

Audio

Iron Curtain
Records

THE AUTHORITATIVE MAGAZINE ABOUT HIGH

JUNE 1977 \$1.00

47425 

Do Turntables
Affect
Sound?

Heyser—
Geometry of
Perception

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DOP L HUNTER
2608 CENTRAL BLVD
EUGENE OR 97403

PRESENTS ACT II. STAND MADE THEM BETTER.

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

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

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

But that's only the beginning. To get the most out of your cartridge, the 9500II has a switch that lets you "tune" the amplifier to the cartridge manufacturer's optimum capacitance. And to get the most out of your records, our three-stage phono equalizer features an incredibly high phono overload level of 300 millivolts. With no more than 0.2 dB variation from the RIAA curve. So even the most complicated passage on one of today's highly engineered records will sound exactly the way it was recorded in the studio.

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

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

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

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

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

TX9500II
SA9500II

High Fidelity Components
PIONEER
WE BRING IT BACK ALIVE.

THE NEW PIONEER AMPS AND TUNERS.

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TX6500II
SA7500II

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

"IT CANNOT BE FAULTED."

SA9500 — Stereo Review

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

TX9500 — Popular Electronics

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

TX9500 — Modern Hi Fi



PIONEER PRO WE STARTED WITH THE BEST

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

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

Here's how we did it.

THE NEW PIONEER TX9500II TUNER: EVEN CLOSER TO PERFECT.

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

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

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

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

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

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

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

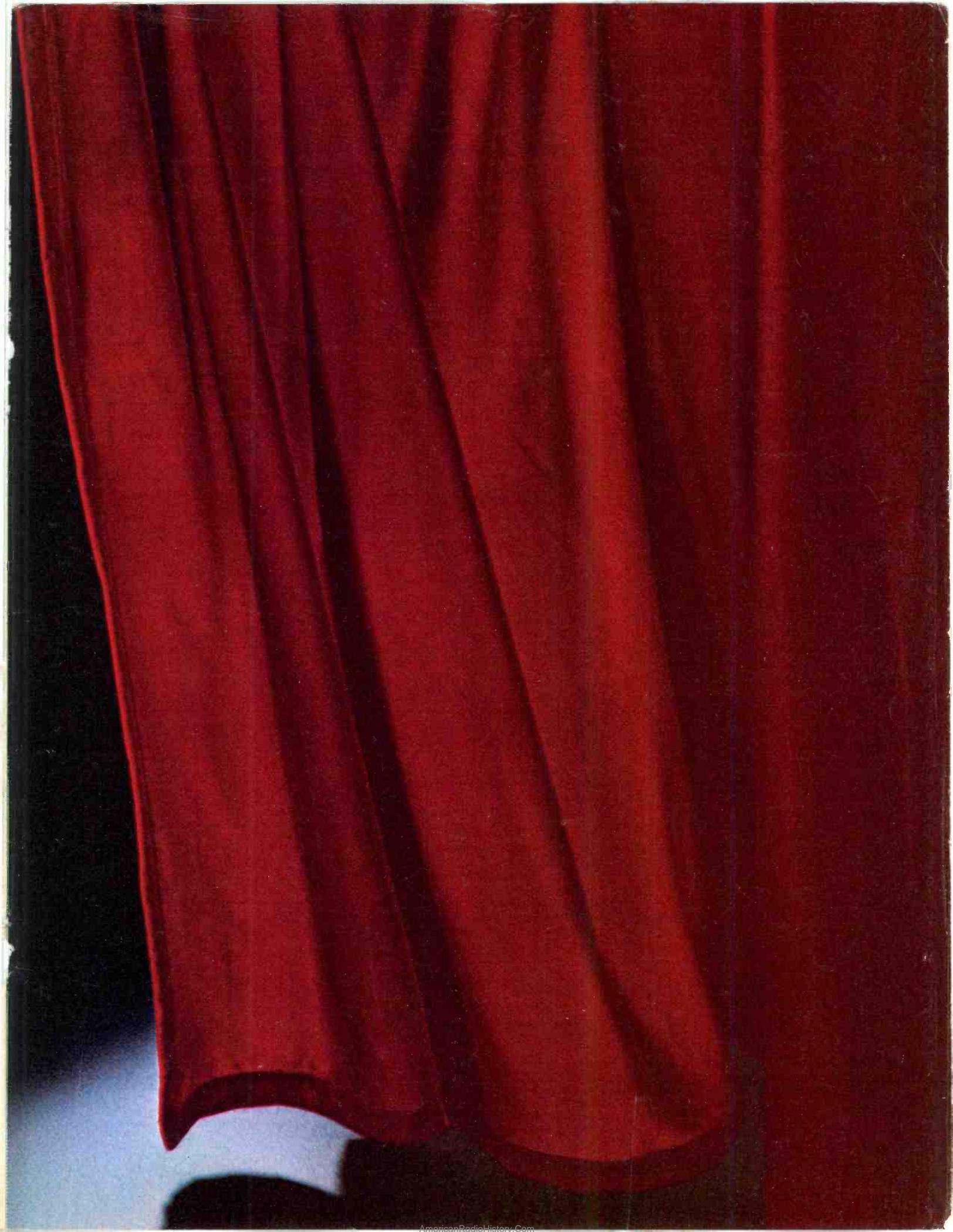
THE NEW SA9500II AMPLIFIER: HOW TO GET THE MOST OUT OF THE BEST.

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

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

TX8500II
SA8500II

THE
TYPE III



DISCWASHER®

presents

The Clean Truth About Your Naked Stylus

When your stylus plays over one light fingerprint or one tiny "bead" of vinyl stabilizer, the clean naked diamond becomes a glazed, dust-holding abrasive weapon wearing away at your records and masking their true sound. This unseen build-up may actually hold the tracking tip of the diamond out of the record groove.



Accumulated grit on stylus that looks "clean" to the naked eye.

The SC-1 Stylus Cleaner from Discwasher is designed with a brush that is stiff enough to remove harmful accumulation, but gentle enough to avoid damaging delicate cartridge assemblies. Two drops of Discwasher's D3 Fluid add extra cleaning action to the SC-1 without the side-effects of alcohol, which can harden rubber cantilever mountings.

After cleaning with SC-1 and D3 Fluid by Discwasher.



The retractable, walnut-handled SC-1 includes a magnifying mirror for convenient inspection of stylus/cartridge alignment and wiring.

Get the clean truth from your records; get the SC-1.

**SC-1 STYLUS
CLEANER**



d discwasher inc.

1407 N. Providence Rd.
Columbia, Missouri 65201

Audio

June 1977

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

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Publisher Jay L. Butler

About The Cover: Dancing has made a comeback (as if you didn't know), but mistracking and distortion result if someone decides to Bump in the wrong direction. Even if you're a quiet type, and enjoy your music sitting down, acoustic feedback can rob you of the "charms that soothe the savage breast." In a new series, beginning on page 36, Joe Grado presents some ways to deal with these problems.

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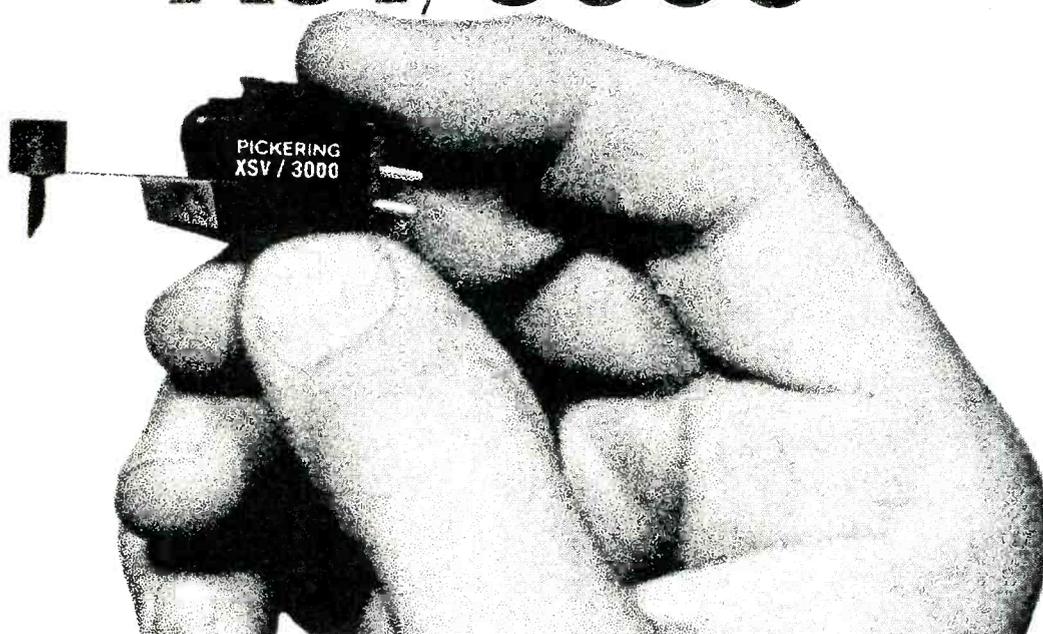


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The source of perfection in stereo sound... Pickering's new XSV/3000



3

The reviewers applaud as never before!

"... we don't see how you can do better at any price."

Hirsch-Houck Laboratories. Stereo Review. February 1977

"The new unit offers the stereo performance of the XUV/4500Q (or perhaps a little better than that) at a lower price. It seems hard to go wrong with such a combination."

CBS Technology Center. High Fidelity. February 1977

"Congratulations to all concerned on a fine contender amongst the world's best stereo pick-ups."

John Borwick. Gramophone. United Kingdom 1977

Pickering's new XSV/3000 is a remarkable development. It possesses a totally new and different design that makes it the precursor of a whole new generation of sophisticated, advanced stereo cartridges.

This has been made possible by technological advances in two areas. **First**, it has an unusually tiny, samarium cobalt (rare earth) magnet of remarkably high power that

permits extremely low mass, and also offers high output.

Second, this cartridge features the new Stereohedron™ stylus tip, a Pickering first! This extraordinary shape has a far larger bearing radius, which provides increased contact area in the record groove. This assures gentler treatment of the record groove, longer record life, and also, far longer stylus life.

This cartridge provides remarkably smooth and flat frequency response; its channel separation is exceptional, its transient response possesses superb definition.

Truly, Pickering's XSV/3000 represents a whole new concept of excellence in stereo cartridges... the true **Source** of perfection in stereo sound.

For further information write to
Pickering & Co., Inc. Dept. A
101 Sunnyside Blvd., Plainview,
New York 11803



"for those who can hear the difference"

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Empire's Blueprint For Better Listening

No matter what system you own, a new Empire phono cartridge is certain to improve its performance.

The advantages of Empire are threefold.

One, your records will last longer. Unlike other magnetic cartridges, Empire's moving iron design allows our diamond stylus to float free of its magnets and coils. This imposes much less weight on the record surface and insures longer record life.

Two, you get better separation. The small, hollow iron armature we use allows for a tighter fit in its positioning among the poles. So, even the most minute movement is accurately reproduced to give you the space and depth of the original recording.

Three, Empire uses 4 poles, 4 coils, and 3 magnets (more than any other cartridge) for better balance and hum rejection.

The end result is great listening. Audition one for yourself or write for our free brochure, "How To Get The Most Out Of Your Records." After you compare our performance specifications we think you'll agree that, for the money, you can't do better than Empire.



EMPIRE

Already your system sounds better.

Empire Scientific Corp.
Garden City, New York 11530

Audioclinic

Joseph Giovanelli

Improving Sound Of a Portable Phonograph

Q. The sound of my daughter's portable record player is thin, hard, wiry, and reedy. Is there any reasonable way (under \$25.00) to significantly improve its sound while retaining the original speaker cases, which are made of thin, light plastic? Each speaker has a 6-in. by 9-in. woofer and a small tweeter in an open-backed cabinet. Although I can find no impedance designation on these speakers, the long leads suggest 16 ohms to me. If I replace these speakers with 8-ohm speakers, would this change damage the amplifier?—Ben Dyer, Easttown, Ky.

A. It is probable that a combination of circumstances has combined to produce the rather bad total sound you have described. These circumstances may include: (1) an amplifier which is deficient in low frequency output; (2) a mismatch between the ceramic cartridge probably used and the input of the amplifier; (3) an imbalance between the output of woofer and tweeter, and (4) woofers whose resonant frequency is too high to enable bass response to be produced in any reasonable quantity.

The amplifier may either have its frequency response measured or, more easily, be connected to loudspeakers known to have good sonic qualities which will provide you with an audible indication of the performance of the amplifier. If the resulting frequency response is reasonably good, obviously the major problem will be the original speakers. A simple series resistor placed in the "hot" tweeter lead may pad the tweeter level down sufficiently produce a better balance in the speaker system. However, the amp's output must be high enough to drive this less efficient load to acceptable levels.

