susp	yes	0-3	yes	yes	yes	yes	349 95		
	SL-1600	B	0 025	73	d c Servo	direct	5	17 3/4 x 14 1/2 x 5	yes			9 1/4	pivot	yes	0-3	yes	yes	yes	yes	279 95		
	SL-1700	B	0 025	73	d c Servo	direct	5	17 3/4 x 14 1/2 x 5	yes			9 1/4	pivot	yes	0-3	yes	yes	yes	yes	229 95		
	SL-1800	B	0 025	73	d c Servo	direct	5	17 3/4 x 14 1/2 x 5	yes			9 1/4	pivot	yes	0-3	yes	yes	yes	yes	179 95		
	SL-2000	B	0 045	70	d c Servo	direct	5	17 x 13 1/2 x 5	yes			8 3/4	pivot	yes	0-3	yes	yes	yes	yes	9 95		
	SL-1900	B	0 042	73	d c Servo	direct	5	17 3/4 x 14 1/2 x 5	yes			9 1/4	pivot	yes	0-3	yes	yes	yes	yes	179 95		
	SL-23	B	0 05	65	d c Servo	belt	3	17 x 13 3/4 x 5 1/2	yes			8 3/4	pivot	yes	0-4	yes	yes	yes	yes	129 95		
SL-20	B	0 05	65	d c Servo	belt	3	17 x 13 3/4 x 5 1/2	no			8 3/4	pivot	yes	0-4	yes	yes	yes	yes	99 95			

A—33, 45, 78
 B—33, 45
 C—33 only
 D—16, 33, 45, 78
 E—16, 33, 45
 F—Cont. variable

Receivers

MANUFACTURER	Model	Ave. watts/chan. - 8 ohms	% THD max. 1/2 watt to max. rated power	% IM max. 1/2 watt to max. rated power	Rated power bandwidth Hz to kHz	dB S/N, "A" wtd., phono 10mV	Phono overload, mV	Mono IHF Sensitivity, μ V (dB)	Stereo IHF Sensitivity, μ V (dB)	Mono Signal Strength for 50-dB Quieting, μ V (dB)	Stereo Signal Strength for 50-dB Quieting, μ V (dB)	Capture Ratio, dB	% THD 100% Modulation, 1 kHz Mono/Stereo	De-emphasis, μ V	All Chan. Select., dB	Max. S/N, dB Mono/Stereo	Dimensions inches, WHHD to nearest 1/2 inch	Net Weight, lbs.	Suggested Price	Notes
Radio Shack	STA-2000	75	0.25		20-20	2.3	230	1.7	2.5	40	1.5	0.1/0.15	75	75	70	19 1/4 x 16 1/2 x 6 1/4	499.95			
	STA-235	55	0.3		20-20	2.5	160	2.0	2.8	38	2	0.2/0.5	75		80	19 x 13 1/2 x 5 1/4	419.95			
	STA-90	45	0.5		20-20	3	150	2.0	3.5	42	2	0.5/0.7	75	70	85	19 1/4 x 14 1/2 x 6	379.95			
	STA-85	35	0.3		20-20	2.5	120	2.0	2.0	25	2	0.3/0.5	75/25	50	70	18 1/2 x 12 3/4 x 5 1/2	299.95			
	STA-78	22	0.5		20-20	2.3	120	1.9	3.0	45	1.5	0.1/0.5	75/25	60	75	12 1/2 x 17 x 6	269.95			
	STA-64	16	0.8		15-30	2.5	95	2.2	4.0	40	2	0.5/0.6	75	70	70	18 1/2 x 14 x 5 1/4	249.95			
	STA-52	12	0.9		15-30	2.5	100	2.5	7.5		2	0.5/0.6	75	70	65	17 1/2 x 11 1/4 x 5 1/4	199.95			
	STA-21	7	0.9		15-30	2.5	70	2.8	4.0	50	3	0.5/0.6	75	45	65	16 1/4 x 11 x 5	159.95			
STA-16	3.5	0.9		30-22	2.5	70	3.2	4.0	50	3.5	0.6/0.8	75	30	60	16 1/4 x 10 x 4 1/2	129.95				
Technics	SA-5770	165	0.08	0.1	20-20	90	2.5	250 (10.3)	2.4 (12.8)	33.4 (35.7)	1	0.1/0.15	75	80	85/75	23 1/4 x 7 1/2 x 19 1/2	58 1/2	799.95	Two phono inputs w/ impedance selector. 12 dB high/low filters.	
	SA-5570	85	0.1	0.1	20-20	90	2.5	150 (10.3)	2.5 (13.2)	35.4 (36.2)	1.5	0.15/0.25	75	70	75/72	21 1/4 x 6 1/4 x 16 1/2	39	499.95	Two tape monitors, hi overmodulation tolerance on FM.	
	SA-5470	65	0.1	0.1	20-20	90	2.5	150 (10.3)	2.5 (13.2)	35.4 (36.2)	1.5	0.15/0.25	75	70	75/72	21 1/4 x 6 1/4 x 16 1/2	34 3/4	399.95	Same as above.	
	SA-5370	48	0.1	0.1	20-20	90	2.5	150 (10.8)	2.7 (13.7)	39.7 (37.2)	1.5	0.15/0.3	75	70	75/70	19 1/4 x 5 3/4 x 13		329.95	Two tape monitors w/ tape-to-tape monitoring.	
	SA-5270	35	0.3	0.3	20-20	90	2.5	130 (10.8)	2.7 (13.7)	39.7 (37.2)	1.5	0.15/0.3	75	70	75/70	18 x 5 3/4 x 11 3/4	19 1/2	279.95	Same as above.	
	SA-5170	25	0.5	0.5	20-20	90	2.5	130 (10.8)	2.7 (13.7)	39.7 (37.2)	1.5	0.15/0.3	75	65	75/70	18 x 5 3/4 x 11 3/4	17 1/4	229.95		
	SA-5070	15	0.8	0.8	40-20	89	2.5	130 (11.2)	3.5 (16.1)	40 (37.3)	1.5	0.15/0.3	75	58	70/65	18 x 5 3/4 x 10 1/4	17 1/4	179.95		

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Loudspeakers

MANUFACTURER	Model	Enclosure type	Woofer dia. inches		Midrange dia. inches		Tweeter dia. inches		Level control? (M = midrange, T = tweeter)	Anechoic freq. response Hz to kHz \pm dB	Recommended min. amp. power	Crossover frequencies, Hz.	Impedance, ohms, Nominal/minimum	Dimensions, W X D X H, inches	Finish?	Grille Material? Color?	Weight, lbs.	Price, \$	Notes
Acousti-Phase	PHASE 3 +	Bass Reflex	12	5	Cone	1	dome	T	32-20 \pm 3	10	700, 4500	4/8	25x15 x14	wal.	brown	47	299.95	\$349.95 in butcher block cabinet.	
	TOWER	Bass reflex	10	3 1/2	Cone	1	dome	M, T	40-20 \pm 3	8	2000, 5000	4/8	13 1/4 x 12 1/2 x 36 1/2	wal.	black	59	259.95		
	Phase II	Bass Reflex	10	5	Cone	1	dome	T	38-20 \pm 3	10	1200, 4500	4/8	24 1/2 x 14 1/4 x 12 1/2	wal.	brown	42	219.95		
	Phase Monitor	Bass Reflex	12			1	dome	T	38-20 \pm 3	10	1500	4/8	25x15 x14	wal.	brown	47	179.95		
	Phase I	bass Reflex	8			1	dome	T	40-20 \pm 4	6	1600	4/8	21 1/2 x 12 1/2 x 11	wal.	brown	29	129.95		
	Microphase	bass reflex	6 1/2			1	dome		48-20 \pm 4.5	5	1600	4/8	17 1/2 x 10 1/2 x 8	wal.	brown	19	89.95		
Advance Speaker	A	Pas Rad	(2 10&8)			1	dome		30-20 \pm 3	15	2k	8/6	14 1/2 x 10 1/2 x 26 1/2	wal & Vin.	Cloth, Blk	44	149.95		
	V	Ac Sus.	8			1	dome		45-20 \pm 3	15	1.8k	8/6	11 1/2 x 9 1/2 x 20	Wal & Vin	Cloth, Blk	24	99.95		
	D	Ac Sus.	8			2	Cone		50-15 \pm 4	15	2.5k	8/6	12x7 17 1/2	Wal & Vin	Cloth, Blk	20	139.95	pair	
DCM	Time Window	Hybrid Trans line								10		8/6	14 3/4 x 11 3/4 x 36	Wal	foam, blk	32	660.00	isotropic/isophasic	
	OED	Hybrid Trans line								10		12/8	11 3/4 x 9 3/4 x 36	Wal	foam, blk	35	480.00	isophasic	

MANUFACTURER	Model	Enclosure type	Woofer dia., inches	Midrange dia., inches	Midrange type	Tweeter dia., inches	Tweeter	Level controls? (M = midrange; T = tweeter)	Anchoic freq. response Hz to kHz ± dB	Recommended min. amp. power	Crossover frequencies, Hz.	Impedance, ohms: Nominal/minimum	Dimensions: W X D X H, inches	Finish?	Grille Material? Color?	Weight, lbs.	Price, \$	Notes
Fried Products	H	Trans. line **	8	5	cone	¾	dome	M	20-20*	25	75, 3.5k	8/5	45x24x21 12x8x6**	Oil Wal	Foam. blk.	180	1900.00	*room response **2 ch woofer/satellite mid/twr
	M	Trans. line *	8	5	cone	¾	dome		12-20	25	110, 3.5k	8/5	22x12 x43	Oil Wal	Foam. blk.	95	800.00	*Satellite mid/twr
	R/II	Line tunnel	8x12	5	cone	¾	dome	M	25-30	35	200, 3.5k	8/5	16x15 x28	Oil wal	Knit. blk.	65	400.00	
	B	"Flow-thru" infinite	5			¾	dome		55-20	25	3.5k	8/5	8x6 x12	Oil Wal	Foam. blk.	13	235.00	
	Q	Line tunnel	8			1	dome	T	40-20	35	2.5k	8/5	12x10 x20	Wal vinyl	Foam. blk.	23	140.00	
Gale Electronics	GS 401A	Ac Sus	(2) 8	4	Cone	¾	Dome	M, T	35-25	25	475, 5k	4/8	23¾x10¾ x13	Chrome	Black	54	450.00	
	GS 401C	Ac Sus	(2) 8	4	Cone	¾	Dome	M, T	35-25	25	475, 5k	4/8	23¾x10¾ x13	Wal	Brn	54	450.00	
Presage	15	Bass Ref	8			2	dome	T	60-19k ± 4	10	1,300	8	11½x8½ x21½	Oak, Walnut or Vinyl	Brn, Blk.	23	99.95-119.95	
	9	Bass Ref	10			2	dome	T	35-19k ± 4	25	1,900	8	14x11x25	Oak or Walnut	Blk, Brn, Blk.	38	179.95	
	S-9	Bass Ref	10			1	dome	T	35-20k ± 3	25	1,450	8	14x11x25	Wal, Oak	Brn, Blk, Brn	38	179.95	
	5	Pas Rad	8	4½	cone	1	dome	T, M	28-20k ± 3	10	470, 3500	8	15x12½ x26	Oak or Walnut	Brn, Blk, Brn	43	329.95	
	4	Pas Rad	10	4½	cone	1	dome	T, M	25-20k ± 2	20	470, 3,500	8	15x15½ x42	Walnut	Black	65	549.95	
Radio Shack	Mach One	Ac Sus	15		Horn		Horn	M, T	20-25			8	17½x12 x28½	Oil Wal	Cloth Brn		119.95	100W program capacity
	Optimus-5B	Ac Sus	12	(2) 3		3		M, T	20-20			8	14x11½ x25	Wal Ven	Cloth Brn		119.95	75W program capacity
	Nova-7B	Ac Sus	10		(2) 3			T	20-20				12½x11¼ x22½	Wal	Cloth, Brn		119.95	55W program capacity
	Optimus 10	Pas Rad	8			¾	Dome	T	40-20 ± 3			8	15½x10 x25	Wal Ven	Cloth Brn		139.95	75W capacity
	Optimus T-100	Ac Sus	(2) 8			3	Dome	T	55-18 ± 3			8	13x12½ x35½	Oil Wal	Cloth, Brn		149.95	75W capacity
	Optimus-21	Ac Sus	10		(2) 3			T	20-20			8	12½x22 11¼	Oil Wal	Cloth, Brn		99.95	70W capacity
	Nova-6	Ac Sus	8			3	Dome	T	30-20			8	11½x10 19¼	Oil Wal	Cloth Brn		79.95	55W capacity
Tannoy	Eaton	Duct ed Port	10			2			50-20 ± 4	20	1k	8	20¾x13¾ x10	Wal	Cloth Brn	40	295.00	All encl in teak & ash
	Devon	Duct ed Port	12			2			45-20 ± 4	20	1k	8	23x15¾ x10¼	Wal	Cloth Brn	46	\$348.00	
	Cheviot	Duct ed Port	12			2			40-20 ± 4	20	1k	8	33x17½ x10¼	Wal	Cloth Brn	66	395.00	Grill colors in Blue & Sand
	Berkeley	Duct ed Port	15			2			35-20 ± 4	20	1k	8	33x21 x12	Wal	Cloth Brn	90	495.00	As above
	Arden	Duct ed Port	15			2			30-20 ± 4	20	1k	8	39x26 x14½	Wal	Cloth Brn	124	588.00	
	Buckingham	Reflex Port	(2) 12	10	Cone	2			30-20 ± 3	10	350, 3.5k	8/6 4	46x24 x18	Wal	Cloth Brn	265	2250.00	Also avail in Rosewood \$250.00 extra @
	Windsor	Reflex Port	12	10	Cone	2		M, T	30-20 ± 3	10	350, 3.5k	8/6 4	23x16 x32½	Wal	Cloth Brn	125	1250.00	Also avail in Rosewood @ J200.00 extra
Technics	SB-7000A	Tuned Port	13¾	4¾	cone	1¼	dome	M, T	37-22		700, 6k	6	19x16¼ x33¼	Blk	cloth blk	73	399.95	Linear phase
	SB-6000A	Tuned Port	12			1¼	dome	T	39-22		1.8k	6	16¾x13½ x33¼	Blk	cloth blk	55	299.95	As above
	SB-5000A	Tuned Port	10			2½	cone	T	40-20		1.5k	8	13¾x12¾ 28¼	Blk	cloth blk	35¼	159.95	As above
Watson Laboratories	10	*	(2) 10	(2) 5, 8	Cone	(2)	Dome	M, T	25-22 ± 3	100	250, 800, 6k, 18k	4	21¾x21½ x47	Rose, or Wal	Black	85	1765.00	*Woofer, gas linearized baffles, midrange dipoles, Tweeter Ac Sus
	7	*	10	5, 8	Cone	1	Dome	M, T	35-20 ± 3	70	250, 800, 6k	4	19½x15 x33	Rose, or Wal	Black	62	1285.00	*As above
	5	*	9x13	5	Cone	1	Dome	T	40-17 ± 3	50	800, 6k	4	16x10 x34½	Rose, or Wal	Black	38	795.00	*As above

Equalizers

MANUFACTURER	Model	No. of Channels	No. of Bands	Bandwidth, octaves	Boost/Cut Range, ± dB	Rated Output, rms V	% THD at rated output	dB S/N at rated output	Dimensions, inches	Weight, lbs.	Price, \$	Notes
Dunlap Clarke	M-30	2	4	1/3	15	5	0.005	90	19x7x7	20	550.00	4 section parametric equalizer. output from each section for use as crossover. Variable Q, bandwidth, frequency and boost and cut
Radio Shack	31-1986	2	5	1.5	12	8	0.05	80	4 1/2 x 10 1/4 x 6		59.95	
Technics	SH-9090P	2	12	1	12	0.1	0.5	*	7x19x14 1/4	21 1/4	999.95	* -88dBm (balanced), -90 dBm (unbalanced)
	SH-9010P	2	10	1/3	12	5	0.02	90	4x19x14 1/4	13 1/4	449.95	

Microphones

MANUFACTURER	Model	Directional pattern	Operating principle	Case material	External finish	Impedance, ohms	Frequency response, Hz to kHz, ± dB	EIA sensitivity, dBm	Mike connection	Cable length, feet	Cable plug type	Dimension, inches	Weight, ounces	Mounting method	Price, \$	Notes
Radio Shack	33-983	Cardioid	Dynamic			50, 250, 50k	18-13		Cannon	15	Amphenol				49.95	W/windscreen
	33-992	Cardioid	Dynamic	Alum	Brush	600-5k	80-12		Screw-on	15	1/4 in phone				24.95	
	33-919	Dual pattern	Elect cond	Alum	Brush	600	30-15	-72 ± 3		10	1/2 1/4 in phone				29.95	Switchable wide & normal patterns
	33-1045	Cardioid		Alum	Brush	600	30-15			10	1/4 in phone				29.95	
	33-1044	Omni		Alum	Brush	600	30-15			10	1/4 in phone				24.95	W/windscreen
	33-1050	Omni	Elect / Cond	Alum	Brush	600	20-13			9	1/4 in phone	6x9, 16x2, 8			15.95	W/windscreen
	33-985	Omni		Alum	Brush	250-50k	90-11								17.95	W/windscreen
	33-922	Dual-Resp Cardioid	Dynamic	Alum	Brush	200	80-15	-76 + 3	XLR							59.95
Technics	RP 3550	Cardioid	elect cond			600	50-15	-74	Switch A3F	15	Phone	6 1/2	5/8x27		79.95	
	RP 3830	Cardioid	elect cond			600	50-15	-74	Switch A3F	15	Phone	7	5/8x27		99.95	
	RP 3850	Cardioid	elect cond			600	20-16	-72	Cannon XLR-3	15	Phone	7	5/8x27		149.95	

Headphones

MANUFACTURER	Model	Operating principle (Dynamic, electrostatic, ...)	Frequency response, Hz to kHz, ± dB	Impedance, ohms	Sensitivity, dB SPL for 1mV input	Maximum input, mV	% THD at 95 dB SPL	Cord length, feet	Weight, ounces	Price, \$	Notes	
Radio Shack	LV-10	Dyn	20-20	4-16			10	10		39.95		
	33-1004											
	Nova-Pro 33-1014									8	34.95	
	Custom-Pro 33-1002									4-16	24.95	
	Nova-15 33-1015									8	21.95	7
	Nova-30 33-1037									4-16	19.95	
	Nova-14 33-1013									4-16	14.95	

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Nikko Electric Corp. announced price changes on some models of their amplifiers, preamplifiers, tuners, and receivers which became effective after publication of the October Annual Equipment Directory.

The new amplifier prices are: Alpha I, \$650.00; NA850, \$260.00; and the NA550, \$210.00.

The Beta I preamplifier is now \$320.00.

The new NT850 tuner price is \$230.00.

The new receiver prices are: NR1415, \$830.00; NR1015, \$550.00; NR815, \$450.00; NR715, \$300.00; NR615, \$260.00; NR515, \$210.00, and the NR315, \$170.00.

The Sony Corp announced price changes in several models of receivers and turntables which were too late to be included in the October issue.

The new prices for receivers are: STR-6800SD, \$565.00; STR-2800, \$215.00, and the STR-1800, \$155.00.

The new prices for turntables are: PS-X7, \$330.00; PS-X6, \$275.00; PS-X5, \$230.00; PS-T3, \$180.00, and the PS-T2, \$135.00.

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Continued on page 117

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Michael Tearson

Jon Tiven

The column



Side Pocket Shot: Nighthawks Adelphi AD 4115, stereo, \$6.98.

The pretty faces of '77 they ain't. But one of meanest rock and roll bands around they are. If you don't know their name, you probably don't live near the Washington, D.C., area where they are the area's most popular homegrown band. **Side Pocket Shot** is their third Adelphi album and follows their doubly nasty live album.

Granted my pool shooting expertise is limited, but in my game a side pocket shot is always trickier than a corner shot. It may be avoidable, but it's often the only way out. Could be that's where the name came from. Their live album captured them well, but a strong studio follow-up was an obvious necessity, and no easy task either.

Well, **Side Pocket Shot** is a confident album not afraid to take risks. Without compromising the hard edge of the band, they try out some off the wall and unexpected ideas. Their risks pay off handsomely. The album opens with a smashing pair of standards, *Are You Lonely for Me, Baby* and *Slow Down* and a blues *I Keep Cryin'*. . . three solid barrels of pure Nighthawks. For this record, the Hawks add a horn section patterned after the great Bar-Keys of the '60s. Having set a hot pace, they break it with *James' Hawaiian Punch*, a

delightful piece of Bob Wills country swing updated. The country ballad *Honky Tonk Queen* is less effective, but the side ends solidly with a no-stops rocker *I'll Get the News* that sports a fine Mark Wenner harp solo.

Tramp on the Street opens side two blisteringly. It is nearly hot enough to melt vinyl, a true sizzler. Next, *Love's So Hard* is a good old-fashioned shuffle number that adds neat *capella* style male backing vocals. Then is a real surprise as guitarist Jim Thackery launches into a Leo Kottke instrumental, *Vaseline Machine #2* that acts as a bridge to *Fatback Mama* right back in the Hawks' main groove. And they redouble the pace for the hot finale, Willie Dixon's *Bring it on Home*.

The Nighthawks worked hard to make **Side Pocket Shot** as good as it is. What it is, is a smashing good album. It has good, punching sound that plays better as the volume goes up. Play it at your next party. And look out, cause the Nighthawks are coming to *your* town. M.T.

Sound: B Performance: A -

Before We Were So Rudely Interrupted: The *Original Animals* Jet/JA JT-LA790-H, stereo, \$7.98.

They mean it, they really do. The *Original Animals* are Eric Burdon, Chas

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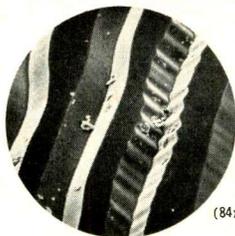
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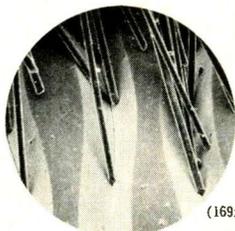
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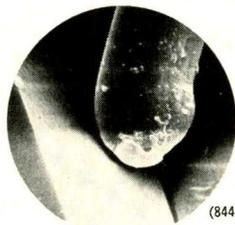
(84x enlargement)

This is an A-T scanning electron microscope photo of the dirt that must be removed if your records are to sound clean. It's dirt that is falling on your records even as you listen.



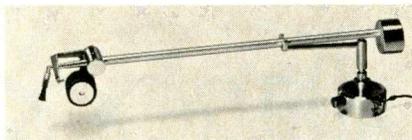
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Chandler, Hilton Valentine, John Steel, and even Alan Price . . . The **House of the Rising Sun Animals**.

The reunion album has been in the can and held up in litigation for over a year since first announced, so that devil anticipation has had its chance to build. Now upon release we find it is a pretty slipshod affair. Chandler produced it and handled it too casually. It sounds like it's been hastily assembled and especially badly mixed, particularly on Chandler's own bass part which is almost inaudible. Maybe he knew something we don't. On the other hand Valentine on guitar and Steel on drums have a serious case of rusty chops. Burdon, though, still has lots of enthusiasm but very little control; he sings like the golfer who outrides everyone 350 yards down the course but then can neither chip nor putt. Alan Price mainly keeps a low profile.

However, when you come to the material you find lackluster stuff: an interpretation of Dylan's *It's All Over Now, Baby Blue* that pales before Van Morrison's similar arrangement on **Them Again**, unfortunate versions of Ray Charles' *Lonely Avenue*, Percy Mayfield's *Please Send Me Somebody to Love*, and a disastrous attack on Jimmy Cliff's *Many Rivers to Cross*.

You come to appreciate just how amazingly Mickey Most handled the Animals way back when. As they sound today, 10,000 bar bands are at least that good.

M.T.

Sound: D Performance: D +

Boats Against the Current: Eric Carmen Arista AB 4124, stereo, \$7.98.

Shiver in the Night: Andy Pratt Nemperor NE 443, stereo, \$6.98.

Here we have two of America's top songwriters whose past track records are nearly flawless. Both of them have written more than their share of memorable tunes with consistency and taste. All of a sudden these two innovators have made some conventional records which are the most boring things this listener has heard lately. Both records seem to fade right into the current crop of mediocre, indistinguished schlock that has permeated your favorite record store. I've not only been disappointed, I feel personally let down by two of the brightest hopes of the Seventies.

First there's Eric, who proved himself a strong rocker in the tradition of England's finest with the Raspberries and then graduated to the Beach Boys school of power pop on his first solo effort. Now he's at it again, but

this time he's taken too many lessons from Elton John. He's too polite, clean, boring, formulaic, and depressing to listen to—he's lost his oomph. The only positive thing I can say about this album is that the two or three fast tunes are fairly listenable and that he's singing well (there's a nice edge to his pipes this time), but as far as Eric's ability to make a contribution this year, you might as well write him off.

Andy Pratt has fallen for trendiness—where once he rocked with feeling he now does so only in the most conventional sense, he falls for Seventies funk, and his vocals are lost in a mire of over-instrumentation. His songs aren't quite up to par, so the record seems locked into bolstering the vacuum with production which just doesn't work. To make matters worse, his singing sounds thin and powerless, and for the most part, lacking in emotion as well. Now I know that Andy can make incredible albums, but he sounds tired and used-up here—I'll take his obtuse eclecticism and weirdness of the past over this muck any day of the week.

J.T.

Sound: B Performance: C -

In Color: Cheap Trick Epic PE 34884, stereo, \$6.98.

Great stuff here—lots of clean, coherent hard rock 'n' roll with no excessive moments. This is the group that sets you up, satisfies you, and gets out before you have a chance to get tired of what they're doing. Unlike their debut album, **In Color** presents the bands with a focus upon their individual talents and yet retains a group sound, which is heavily primed with British influences like the Move and the Rolling Stones. The cacophonous echo is gone—instead of hearing 15 contributing to a sonorous zero, there's only one or two which really have something to say. Rick Nielsen really proves that he has it here, with axework as stimulating as his onstage delivery.

In fact, the whole band makes it happen here, there's not a performance to fault on the whole album. Strangely enough, the songs on side two are far and away superior to those on side one—from *Oh Caroline* to *So Good To See You* there's not a moment of boredom, while side one seems to lack the same intensity and intelligence in the compositions. If there's any inconsistency in the band's creative abilities, it's that they still lean a little too hard on the simplistic stupid numbers when their strength is in melodic rockers. Still, most of this

album is irresistible, captivating rock 'n' roll from one of the most exciting outfits in the world, certainly the best thing America's had to offer in the past 10 years. J.T.

Sound: A- Performance: A

Starting Point: David Bowie

London LC 50007, stereo, \$6.98.

Victory in Rock City: Roderick Falconer

United Artists LA 7776, stereo, \$6.98.

This is Bowie at his schlockiest, with his musical style in between the worst of British poprock and the last gasp of cabaret. Why London chooses to re-release these cuts 10 years after they were recorded time and time again is beyond me, especially when they can't sell well enough to justify the effort involved. The lyrics are the only interesting contribution Bowie could make at this point in his career, all minimally abstract and moderately amusing.

Falconer's album, on the other hand, should appeal to Bowie fans as it's a direct steal from **Diamond Dogs**, occasionally letting loose with **Ziggy & Aladdin** reference points to boot. He apes David B. just as the latter used Anthony Newley as his jumping off point, except Falconer never really jumps off. He's amusing and occasionally enjoyable, but unfortunately he doesn't carry the ball anywhere once he's caught it. Maybe next time. J.T.

Sound: C Performance: C+

Burning for You: Strawbs

Oyster OY-1-1604, stereo, \$6.98.

My unfavorable review of **Deep Cuts**, the previous Strawbs album, received more hate mail than any other I've written for *Audio*—I still stand behind it. At that time I cited Jeffrey Lesser's production as excessive and misguided and the group's material as less than legendary.

The situation is less dire on **Burning for You**. Both the production and material feel stronger and more in synch, but it still doesn't come near matching the legendary Strawbs of **Grave New World** or **Bursting at the Seams**. Still three songs are the strongest Strawbs stuff in moons, namely the title song, *Cut Like a Diamond* and *Alexander the Great*, which last ostensibly is inspired by the Sensational Alex Harvey Band. The two numbers recapture the magic mix of substance and lofty flight that has always been leader Dave Cousins'

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strong suit. However with all three clustered on side one, side two can't avoid sounding relatively disjointed and lifeless.

At least it's off the ropes and back into the fray for some tried and true campaigners. M.T.

Sound: B Performance: C+

Simple Dreams: Linda Ronstadt

Asylum 6E-104, stereo, \$7.98.

At the peak of both her talents and career, Linda Ronstadt is clearly one of the finest singers working, and **Simple Dreams** is continuing evidence. She's working with the same crew who have guided her to this point. Consequently **Simple Dreams** is quintessential West Coast country, immaculately recorded bright and clear and played with both class and restraint.