If the amplifier itself lacks low frequencies, then it is often possible to improve this situation by the use of larger values of both interstage cou-

pling capacitors and emitter bypass capacitors than are now provided. Because the amplifier used in this record player probably has a relatively low power output, the overall audio volume may appear to be reduced from what it was before the capacitors were changed. This is because more of the power developed after the change in the amplifier will be used to produce low frequencies; before, most of the available amplifier power was available as midrange energy, making the system appear to play more loudly.

Where a portable record player employs a ceramic cartridge, it is possible that the bass frequencies are lost because of an impedance mismatch between that cartridge and the input of the amplifier. Ceramic cartridges require impedances which are typically 1 megOhm. If the input impedance of the amplifier is significantly lower than this value, say 100 kOhms, bass response will be lost. If there is sufficient amplifier gain, it may be possible to improve this situation merely by inserting a resistor of perhaps 0.5 megOhm in series with the "hot" cartridge lead of each channel though there will be a significant overall signal loss.

If the resonant frequency of the original woofers is very high, then they should be replaced. The impedance of the speakers should be measured, if possible, since the speakers used are probably 4-ohm types for this application, rather than 16 ohm. You may be able to learn the impedance of the speakers by writing the maker, but I do not think we can make a good guess just on the basis of the long leads. The thin interconnecting cables ordinarily used with such equipment are not conducive to good performance, and you may improve things by using heavier gauge wire, something on the order of 18 gauge zip cord.

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.

AUDIO • June 1977

Performance. Scott Stacks Up.

Every serious listener knows that separate tuners and amplifiers offer greater system versatility and flexibility than the all-in-one receiver. But Scott separates stack up where it really counts—performance.

Every one of Scott's complete line of tuners and amplifiers is engineered and designed to give you all the performance features you expect, at a price no higher than many receivers currently on the market.

Scott's T 526 AM/FM Stereo Tuner and A 436 Integrated Power Amplifier provide such important performance features as front panel Dolby de-emphasis switching, a phase locked loop multiplex section and linear motion calibrated controls.

And that's only part of the story. Compare these important performance features with any other medium-priced tuner and amplifier on the market today.

The Scott T 526 Tuner

IHF sensitivity rated at $1.9 \mu\text{V}$, S/N ratio 68 dB and a capture ratio of 1.5 dB.

Signal strength and center channel tuning meters.

Four gang tuning capacitor for better image rejection.

AM section designed around a tuned RF amplifier using J-FET for improved signal-to-noise ratio.

AM noise suppression circuitry.

The Scott A 436 Amplifier

42 watts RMS per channel, driven into 8 ohms from 20 Hz to 20 kHz with no more than 0.3% THD.

True logarithmic meter amplifier obviates the need for range switching.

Individual channel power level meters calibrated in % of full power output capability eliminates confusing dB and VU readings.

Two completely independent tape monitors allow two tape recorders to be used simultaneously for direct tape-to-tape copying.

Instantaneous electronic protection circuit in the output stage.

IM distortion lower than 0.15% for a cleaner sound without listening fatigue.

High and Low filters, two auxiliary outlets and mic inputs.

And the Scott T 526 and A 436 come complete with professional rack-mount handles, and are backed by a three-year, parts and labor limited warranty.

For specifications on Scott's complete line of audio components, write or call H.H. Scott, Inc., 20 Commerce Way, Woburn, Mass. 01301. (617) 933-8800. In Canada: Paco Electronics, Ltd., Quebec, Canada. In Europe: Syma International S.A., 419 Avenue Louise, Brussels, Belgium.



 **SCOTT**
The Name to listen to.

Receivers / Tuners / Amplifiers / Turntables / Speakers

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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 styli.

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

 **ROCELCO INC.**

160 Ronald Dr., Montreal
Canada H4X 1M8 (514) 489-6841

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Tape guide

Herman Burstein

Intermittent Popping

Q. I've had an intermittent problem for a long time with my Sony 250-A tape deck when using the thinner tapes which takes the form of sharp, static-type pops, mainly in the left channel, with a variable rate of repetition, sometimes several times a minute and sometimes several times per hour. The more often the tape is played, the more frequent the pops. I have another Sony tape deck which does not exhibit the pops even though it is used with the same audio equipment as the 250-A.—L.M. Lorentz, Azusa, Cal.

A. Clean and demagnetize the heads and all other metal objects contacted by the tape. The head shields should be well grounded. Perhaps a good earth ground from the tape deck may help. One reader had success in solving a similar problem by having a grounded bit of metal foil in contact with the moving tape.

Cassette Adaptation

Q. I have a Magnavox receiver which powers a stereo turntable and a tape player, and I would like to add a cassette deck to tape through it internally. The man at Radio Shack said I would have to have the receiver modified, but was hesitant to say what it would cost. If I have it modified, could I record everything internally including the phonograph and the AM radio?—James Steiner, Richmond Hill, N.Y.

A. Unless there is something special about the Magnavox circuitry, this should be relatively simple. It is necessary to take the signal from across the Magnavox's volume control and feed it into the tape machine for recording. The signal is taken across the hot and ground leads of the con-

trol and is usually of sufficient strength, at this point, to drive the tape recorder. The cost of having this done by a technician should be approximately \$10 to \$15.

Demagnetization Procedure

Q. What is the proper procedure for using a demagnetizer? I first position the tool, apply power, gradually withdraw the tool to about five feet from the heads, then turn the power off.—Alan Sandler, Brooklyn, N.Y.

A. The proper use of a demagnetizer consists in turning it on at a distance of several feet from the unit to be demagnetized, bringing it very near the unit and moving it in a rotary fashion. Then very gradually withdrawing it from the unit, and shutting it off at a distance several feet away.

Thin Tape Troubles

Q. I use both Scotch ½ mil and 1 mil tapes. On the ½ mil tapes I have noticed a bending of the edges, the folding of one edge onto the top of the other. This deformation is a gradual process ranging from a slight frilling of the edge to the pancake effect. My tape deck is kept clean, and nothing seems out of alignment.—James Cockerham, San Antonio, Texas.

A. It is probable that the tape guides are not correctly mounted or not of the proper dimension. Beyond this I can only suggest that you consult the manufacturers of either the tape or the tape deck.

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 • June 1977

"...in the same class with a number of more expensive products, including many of the direct-drive record players we have seen."

This quote, from the Hirsch-Houck Labs' report in *Stereo Review*, refers to the Dual 510, a semi-automatic belt-drive turntable. Since direct-drive models (especially our own) are accepted as the standard of performance, Hirsch-Houck's comparison is not to be taken lightly.

We'll let someone else tell you how good our belt-drive turntables really are.

The 510 also benefits from comparison with other semi-automatic turntables. Dual's unique sensor locates the 12-inch and 7-inch lead-in grooves for you. You don't have to guess where they are. And there's no way to drop the tonearm accidentally; the cue-control lifts it automatically at the end of play and supports it until you release it.

You might also compare the 510 with your present turntable, or any other you may be considering. When you do, keep in mind the 510's many other features and refinements described below. Your old records will sound better, your new ones last longer.

Dual

United Audio Products, 120 So. Columbus Ave., Mt. Vernon, N.Y. 10553

Dual 510. Semi-automatic, single-play. True four-point gimbal tonearm suspension. Synchronous motor, precision-ground belt, unique Vario-pulley, dynamically-balanced platter, 6% pitch-control, illuminated strobe. Lead-in groove sensor. Cue-control viscous-damped in both directions. Less than \$200.

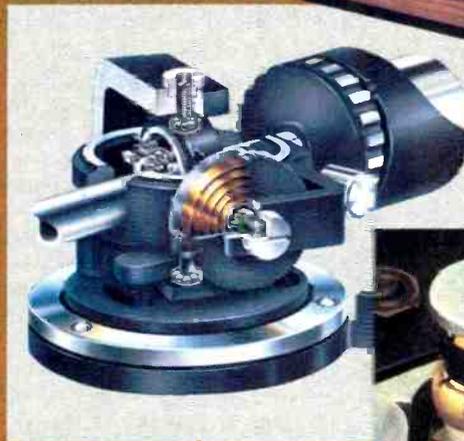
Dual 502. Similar except less sensor, pitch-control and strobe. Less than \$160.

Dual 1249, fully automatic single-play/multi-play. Less than \$280.



The four-point gimbal centers and pivots the tonearm mass at intersection of horizontal and vertical axes. Tonearm is dynamically balanced in all planes. The four needle-point pivots are first hardened, then honed, a process which produces microscopically smooth surfaces. The precision ball-bearing races are only 0.157 inch diameter. Bearing friction: vertical, <0.007 gram; horizontal, <0.015 gram.

Stylus force, applied by long coiled spring around vertical pivot, remains perpendicular to record even if turntable is not level.



Unique Vario-pulley used in Dual's three belt-drive models is precision-machined for perfect concentricity and balance. Speeds are adjusted by expansion and contraction of pulley circumference; belt is never twisted or distorted.

Specifications (DIN B1): Rumble, >63dB; Wow and flutter, <±0.25%

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Audio etc.

Edward Tatnall Canby

I got so involved last month with Charles Cros of France, the man who conceived of the phonograph some eight months before Thomas A. Edison independently invented it, that I never got to some nagging little mechanical questions about Edison's First Phonograph which, in this 100th anniversary year, have been bothering me as never before. Not very epochal questions—just minor tantalizations. I trot them out, even so, because they illustrate a big point about our informational system, that vast transmission belt of second-hand knowledge that makes up maybe 95 per cent of our day-to-day reality. Do we trust anything first-hand? It's got so the things we find out for ourselves, right on the spot, aren't as real to us as that omniscient Voice of Authority that comes to us over the air or in print.

In other words, if the weather people say it's fair outside and you see the rain, there must be something wrong. With the rain, of course.

I have no first-hand experience with the First Phonograph nor have most of us. It's right there, in New Jersey. But you don't just walk in and ask to turn its crank, just to hear the sound that comes out. Like the Declaration of Independence, that machine is now a well-guarded and priceless relic and rightly so. So you read about it. You look at pictures and study diagrams, as who hasn't, this 100th year. It's all second hand. And the trouble is, when I do this I find holes in the info. Silly little things that in a half-second first-hand look I could answer for myself—but no! I have to depend on the transmission belt. Drives me crazy.

So what more do we need to know about Edison? His machine worked. It had a stylus and grooves, it recorded and it played back, no doubt with excrable quality. Isn't that enough? No, not enough, at least until my curiosity is satisfied.

A Question of Curiosity

Question One. Not really a question, since I have figured out the answer—but I'll bet nine-tenths of our

crank, and screws through the threaded support on that side. On the other side the shaft is unthreaded and moves freely through the smooth bearing hole in the second support. The styli remain in one place as the cylinder winds past them.

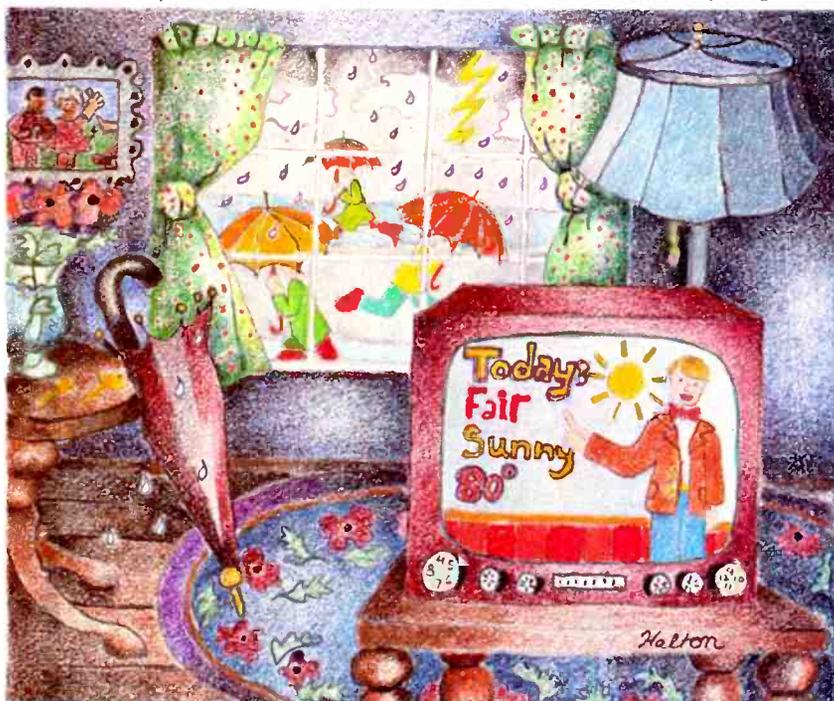
Simple—but note that in later cylinder machines the system was reversed, if I am right. The cylinder turned in one position while the stylus and diaphragm moved sidewise along a

sort of threaded track. Or so I remember. (My second-hand info, via numerous pictures, is exasperatingly uninformative on this score, as usual, but I think I can make out the traveling stylus, moveable along an overhead screw.)

Now this involves some interesting mechanical analogies with present audio equipment—tricky motion problems that are directly related to those we face in our overhead-type tangential disc cutters and playback systems. How do you persuade a relatively heavy "carriage", the sonic

mechanism plus stylus, to slip sidewise so that the groove is accurately traced in playback without even the tiniest side pull? Those who have designed such systems know all about it—and there are even more recent developments such as the ingenious Teldec TV disc system with its dangling stylus and those "motional feedback" arrangements that give the traveling crane a nudge when it goes too slowly. And on top of all this, there's the RCA laser beam tracking system.

All these mechanisms trace directly back to the very first instant of recorded sound in 1877. The sidewise tracking problem was solved, right there, at least for the moment! Otherwise im-



readers won't know. Without looking at a picture of the First Phonograph, can you say whether the big cylinder turns along a stationary threaded shaft, to make the spiral groove pattern, or the cylinder and shaft are one and turn together. I had never thought about it, natch. Well, the cylinder and shaft are one. That you can figure out by study of the pictures. OK, then does the cylinder move sidewise, or does the stylus and its diaphragm assembly (two of these, one for recording and the other for playback)? Well, I can tell you that one too; the cylinder moves sidewise and so does the shaft with it. The shaft is threaded at one end, next to the

WE'RE ALL EARS



Mia Halton

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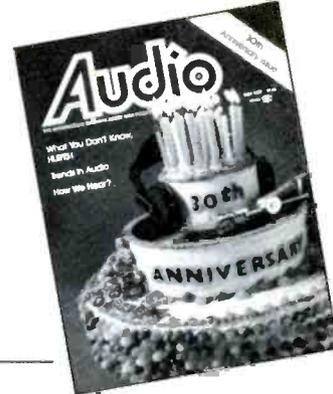
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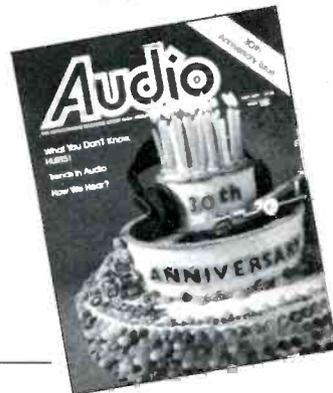
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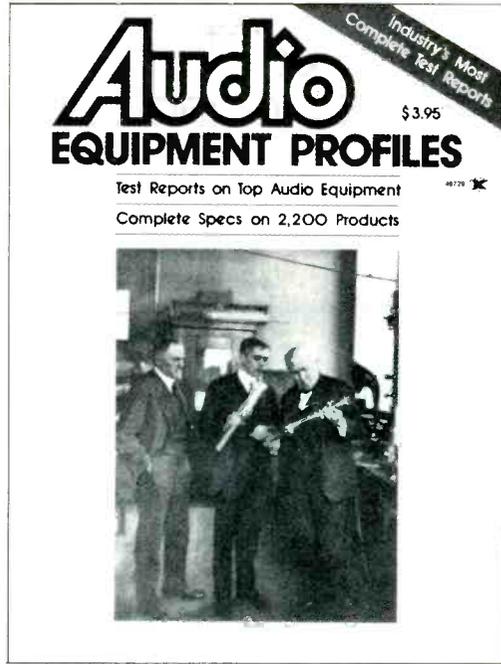
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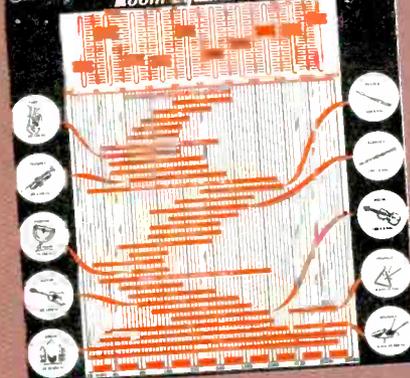
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agine the sad result: "Mary had a little lamb whose lamb whose lamb whose lamb whose lamb---".

Which brings forth a slightly more cogent question. So Edison wrapped tinfoil around a brass cylinder, one in which his stylus embossed or indented a vertical audio signal. Did that cylinder have pre-cut grooves already on it? (Or did the stylus press its own spiral groove onto the foil as the cylinder moved?) Well, I have deduced the answer to that one, too; but

look: I have two authoritative pictures of the First Phonograph and they disagree emphatically on this. They are in fact the same photograph, or at least taken at precisely the same angle. But in those days the folks liked to retouch their pictures for greater impact. *One of these pictures shows a smooth cylinder. The other shows a cylinder with grooves cut in it.* Wouldn'tcha know. That's second-hand info for you. And Roland Gelatt, in his "Fabulous Phonograph," unin-

tionally makes for more confusion by writing that "a piece of tinfoil was to be wrapped around the cylinder (with a fine spiral groove impressed on the surface) and two diaphragm-and-needle units..." Impressed on WHICH surface, Roland? The tinfoil or the cylinder itself?

Photographic Fallacy

Actually, I can infer (not having seen with my own eyes) that indeed there are pre-cut groovings on the brass cylinder—retouched out by some idiot in one of those photographs—and thus the wrapped tinfoil lay over these, the stylus gently pressing the foil into the V-shaped space beneath. Tricky, come to think of it, and typical of Edison's fine-tuned thinking, in an area, remember, where no soul on earth had experimented before. It's clear that the pre-cut grooves were *not* intended for tracking but were a part of the actual embossing system. Would you have thought of it? It was surely a much better idea than forcing the stylus against a flat, non-grooved hard surface beneath the foil.

A baffling unanswered question for me is the tinfoil itself. First—was it *tin* foil? Made of tin? This was before the days of aluminum, which if it was known at all was then an extremely scarce metal, the electrical reduction process from bauxite not yet having been invented. So—what are the properties of tinfoil, if different from aluminum? If we were to reconstruct an Edison machine today, could we use aluminum foil as an authentic substitute? Probably. Yet in my mind a nagging little doubt remains, *maybe not?* We would need more info, first-hand.

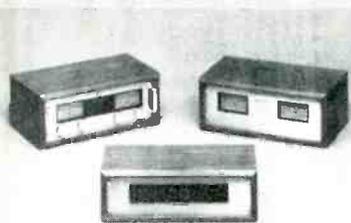
Now comes the tinfoil clincher. How, if you please, do you go about "wrapping around" a sheet of tinfoil? Shades of a thousand Xmas packages, all crinkled up and crumpled! How do you wrap a flat sheet of tinfoil so that on a cylinder it will turn nicely and evenly under a stylus with never a wrinkle or fold? To me, mostly a man of many thumbs, this is unimaginable. I'd have to see it done, first-hand, before my eyes. (As Edison said, only an "expert" could get results out of his first phonograph. Maybe the foil was the problem.) But there is a further problem, about which I have never heard a single word, a matter of sheer topology. How do you convert a flat, finite rectangle into a *seamless* cylinder or tube? You can't, short of welding and polishing down.

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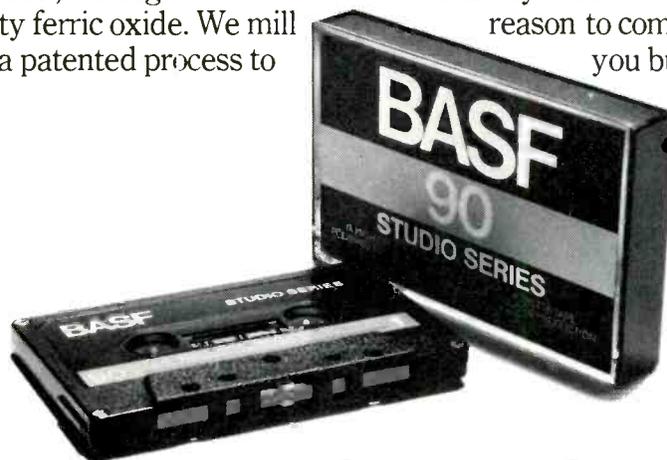
Faithful reproduction entails more than miracle ingredients and fanciful initials on a cassette label. At BASF, we begin with the best quality ferric oxide. We mill it by a patented process to

achieve maximum packing density and uniformity of coating. We use an exclusive chemically cross-linked polymer binding which will never deteriorate and cause head-related frictional noise or wow and flutter.

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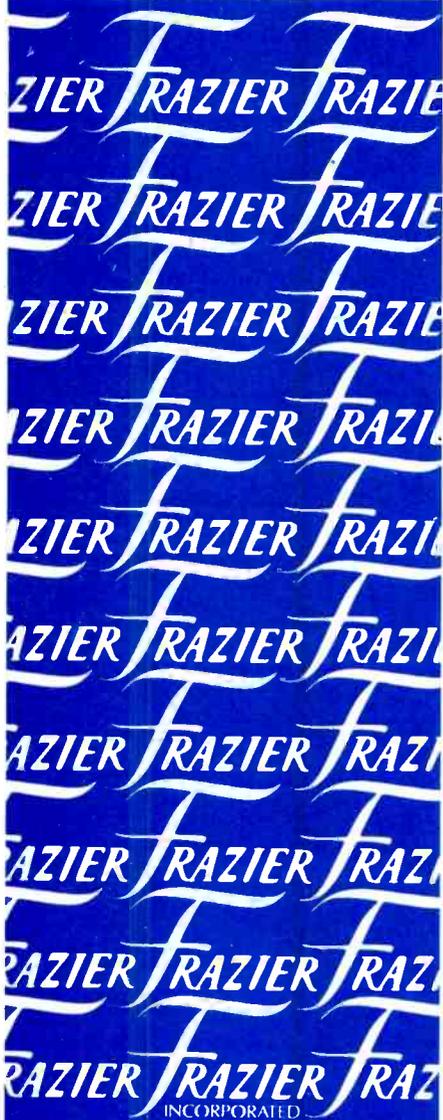


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Therefore, in all my second-hand-
edness, I am assuming that the Edison
phonograph played with an audible
fast tick, tick, tick as the stylus passed
repeatedly over the tinfoil joint. What
else? Well, maybe it was just a nice,
soft purr, tinfoil (aluminum?) being so
smooth and impressionable? But that
again raises questions about metal
characteristics. Hardness, ductility.
My second-hand library on the First
Phonograph says precisely nothing.
No help at all. In any case, one would
have to overlap the foil the right way,
so the stylus would move from the top
layer onto the lower—otherwise the
point would surely rip the whole
thing off the cylinder on the first revo-
lution. Or would it? Perhaps the tin-
foil would smooth itself to a near-
soundless joint, which might have
been Edison's canny thought ahead of
time. Just like him.

But, of course, that brings back
again the matter of the choice of met-
al. Was tin actually the best, or just a
handy choice? How about silver or
lead foil? Old Tom was never one to
bypass a possible candidate. The dif-
fering metallic properties obviously
must make some difference. How
about gold leaf? Expensive—but the
Edison laboratory used all sorts of ex-
otic metals, notably in the electric
light filament experiments of the very
next year. Platinum, tungsten. So per-
haps gold foil might have been used,
if it worked well. Or scarce aluminum.

Phono "Printing Press"

Speaking of topology, I have a little
whopper of a similar question that has
to do with the same sort of change of
shape in a different aspect of the
phonograph. As we all know, the tin-
foil cylinder was soon replaced by cyl-
inders of wax, removeable, on which
the stylus directly pressed its vertical
groove. (No longer any need for the
pre-cut grooves, wax being soft.)
When Emile Berliner worked out the
flat disc and the lateral-modulated
groove—at first etched by acid instead
of cut or embossed, due to patent re-
strictions—he also hit upon an enor-
mously important principle, the key
to the future audio industry, no less
than the mass production stamper sys-
tem for multiple duplication of
recordings, a phono "printing press".
Now it is astonishing that for a num-
ber of years of heavy competition be-
tween the cylinder and the disc, the
newer disc records were "published"
on a mass scale whereas every single
cylinder was individually cut in its
wax, aided only by a pantograph sys-
tem whereby a few cylinders could be

cut simultaneously while the perform-
ers did their thing. Thus—popular
items had to be reperformed live
sometimes hundreds of times on end
in order to meet the market demand.
Even the use of two or three machines
(the maximum, due to close-up
recording horns) didn't do much to
help. So, oddly, the cylinders of that
era, the 1890s, are not in fact identical
for a given catalogue item but contain
different performances, which adds
spice and variety to the reproduced
sound. Something we could use to-
day. (*Editor's Note:* Talk about your
direct-to-disc process!)