The restraint runs through to the selections as well, as none packs the punch of the Ronstadt interpretations of Karla Bonoff's songs on the **Hasten Down the Wind** album. Still, they are a comfortable bunch that include a Buddy Holly song *It's So Easy*, two by Warren Zevon, one each by Roy Orbison and J.D. Souther, all familiar sources for songs by Linda. She steps tentatively away from her formula arranging on the early Eric Kaz song *Sorrow Lives Here* backed only by Dan Grolnick's piano. The pair of traditional folk songs with guest dobro by Mike Auldridge are very relaxed and tasty. Dolly Parton's clear uninhibited harmonies on *I Never Will Marry* are quietly brilliant. Linda's version of the Stones' *Tumbling Dice* is surprisingly effective, an unlikely and refreshing highlight.

So **Simple Dreams** is unashamedly a formula album. It's her formula that the others have been copping, hasn't it? M.T.

Sound: A- Performance: B

Benny & Us: Average White Band and Ben E. King

Atlantic SD 19105, stereo, \$7.98.

What an inspired and unexpected combination this is. Take the great one-time voice of the Drifters whose *Spanish Harlem* is only one of the greatest singles ever, then add the very funky Average White Band who needed some kind of shot in the arm after a live album and a sleepy studio job. Praise be to the genius who put the two together.

The material is impeccably contemporary. There is an A. W. B. original, and one from Mr. King as well as a col-

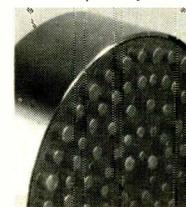
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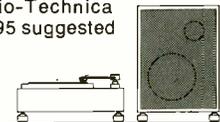
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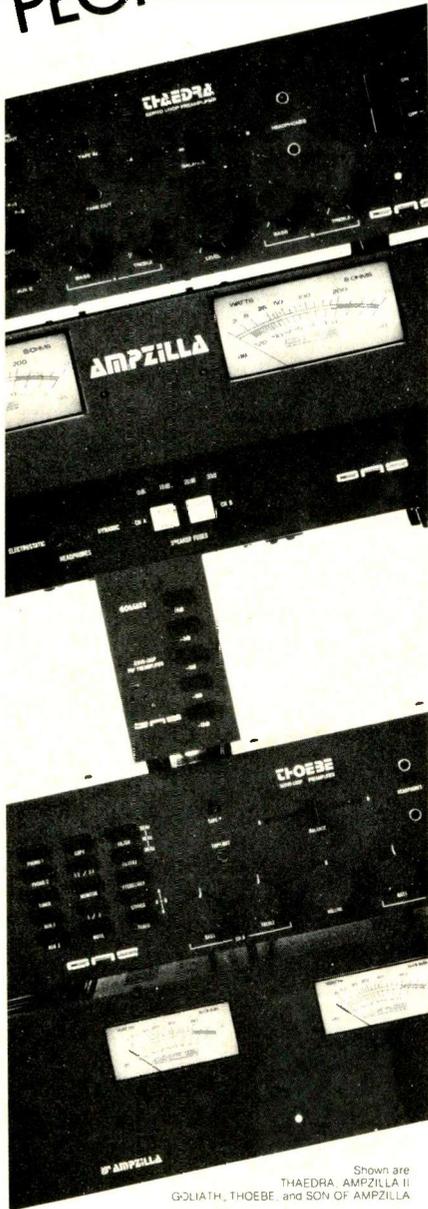
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laboration. Among the covers are a couple intriguing choices, *Fool for You* Anyway from the Foreigner album and John Lennon's *Imagine*. The album's summer hit was Ned Doheny's *Get it up for Love*, probably the best of the several recorded versions of that song.

Benny & Us is a good fun album not to be taken too weightily. The recorded sound is good in the silk and brass tradition. It could be a bit brighter and fuller at the bottom, but performance and exuberance carry the album. It plays effortlessly. *M.T.*

Sound: B — Performance: B

Karla Bonoff

Columbia PC 34672, stereo, \$6.98.

The sheer strength of the three Karla Bonoff songs contained on Linda Ronstadt's **Hasten Down the Wind** album plus the one Bonnie Raitt did on **Sweet Forgiveness** have established Karla as a songwriter of uncommon emotion and impact. It has also made the prospect of her own album inevitable.

Ronstadt bassist Kenny Edwards has produced the album liberally using his mates in the Ronstadt crew. What makes the album special is the sustained quality and sensitivity of the songs. Karla's singing is unmannered and natural. She may not have Linda's pipes, but she is a far more vulnerable figure. This is never truer than on her own version of *Lose Again*, backed only by her own piano. Her *Home* on the other hand is more robust than the Raitt version.

Of the previously unrecorded songs *Falling Star* is outstanding, a heart-breaking near-equal to *Lose Again* and *Someone to Lay Down Beside Me*.

Karla Bonoff plays like a bird just learning the strength of its own wings. She is gaining confidence as she goes. Her debut is substantial. *M.T.*

Sound: B — Performance: B+

Lovin' in the Valley of the Moon: Norton Buffalo

Capitol ST-11625, stereo, \$6.98.

Norton Buffalo is a Steve Miller discovery. He is Miller's superflash harmonica player as well as opening act currently. Miller is listed as executive producer on Norton's album.

Lovin' in the Valley is a wildly diverse affair. The Stevie Wonder harmonica sound in the opening title track leads into a reggae-ish pop song. *Ghetto Hotel* is another Buffalo original, a strong piece of inner city scenario. *Hangin' Tree* is in style of a

Marty Robbins gunfighter ballad complete to Buffalo's Walter Brennen impression. *Another Day* is a sensitive personal ballad, while *Rosalie* is a jumpy celebration. The album in addition features a trio of diverse instrumentals.

Norton's music doesn't hit you squarely on the noggin as Miller does, he is more subtle. His album plays kind of slight the first time through, but there are enough hooks to keep drawing you back to it. Buffalo's music may not be complex, but as encompassing as it is he is able to keep you guessing and enough off balance to be entertaining. The recorded sound is light at the bottom, but pleasant nonetheless.

If Norton Buffalo does not yet seem a likely candidate for the superstardom his mentor has achieved, at least he has some personality of his own. *M.T.*

Sound: B Performance: B

Crawler

Epic PE 34900, stereo, \$6.98.

Once an aggressive and exciting band, with their prime mover a rock 'n' roll casualty and playing that great band in the sky, the revamped line up has nothing going for it. They sound sort of like a hard rock Average White Band, funky and repetitive but without the virtuosity and drive that the old band had.

I mean it's OK to dance to, it's better than Brass Construction or the Ohio Players—but it ain't Back Street Crawler and should not be compared to their previous incarnation. *J.T.*

Sound: C Performance: D

Luna Sea: Firefall

Atlantic SD 19101, stereo, \$7.98.

In reviewing Firefall's debut last year I predicted commercial success. With the album going gold and spawning a hit single that happened. With their mellower Eagles sound I predicted, too, that time could only strengthen the band if egos didn't get in the way. This also has come true, for **Luna Sea** is a stronger album than the first, better played and better recorded. One key factor in the growth is the addition of David Muse on keyboards and woodwinds which gives the band more dimension and kick.

The songs that Rick Roberts and Larry Burnett have come up with are also better than on the debut. With a better feel for the peculiarities of the band they allow Firefall to rock harder

Continued on page 118

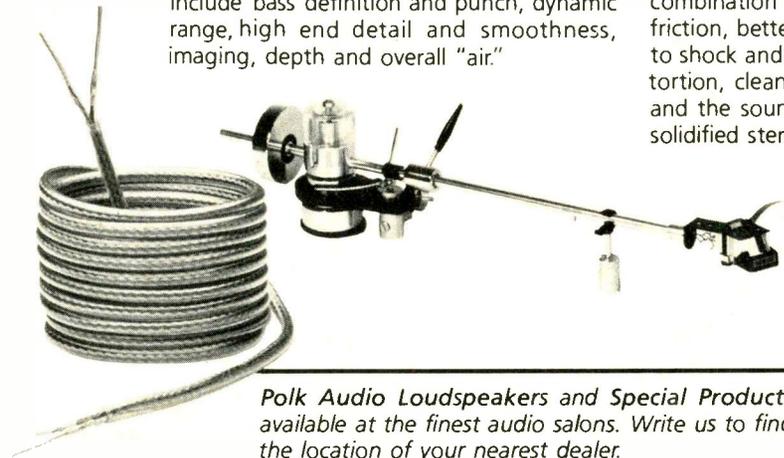
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1 Polk SoundCable High Definition Speaker Cable

Polk SoundCable is a remarkable new high definition, low distortion speaker wire which is capable of significantly improving the sonic performance of any high fidelity system. Areas which greatly benefit from the use of Polk SoundCable include bass definition and punch, dynamic range, high end detail and smoothness, imaging, depth and overall "air."



2 Mayware Formula 4 MK II Tone Arm

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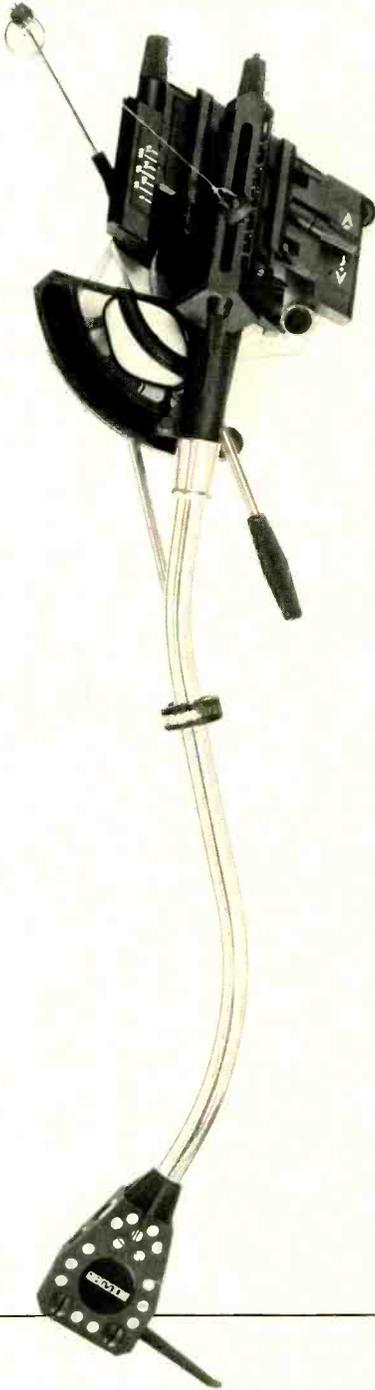
1205 South Carey Street
Baltimore, Maryland 21230

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Cassette and Cartridge Tape Decks (Cont. from page 112)

MANUFACTURER	Model	X" cassette... 8" il cartridge	Frequency response, Hz, kHz = db with best tape	Number of heads	% wow & flutter, W rms	S/N, db without Dolby	S/N, db with Dolby	Number of bias & EQ settings	Mike mixing? If yes, no inputs	Locking pause control?	Dees unit record?	Memory rewind?	Peak level indicator(s)?	Dimensions, W x D x H, inches	Net weight, lbs.	Price, \$	Notes
Radio Shack	SCT-11	X	30-15	2	0.12	60	2	2	Yes	Yes	No	No	15 1/2 x 10 1/4 x 5 1/4		229.95	Dual VU mtrs. THD less than 2% @ 1kHz, 0 VU. FM Dolby	
	SCT-15	X	30-14	2	0.15	60	3	2	Yes	Yes	No	No	15 1/4 x 10 1/4 x 5 1/2		199.95	Dual VU mtrs. THD less than 1.5% @ 1 kHz, 0 VU. Dolby	
	SCT-14	X	40-13	2	0.15	55	2	2	Yes	Yes	No	No	11 3/4 x 9 x 3 3/4		159.95	Dual VU mtrs. THD less than 2%. 0 VU. Dolby	
	SCT-10	X	40-10	2	0.16	49		2	Yes	Yes	No	No	15 x 8 3/4 x 4 1/4		99.95	Dual VU mtrs. THD less than 2%. 0 VU	
	TR-802	B	50-12	2	0.14	55			Yes	Yes	No	No	16 1/2 x 10 1/4 x 5 1/4		179.95	Dual VU. THD less than 2.5% @ 1 kHz, 0 VU. Dolby	
	TR-882	B	50-10	2	0.14	45		2	Yes	Yes	No	No	13 1/4 x 8 3/4 x 4		99.95	Dual VU. THD less than 3% @ 1 kHz, 0 VU	
	TR-80	B		2				2	No	Yes	No	No	8 x 5 1/2 x 9 3/4		99.95	W/main amp & 2 spkrs	
Technics	RS-9900US	X	25-20 ± 3	3	0.04	57	67	3	yes	yes		yes	7 3/4 x 19 x 14 3/4	33	1500.00		
	RS-686DS	X	50-16 ± 3	3	0.07	53	63	2	yes	yes		yes	3 x 9 1/2 x 8	6 1/4	599.95		
	RS-646-DS	X	50-14 ± 3	2	0.1	55	65	2	yes	yes		yes	4 1/4 x 14 1/4 x 11	12 1/2	299.95		
	RS-671AUS	X	30-17	2	0.075	52	65	2	yes	yes	yes	yes	5 3/4 x 17 1/4 x 13	22	399.95		
	RS-640US	X	30-16	2	0.08	51	64	2	yes	yes	yes	yes	5 1/4 x 17 x 12	12 3/4	349.95		
	RS-630TUS	X	30-16	2	0.09	50	63	2	yes	yes	no	yes	5 3/4 x 17 1/4 x 12 1/2	17 1/2	249.95		
	RS-625US	X	40-12	2	0.1	49	57	2	yes	yes	yes	yes	5 x 15 3/4 x 11	13 3/4	299.95		
	RS-615US	X	30-15	2	0.1	50	63	2	yes	yes	no	yes	5 1/2 x 16 1/4 x 12	13 3/4	199.95		
	RS263AUS	X	30-14	2	0.15	49	57	2	yes	yes	yes	yes	4 3/4 x 13 3/4 x 9 1/2	10 1/2	179.95		
	RS-7500US	*	25-22 ± 3	3	0.06	63		3		yes	yes	yes	yes	10 x 17 3/4 x 13 3/4	30 1/4	649.95	*Elicaset
RS-677US	X	30-17	2	0.07	52	65	2	Yes	Yes	Yes	Yes	5 1/2 x 17 1/4 x 13 1/4	26 1/2	499.95			

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THE COLUMN / continued from page 116

and more convincingly, while giving up none of their credibility on the ballads. Songs like *So Long*, *Getaway*, *Head On Home* and *Even Steven* have the brisk stride of the middle of the middle of the rock. Roberts writes their best slow stuff and *Just Remember I Love You* and *Someday Soon* are as fine as anything he's written to date. With the band's fine musicianship and creamy harmonies Firefall can at will sound like Poco, Eagles, Buffalo Springfield or any of their forebearers.