The topological problem was again
the shape of a cylinder and its endless
circular "plane," like an Einstein time
warp. It could not be broken by any
sort of joint. And nobody could figure
a way to "press" that sort of baffling
shape. The problem wasn't solved un-
til 1901, and meanwhile the disc
people were stamping out their crude
but multiple-pressed duplicates in
vast quantities. Curious situation. Re-
minds us of tape vs. disc today, where
tape still can only be copied and cop-
ied for publication, if from a single
master recording.

Finally, as Roland Gelatt cryptically
puts it, "a successful process for mold-
ing cylinders was perfected." Period.
No further explanation.

Circle of Confusion

Now all I ask is HOW? To this very
moment, though I've heard and seen
plenty of wax cylinders and still have a
few lying around, I am unable to fi-
gure out how they were made—how
that virgin expanse of grooving was
molded free of faults. If you pour liq-
uid material into a circular slot mold
with grooves on its outer segment,
how do you get the product out? If
the mold were to come apart in sec-
tions, there would be joint marks and
audible breaks in the grooving. If they
matched up at all. On the other hand,
if the mold comes away all in one
piece, it has to expand, grow larger, if
it is to break free of the groove sur-
face. (You couldn't have the record it-
self shrink—that would make it play
sharp.) I somehow keep thinking of
the (non-disc) brake linings on my
car; is the cylinder mold external-ex-
panding?

Well, of course I know that cylin-
ders can be molded, and were mold-
ed for a quarter century. But nobody's
second-hand info has yet given me
the slightest idea as to how. That's a
typical information hole for you.

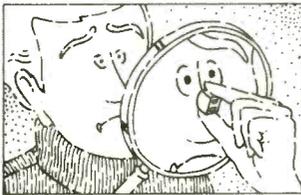
P.S. A brilliant idea: how about Bab-
bitt metal foil? Nice and slippery.

ARE YOU BLAMING YOUR TAPE RECORDER FOR PROBLEMS CAUSED BY YOUR TAPES?

Every day people all over the country go into hi fi dealers with complaints about their tape recorders.

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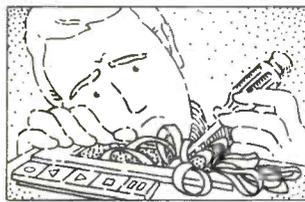
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even after years of use, we finish them to tolerances as much as 60% higher than industry standards.

Inside, we use free rolling Delrin rollers so the tape doesn't stick.

And finally, we screw instead of weld everything together because screws make

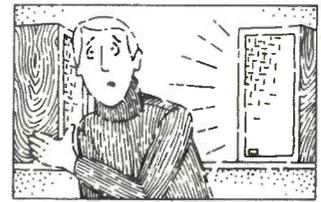
for stronger cassettes.

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DROPOUTS ARE CAUSED BY YOUR RECORDER. OR ARE THEY?

Maxell tape is made of only the finest polyesters. And then every



POOR TRACKING IS CAUSED BY YOUR RECORDER. OR IS IT?

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So if you're having problems with your recorder, try a Maxell cassette, 8-track or reel-to-reel tape.

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Behind the scenes

Way back in 1950, when a thing called *hi-fi* was beginning to be taken seriously, an enterprising gentleman by the name of Harry Riezies decided to promote this phenomenon by presenting what he called an "Audio Fair." The venue was the New Yorker Hotel, where the hotel rooms were converted to exhibit spaces and various hi-fi manufacturers gave sound demonstrations of their components.

The Audio Fair was a resounding success...and no wonder...since it was the first time the pioneering audiophiles of those days could hear such a wide variety of hi-fi components in one place, and it was also a chance to meet some of the people behind the products. They found out there really was an Avery Fisher, a Rudy Bozak, a Frank McIntosh, a Norman Pickering, et al., and what a thrill to discuss hi-fi and music with the very people who designed the equipment!

The Audio Fair became an annual event and was widely copied all over the country. Some years later, the Institute of High Fidelity was formed, and it sponsored a New York "Hi-Fi Show" which replaced the Audio Fair. The New Yorker Hotel continued to be the site of the show for a number of years, and then the show was moved to such places as the New York Trade Show Bldg., the Statler/Hilton Hotel, etc. The IHF sponsored hi-fi shows in other sections of the country as well.

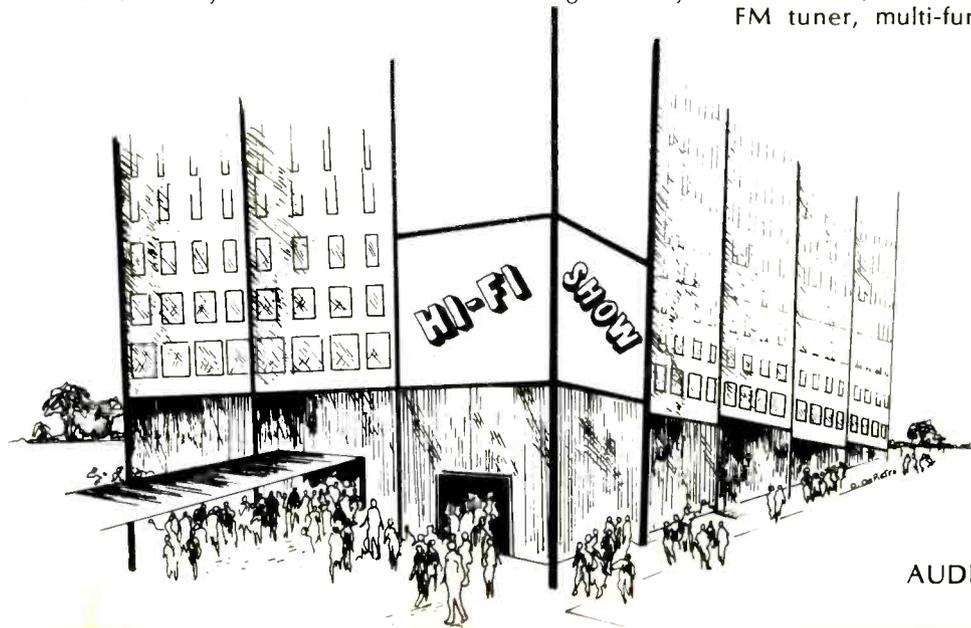
It must be admitted that after the glamour of the early hi-fi shows wore a bit thin, some of the more negative aspects of the shows gave rise to an ever-increasing din of gripes and complaints. Paradoxically, there was anguish about the low attendance at some shows, yet annoyance over inadequate crowd control. It was said that there were too many "repeaters" at the shows...not enough "new blood" entering the hi-fi components market. There was much grumbling about the increasing costs of exhibiting at the hi-fi shows and whether the results justified the expense. In later years, the IHF abandoned the hotel shows and tried other formats to promote hi-fi, but the results were indecisive. The hi-fi components industry needs a strong, effective Institute of High Fidelity. Currently, the IHF is in the process of reorganization, an Executive Director is to be hired, and more money is to be made available for new promotional ideas. We wish them well, and hope everyone will offer their support.

Of course, there are always two sides to the coin. There is a large segment of the hi-fi public that likes "hotel shows," and more than a few manufacturers feel the same way. Some 20 odd years ago, Teresa and Bob Rogers, a Washington, D.C., couple who own classical music radio stations in that city, decided to cater to these tastes and formed the High Fidelity

Music Show, Inc. They concentrated exclusively on hotel hi-fi shows and presented them on an alternating year basis in such cities as Washington, D.C., Philadelphia, Detroit, and Atlanta. Like anything else, they've had their share of problems, but in general, their hi-fi shows have been well received and well attended. I attended the most recent Rogers shows, the "Washington Hi-Fi Stereo Music Show," February 11th through 13th, and the "Philadelphia Hi-Fi Stereo Music Show," March 18th through 20th. Herewith is my report on what I found of interest at these shows.

French Connection

Industry marketing veteran Harold Weinberg chose the Washington show to debut his Setton International line of receivers and amplifiers. Setton is the brainchild of French industrialist Jacque Setton, an audio component manufacturer who has combined the talents and technology of French, American, Japanese, and British engineers. Design and engineering is done in France and the U.S., while the actual manufacturing is done in Japan. Thus far, the line comprises 40-, 55- and 100-watt per channel receivers, two integrated amplifiers of 40- and 55-watts per channel respectively, a separate pre-amp/100-watt per channel amplifier combination, and their RCS-X-1000, which is a far out digital FM tuner, multi-function pre-amp,



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We invite you to test the Optimum turntable at one of the select audio dealers now carrying the full line of Optonica stereo compo-

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remote control center, and 200-watt per channel amplifier. For the man who has everything, this will be sold for "around \$5000!" All the Setton units are distinguished by their very attractive and functional appearance, the styling being done by the industrial design division of famed French designer, Pierre Cardin.

Tandberg had a most interesting set up in their room. Their top of the line receiver was receiving signals from a closed-circuit broadcasting station, and the signals were deliberately "doctored" to demonstrate what poor selectivity, sensitivity, separation, etc. would sound like, and how well their receiver could cope with these problems.

Speaker Reception

Throughout the Washington show there were long lines of people waiting to get into the Bose and ESS rooms. The feature in the Bose room was their Series Three redesign of the 901 speaker, which is said to have even better bass response with increased efficiency so that a 25-watt amplifier can produce an SPL formerly requiring several hundred watts. Bose now makes their own drive units, an ultra-precise, completely automated process which is the result of much basic research in plastics, metallurgy and related disciplines. In a film Bose presented to the audio press corps some months before the show, we saw the entire process, including a machine of their own design which automatically produces a complete voice-coil assembly in about two seconds. The attraction in the ESS room was the debut of the long-awaited Heil bass unit. Called the "Transar," it looks like something out of *Buck Rogers*, with five diaphragms linked together by carbon fiber rods driving them in common—much too complex to describe here. Suffice to say, it puts out some really low frequency bass, but it was hard to make any quality assessments, since the room in which it was demonstrated was criminally small. It would be interesting to hear this speaker in better controlled circumstances.

Onkyo was showing a comprehensive line of receivers, amplifiers, and loudspeakers, and their point of pride was the quartz-crystal-locked tuning featured on all their receivers. Saul Marantz was doing yeoman duty demonstrating his partner's Dahlquist speakers, with their new sub-woofer, and both passive and electronic cross-over networks. Both

classical and rock music came over with a lot of "oomph." New to the audio scene was Shahinian Acoustics with a pyramidal shaped speaker called the "Obelisk." Hardly new to speaker design is Dick Shahinian, who has been at it for over 20 years and has designed speakers for companies like Harman-Kardon and Rectilinear. Tweeters and mid-range drivers are clustered in the top of the unit, while bass response is via an eight-inch woofer and a rear-mounted passive radiator. The unique shape of the speaker eliminates any parallel surfaces and standing waves. With Dick's impeccable demonstration techniques and superb selection of classical recordings, the small speaker was impressive for its mid-range and top end smoothness, good stereo imaging, and solid extended bass. In short, a thoroughly musical sound.

Sansui kept the quadrasonic flags flying with a new four-channel receiver, the QRX 9001, with 50-watts per channel, which can be bridged to produce 120 watts in stereo. Hitachi was getting good mileage showing how its Class-G receiver works. In the Discwasher room, people were titillated by listening to a tape made during the recent Cleveland Orchestra direct-disc recording session. The disc itself should be at most hi-fi dealers by the time you read this.

Philly-Fi Show

Moving on to Philadelphia, Phase Linear was showing its new speaker system, consisting of two large free-standing panels, which look like electrostatics, but use dynamic drivers, and a bass cube. The system is obviously capable of very high SPL, and there was plenty of solid bass, but here again, the room was too small for true appreciation of its quality. In the Bozak room, Rudy himself was on hand, looking quite fit and beaming with pride about his new continuously variable bucket-brigade delay line. He was playing his monolithic "Concert Grand" speakers, which have newly designed tweeter arrays, and in his good-sized room many people were quite impressed with the sheer musicality of the sound.