Innovators they are not nor do they pretend to be. They are master craftsmen who know what ends they want. *Luna Sea* is a well-wrought work. Some of it even sticks to the ribs. *M.T.*

Sound: A- Performance: B+

In the City, The Jam

Polydor PD1-6110, stereo, \$6.98.

Now, I consider myself a fan of all this punkrock/New Wave stuff so I feel I do have some perspective on the situation and The Jam really are second rate all the way. They do a mediocre imitation of early Who and look rather trendy, but are both predicatable and unlistenable, for the most part. Prepare yourself for the swarm of flat-sounding punk rockers who jump on the bandwagon just because they think that not being able to play your instrument well is a necessary ingredient for a New Wave band. *J.T.*

Sound D- Performance: C

Hard Rock Town: Murray McLauchlan and the Silver Tractors

True North/Island ILTN 9466, stereo, \$6.98.

With **Hard Rock Town** Murray McLauchlan is no folkie. His aim here is straight for the gut. The new album has an immediate, punchy rock sound with an aggressive attack to the music.

This is the second album Murray has cut with his band the Silver Tractors, and it is a stronger album than his first, the excellent **Boulevard**, whose main themes were loneliness and losers. **Hard Rock Town** deals with bread and butter issues. The title track, including a jolting Eugene Martynec guitar break, is a musical picture of the working class factory town pictured on the cover in night-shade blue and white. *The Man Who Sings the Blues* is for the "hard-living," rock and rollers whose main claims are out-hard-living each other. It has an Allman Brothers Band edge to the arrangement. Ironically the "dreamland" in the song reappears on

the cover as the name of the town's one movie theatre.

Immigrant is a sensitive, tender look at those who made the Big Trip, leaving everything behind in the old country, getting something a bit different than they expected in the name of assimilation. *Poor Boys* chronicles the lot of scuffling, itinerant bar bands. *Sweet Song of Asia* is a rocking slum love song with spunk, an album highlight. *Straight Outa Midnight* is a youthful rocker with the release and drive of a Springsteen at his best and a dandy airflow arrangement. *Love Comes and Goes* and *Love Can Make Ya* are a pair of rock and roll love songs more about what love is than seduction.

Hard Rock Town is Murray McLauchlan's most up-beat album ever. The band really feels its oats playing strong and hard-edged. Engineer Ken Friesen has given it all a bright rock mix, mighty in the midrange. I'd betcha they did a lot of the mixing on little car-sized speakers for maximum effect. The record sounds real good on big speakers, even better on little ones.

Murray and the Tractors were already doing about half of the album's songs in concert at least eight months ago. Thus when recording time came the songs were pretty well set and focused. Recording them must have been easy with that clear vision.

Hard Rock Town is a real sharp album. *M.T.*

Sound: A Performance: A

Sneakin' Suspicion: Dr. Feelgood
Columbia PC 34806, stereo, \$6.98.

Dr. Feelgood plays basic rock and roll, hard, driving blues rock. They've been around just long enough to predate the punk/New Wave phenomenon, but their raw music is virtually in the same energy vein. In England they have become a very popular outfit, perhaps a way paver for the punks.

Sneakin' Suspicion is not Dr. Feelgood at their best. There is a tension in the band which has been relieved only by the departure of mondo wierdo guitarist Wilko Johnson, one of Feelgood's original spirits. When #1 lead voice Lee Brilleaux sings they are capable of magic. When Wilko sings there are problems, as well as with Wilko's original material which does not have the energy of the Willy Dixon and Bo Diddley oldies the band does.

Ordinary non-production and sound do little to salvage what can best be described as a holding action. *M.T.*

Sound: C- Performance: C-



Home Sweet Home

Introducing Model 410, from BGW: a 200 watt per channel power amplifier* with performance and features that just might tempt you to turn Home Sweet Home into a full-fledged recording studio.

BGW amplifiers are the standard of the professional sound industry—you will find us in recording studios, on concert stages, in research labs, in theaters; wherever people who depend on their sound equipment to make a living demand the highest quality and reliability.

From this heritage comes the 410. Designed for the person who knows the difference between transient intermodulation distortion and rapid transit districts, the 410 will either cause you to sit-up on the edge of your easy chair, or lay back in total relaxation.

Unparalleled for a home music system, the 410 delivers extraordinarily clear, uncolored, neutral sound. There's plenty of headroom too. You'll drive virtually any loudspeaker system with power to spare, whether you listen to fine classical recordings with its wide dynamic range, or get into progressive rock and its sharp changes in transient amplitudes.

Exclusive Light Metering and Controls

Unlike conventional V.U. meters and fixed-scale indicators or ordinary amps, the 410 has a unique, ten-segment, dual channel, LED peak power display with switchable sensitivity. This feature gives you an exact peak power indication of the performance within plus or minus 1.0dB. Calibrated in both decibels and watts, the metering adjusts over a 20dB range... and not only are they accurate, their eye-pleasing curved read-out makes sense.

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CHRISTMAS BUYING GUIDE

1) The El Sound Levels speaker stands are designed to keep loudspeakers off the floor for better acoustic projection while, at the same time, enhancing the decor of the household. Constructed of mountain pine, the stands are strong enough to hold any size speaker and can be custom tilted for the best sound in any listening environment.

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2) The Fried Model Q loudspeaker system is a two-way bookshelf speaker, weighing 23 lbs. and features an eight-in. woofer and a one-in. dome tweeter in a line tunnel enclosure. With a fre-

quency response of 40 Hz to 20 kHz and the crossover at 2.5 kHz, these speakers have a walnut vinyl finish, weigh 23 lbs., measure 12x10x20 in., and are designed for use in small areas where true reproduction of the sound is of paramount importance.

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3) The Sony PS-X6 is a d.c. servo, direct-drive, single-play turntable with high torque for quick start-up and constant speed accuracy. The unit has an acoustically dead cabinet to prevent acoustic feedback from the speakers, and vibration is also lowered through use of thick rubber matting and a heavy aluminum platter. In addition, viscous filled rubber feet prevent vibration from coming up through the base of the turntable.

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4) The Toshiba PC3060 cassette deck has FM Dolby with separate bias and equalization settings for both normal and chrome cassettes. The frequency response with chrome tape is

from 40 Hz to 15 kHz. The deck features a timer for setting either recording or playing automatically and full auto stop when the tape has finished playing. The unit weighs 10½ lbs. and measures 16x12x5¼ inches.

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5) The Pioneer C-21 preamp has very low distortion and is designed for use with all better quality components. Weighing 14 lbs., this compact unit measures 16½x3¼x14 inches. The rated THD is 0.005 per cent, and the frequency response is from 10 Hz to 100 kHz.

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6) The Marantz 2500 receiver is the world's most powerful receiver with 250 watts per channel into 8 ohms with no more than 0.05 per cent THD. The amplifier section features two independent power supply sections, plus full complimentary-symmetry direct coupled output. There is also a built-in



oscilloscope for precise signal display. Also featured is an 18-dB-per-octave, 15-Hz sub-sonic Butterworth low filter. An optional plug-in Dolby FM noise reduction system to provide the best possible FM reception is optional.

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7) The Bib tape head maintenance kit is designed to reduce the loss of quality due to dirty tape heads, plus poor quality reproduction due to wow and flutter which may be caused by the capstan and/or roller becoming coated with oxide so that it becomes slippery. The kit includes all the necessary tools, including an angled mirror, needed to perform a professional job on your cassette deck.

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8) The Analog Engineering Model 515 moving-coil cartridge preamplifier has a frequency response from 10 Hz

to 30 kHz, ± 0.5 dB re RIAA, and is constructed of the highest quality components, secured in an all modular, sealed epoxy design. These units are designed for heavy use in the home system and will give long years of service when properly maintained.

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9) Revox B-77 reel-to-reel stereo tape recorder is the latest in the long line of Studer-Revox tape machines. This new high-end machine features full electronic logic control of tape motion without levers or relays, plus the nicety of 24 dB of headroom in both record and play, more than any other deck available to the audiophile. At $7\frac{1}{2}$ ips the frequency response is 30 Hz to 20 kHz, +2, -3 dB. Housed in a high-impact polypropylene portable case, the unit weighs 38 lbs.

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10) Robins stylus microscope is a miniature hand-held magnifier for examining styli for wear, dirt, and flaked off pieces of record vinyl. With this miniature scope, one can immediately see whether it is time to either clean or replace the phono cartridge stylus to prevent damage to valuable records.

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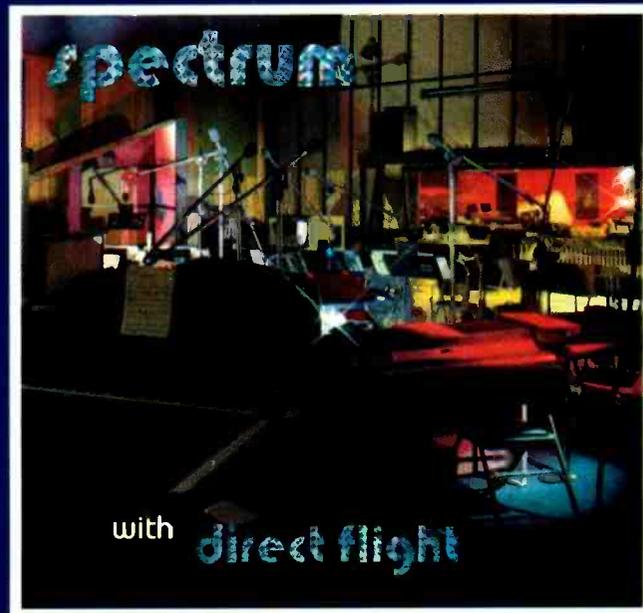
11) Bonus-Wik is a solder removing agent to clean up errors before resoldering. This replaces the older bulb method of removing old solder from joints, and is quick and easy to use. The hot soldering iron is applied to the braided metallic strip which instantly cleans away all the old solder by capillary action. This is, a real boon to the audio hobbyist.

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12) 3M cassette editing kit is for the editing and repair of cassette tapes. Incorporated into the design is a precision splicing block for holding, cutting, and joining tapes, plus a convenient



Apart from sublime musical performances, what distinguishes these records from all the others you'll buy for Christmas?



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Progressive Jazz-Rock



Buddy Spicher and Friends
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Country, Jazz, & Rock



Dixie-Direct
Catalog #DD103
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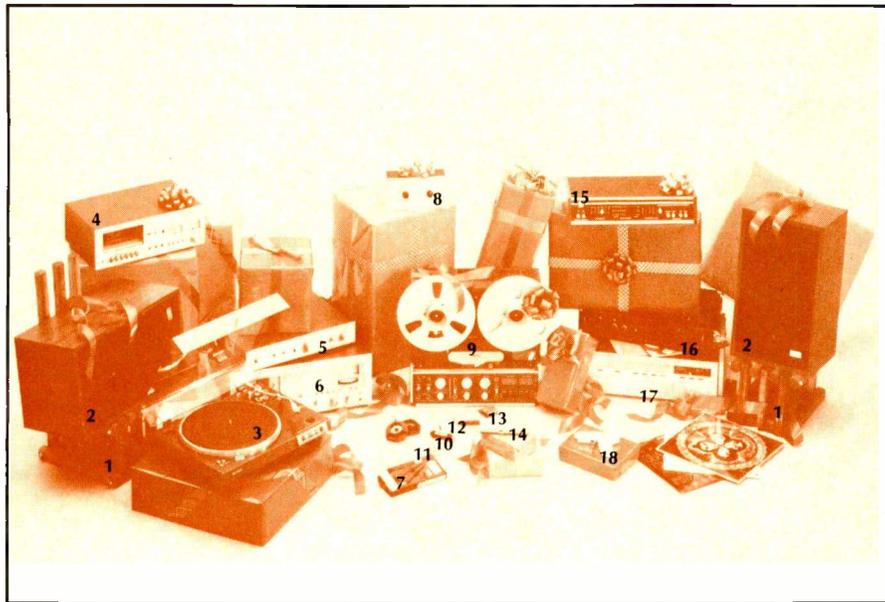


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hex-shaped spindle for manually winding the cassette tape. Also included are adhesive-tipped polyester picks for retrieving tape ends lost inside the cassette and splicing tabs for joining the tape ends.

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13) Decca record cleaner is a highly effective remover of dust and static from records. The cleaning brush, containing over 20,000 individual bristles, is designed to reach the bottom of the record groove and clean out all the dust and accumulated grit. The kit consists of a sweep arm with a brush at one end and a counterweight at the other end, a plug, lead, crocodile clip, screws, washer and nut, and a small cleaning pad for the brush.

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14) Metrosound stylus balance is for the alignment and balance of the turntable tonearm. Through use of the kit you are able to set the tracking force range and adjust the anti-skating force to within 0.25 gram. The unit permits precision adjustment of the tracking force to insure long stylus and record life.

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15) The dbx 3BX three-band dynamic range expander can expand the dynamic range up to 1.5 times to truly restore the natural dynamic range which many times is lost in the recording process. The dynamic range expander can eliminate the compression and limiting used when the original music was recorded onto either disc or tape, hence the natural dynamic range of the music is restored.

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16) The Technics SE-9060 is a 110-watt amplifier with a constant current and constant voltage power supply for minimum transient modulation distortion and transient crosstalk. Adaptable for rack mounting, the amp features a variable damping factor and fast response power meters. This basic amp has a frequency response of 20 Hz to 20 kHz and a rated THD of 0.08 per cent.

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17) The Sherwood Micro/CPU 100 tuner is a high quality unit which has been classified in tests as "... probably the world's greatest FM tuner! The 'probably' qualifier is used simply because we know that many of the test measurements we tried to make were limited by the capabilities of our test equipment." Featuring digital tuning and a memory button to recall both the station call letters and the exact location on the FM dial, the unit can store up to 48 different stations to be recalled instantly upon pushing a button.

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18) The Zerostat is an anti-static gun which de-ionizes the surface of the record to keep dust from adhering to it. The gun, looking like something from one of the "Flash Gordon" or "Buck Rogers" comic strips of the 40s, operates with a pull-and-release action. You pull the trigger slowly and then release it so that both the negative and positive static charges are neutralized. This is very effective for records and all plastic surfaces which have a tendency to retain static charges.

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ALLISON

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loudspeaker systems*



ALLISON ACOUSTICS INC.

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123

An introductory section explains why loudspeakers designed for flat response in anechoic chambers (the usual procedure) cannot be flat in a listening room, and how the design of Allison Room-Matched™ speaker systems enables them to generate flat power output in a real room.

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The rest of the catalog is devoted to descriptions of the four Allison models, a statement of Full Warranty for Five Years, and what we believe to be the most comprehensive set of mechanical, electrical, and performance specifications ever published on loudspeaker systems for consumer use.