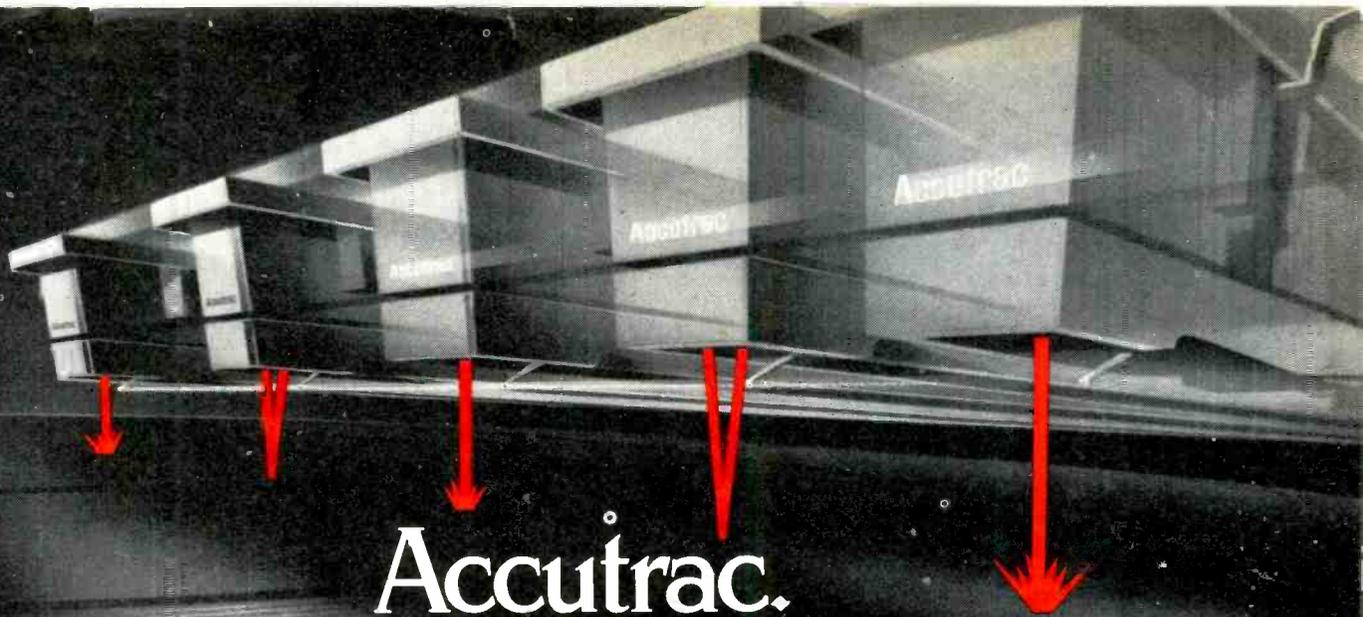
Technics was demonstrating their new "Linear Phase" loudspeakers, using their new RS-1500 closed-loop tape deck, with 15 ips Dolby "A" master tape copies. Interest...as well as the SPL...was high! Roy Allison was on hand with his interesting concept in loudspeakers, and his room was a

haven for ears overloaded with 200 dB of boomy rock bass. You always can hear high quality civilized music in Roy's room. IMF of England was demonstrating their smooth-sounding transmission line speakers, here again with well-chosen classical music. Their presence at a show like this is a sign of a more aggressive sales effort in the U.S.

One of the things that has always been permitted at the Rogers shows is the participation of hi-fi dealers. Thus, it is possible to see equipment, much of it exotic high end stuff, that would never be exhibited in the normal fashion. For example, Barclay Recording and Electronics of Wynnewood, Pa., had a whole room full of gear, dear to the heart of the far-out audiophile. A Lux turntable was mated with a SAEC (Sound of Audio Engineering Co.) arm and an EMT moving-coil phono cartridge. The SAEC arm, like the well-known SME, uses knife edges, but in this case, two of them and a ruby thrust bearing. A unique feature is their "stabilizer," a massive, fist-sized, very heavy piece of metal which screws under the arm base, and is said to help attenuate resonances. Barclay heavily features Crown equipment, and they had a whole rack of it, tape machines, pre-amps, amplifiers, and the latest item, the EQ-2 equalization unit, an elaborate phase-compensated octave band device for room equalization. Also in the rack was the new dbx DB-3, which is a single pass, three-band noise reduction unit said to afford up to 30 dB of noise attenuation without pumping or breathing effects. Also on display in this room were the Magneplanar speakers and such professional items as Neumann mikes and Malatchi mixing units. Last but not least, I was shown a prototype of a large-screen (19-inch) real-time analyzer. If they can turn it out at a projected price under \$3000, it should attract immediate interest.

Needless to say, at both the Washington and Philadelphia shows, there was a great deal of equipment from most of the well-established names in the industry. However, since most of it had been shown before, I've had of necessity to be selective, and report on what I thought were the main items of interest.

One last note. . .New York has not had a "hotel hi-fi show" for some years, so the Rogers have finally decided to tackle the Big Apple and will run the New York Hi-Fi Stereo Music Show at the Statler-Hilton Hotel, November 10th through 13th.



Accutrac. The turntable with eyes.



Introducing Accutrac.
The only turntable in the world that lets you tell an LP which selections you want to hear, the order you want to hear them in, even how many times you want to hear each one.

Sounds like something out of the 21st century, doesn't it? Well, as a result of Accutrac's electro-optics, computer programming and direct drive capabilities, you can have it today.

Just imagine you want to hear cuts 5, 3 and 7 in that order. Maybe you even want to hear cut 3 twice, because it's an old favorite. Simply press buttons 5, 3, 3 again, then 7. Accutrac's unique infra-red beam, located in the tonearm head, scans the record surface. Over the recorded portion the beam scatters but over the smooth surface between selections the infra-red light is reflected back to the tonearm, directing it to follow your instructions.



What's more, it can do this by cordless remote control, even from across the room.

The arm your fingers never have to touch.

Since Accutrac's tonearm is electronically directed to the record, you never risk dropping the tonearm accidentally and scratching a record, or damaging a stylus.

And, since it cues electronically, too, you can interrupt your listening and then pick it up again in the same groove, within a fraction of a revolution. Even the best damped cue lever can't provide such accuracy. Or safety.

What you hear is as incredible as what you see.

Because the Accutrac servo-motor which drives the tonearm is decoupled the instant the stylus goes into play, both horizontal and vertical friction are virtually eliminated. That means you get the most accurate tracking possible and the most faithful reproduction.

You also get wow and flutter at a completely inaudible 0.03% WRMS. Rumble at -70 dB (DIN B). A tracking force of a mere 3/4 gram. And tonearm resonance at the ideal 8-10 Hz.

The Accutrac 4000 system. When you see and hear what it can do, you'll never be satisfied owning anything else.

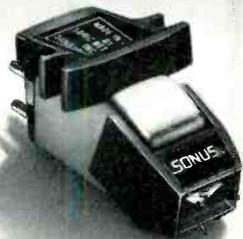
**Its father was a turntable.
Its mother was a computer.**

The Accutrac™ 4000



ADC Professional Products Group, A division of BSR (USA) Ltd, Route 303 Blauvelt, N.Y. 10913

MAN
DOES NOT
LISTEN
BY SPECS
ALONE.



Specs and numbers by themselves can be meaningless. Take phono cartridges. Despite the fact that this state of the art has never been higher, with wide range, flat frequency response, excellent separation and superb tracking ability taken for granted, there's still room for improvement in the sound reproduction of even the best records. And in many systems, the cartridge itself is the limiting factor. We believe Sonus effectively removes this limitation.

What makes Sonus so audibly superior?

Differences in cartridges are hard to readily identify. But sensitive ears will easily recognize Sonus as having a reproductive quality that brings out the inner voices of complex musical passages with extraordinary clarity. A high definition cartridge that, because of a combination of design features, including its newly patented cantilever suspension, reproduces music with an uncanny sense of depth, ambience and realism.

So the next time you're considering an improvement in your audio system, consider upgrading your cartridge. Compare specs if you must. (You'll find that ours are equal to, if not better than anybody's.) But buy with your ears, not your eyes.

Because man does not listen by specs alone.

SONIC RESEARCH, INC., Sugar Hollow Rd.
Danbury, Conn. 06810

SONUS

High Definition Phono Cartridges

Dear editor

Software Consensus

Dear Sir:

If asked, most audio buffs will cite loudspeakers as the weakest link in the audio reproduction chain. This simply is not true in any sense. The main or primary (literally) deterrent to our reproduction quality is the source...records and tapes, with records being the main offender.

In response, the hardware manufacturers have recently designed and marketed a host of noise reduction components for both records and tapes, which is one of my reasons for writing this letter. In the interest of most of us who either own or are purchasing equipment which exceeds the current and potential quality of records and tapes, an article surveying this noise reduction hardware would be a welcome service. Such an article might include a list of the manufacturers, their addresses, a breakdown of which equipment is designed for discs and which for tape, which handles both, and an insight into how each system operates.

I realize that *Audio* magazine caters to the hardware industry but, as must be obvious, an improvement in software would certainly enhance the enjoyment of the hardware components and their sales.

With this in mind, editorials, articles, polls, and similar devices may serve to arouse reader interest and action, thus suggesting appropriate action by the record and tape manufacturers.

Raphael F. Segura Jr.
Jefferson, La.

Loose Wrapping

Dear Sir:

In regards to your January, 1977, "Behind the Scenes" article concerning record quality...I feel that I may be able to help in a small way.

The column questions, and justifiably so, the continued use of the "shrink wrap" format in the retail sale of record albums. Bert Whyte pointed out that the shrink-wrap affords the purchaser, more often than not, a factory fresh copy of the recording, which is what the majority of the buying public wishes. However, Mr.

Whyte also points out that it is the shrink-wrap which is responsible for record warps capable of inducing seasickness. To quote from the text:

"What we need, then, is some new kind of seal that will guarantee the record is virgin, but will not cause warpage."

There in Victoria, British Columbia, it is possible to purchase, in some stores, record albums with a clear plastic shrink-wrap which has been cut and sealed approximately 0.5 cm (0.20-in.) larger than the record jacket. This, naturally, solves both problems as the consumer can purchase a virgin, sealed record, and since the plastic wrap is rather loose fitting, the warp inducing pressure on both the record and the jacket is eliminated. While this does not totally eliminate warping, it does significantly reduce the possibility of buying an album which is totally unplayable. The albums are from EMI, British imports, in both classical and rock titles. I am unable to inform you whether this "not-so-shrink-wrap" is placed on album covers in Britain and Canada both, but, perhaps, you could find out who is responsible for this simple, yet excellent idea.

I can only hope that this particular solution to the problem of record warpage catches on with North America's EMI subsidiary, Capital Records, and indeed with all other record companies too. I think the added cost would be minimal and more than be recovered in the savings on returned defective records, plus it would be a public relations bonanza for the companies...fewer dissatisfied customers.

George Carson
Victoria, B.C.
Canada

Vintage Repairmen

Dear Sir:

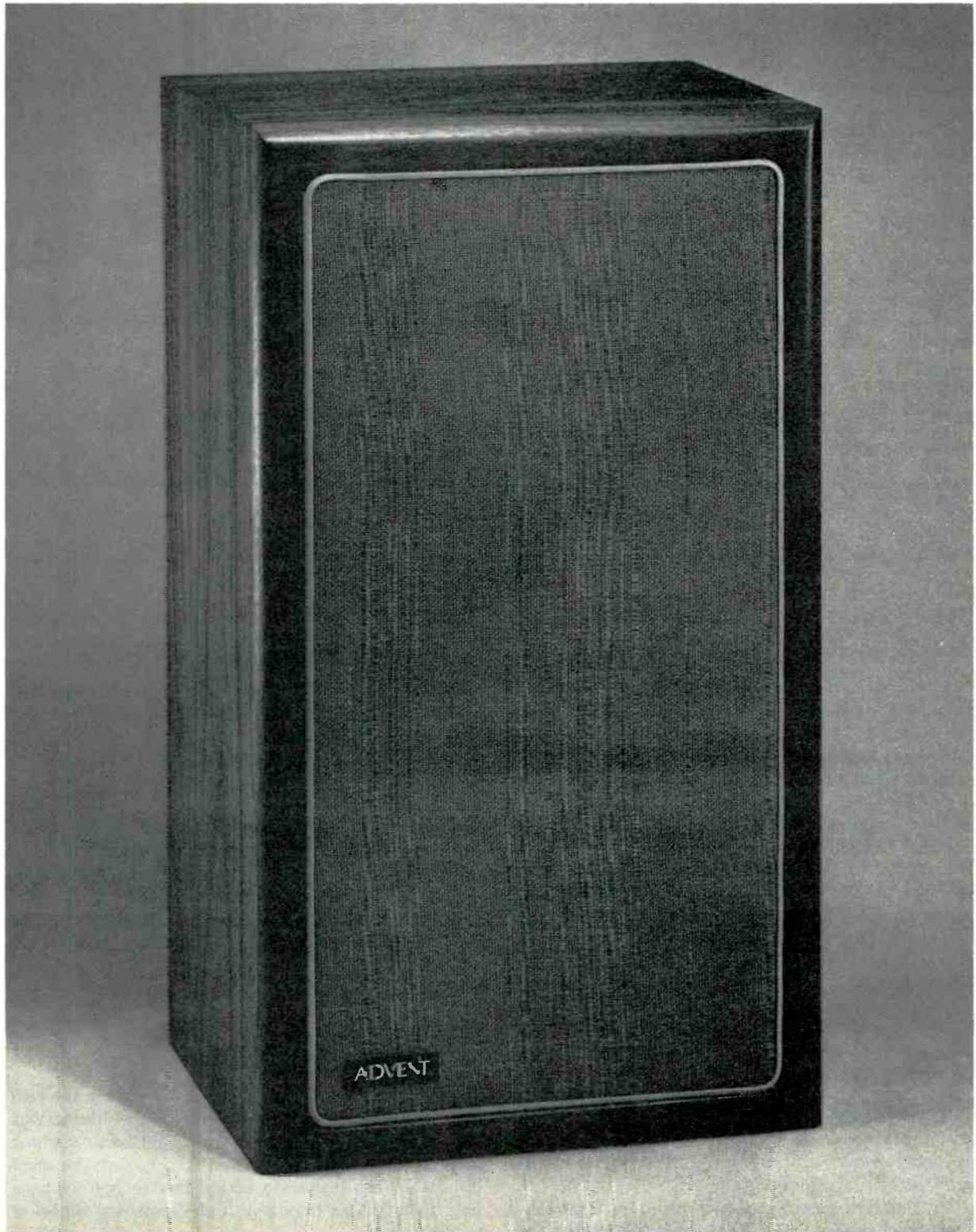
I need your help, or rather a number of *Audio* readers need your help. As with automobiles, people fall in love with vintage magnetic recorders such as: Magnecord, Concertone, Ampex, Stancil-Hoffman, Tapersonic, Webcor, Pentron, Brush, etc.