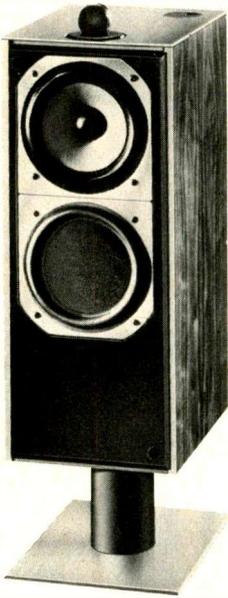
A free copy of the catalog, review reprints, and a list of Allison dealers are available on request.

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Jazz & blues



Supertrios: McCoy Tyner

Musicians: Tyner, piano; Ron Carter, bass; Tony Williams, drums; Eddie Gomez, bass; Jack De Johnette, drums.

Songs: *Wave, Blues on the Corner, I Mean You, The Greeting, Prelude to A Kiss, Moment's Notice, Hymn Song, Consensus, Four by Five, Stella by Starlight, Lush Life, Blues for Ball.*

Milestone 55003, Stereo, \$8.98.

Supertrios documents an aspect of McCoy Tyner's playing which has gone underexposed in recent years—that is Tyner's performance of standards in a trio setting. **Supertrios** affords Tyner the opportunity to play over tunes with decidedly more changes than the modal and suspended sounds which characterize the tunes his regular groups have recorded. To hear Tyner unleash his powder keg of pentatonic, fourth, and modal ideas in the context of tunes heavily laden with chord changes, is the audible realization of a musically symbiotic relationship. Tyner's high energy, multi-inspirational approach unmask certain internal aspects of standard tunes, ordinarily not laid bare. Similarly, the tunes force Tyner to take certain routes and forks in the road, exposing his playing in ways seldom heard.

Additionally, the presentation of Tyner in the company of two different bass-drum superstar combinations is an impressive change of pace. Each of these uniquely identifiable bass-drum combinations harbors such strong musical influences that the positive variables ornament and frame Tyner's

keyboard escapades in sunlit brilliance.

The first disc of this two record set features Carter and Williams. *Wave* opens up with a drum solo by Williams, quickly storming into Tyner's sea of high energy vamps of suspensions and pedal tones and finally into the meat of this Jobim bossa-nova. Energized fills and contrapuntal excursions highlight this composition, which rarely receives such dynamic treatment.

Blues on the Corner is a lively theme that jumps and pivots around inside you. Originally recorded on **The Real McCoy (Blue Note BST 84284)**, this tune has developed into a jazz standard, typically Tyner.

Coltrane composed the magical *Moment's Notice* at the last minute, during the legendary **Blue Trane** session which occurred a few years before he formed the classic quartet with Tyner. Consequently, this is Tyner's first recording of the tune and the performance is nothing less than brilliant. The Tyner-Carter-Williams chemistry ignites to spew forth a starburst of new moods.

One minor point of dissatisfaction concerning this first disc is the sound of Williams cymbals and drums. His drums have a very dead and ordinary rock sound, such as is found on a myriad of rock and jazz-rock albums including his own. This is especially disappointing in light of Williams past taste in cymbals, tuning of drums, and employment of subtleties with Miles Davis, Herbie Hancock, et. al. This is

the same brown-shoes-with-a-black-tuxedo type of playing as Billy Cobham dropped on Tyner's **Fly With The Wind** album.

Sides three and four feature Gomez and De Johnette. The first and immediate difference between this group and the one on the first disc, is the more listening type of approach taken by De Johnette and Gomez. Williams, so caught up in the role he plays with his own fusion band, that volume, power, and technique dictate more of a rock milieu to this acoustic session. De Johnette, however, sounds like the complimentary drummer, shading melodies and harmonies with rhythmic colors and implying various moods with tingling subtleties on cymbals.

Four by Five allows space for Gomez to display his amazing technical skills in a rhythmic bass solo, delicately buoyed by De Johnette's rhythmic threads. While De Johnette does not solo per se on this cut, his brilliant polyrhythms track Tyner's movement and pick up on Gomez' ideas. His uncanny ability to convert these signals into sound, while weaving in and out of his companions musical interactions, indeed show De Johnette as soloing throughout. In essence, he is a live pencil transcribing other musicians' ideas simultaneously into sound.

The tranquility of Strayhorn's *Lush Life* and the up-tempo transience of *Stella* round out a magnificent second session by Tyner. **Supertrios** is one of the most worthwhile releases of 1977. In light of the excellent recording and fine music, don't neglect to listen to this one.

Eric Henry

Sound: B

Performance: A

John Kirby, Boss of the Bass

Columbia CG 33502, mono, \$7.98.

John Kirby, **Boss of the Bass**, is another of Columbia's random reissues, and it's a good one. It's a long time since the company has had a coherent, classic jazz reissue series, so we have to be thankful for such spasmodic efforts as this two-record set. Michael Brooks, apparently the only producer who knows or cares about this kind of music at Columbia, deserves a round of applause for the intelligent editing and excellent sound transfer job.

Kirby, in many ways, was ahead of his time. In the late 30s and early 40s when big bands were the rage, the bassist led a polished, swinging little band that had a long run at NYC's Cafe Society. The Kirby Sextet featured Charlie Shavers' muted trumpet; Russell Procope's liquid, bouncy alto

sax; Buster Bailey's quicksilver clarinet; Billy Kyle's elegant piano, and Maxine Sullivan's cool vocals. Some of the echoes of the Kirby sound can be heard in the work of such 50's chamber jazz combos as the Art Van Damme and Joe Mooney groups.

The Kirby Sextet sides are collected on the second disc of the set, and the sprightly, tightly-arranged music still communicates 35 years after it was recorded. On such numbers as *Jumpin' at the Pump Room*, *Sweet Georgia Brown*, *Royal Garden Blues*, *Beethoven Riffs On*, and *Blue Petite*, the players sound as if they are enjoying them-

selves, and the ebullience is infectious and gratifying. Maxine Sullivan's petal-soft vocals on *If I Wore a Ribbon Bow* and *It Feels So Good*, fall easily on the ear.

Record One covers the Kirby years as a sideman. We hear him as a tubist on the *Chocolate Dandies' How 'M Doin'*, and then on string bass with the Fletcher Henderson, Putney Dandridge, Chick Webb, and Lucky Millinder bands; also with Teddy Wilson, and with other combos. There are superb vocals by Billie Holiday and Mildred Bailey. Bailey, one of our greatest singers, who has never gotten

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the posthumous attention accorded Lady Day, is in top form on *St. Louis Blues*. The intrinsic loveliness of her light, high voice, and the fine, rocking beat she gets on the W.C. Handy classic ought to be required listening for some of the caterwauling singing "stars" who assault our ears on TV, and on the AM and FM bands.

Record One on **John Kirby, Boss of the Bass** is really a potpourri of splendid sides including a rouser by Charlie Barnet's early big band, *Algier's Stomp*; there is outstanding solo work on each track by such talents as trumpeters Frankie Newton and Red Allen, and tenor great Coleman Hawkins. Indeed, what links these diverse cuts is that Kirby appears on each of them, and that's as good an excuse to get these excellent recordings back in circulation as any.

John Lissner

Sound: A-

Performance: A

Good Morning Blues: Count Basie & His Orchestra

MCA 2 4108, mono, \$7.98.

Count Basie 1942/Blues by Basie

Tax M 8025, mono, \$6.98.

Count Basie V Discs 1944-46

Jazz Society AA 505, mono, \$7.98.

Count Basie V Discs Vol. 2

Jazz Society AA 506, mono, \$7.98.

Sixteen Men Swinging: Count Basie Verve VE2-2517, mono, \$7.98.

The Great Concert of Count Basie Festival 231, mono, \$7.98.

I Told You So: Count Basie & His Orchestra

Pablo 2310 767, stereo, \$6.98.

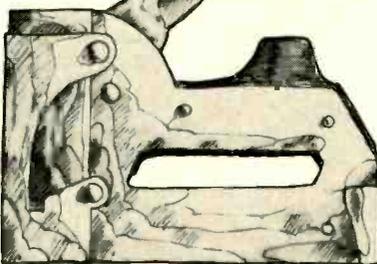
The panther-like tread of Count Basie and his rhythm section is at the core of all Basie orchestras—the loose-limbed Basie band of the late 30s, and the streamlined swing machines of later years. These recordings offer a good perspective of Basie's entire career from the raw, ebullient band that came out of Kansas City in 1936 to the polished, powerhouse units of the 50s, 60s, and 70s.

Between January of 1937 and February of 1939 Basie cut 57 sides for Decca; 24 of them were reissued by Decca a dozen years ago, and that album, **The Best of Basie**, has been kept in circulation by MCA which has inherited the Decca catalog. Now MCA has issued 32 more Decca Basie sides in **Good Morning Blues**, and this double set together with **The Best of Basie**, adds up to an historical document of the greatest of all swing bands.

Good Morning Blues brings unalloyed pleasure. You can't help jumping to the Basie beat on numbers like *Exactly Like You*, *Do You Wanna*

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Jump Children, and *Stop Beatin Around the Mulberry Bush* in which single riff figures are tossed back and forth by free-phrasing brass and saxes. Superb solos abound—brilliant, flowing contributions by tenor men Lester Young and Herschel Evans, and the extroverted trumpeter Buck Clayton. The majestic Jimmie Rushing is heard shouting his expressive blues as the band reaches a wailing peak of swing. An added plus in this MCA doublet are the 10 piano/rhythm section pieces focusing on a more loquacious Basie. On these early sides Basie plays a lot more notes than one is accustomed to hearing. On numbers like *The Fives*, and *Boogie Woogie*, you hear lots of romping, striding left hand and walking bass; then there is the magnificent *How Long Blues*, taken at an easy, strolling tempo that shows the Basie piano at its most relaxed.

The MCA collection demonstrates what can be done when a major record company puts out a definitive reissue. MCA has authoritatively covered the Basie band of the late 30s, and Columbia could fill in more gaps by doing the same with Basie's early-to-mid-40s middle swing period. But until Columbia rouses itself, one must be content with such unauthorized offerings as the Tax collection of "bootlegged" Columbia 78s from 1942, and the two Jazz Society albums focusing on the 1944-46 V Discs. The Tax album suffers from indifferent sound because of the quality of the wartime Columbia shellac 78s which have been used for dubbing. Even with some sonic deficiency, the Tax release is welcome. 1942 was an interesting year for Basie; the great tenor sax team of Young and Evans had been replaced by the talented Don Byas and Buddy Tate. Byas and trumpeter Buck Clayton are featured with Basie and his All American Rhythm Section (Freddie Green, guitar; Jo Jones; drums, and Walter Page bass) on four superb blues; Rushing also wails his famous *Harvard Blues*, and the big band shows its ensemble poise on *Its Sand Man* and *Ain't It The Truth*. There are a couple of dated "war effort" numbers like *For The Good of Your Country* and *Blackout Blues*, and Earl Warren has a saccharine vocal on *Time on My Hands*.

By 1944 when Basie began to cut V Discs (much of this material was later recorded for Columbia), the band had grown in size; it was now carrying eight brass and five saxes, and the increased instrumentation had led to a heavier sound. The band still swings mightily; the harmonies are weightier and the ensemble punch sleeker on numbers like *Taps Miller*, *Basie Strides Again*,

and *GI Stomp*. The Jazz Society V Disc albums are invaluable because they fill a gap for collectors, between 1943 and 1945 Basie was prevented from making commercial recordings due to the American Federation of Musicians ban.

By 1947, the post war big band decline had caught up with the Count. The prevailing trend in jazz was to small combos, and in 1949 Basie disbanded and took a fling with an octet. In 1952 he returned with a splendid band that shook jazz out of its "cool" lethargy. This steamroller is

heard on Verve's **Sixteen Men Swinging**. It is primarily an ensemble band with a sound and style that sets the standards for Basie's contemporary ensembles. The competent but rarely inspired soloists tend to take a back seat to such talented arrangers as Ernie Wilkins, Neil Hefti, Thad Jones, and Quincy Jones.

Verve's splendidly recorded **Sixteen Men Swinging** offers little of the individualism found in Basie's 30s music. The 50s band is, of course, powerful and precise with numbers like *Cherry Point* and *Two For The Blues* offering

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crisp dynamics and layered riffs that extend and preserve the classic big band feeling. In an age when rock and roll was emerging, this Basie band could still produce graceful, mid-tempoed dance music, along with big brassy sounds that maintained a continuity with the big band era.

Some jazz fans complained about Basie's big band machines as they swung powerfully into the 60s and on into the 70s. The tigerish ensembles that Basie and his contemporary band can unleash are heard on Festival's **Great Concert of Count Basie**. Festival,

a French label, has preserved someone's taping of a 1966 London concert; the sound, while not ultra-professional, is adequate, and the recording preserves much of the excitement the Basie band generates in person. On numbers like *Whirly Bird*, *Jumpin at the Woodside*, and *All of Me*, the sections crackle and pop, and soloists like Eddie "Lockjaw" Davis perform with distinction.

Pablo's **I Told You So** is a good example of the ultra-formalized approach the present day Basie band often takes in a recording studio. There

is a certain complacency in the playing. Although the Bill Holman arrangements and compositions offer interesting melodies and provocative voicings, and though the band responds with drive and impeccable precision, you get the feeling that they might be a bit bored. The Pablo selections are well recorded by engineer Bob Simpson in RCA's studios.

John Lissner

Good Morning Blues

Sound: A - Performance: A +

Count Basie 1942/Blues by Basie

Sound: C Performance: A

Count Basie V Discs 1944-46

Sound: B + Performance: A

Count Basie V Discs Vol. 2

Sound: B Performance: A +

Sixteen Men Swinging

Sound: A Performance: A

The Great Concert of Count Basie

Sound: B Performance: A

I Told You So

Sound: A + Performance: A -

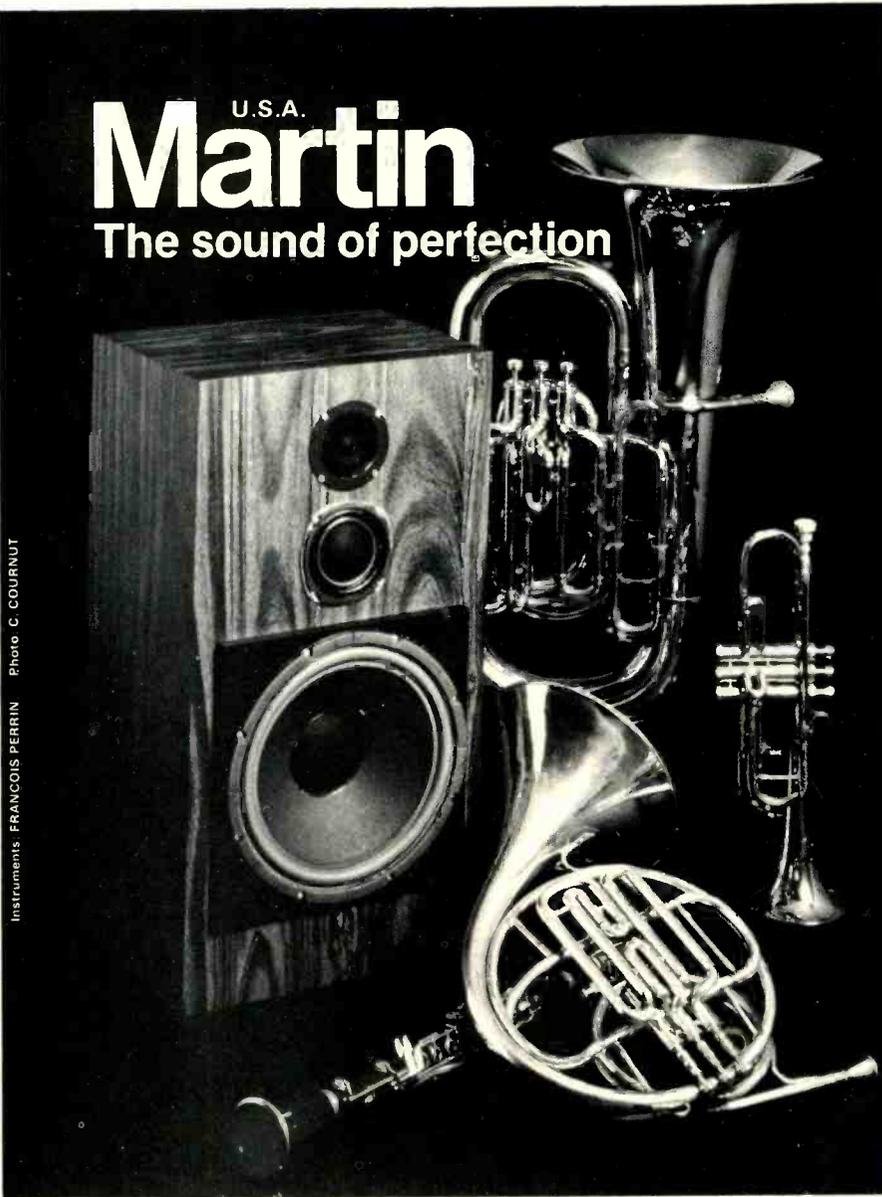
Black Snake: John Lee Hooker

Fantasy F-24722, stereo, two records, \$7.98.

Black Snake is a reissue of **The Folk Blues of John Lee Hooker** and **That's My Story**, recorded in 1959 and 1960 respectively for Riverside (and both later reissued on the Battle label). The reference to "folk blues" was intended to indicate that, unlike the vast majority of his recordings, these discs feature Hooker on acoustic guitar.

I confess I had my doubts about acoustic Hooker, because Hooker's voice and the electric guitar always seemed made for each other. His dark, bass-heavy, reverberating guitar extemporizations perfectly complement the deep, somber hues of his expressive, conversational-moan singing. Moreover, the electric guitar is, apparently, not only the most suitable vehicle to carry his patented boogie-shuffle rhythm, but a more responsive means for punctuating his free-rhythmed, asymmetric vocal lines, and a more impassioned backdrop for his ultra-slow recitatives (such as *Behind the Plow*, *Gonna Use My Rod*, or *That's My Story* on these two records).

Any fears about the acoustic guitar's compatibility with the unique Hooker style are immediately dispelled by the opening notes of the first track. His guitar accompaniments throughout are rarely less than imaginative, always fitting, and often subtly brilliant. Note for example, the extended tremolos of



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I'm Prison Bound, or the triple-strum figure that assumes the "response" role in the call-and-response work song *Water Boy*. Its surprising how easily Hooker's loping boogie beat adapts to acoustic guitar, as illustrated on *Wobblin' Baby* and *No More Doggin'*. As always his constructions are entirely without parallel, possessing that special brand of John Lee Hooker anti-logic that would spell disaster for a lesser artist, but which sounds perfectly natural in Hooker's hands. Who else could get away with the formlessness of *She's Long, She's Tall, She Weeps Like Willow Tree*, or *Democrat Man*, to name just two of many examples?

If anything, the acoustic guitar seems to have relaxed Hooker, allowing him to open up, to communicate his seemingly boundless torment with less naked determination. His singing is softer than usual, but no less emotionally gripping.

Part of the idea behind the **Folk Blues** album (sides one and two of this set) was to reconstruct Hooker's Mississippi roots. His adaptations of such Delta standards as *Pea Vine Special* and *Bundle Up and Go*, as well as such other pre-war blues classics as the title tune, *Good Mornin' Lil' School Girl* and *One of These Days*, retain

enough of the old ways to show how deep into the Mississippi earth Hooker's roots extend. Nevertheless, his versions are so personalized that the results are as much pure John Lee Hooker as any of his original compositions.

Sides one and two are solo performances, but on sides three and four he is joined by an unlikely pair of jazz musicians, Sam Jones on bass and drummer Louis Hayes. Hooker rarely mixes well with rhythm sections; they either inhibit his tendency toward free-form structures and fanciful guitar extensions, or else he completely ignores them, resulting in a sloppy mess. Hayes and Jones neither inhibit him nor contribute much, but at least they stay out of his way (with the noteworthy exception of *I Believe I'll Go Back Home*).

The recording focuses on Hooker's voice, which on the first two sides is closer, more intimate than on virtually any of his vast LP catalog. The guitar has a crisp, natural tone, while the bass and drums can be plainly heard without overpowering the quiet guitar. Side one is considerably lower in volume than the other three sides. Surfaces are, fortunately, virtually silent.

Tom Bingham

Sound: B+

Performance: A-

Music for Xaba: Dyani, Temiz, and Feza

Antilles AN 7035, stereo, \$4.98.

Dyani, Temiz, and Feza are global musicians who have brought their unique heritages to bear on contemporary jazz. Bassist Johnny Dyani and trumpeter Mongezi Feza are Xhosa tribesmen of South Africa who have chosen jazz as the mode for expressing their roots. Dyani has played with pianist Dollar Brand and Don Cherry. Feza, until his untimely end in December, 1975, was a focal point of the British avant-garde scene playing in Chris McGregor's Brotherhood of Breath and with rock mutant Robert Wyatt. Okay Temiz, who played alongside Dyani with Don Cherry, brings a singular approach of melody and color to the drums.

Music for Xaba celebrates these roots in a vibrant and rhythmic album. Not surprisingly it is very similar to the Don Cherry trio featuring Temiz and Dyani. The album opens with a piece called *Idyongwana*. It's a bright rhythmic melody with everyone playing percussion, singing, and chanting. On *Feelings* they return to their regular instruments. It's propelled by the muscular bass of Dyani and Temiz' bouncing percussives. Feza launches into a solo that recalls the staccato

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runs of Cherry. He gives way to Dyani's throbbing bass over the sparse accompaniment of bells, then Feza returns for another breakneck squeal. Temiz concludes the tune with a lyrical drum solo.

Traditional South African Songs is sung by Dyani who also plays a Dollar Brand style piano with sparse linear chording. Feza underscores Dyani's hearty vocal with a sense of urgency. *Corans Soder* is the only straight jazz vamp with an infectious opening chorus and Feza's jaunty trumpet.

The performance is marred only by a hollow tone which surrounds the recording and the tendency for Mongezi to wander away from the mike during his most climactic moments. But then the whole approach to the recording is the simple, almost naive excitement of musicians who play eloquently from the gut.

John Diliberto

Sound: C Performance: B

Time Zones: Richard Teitelbaum
Arista/Freedom AL1037, stereo, \$6.98.

Richard Teitelbaum is a refugee from academic electronic music. While he is influenced by Subotnick, Cage, and Stockhausen, he prefers to be associated with the avant-garde jazz world. He has performed with Karl

Berger, Dave Holland, Anthony Braxton and formed the live electronic music group, *Musica Electronica Viva*, with Alvin Curran and Frederic Rzewski.

For his most recent recording, *Time Zones*, he has employed saxophonist and composer Anthony Braxton with whom he's recorded before. *Crossings*, recorded live, is an exploratory piece ranging from the contemplative to the chaotic. At times Braxton's alto is unusually sweet, recalling his professed debt to Paul Desmond. Here Teitelbaum blends with Braxton's reed, creating plaintive willowy lines that are sometimes indiscernible from Braxton's own. Then there are the segments where Braxton spews out his convoluted scales and flurries. Teitelbaum counters him with anguished swirls and scribbles. The growls created by the contrabass clarinet are offset by low density rumbles and wave-like roars.

On *Behemoth Dreams*, Teitelbaum's space probe scan encounters the grumbling of the contrabass which is used throughout the piece. Braxton plays with his greatest dexterity here, often raising this eccentric instrument above the level of a joke. At one point he imitates the staccato of a sequencer while at others he merges with Teitelbaum's flutters.

Time Zones lends further credence to the use of synthesizers as flexible instruments capable of expressing the feeling of the moment. The crystal clear recording of both the live and studio sides emphasize the sonic relationships between the instruments and allows the listener to get into the actual performance and the empathy between these two musicians.

John Diliberto

Sound: B+ Performance: A

Heavy Timbre—Chicago Boogie Piano
The Sirens 102, stereo, \$6.98.

Heavy Timbre is an attempt to recapture the aura of the old-time "house rent parties," with blues, boogies, and stomps by five of Chicago's best singer-pianists. Indeed, "Chicago Blues Piano" might be a more accurate subtitle, since—depending on how strictly you define it—boogie is an important component of the album, but by no means the only one.

Blind John Davis, most famous for his tasty accompaniments on dozens of pre-war 78's by Sonny Boy Williamson, Lonnie Johnson, Big Bill Broonzy, and others, has enjoyed great success in Europe in the past few years. His

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Davis Boogie is high-flying boogie, with a monstrously deep, galloping bass line under dense, subtly syncopated chordal spurts. His singing on the slow lowdown *A Little Every Day* is as relaxed-yet-melancholy as the piano fills which effectively connect the vocal phrases; his alternating bass-to-treble melodies on the extended instrumental break are beautifully linked with fresh, inventive ideas. Davis also manages to come up with an original interpretation of Ivory Joe Hunter's over-familiar *I Almost Lost My Mind*.

Following Davis is Albert "Sunnyland Slim" Luandrew, an inconsistent performer who can rank with the all-time greats when everything falls into place, as it does here. *She's Got a Thing Goin' On* is a midtempo boogie, with playful right-hand chords over a timeless, highly effective bass vamp. The instrumental *Canadian Walk* is a fine example of a walking bass in support of effortless, deceptively off-hand riffs. The two-fisted Slim spaces thick chords to excellent advantage on the slow-drag *Gotta See My Lawyer*.

The only artist here who was ever a "star," however briefly, is the shamefully under-regarded Willie Mabon. Mabon has one of those curious voices that's easier to recognize

than to describe—deep, soft, and rough, but not really all *that* deep, soft, or rough. Though known primarily as a singer backed by r&b bands, his cohesive orchestral-style piano rolls along jauntily on *I Don't Know* (the song that catapulted him to short-lived fame almost a quarter-century ago) and *World of Trouble*, while he gets into some jazz-tinged variations on *Seventh Son* (a song that's been done to death, though this version—closely patterned on his own 1955 original—restores much of its credibility).

Jimmy Walker is equally at home on slow dirges and rapid boogies but on the midtempo shuffle, *Four O'Clock Blues*, he relies so heavily on his changing bass pattern that there's too little of real interest coming from the right hand. The bright-colored splashes enriching his down-cast vocal on *I Just Want To Hold On* are a better sample of Walker's capabilities.

Erwin Helfer, the album's only non-vocalist, uses the blues format and its conventions as a starting point for highly personal harmonic and mood explorations. He has the lightest rhythmic feel of the five pianists heard here, though he balances it with an airily chiming upper register, as the uptempo boogie, *The Fives*, and the introspective *Improvizations* demon-

strate. The album closes with a piano-organ duet, with bittersweet Helfer piano marred by Sunnyland Slim's singularly unattractive (at least to my ears) organ tone.

The recording is excellent, with a natural warmth to the singing and a full-bodied piano sound convincingly mixed. The noisy pressing is disturbing, however.

Available from The Sirens Records, 616 North Rush Street, Chicago, IL 60611.

Tom Bingham

Sound: B Performance: B to A

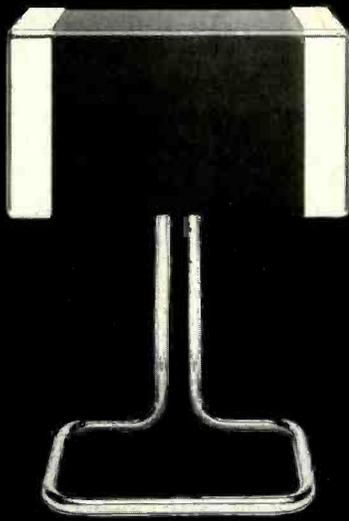
O Glory: Rev. Gary Davis
Adelphi AD 1008, stereo, \$6.98.

This recording of the late blues immortal Rev. Gary Davis may be the only modern multitrack recording of the man. He handpicked Larry Johnson to add some harp, let his wife, Sister Annie Davis, and the Apostolic Family, which is John Townley who recorded the album, and some friends add voices.

Davis is in top form, and that means the album has to be a delight. It was issued in 1973 and I've only now discovered its existence, and I had to share it with you.

Michael Tearson

Sound: A Performance: A



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Classical reviews

Edward Tatnall Canby



"Jesu, Joy of Man's Desiring." A Baroque Concert by Leopold Stokowski & His Orchestra. Vanguard Everyman SRV 363 SD, stereo, \$3.98.

Well, the old man's gone at last. Not many months more and he could have celebrated no less than seventy five years of orchestral conducting. The end of an era.

This reissue (put out before his death) is as good as any memorial in its zany way, if you will remember that in many recordings, even recently, Stokowski was a model of conductorial purity. This is his more famous other side, in modern dress only a few years ago. Shades of many an earlier band playing under the famous heading, "& His Orchestra." Stoky must have been about the first to use a trade mark name for any old group that happened to be hired, anonymously, for a recording session, this during his days as an at-loose free lance celebrity but before he was old enough to be a monument.