Hence, with fair regularity I get letters from readers who would like to restore an old "deck" to operation. In

AUDIO • June 1977

continued from previous page

The New Advent Loudspeaker



Almost twenty years ago, for instance, some of us now at Advent were involved in a live-vs-recorded test of an "ideal" tweeter design that could, and did, sound identical to the live source. But this same tweeter was absolutely unlistenable for playback of recordings, particularly for LP records. It mercifully revealed the tremendous residual noise and distortion (from tape hiss, cutter limitations, vinyl imperfections, and other sources) present on records at high frequencies.

By the time we designed the original Advent Loudspeaker in 1969, tremendous improvements had been made in recordings and broadcasts. But there were still important limitations, and the total high-frequency energy output of the Advent was balanced to suit that reality and match well with the mixture of new, not-so-new and old LP's in most people's record collections.

In the 1970's, however, two very important improvements have been made in the high-frequency capabilities of recordings and broadcasts:

■ The almost universal adoption of the Dolby® system and other noise reduction measures for recordings has reduced background tape hiss and residual "hash" at high frequencies by a tremendous amount. The entry of the Dolby system into FM broadcasting is also beginning to be felt.

■ A new generation of record-cutting equipment has made it possible to put more essentially undistorted output onto records in the 10,000 Hz region. And a new generation of phono cartridges has been designed to take advantage of the opening for cleaner high-frequency response.

These factors add up to more *recoverable, usable* high-frequency content in source material than ever before—more clean sound above the noise and distortion in the recording process.

With these improvements, and influenced by the fact that most people's record and tape collections now date mainly from the early 1970's onward, we decided to change the high-frequency capabilities of the Advent Loudspeaker. Also involved in the decision was the knowledge that we could make use of developments like ferro-fluid damping for the tweeter to come up with a higher-output design of very high reliability at very little added cost.

The New Advent Loudspeaker, then, can radiate significantly more energy at 10,000 Hz than our original design—more than enough to reveal the cleaner high-frequency output on records. The audible difference is subtle on most recordings (a slightly more open and defined quality) and most noticeable on recordings that have a heavy content of brass, snares, cymbals, and other demanding high-frequency material.

We don't believe that the difference is great enough to make more than a tiny percentage of

present Advent Loudspeaker owners want to trade in their speakers. (We don't design any of our speakers, including the least expensive, to make people want to trade them in after the honeymoon, however long, is over.) But the change is the kind we think should be made in a speaker designed to compete in the "best" category without compromise. And we think it will be appreciated by today's and tomorrow's speaker and record buyers.

What Stays The Same.

Like the original Advent, the New Advent Loudspeaker is the best answer we know how to make to two fundamental questions:

■ What is the highest level of performance that has real meaning for the great majority of truly critical, demanding listeners?

■ How do you get that performance at a cost low enough to make it available to the widest number of people who would like it?

We realize that it is hard to believe, especially when speaker advertising consistently suggests that more dollars and more complexity and more novelty are the key to speaker performance, that a relatively simple two-way speaker system can really fit into the very highest performance category. Especially a speaker that costs only \$129 to \$159* (depending on cabinet finish and how far we have shipped it).

But it can and does.

The New Advent Loudspeaker has a useful frequency range as wide as that of any speaker at any price. Its bass response is approached by few speakers at any price. It will fill a large living room with a satisfying amount of undistorted sound. And it doesn't require a super-power amplifier or receiver.

It also has an all-important octave-to-octave tonal balance that's based on long experience with the performance both of equipment and of recordings in the real world. We don't have enough room left here to explain the full implications of that statement, and to explore the design of the New Advent Loudspeaker in full detail. But if you will send us the coupon, we will be happy to provide full information on what the New Advent Loudspeaker is and how it does what it does.

Thank you.

To: Advent Corporation, 195 Albany Street,
Cambridge, Massachusetts 02139

Please send full information on the New Advent Loudspeaker, and a list of your dealers.

Name _____

Address _____

City _____

State _____ Zip _____

*Suggested price, subject to change without notice.
"Dolby" is a trademark of Dolby Laboratories Inc.

Advent Corporation, 195 Albany Street, Cambridge, Massachusetts 02139.

the case of automobiles, there are devotees who can breathe life back into any model. I, and your readers, are wondering if similar specialists exist in the audio field. I have spoken to some of my colleagues, but have yet to find anyone to whom I can refer my readers.

Perhaps *Audio Magazine* can be enlisted in this search. We could sound a call for the names of labs, repairs shops, individuals, et al. that have the knowledge, parts, and willingness

to restore old tape decks and, perhaps, other audio components.

Herman Burstein
Contributing Editor

Editor's Note: We would like to commend Herman Burstein for this excellent idea, and we will print the names of those repair shops and individuals who repair vintage audio equipment. However, fair warning, we will also print letters from persons who have had unsatisfactory work performed. *E.P.*

Nulling AM Distortion

Dear Sir:

For the past several months a number of my counterparts at other broadcast stations and I have been writing to you concerning the capabilities of AM radio. I am certain that we were not trying to create an "AM versus FM" controversy, but after reading Mr. Stephen Waldee's comments in the March Issue of *Audio* I feel compelled to write you again. I feel that Mr. Waldee has misinterpreted the purpose of my letter and those of others.

While what Mr. Waldee says about AM technical standards is true, there is no reason why a conscientious broadcaster should permit such performance standards in his physical plant. The AM technical standards were composed many years ago when equipment was incapable of the superior performance found on modern equipment. And these standards have never been upgraded. If one examines the minimum permissible performance standards for FM transmission, they are almost as laughable as those for AM. But I am certain that Mr. Waldee would not permit his transmitting plant to drop to the minimum performance parameters, even though he would still be legal in the eyes of the FCC.

While it is true that, in AM, a frequency removed from the carrier by 15 kHz or more must be attenuated by at least 25 dB from the unmodulated carrier, one must examine the applicable FCC rule, 73.40 (a) [12], to really clarify the matter. The rule states: "Any emission appearing on a frequency removed from the carrier by between 15 kc/s and 30 kc/s, inclusive, shall be attenuated at least 25 dB below the level of the unmodulated carrier. Compliance with the specifications will be deemed to show the occupied bandwidth to be 30 kc/s or less." Thus, a frequency of 14,999.999... Hz may be legally transmitted at 100 per cent modulation. The upper limit for stereo FM is 15,000 Hz, but who's counting?

Incidentally, how many recordings do you know that contain enough high frequency information in the region of 15,000 Hz to modulate the transmitter 100 per cent? Or, for that matter, even 25 per cent? 10 per cent?

As to his cases of 17 per cent intermodulation distortion in an AM transmitter, I suggest that there is something very basically wrong with a transmitter that produces that kind of a figure. Perhaps a defective power supply transformer, capacitor, or

Our Secret For Unmatched Performance



Hartley Zodiac I

We build all our speaker cabinets in asymmetrical pairs for the best sound dispersion.

Then we match each pair for wood graining and color.

Finally we match the speaker drivers to maintain perfect system balance.

We do all of this for about the same price as our competition. You see, we believe when you spend your hard earned dollars for speakers, you deserve the best sound your money can buy.

For other innovative features of Hartley speakers, write:

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The "Click and Pop" machine

Ever since the invention of the recorded disc annoying "clicks" and "pops" caused by scratches, static and imperfections have consistently disturbed the listening pleasure of music lovers.

Now, SAE introduces the unique model 5000, an Impulse Noise Reduction System which eliminates those unwanted sounds with no adverse effect on the quality of the recorded material. This breakthrough in electronic circuitry is so demonstrably

effective that the SAE 5000 is destined to become an essential part of any sound system.

The SAE 5000 is compact and sleek, built to SAE's exacting standards, and ready to enhance the performance of any system, from the standard receiver/turntable combination, to the most sophisticated audiophile components.

SAE is proud to add the 5000 to their broad line of Components for the Connoisseur.



only by **SAE**
Scientific Audio Electronics, Inc.
P. O. Box 60271 Terminal Annex, Los Angeles, CA 90060

Enter No. 39 on Reader Service Card

Take a close look at a better record cleaner. Audio-Technica AT6002



(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.



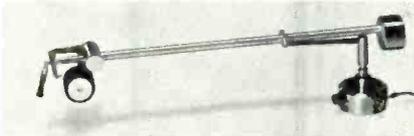
(169x enlargement)

Our unique carbon fiber brush sweeps each groove literally hundreds of times as the record plays, just before the stylus touches the groove. The carbon fiber brush helps conduct static charges away, making groove cleaning easier. And the incredibly small 6 micron diameter reaches deep into the groove for the smallest particles.



(844x enlargement)

Immediately behind the brush, our velvet pad captures and holds dust particles as you play. And moisture released from an inner reservoir helps to dissolve stubborn deposits to prevent static build-up.



This 4-way attack on dirt (brush, pad, liquid, and conductive path to ground) is uniquely effective. For proof, clean a record with any other system. Then "play" it with the AT6002. You'll find dirt removed by the AT6002 that was left behind by other cleaners. Try it today. Just \$9.95 at all Audio-Technica dealers.



audio-technica
INNOVATION □ PRECISION □ INTEGRITY

AUDIO-TECHNICA U.S., INC.
Dept. 67A, 33 Shiawassee Ave.
Fairlawn, Ohio 44313
In Canada: Superior Electronics, Inc.

choke. Maybe a defective modulation transformer or reactor. Even something not the fault of the transmitter could be responsible, such as insufficient power mains. Perhaps, even, the detector in the distortion analyzer is not linear.

Concerning low frequency phase shift, once again I suggest that there is a deep seated problem in any transmitter that shifts phases excessively in the audio. Some phase shift is inevitable when audio passes through any transformer, but a high quality transformer will produce a minimal amount of phase shift, well within acceptable limits.

It is true that the new Harris MW-1 transmitter eliminates phase shift because of the absence of a modulation transformer and reactor. However, in 1957, RCA developed their "Amplitude-phase" transmitter utilizing a phase-to-amplitude modulation system. There is no modulation transformer and reactor involved in this system, consequently, no phase shift. Several years ago Gates Radio (now Harris Corp.) developed their line of "PDM" transmitters which utilize a Class-D pulse-width modulation system. Once again, the modulation transformer and reactor have been eliminated, thus phase shift is also eliminated. The technology necessary to eliminate audio phase shift in AM transmitters has been around for a long time in regular use.

What all this boils down to is the fact that with a good solid signal, transmitted properly by the station, a good receiver can recover as high a fidelity audio signal from an AM station as from an FM station. However, sloppy engineering will destroy fidelity no matter what type of modulation is used.

While it is true that modulation-mad program directors and managers exist, they are not exclusive to AM radio. I once worked for an FM-only station whose manager insisted on seeing the modulation meter hovering near 100 per cent at all times. It did, but at the expense of fidelity. He had the loudest sound in town, but also the dullest sounding one.

I am as happy as anyone else to see the new state-of-the-art equipment make its appearance, and I hope more manufacturers will get the message that they must produce better equipment to remain in business.

But don't dismiss AM as a hopeless case. It's still a very much alive medium, and soon to be stereo. If better receivers were produced by manu-

facturers, AM radio might even become a serious listening medium. Incidentally, I'm 28 years old, hardly a "radio old timer."

Robert I. MacDonald, CE
Village Broadcasting
Radio Station WCHL
Chapel Hill, North Carolina

Equations in Error

Dear Sirs:

Thank you for publishing my article "Simple Pink Noise Filter" in the March, 1977, issue of *Audio*. Unfortunately, Fig. 4 of the article contains a few minor errors which I thought I should bring to your attention. Specifically, the equations should read:

$$\frac{e_2}{e_1} = \left(\frac{R_a + R_b + R_c}{R_a} \right) \frac{(1+j f/f_H)}{(1+j f/f_L)}$$

$$\text{Where: } f_L = \frac{1}{2\pi R_c C}$$

$$f_H = \frac{1}{2\pi R_p C}$$

$$\text{and } R_p = \frac{(R_a + R_b) R_c}{R_a + R_b + R_c}$$

Dr. Robert Mauro
Asst. Professor of
Electrical Engineering
Manhattan College
Riverdale, N.Y.

Quadraphonic Clique

Dear Sir:

We are both die-hard quadraphonic enthusiasts. Through reading *Audio* magazine, we know that this enthusiasm is shared by many other devoted fans.

Quadraphonic is a very exciting format, but let's be realistic about the subject; four-channel is dying. Sure, we've all heard of the newest technological advances in encoders, decoders, demodulators, etc., but where are the results? Not in our local hi-fi shop, and certainly not in the bins of our favorite records stores.

We can throw the blame at whom-ever we want, the hardware/software manufacturers, or the public, but let us stop harping on who should take the blame. It's time to make a positive move straight ahead. We now have the proper technology and the means for properly educating the audio salesmen, the record dealers, and the general public.

Here is what this letter is leading up to, a plea for anyone interested in the future of quadraphonic to form a Quadraphonic Club. All that is needed is a group of people rallying



Ah So. Made in America Made in America!?

We'd have to be crazy to take on the big Shoguns and their top-of-the-line equipment if we weren't absolutely certain that inside of our new 203 preamp beats a heart of pure, solid-state dependability—which is how we made our reputation with the pros to begin with...solid.

Our numbers stick it to the honorable competition, and we're gonna get a slice of their market 'cause our stuff cuts it: like a classic samurai's sword.

You don't know us yet, but you will.
Go on in to your nearest BGW dealer and take a listen.

The BGW Model 50
Pre-Preamp



BGW Systems: 13130 S. Yukon Ave., Hawthorne, CA 90250 213/973-8090
In Canada: Omnimedia Corp., 10245 Cote de Liesse, Dorval, Quebec H9P1A3 514/636-9971

We Bow To No One.



Bold, Basic,

The Nakamichi 600 Series components bring a new approach to system high fidelity—a bold concept distinctly ahead of its time. Never has a group of components combined such high standards of excellence in performance and quality, uniquely attractive styling and supreme ease of installation and operation.

The basic Nakamichi 600 Series trio consists of the 600 Cassette Console, 620 Power Amplifier and 630 FM Tuner Preamplifier. Each is a study in human engineering; witness the gracefully sloped front panels with logically positioned controls. All three are timeless design expressions—sculptures worthy of artistic praise. And each performs its assigned function elegantly and flawlessly. But the three together form the nucleus of an incredibly impressive music system that is not likely to be equalled for many years to come. See and hear the trio at your nearest Nakamichi dealer. For complete information, write Nakamichi Research (USA) Inc., 220 Westbury Avenue, Carle Place, New York 11514



600 The highly acclaimed 600 Cassette Console enjoys the established reputation as the world's best two-head cassette deck. And, as such, it actually outperforms other manufacturer's three-head cassette decks! It is loaded with unique features, including Nakamichi's famous Focused-Field Crystal Permalloy head, rock steady DC Servomotor transport, lightning-fast peak level meters with an unheard of 47dB range, front panel calibration controls, phase-corrected electronics, and special IM Suppressor circuitry. Guaranteed minimum frequency response is 40–18,000 Hz \pm 3dB (EX or SX tape, with or without Dolby[®]). Signal-to-noise ratio is better than 65dB (Wrms at 400 Hz, 3% THD, with Dolby[®] and SX tape)—a greater dynamic range than today's best records.

around four-channel to get this "turkey" up and changed into a "race horse." Why not?

Please send us any thoughts, notions, inspirations, anything at all to help keep quadrasonic alive. All the major companies have adopted a "wait and see" attitude. We're tired of waiting, so let's see, or better yet HEAR some results. It doesn't matter what you prefer: QS, SQ, CD-4, it's all quadrasonic. If you think four-channel is a fantastic idea, send us your ideas and opinions.

Jay Frank
23757 Canzonet St.
Woodland Hills, CA 91364

Steve Walker
4028 N. Yankee Dr.
Agoura, CA 91301

Professional Nostalgia

Dear Sir:

As a long time professional in the audio art, FCC First Class License No. P1-11-41380, and a motion picture and television sound mixer whose credits include everything from the now-defunct "I Spy" series through many feature motion pictures, the recently popular "Family" series on ABC, and the pilot film for "Charlie's Angels," I

read with a great deal of interest the article in the January 1977 issue of *Audio* on the vintage E. H. Scott AM receivers. As one who remembers the Scott, but could not afford one, it was a very pleasant trip through "nostalgia land."

Coincidentally, in Edward Tatnall Canby's *Audio ETC* column in the same issue, regarding "miniaturization," Canby mentions the Fisher Series 80 tuners. However, he failed to mention that those Fishers did have a "broad" and "narrow" i.f. bandwidth, controllable from the front panel. This writer is still using a Fisher 80T with a new, home-built IC preamp section, and an outboard solid-state multiplex adaptor — all of which works very well indeed.

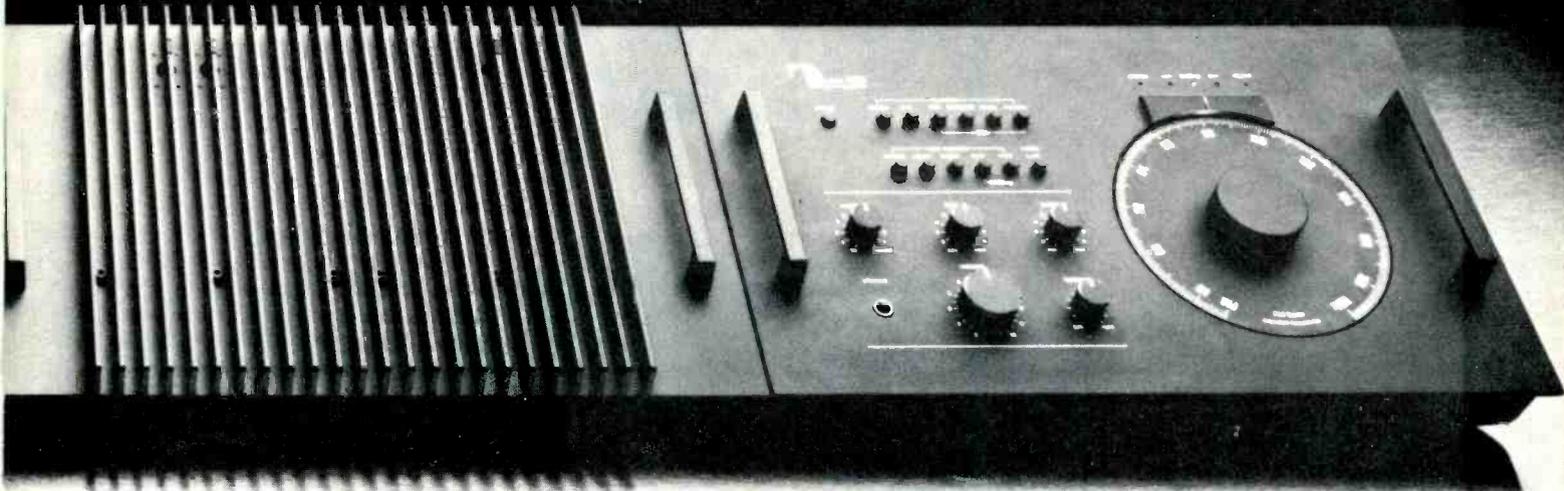
The main point of this letter, however, is to shed a little more light on the state of the art in the 30s. The writer has had for a number of years a vintage 1936 Sparton all-wave receiver sitting on the shelf of my shop. It was purchased in 1937 when the Sparks-Withington Co. was on the verge of bankruptcy. A department store in Portland, Oregon, sold them as a "loss leader" for \$85.00. It had five wave bands, tuned from 150 kHz to 60 MHz without skips, had an r.f. stage on all

bands, a separate oscillator and mixer, two stages of i.f., and a diode detector-first audio. This was followed by a "switchable" volume expander and an electronic crossover. Bi-amped, if you please, in 1936, with a single-ended 6F6 pentode, driving two six-in. tweeters, and a pair of class AB 2 6L6s providing about 45 W rms to a 15-in. woofer.

A few months ago, a very slight interest in listening to "CB" prompted me to tune in the "old girl" to see what it could do on about 27 MHz. Alas, it had sat on the shelf for too many years ... dried out capacitors, tired tubes, and coils which had absorbed too much moisture, all had taken their toll. However, a visit to the science section of the Los Angeles Public Library yielded the original schematic from one of the old Ryder Service Manuals.

So, the old Sparton was stripped down to the bare chassis and tube sockets, then completely rewired, bad capacitors replaced, and the coils dried out and lacquered. A visit to friends at some of the studios supplied from the "obsolete" shelves the necessary 6K7s, 6L7s, 6J5s, 6J7, and 6Q7, even a 6E5 tuning eye. The bi-amped output stages had long ago

Beautiful... Nakamichi!



620 Although the 620 Power Amplifier is distinguished by an unusual exterior, the real story is its impeccable performance, the result of Nakamichi's unique "complete-mirror" push-pull circuitry, which eliminates distortion without the use of high idling current or high negative feedback. A massive toroidal core transformer and two 40,000 μ f filter capacitors assure ample power reserve. The 620 handles all types of loads in stride, and its low operating temperature assures long-term reliability far surpassing conventional designs. Power output is 100 Watts per channel, minimum rms at 8 ohms, 5-20,000 Hz with less than 0.01% THD.

630 The unusual and versatile 630 FM Tuner Preamp offers a degree of performance unmatched by receivers and rarely found in complete "separates." The tuner section boasts stereo distortion under 0.08% and separation better than 50dB (1 kHz, normal selectivity). Selectivity can be switched from normal (over 40dB) to narrow (over 80dB). Signal-to-noise ratio is better than 70dB *without* the help of built-in Dolby[®] Noise Reduction circuitry provided for Dolby[®] FM broadcasts. The preamplifier section defies conventional distortion measurement while phono equivalent input noise is an incredible -140dB.

[®]Dolby is a Trademark of Dolby Laboratories, Inc.

Enter No. 26 on Reader Service Card

29

been replaced by a pair of 6550s and a modern output transformer. Even the volume expander was rebuilt to factory specifications and works just fine.

Today, this 40-year-old receiver sits on a rack in the shop, together with an ancient Pilotuner for FM, a couple of 35 watt, Williamson-type tube amplifiers, a Type-A Garrard turntable with a Shure V15-II cartridge, and an old PT 6 Magnecorder tape deck. The speakers are, a 30-year-old 15-in. Jensen co-axial and, on the other side, an even older 18-in. Jensen Theater woofer with a 5Y3 rectifier tube on the side, combined with an eight-in. midrange, and a resurrected Kelly ribbon tweeter. And for their age, they sound remarkably good, even by today's standards. So, the newest is not necessarily the best.

Lest the writer be accused, or a-"cussed," of living in the past with a "tin ear," let me hasten to add that the main system in my house is all solid state with large bi-amped JBLs, and since this writer, because of his work, has access to sophisticated measuring equipment, the entire system is equalized to be "flat" ± 1 dB in the listening room from an honest 20 Hz to at least 18.5 kHz, above which it is hard to make a meaningful measurement.

Before ending this letter, let me add one note of "self protection" if you will about the atrocious quality of the sound usually heard on television. It is not the fault of people, like myself, who do the recording and engineering. By the time a filmed TV show, for example "Charlie's Angels," reaches the broadcasting network, it has been through many skilled hands, listened to by many trained ears, and put through the best sound equipment the "state of the art" can provide.

The real culprit is the inexpensive TV audio system, and the downright cheap four to six inch speaker used in the average television receiver. This has long been a sore spot with many of us who know how good TV audio should sound.

Burdick S. Trask
Sherman Oaks, Cal.

Cover Congratulations

Dear Sir:

I just saw your April issue with the test of the Lirpa-1 Receiver. It was hilarious. Where do you guys get all those neat ideas?