The group here is a high-level assemblage, New York based by the sound of it, all soloists of name, and it sounds the way such groups usually do—not much blend and an awful lot of individual energy. Canny old bird, here he updated his Baroque in the latest fashion, with a genuine harpsichord (Igor Kipnis) and a stylishly small group of strings—no doubt conveniently inexpensive as well. Far removed from the vast lush orchestras of the early Bach-Stokowski and

Vivaldi-Stokowski. But do not think that "authentic" means merely the right instruments. Ten seconds of this update and we are right back in the Thirties, the old Stokowski musical heaven in which we oldsters grew up. Igor Kipnis does his best to improvise musicologically proper cadenzas and the like—but Stoky marches on exactly as before; huge ritards, great Baroque signs of passion, a Hollywood solemnity à la *Fantasia!* Harpsichord or no, this is the old Stokowski schmalz, and all the same old familiar "Baroque" pieces, too, the Bachs and Vivaldis and Corellis we always heard. You don't teach an old conductorial horse new tricks, especially a clever horse like this one. I loved every moment of it. And I could almost see Igor Kipnis' face, over there at the musicological harpsichord. Well, a job's a job, especially with Stokowski . . . It'll be a long time before we forget *this* side of Stokowski.

20th National Convention of the Organ Historical Society, June 1975.
Organ Historical Soc., P. O. Box 209, Wilmington, Ohio 45177

It's worth noting that this special sort of LP recording comes along every so often—the custom job, done for an organization and available only through the same. The record label normally carries the custom maker's name, not the org (in this case Stith of Ithaca, New York) and there is seldom

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a positive identification number. These are "live" performances at the convention, on a number of organs which seem to be located in New Haven, Conn. though no direct info on this is given. Perfectly adequate modern recording—but the abrupt changes from one milieu to another, and likewise with composers and performers, makes listening arduous for all but organ specialists. Much of the sound is on the dead side, the fault of the churches, not the recording people. Music is listed by performer, organ, and last of all composer. A yearly series.

Chamber Music of Anthony Iannaccone. (Rituals, Bicinia, Sonata, Partita). Assorted instruments.

Coronet LPS 3038, stereo, \$7.98

Though the title is maybe forbidding, the music on this disc is interesting and varied for sonically contrasted combinations of a few instruments—flute and alto sax, violin and piano, piano alone, trumpet, and tuba. It all has a pleasantly academic and very economical sound, nothing pompous or too long, and makes for good phono listening. Mr. Iannaccone directs a Collegium Musicum at Eastern Michigan University, which means he indulges in old music on ancient instruments—perhaps this is where he finds the spareness and brevity that make his own works easy listening.

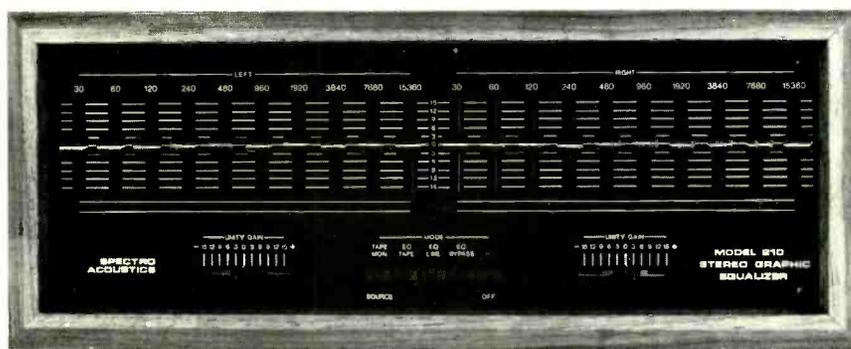
Anton Rubinstein: The Four Violin Sonatas. Robert Murray, vl., Daniel Graham, pf. **Musical Heritage MHS 3385/86,** 2 discs, stereo. (Mail order only: 1991 B'way NYC 10023)

Musical Heritage Society continues year after year to build its huge mail order catalogue with more budget recordings, still packaged in budget black and white—against the times, but more power to them. Some people continue to want good music at prices less than "affordable (which means too expensive). The mail order deal keeps alive, I suspect, not only because of careful economics but more vitally thanks to intelligent musical policy, the music itself and the performances, recognizing that though the big-company star system may sell (not very will these days!) it does *not* reflect the whole of the record buying market. Far from it. Enterprising, out-of-the-way music well presented to the ear will always find a market in this country.

Anton Rubinstein was the more famous of two Russian brothers, a superb pianist and fluent composer trained, however, in strictly West Euro-

pean terms. The Rubinsteins' association with Tchaikowsky helped brand that composer at home as non-nationalist—certainly not the truth. But Anton Rubinstein's music is indeed as non-Russian as you can imagine, the whole sound redolent of the German Romantic school with only a faint flicker of French coloration now and then. He might just as well have come from Hamburg with Brahms, or Dusseldorf with Schumann, and in fact lived extensively in the West. Even toured America.

These Sonatas are really lovely. If not absolutely top Romantic, then only a peg or two below. How we do neglect such good things! Though they are probably the best out of a much too vast mass of his composition. The early Sonatas here are heavily Mendelssohnian but of a later, more lush expression as of the 1860s. The late *Fourth Sonatas, Op. 98,* is far closer to Brahms, a more weighty and passionate style. Two young American artists do an excellent and serious interpretative job, Robert Murray's



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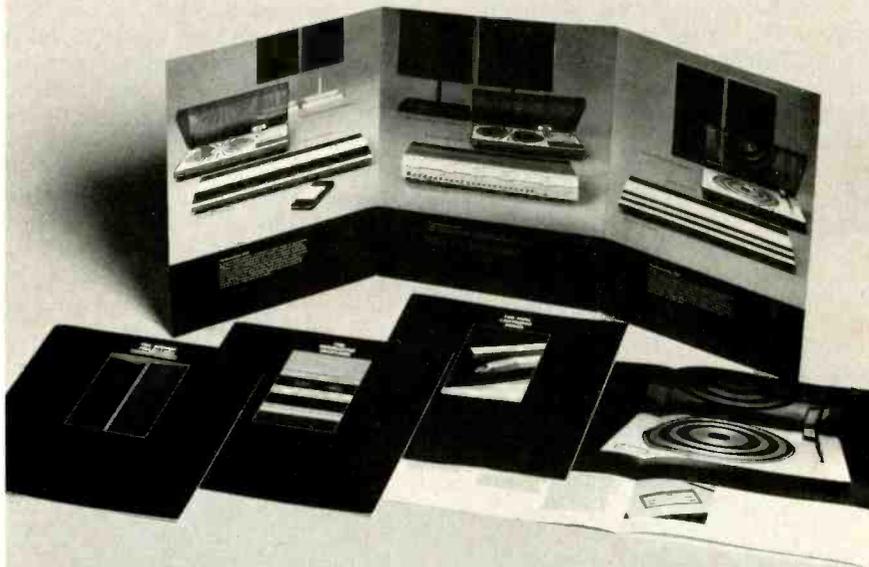
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violin (Guarneri) rather small in tone and a bit blurred in detail but highly musical, and Daniel Graham's piano full of energy, reflecting Rubinstein's own masterful pianism.

Curious piano sound, rather non-resonant and thin in the bass; is this a (properly) oldish piano? The recording is good for the violin but puts the piano somewhat in the background, not ideal for such an energetic element in the partnership. It often happens—aren't these, after all, listed as "Violin Sonatas"? Better to call them Sonatas for Piano and Violin, to reflect the proper sonic priorities for the benefit of our engineers.

A Christmas Yet to Come. Joseph Byrd (synthesizer).

Takoma C-1045, stereo, \$6.98.

Lucky there's another Christmas, or I wouldn't have discovered this little charmer, out of season. It's a sort of synthesizer game with a brace of Christmas pieces, all times and types, sounding like an animated music box and not only beautifully synthesized for tonal variety and impact but also largely composed—when he isn't quoting Bach or Praetorius or Mendelssohn—by Joseph Byrd.

The man is an overflowing genius of the miniature, one of those who is so full of quaint little musical ideas he just has to do something about them. Leroy Anderson wrote typewriter tunes for the Boston Pops. Peter Schickele invented P.D.Q. Bach and writes superb old-fashioned music for P.D.Q.'s antics. Cole Porter wrote *Begin the Beguine* ... so Joseph Byrd does synthesizer tidbits. The best thing about them is their humorous and very urbane sense of style and musical history. For instance, his *Lo How a Rose*, quoting Praetorius of the 17th century, is a perfect recorder ensemble, synthesizer-suggested, while a late Medieval Spanish Christmas piece sounds exactly like one of those Collegium Musicum playing ancient instruments. You also hear wonderful evocations of a brace of weighty trombones (up in a tower, as they used to play carols), a squealy Baroque organ, even a hillbilly squeeze box. Such a synthesizer-imagination, and all in such tiny little pieces, over before they begin! I was fascinated.

Byrd's only longer items are in the form of a sort of carillon-like variation on a few notes of a tune, as for instance *Hark the Herald Angels*, but one item, my favorite, turns sedate old *Silent Night* into a whirling waltz with a country-music swirl. Unexpected and delightful.

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Folk bag

Tom Bingham



Midnight Son: Son Seals
Alligator AL 4708, stereo, \$6.98.

With **Midnight Son**, Son Seals enters the top echelon of modern bluesmen. In the three years since his earthy, barroom-funky debut album, **The Son Seals Blues Band**, he has matured into a seasoned professional without sacrificing the galvanic urgency of his singing, or toning down the corrosive bite of his guitar.

Indeed, it appears that the three years spent on the road between albums has taught him much about pacing and dynamics. His voice has taken on a darker timbre, while his insistent emotionalism has been tempered with an increased sensibility. His singing is rooted in time-honored blues basics by a gruff chesty growl, yet he's free to take liberties like a patriarchal gospel singer. Note for example the grunts and chuckles of *No, No Baby* and the vocal catches and mood-toying of *Don't Fool With My Baby*. On the tough *I Believe*, Seals cuts through the strong three-horn arrangement with an angered determination that matches his spitefully mocking guitar break. Yet on Junior Parker's *Telephone Angel*, he sounds almost matter-of-fact, with

only his recognizable vocal quaver betraying his true emotion.

His guitar work, with its origins in the acidic single-note style of his former employer, Albert King, has likewise developed its own searingly passionate identity. He sparks his solos with fleshy chords (*Four Full Seasons of Love* is the best example), building them to a teeth-gritting, screamingly intense peak (as in the opening solo of *Telephone Angel*, or his engrossing expansions on the gospel-mournful *Going Back Home*). The contemporary stomp, *On My Knees*, has an especially inventive solo, as he dallies with a simple rhythmic phrase, which he approaches from a variety of angles.

His backup band is much more adept and accessible than that of the first album. Bass player Snapper Mitchum carries the soul-blues *No, No Baby* with an infectious bump-along bottom, and effectively pumps *Don't Fool With My Baby*, the album's hardest rocker. Drummer Bert Robinson drives the horns forcefully, whether he's hopping onto the persuasive *Four Full Seasons of Love* or insuring that the slow, seven-minute *Going Back Home* never drags. Alberto

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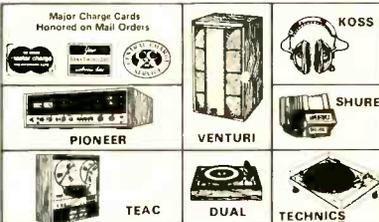
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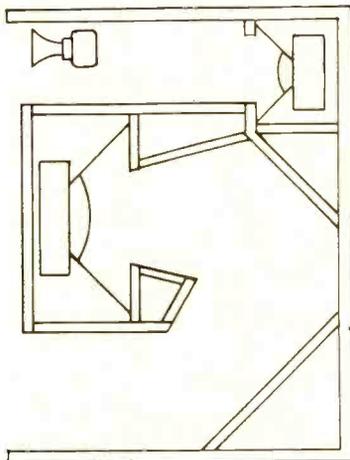
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Gianquinto has a playful electric piano solo on *On My Knees* and fills in the textures on a variety of keyboards elsewhere. The horns (three of them, though they often sound more like six) add much to the album's excitement, as they blow wailing r&b riffs on tracks like *Don't Bother Me* and *Strung Out Woman* (which recounts a troubled love affair with an addict).

The recording successfully communicates the forceful power of the horns, the chugging sock of the rhythm section, the sharp-toned distortion of Seals' lead guitar, and the keen fervor of the singing. Steve Plair's deft second guitar parts are not obscured as on so many Chicago blues records. Only Gianquinto's keyboards lack the required definition.

Alligator Records, Box 11741, Chicago, Ill. 60611. *Tom Bingham*

Sound: B+ Performance: A

1st Annual Brandywine Mountain Music Convention Heritage VI, mono, \$4.50.

This live album is devoted to the "Galax Sound," that highly touted subclass of traditional Appalachian music centered around the Blue Ridge Mountain community of Galax, Virginia, and extending below the border into North Carolina.

The Galax region has long been a fertile breeding ground for string-band musicians. Archaic tunes and instrumental methods have been passed down through several generations, the older musicians of the area having faithfully preserved styles and approaches unique to the region. In particular, Galax musicians have an uncannily ingrained sense of hard-driving rhythm that virtually renders accompaniment superfluous, though backing is often used to optimum effect.

Nowhere is the innately energetic vitality of the Galax Sound more apparent than in the performances of Kyle Creed and Fred Cockerham in this collection. Listen to the way they leap into *Step Back Cindy*, with Cockerham's thin-toned, scratchy, yet thickly textured fiddle perfectly matching Creed's mellifluous banjo ripples, with a steady guitar backdrop by Bobby Patterson. Their *John Brown's Dream* is a gem, with vehement, impassioned twin fiddling.

Cockerham is also heard on three solo pieces. His fretless banjo on the archaic *Little Satchel* and *Let Me Fall* combines elemental melody picking with a strong, intricate accompanying pattern. *Deford Blues* is an eerie, quick-paced blues on a pizzicato fid-

dle that sounds more like a crazed mandolin!

Another eminent Galax artist, Kilby Snow, sings an interesting variant (*Wind and Rain*) of the same traditional ballad which served as the model for Bob Dylan's *Percy's Song*. He adroitly accompanies himself on autoharp, differentiating the harmonic and rhythmic aspects of his strumming more distinctly than do most practitioners of that much-maligned instrument. Equally impressive is Raymond Melton's translation of the famous fiddle tune *Flop Eared Mule* to the mountain dulcimer, negotiated with admirable speed, precision, and clarity.

Also included are several artists from outside the immediate Galax area. Ola Belle Reed, a North Carolinian, long a resident of Pennsylvania, demonstrates her personal banjo style, combining brittle two-finger picking with an ostinato strumming effect. The Strande Creek singers recall the 1930s, when the old-time stringband styles were beginning to mutate into bluegrass; while the Highwoods String Band plays *Carroll County Blues* in a jumping, hot-ragtime manner reminiscent of the Georgia bands of the late 20s (Lowe Stokes comes to mind). *Bill Cheatum*, by Ted Lundy (a Galax-born banjoist transplanted to Delaware) and the Southern Mountain Boys, is in a more fluent, contemporary vein, featuring Ted's cousin, Jerry Lundy, on fiddle with deft bluegrass backing.

Available from Heritage Records, Rt. 3, Box 278, Galax, VA 24333.

Sound: C+ Performance: A - to A

The Essential Richard Dyer-Bennett Vanguard VSD 95/96, stereo, two records, \$7.98.

Richard Dyer-Bennett is a holdover from the era when it was deemed necessary to dress up rural folk material in artsy "concert" arrangements, sung by a trained urban singer in a "sophisticated" manner.

Along with John Jacob Niles, Dyer-Bennett was a major exponent of concert-folk's "troubadour" division, as opposed to the roughly contemporaneous Paul Robeson-style "concert spiritual." This reissue of recordings made between 1955 and 1965 for the Dyer-Bennett label serves as an effective summation of the English-born singer-guitarist's career, with a repertoire spanning several centuries and a variety of British, American, and Irish song-types.

Dyer-Bennett sings in a clear, stylized, yet somewhat slight tenor. He takes pains to enunciate each syllable (indeed, every consonant, as in "t-ree")

for "tree," "bir-d" for "bird," or pronouncing both "t"s in "ofttimes") with such exactitude that when he lapses into the vernacular (such as the occasional "ain't" or "durn," or a highly self-conscious "damn it") the result is often unintentionally humorous. It is this sort of affectation, so different in concept from the modern-day casual-folk aesthetic that gives the album an unfortunate dated character.

Dyer-Bennett's solo classical-guitar accompaniments are finely integrated with his vocals (note the pseudo pipe-band background to *The Bonnie Earl of Morey* and the quasi-military-drums of *The Soldier and the Lady*), and are played in a distinctive, personal style that's somewhat more intricate than it seems at first. Hear *The Lonesome Valley*, *The Drunken Sailor*, and *Phyllis and her Mother* for examples.

Now that traditional performance values have become more familiar thanks to increased exposure, it's all too easy to poke fun at this exaggerated pronunciation or that mincing bit of frolic, this rolled "r" or that "fiddle-I-day." Nevertheless, **The Essential Richard Dyer-Bennett** is a very pleasant anthology, particularly if taken in small doses (say, a song at a time). I have little doubt that there are many people who still prefer concert-folk to the more "authentic" traditional, ethnic, or contemporary varieties. To them, this set will be a god-send.

Though labeled "stereo," the great majority of the tracks sound like mono to me, though of a high calibre. As Dyer-Bennett himself points out in the liner notes, the sound varies according to the time and place of recording. In any event, one thing an intimate solo performer doesn't really require is big, booming sonics. The sound here is clean, distinct, and entirely appropriate, though a very few tracks have a bit of echo on the voice. Surfaces are thankfully quiet.

Tom Bingham

Sound: B Performance: A-

Gabby Pahinui Hawaiian Band, Vol. 1
Warner Brothers BS 3023, stereo, \$6.98.

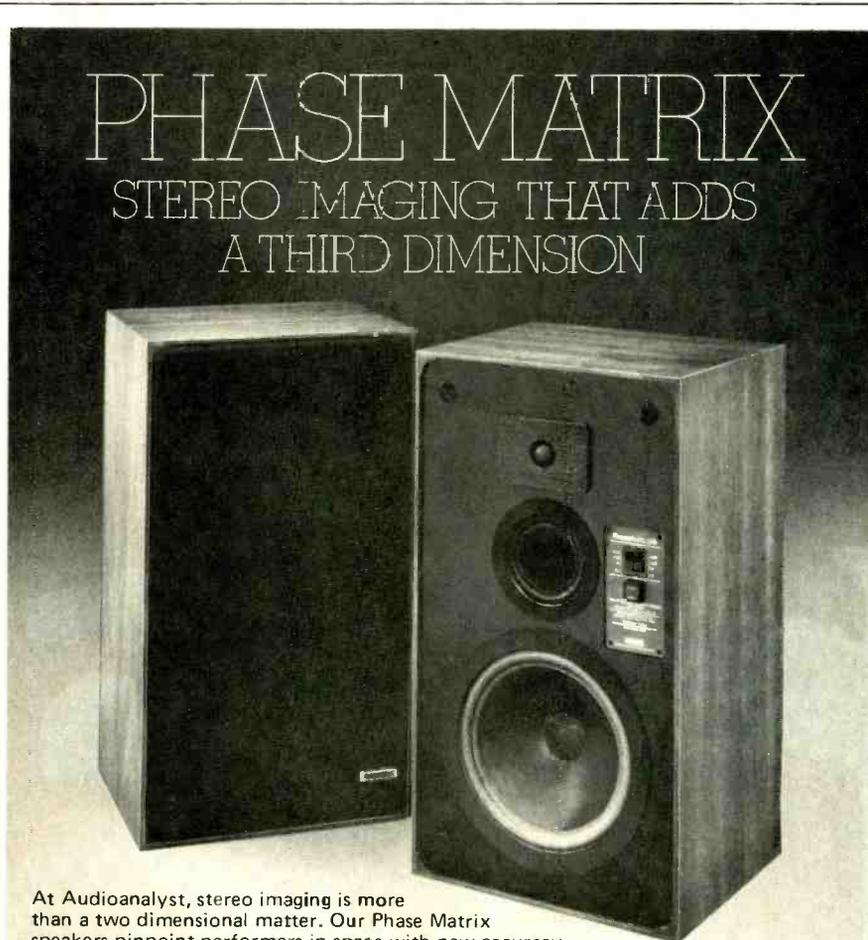
Although Phillip Pahinui had been recording for small Hawaiian labels since 1947, his appearance on Ry Cooder's *Chicken Skin Music* brought him his first mainland exposure. **The Gabby Pahinui Hawaiian Band, Vol. 1**, originally issued on Panini in 1975, features performances by several of Hawaii's most renowned artists, along with Cooder himself on mandolin.

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The native guitar style which predominates the album, *ki ho'alu* (literally, "slack key," so called because the guitar strings are loosened to give off richly sonorous bass tones), combines melodic fingerpicking with strong thumb strumming, utilizing dozens of peculiarly Hawaiian tunings. Although most slack-key recordings use only one or two guitars, as many as five guitarists are heard on this record at any given time. The result is a lush-textured flow of lazily bouncing, elegantly rippling string rhythms.

Pahinui sings in an indigenous Hawaiian manner, with a deep, barrel-toned, quavering voice that strains upward to a full, chesty falsetto. The vocal duets—both these with Sonny Chillingworth (*Aloha Ka Manini, Pu'uanahulu*) and Pahinui's over-dubbed self-duets (*Ku'u Pua Lei Mokihana, Ipo Lei Manu*)—blend dulcet harmonies with singularly exotic timbres.

Gabby, plays on both a 12-string (hear *E Nihī Ka Hele* and *Ipo Lei Manu*) and Hawaiian steel guitar (most im-



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pressive on Moani Ke'ala, *Blue Hawaiian Moonlight*, and the instrumental *Hawaiian Love*.

Blue Hawaiian Moonlight and *Wahine U'i* are the type of semi-Americanized Hawaiian songs which were popular on the mainland during the 1930s. *Moonlight Lady*, with a barely adequate vocal by Bla Pahinui and bassist Randy Lorenzo, is distinctly contemporary folk-pop. Otherwise, the music is a fleshed-out, updated, yet a non-commercialized version of the traditional ki-ho'alu-with-vocals style. Three other tracks, though, attempt a mainland-MOR sound, through the overdubbing of a soaring string orchestra. Not only is this totally irrelevant, it tends to obscure the more genuine, natural beauty of the guitar textures.

The multiple ki ho'alu resonances are enhanced by a full, rich recording with a highly judicious stereo spread.
Tom Bingham

Sound: A — Performance: A —

Gospel: Cliff Waldron
Rebel SLP 1558, stereo, \$5.98.

Cliff Waldron was one of the major figures in contemporary bluegrass until he was "born again" and dropped out of the newgrass scene. **Gospel** finds Waldron applying his progressive tendencies to the perpetually conservative field of Bluegrass-gospel.

Live Beyond the Grave, *Clinging to a Saving Hand*, and *Can't You Hear the Blessed Savior* are particularly noteworthy examples of Waldron's low-key syncretism. The front line instrumentation is strictly bluegrass, spotlighting Bill Wheeler's tasty, understated banjo; Akira Otsuka's swing-tinged mandolin and supple lead guitar, and Steve Wilson's always imaginative dobro licks. Waldron's lead vocals, though, are closer to Nashville-style country; the rhythm section (Arthur Penn, bass and Ronnie Bucke, drums) adds a light, yet insinuating country-rock kick; while the harmony vocals (Gracie Williams and John Davis) are pure gospel.

Stand By Me and the a cappella *He Whispered Sweet Peace To Me* are considerably more traditional in flavor. *Green Pastures in the Sky* is at the opposite extreme, with bluesy Wilson dobro and Otsuka's phased guitar adding a touch of earthiness over the rock punch of the rhythm section.

Not your everyday gospel album, but a highly successful experiment nonetheless. Write to Rebel Recording Co., Route 12, Asbury, WV 24916.

Tom Bingham

Sound: B + Performance: A

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Tape & turntable

Scandinavian Suite: Bingo Miki
Three Blind Mice TBM 1005, stereo, \$14.95.

This is one of 82 discs from Three Blind Mice, a Japanese firm, which are being imported by Jim Bongiorno's A-Train Ltd., 8719 Wilshire Blvd., Beverly Hills, Calif. 90211.

This is not a direct-to-disc recording, but rather uses tape, and apparently some sort of noise-reduction system—dbx is my guess—as there is absolutely no tape hiss evident. Precious little information is given on the jacket about the recording process, though there is a listing of the musicians in Tatsuya Takahashi's big band, The Tokyo Union. Also listed are the recording engineer, Yoshihiko Kannari; cutting engineer, Mitsuharu Kobayashi, and art director, Ben Nishizawa, as well as the recording dates, May 15 and 22 of this year, and studio, Epicurus, in Tokyo. The disc itself was pressed, and apparently mastered, by Toshiba-EMI in Japan.

There is 21 minutes of music on side one, which has been cut down to a 4-3/4-inch diameter. The three songs here are *Midnight Sunrise*, 7'10"; *Sketches of Munich*, 7', 20", and *The Legend of Garbo*, 6', 33". Side two has 19 minutes, with a 5-inch inner diameter, and three cuts, *Andersen Fantasia*, 7', 20"; *Sibelius Testament*, 5', 10", and *Children At Play*, 6', 24". These are all apparently original compositions by Miki, with credit also given to Sibelius on *Testament*. (I recognise the melody here but am unable to identify it.)

The surfaces are flawless, absolutely quiet and clean; if you hear any noise off this one, you'd better check your system. I originally had a good deal of trouble getting any of three top-rated cartridges to track the high levels on this disc, a real system burner, but was finally able to get things ironed out through Bongiorno's kind loan of one of his Sleeping Beauty cartridges (Jim, take note; you're going to have trouble getting this back from me).

AUDIO • December 1977

This is big band jazz, much like the earlier Sheffield *King James Version*, and the clarity of the reproduced instruments was enough to make the hair on the back of my neck stand up. I have to admit that I am not a fan of this type of music; hard bop and fusion are more where I'm at. Nonetheless, this was an extremely enjoyable disc for me, as the level of recording science (or is that "art") has set a standard which few other discs even approach. —E. P.

Sound: A Performance: B

Direct from Cleveland—Lorin Maazel the Cleveland Orchestra (Falla, Bizet, Tchaikowsky, Berlioz). **Telarc Direct-to-Disc 5020**, stereo, (Available through *Discwasher Group dealers*).

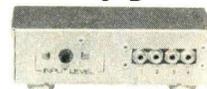
As the first "classical" direct-to-disc offering, this record made a considerable impact—I ran into it in England last summer, for sale at a horrendous price. The sound itself confirms all that the informative notes by our own Burt Whyte tell of the direct-to-disc procedures used. Even the surfaces are good. Yes—you can really hear the difference. An unaccustomed shininess, a certain simplicity of sound, minus extra coloration, a cleanness of cymbals, and brass and percussion. It's all there, true to life. I do not think you will be disappointed if you are insatiable in your search for fi.

It remains merely to comment on the fi/music aspect. If you want super-music, by all means start with side 2, the Berlioz—the *Overture Le Corsaire* and the *Hungarian March* from the *Damnation of Faust*. Here, Lorin Maazel's nervously rapid tempi, plus a certain very audible nervousness in the orchestra itself (after all, this was a nerve wracking occasion!) fits perfectly with Berlioz' extremely high-tension music, and the fi does splendid things for the Berlioz orchestra, always highly colorful. This side should please even

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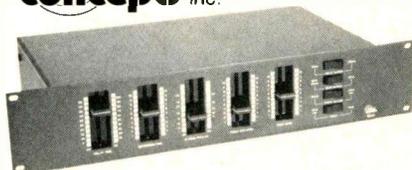
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The first side, however, I found problematical. The same nervously fast tempi are not as good for the final dance from Falla's familiar *Three Cornered Hat*—that starts too abruptly as an opener—while both Bizet and Tchaikovsky sound hurried and forced to this old-hand musician. Well, you can't have everything.

The two band-separation breaks on side 1 and one on side 2 are well managed, a quick fade-down (while the musicians hastily cough and rearrange their music) and fade-up after around 12 seconds. As for acoustics, you will find them a bit dead for optimum effect. The hall is that way, and of course no reverb is added. For some reason, this is more noticeable on side 1 than in the Berlioz on side 2, probably a by-product of the music itself.

Playing time is disconcertingly short you should be warned, that is in part the consequence of direct-to-disc recording without the tape-recorder automatic advance groove separation—also, of course, the wider the spacing the safer the fi. If you want longer play, there are plenty of standard LPs awaiting you. —E.T.C.

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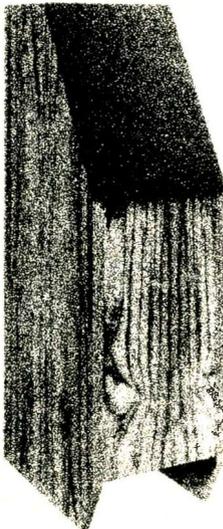
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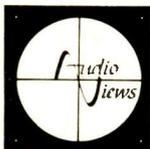
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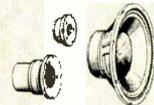
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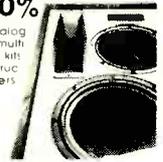
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