I looked all over the issue trying to find a credit for the constructor of the prototype, but I couldn't find the

name. Was it by chance, Karl Kofoed? I remember that he built the Ultima One amplifier that fooled all those people two years ago. If it was, indeed, Mr. Kofoed's work he should be congratulated for another fine job. Keep those *Kofoed Kovers Coming*, please.

Congratulations are due you, also, for having the exquisite taste and humor to liven up a basically dull field with gems like the Ultima and Lirpa. Good show!

Jim Wilson
Phila., Pa.

Editor's Note: Yes, Karl Kofoed designed the Lirpa I for the April cover of *Audio*, but he has taken a better paying job as a union jackhammer operator in the oil fields of Shake Nima-Idi somewhere in Lower Saudi Iran.

Audio Afficionado

Dear Sir:

After reading your Equipment Profile on the Lirpa I Receiver while simultaneously perusing the AKAI advertisement on page 43 with my x-ray vision, I cancelled my subscription to the *National Lampoon*.

Charles J. Oeler
Pittsburgh, Penna.

What's new

Cassette Deck

The Sansui SC3000 stereo cassette deck has a high torque d.c. motor with accuracy specified as within ± 2 per cent, even with wide variations in line voltage, and a slip-free drive belt with claimed wow and flutter performance of 0.09 per cent. The two-position bias/EQ switch can be set for either normal or chromium tape. The signal-to-noise ratio for chromium tape, without Dolby, is 50 dB, weighted, and frequency response is 30 Hz to 16 kHz. There are two VU level meters driven by a two-transistor amplifier showing input-output levels of -20 to +3 dB and a red LED which flashes when input signals over +6 dB enters the recording amplifier. Two other LEDs show when the deck is in the recording mode and when the Dolby type B Noise Reduction System is on-line. Price: \$360.00
Enter No. 81 on Reader Service Card

Paragon Preamplifier

The System-E preamplifier is a straight through, all triode tube design using a minimum of amplifying stages, but has a 70 dB input to output gain. There are three phono, three aux, and one tape monitor inputs, and one main and one tape output. The stated specifications include a phono S/N of 70 dB below 10 mV, a high level gain of 27 dB, a high level S/N of 80 dB below 2V, a phono gain of 42.5 dB @ 1 kHz, and a phono overload of 600 mV @ 1 kHz. The unit features a separate power supply, solid walnut side panels, and a low frequency filter. Price: \$495.00
Enter No. 82 on Reader Service Card



Nakamichi Preamplifier

The Model 610 control preamplifier is a basic, no frills approach to component design with THD below 0.001 per cent and phono noise 80 dB below the 1 mV reference level (IHF A weighted). A built-in, switchable, active subsonic filter, with no effect

above 30 Hz, provides 45 dB attenuation at the critical 10 Hz area to prevent rumble and tonearm resonances from degrading sound quality. The tone control circuits are fully defeatable, and the variable contour control permits low and high frequency compensation at low listening levels. Price: \$300.00.

Enter No. 83 on Reader Service Card



ADI Spectrum Analyzer

The Model 1000 audio spectrum analyzer is designed for fast speaker response measurements, room testing, equalization, A-B comparisons, and microphone and recorder evaluation. The unit features two

separate memories for freezing frame displays, a noise generator with gating, a calibrated condenser microphone, microphone and line inputs, and scope outputs. The octave band filters are to ANSI standards from 20 Hz to 22 kHz. Price: \$1295.00

Enter No. 84 on Reader Service Card

WD-40 Spray

WD-40 is a non-greasy spray for cleaning, displacing moisture, and lubricating electronic components.

Leaving no sticky or gummy residue, WD-40 is said to be harmless to rubber, plastics, fabrics, and painted surfaces. Price: \$2.15 per can.

Quam-Nichols Catalogue

"Quam '77, The Sound Decision" is a 12-page catalogue to aid in loudspeaker driver selection. The booklet contains drawings of speaker shapes and mounting configurations along with a description of the magnetic properties. Drivers covered are general purpose, automotive, high fidelity, music instrument and sound system loudspeakers, as well as matching line transformers.

Enter No. 85 on Reader Service Card

Radio Shack Handbook

The Archer Semiconductor Reference Handbook is a 128-page cross-referenced listing of over 36,000 replacement transistors, diodes, and other interchangeable devices. The handbook is obtainable at Radio Shack stores for \$1.95.

ITA Directory

The Spring 1977 ITA Source Directory is a 60-page catalogue of products and services offered by International Tape Association member companies, as well as activities of the audio/video industry.

Enter No. 86 on Reader Service Card

3A Acoustique Speaker System

The Adagio ∞ is a three-way speaker system with a power rating 80 W rms from 30-to-30,000 Hz ± 3 dB with an 11 in. woofer, a six-in. midrange, and a four-in. tweeter. Measuring 12 in. x 13 in. x 12 in., the unit weighs 67 lbs. Price: \$399.00.

Enter No. 87 on Reader Service Card

The new Auditor™ Series by Koss. Don't buy one unless your system is ready for it.

The pleasure of listening to unadulterated music is reserved for those who have carefully put together a system that delivers totally accurate reproduction. Now, for people who wish to explore and expand this realm of pure sound, Koss has designed their Auditor Stereo Headphones. Full, state of the art knowledge of perfect mechanical reproduction of music, and the psychoacoustics of the way the ear and mind respond to sound went into making these phones true to the most intense level of performance possible today.

The sound.

The Auditor Dynamic/10 features an expansive frequency response range of 10-20,000 Hz, while dazzling any ear attuned to the delicate musical balance of psychoacoustically pleasing sound, in a way no other dynamic phone can

duplicate. They are designed to deliver the full impact of letter perfect sound reproduction characteristic of the finest equipment.

And the fury.

On the other hand, for the most carefully designed and engineered excursion into sound ever, the Koss ESP™/10 Electrostatic Stereo Headphone is an unparalleled instrument of beauty. It is a perfectly articulated statement of technological and electronic genius so thoroughly sensitive it belongs in a recording studio serving as the last word in monitoring production. The ESP/10's almost boundless frequency response lays out the entire spectrum of sound for your scrutiny, bringing you every spark of timing, a deep, rich flood of bass, and a smooth, clear lake of treble, with every note balanced and defined.

So if you're content to live with the impurities in second best stereo, the

Koss Auditors aren't for you. Only the high-end connoisseur who has taken all the necessary steps toward putting together a system that is true to perfection will acknowledge and appreciate these precise products as breakthroughs in scientific musical development. The personal signature of John C. Koss says that these headphones are for the audiophile. So if you're ready for the best, and you think your system can measure up to the Sound of Koss, hear the headphones that are designed to put it to the test at a specialist in audio products near you. Or write to Fred Forbes, Audiophile Products Division, for more information on the new Auditor Series by Koss.



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Dynamic/10



ESP/10



auditor™ series by Koss

KOSS® Corporation, Audiophile Products Division, 4129 N. Port Washington Ave., Milwaukee, Wisconsin 53212
Koss International/London, Dublin, Paris, Frankfurt • Amsterdam • Koss Limited/Burlington, Ontario • Koss K.K./Tokyo

Enter No. 21 on Reader Service Card

Technics Speaker System

The Model SB-7000A is a bass reflex, three-way speaker system with a 13 3/4 in. woofer, a 4 1/4 in. cone type midrange, and a 1 1/4 in. dome tweeter in a linear phase configuration. The system has a nominal impedance of 6 ohms, the crossover frequencies are 700 Hz and 6 kHz, and the frequency response is 37 Hz to 22 kHz. Having a claimed SPL of 90.5 dB (one meter, one watt) and a peak input power of 150 watts, the unit measures 33 1/4 x 19 x 16 1/8 in., and weighs 72.8 lbs. Price: \$399.95.

Enter No. 88 on Reader Service Card

Kenwood Receiver

Model KR-5600 AM/FM receiver delivers 40 watts average per channel into 8 ohms from 20 to 20,000 Hz with no more than 0.5 per cent IM or THD, and has a 70 dB S/N ratio on phono. The FM tuner section's rated usable sensitivity is 10.3 dBf, (1.8 μF), and it is spec'ed at



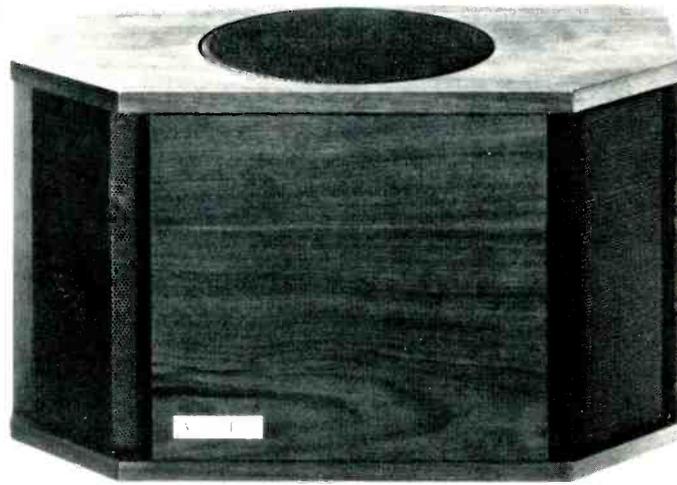
14.8 dBf mono, and 36.6 dBf stereo, for 50-dB quieting. Other features include direct coupled, complementary symmetry in the power stages with multiple protection circuits, and a phase-locked loop FM multiplex section. Price: \$359.95.

Enter No. 89 on Reader Service Card

Wood Fabricating Speaker Stands

The Enhancers are speaker stands designed to raise bookshelf loudspeakers from floor level in order to eliminate performance loss and improve definition. There are three models: the RS-1 is a circular cold-rolled steel unit for 12-in. woofer speaker systems; the RS-2 is a hardwood stand designed for 12-in. or larger speakers, and the RS-3 is a hardwood stand with a 360° swivel action for precise speaker positioning. Prices: from \$15.95 to \$39.95 per pair.

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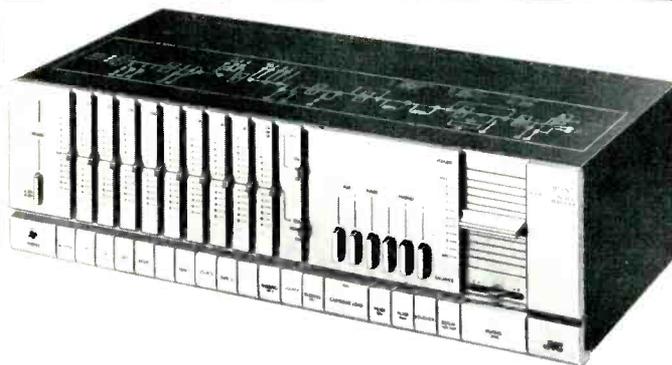


Allison Loudspeaker

The Allison:Four is a bookshelf size acoustic suspension loudspeaker with an 8-in. woofer, and two 1-in. convex diaphragm tweeters with a 2 kHz crossover frequency. The stabilized radiation loading design is said to minimize variations in reflected impedance from listening room boundaries which, with conventional speaker systems, is

very large and causes proportional changes in acoustic power output at middle bass frequencies. With a nominal impedance of 8 ohms, the unit requires a minimum amplifier power of 30 watts to produce 100 dB SPL in most domestic room environments. Weighing 23 1/2 lbs, the unit measures 11 x 19 3/8 x 10 in. Price: \$175.00 each.

Enter No. 91 on Reader Service Card



JVC Preamplifier

The Model JP-S7 stereo control preamplifier utilizes a three-stage, direct-coupled equalizer circuit with a differential amplifier for input, and a class-A fully complementary push-pull circuit for output. The claimed phono frequency response is

Enter No. 92 on Reader Service Card

RIAA from 20 Hz to 20 kHz ±0.3 dB, a THD of 0.05 per cent @ 1 kHz, and a S/N ratio of 65 dB. The unit includes subsonic and high frequency filters, electronic audio muting, a three-position impedance selector, and a built-in headphone amplifier. Price: \$700.00.

Nikko Amplifier

The Alpha 1 is a dual-channel amplifier with a power output of 220 watts into 8 ohms with a claimed THD of 0.08 per cent, an IM distortion of 0.08 per cent, a fre-

Enter No. 93 on Reader Service Card

quency response from 10 Hz to 100 kHz, and a S/N ratio of 100 dB. Designed for rack mounting, the amp has a brushed aluminum front and stainless steel handles. Price: \$599.95.

Quadraphonics Anthology

The first in a series of anthologies from the pages of the Journal of the Audio Engineering Society has been compiled into a 264-page volume containing the most significant papers on quadraphony to appear in the Journal, Vol. 17-Vol. 23 (1969-1975). This 8 1/4 x 11 1/4 in. paperbound text gives the reader both an historical perspective and a basic understanding of quadraphonic sound reproduction and systems. Price: \$9.00.

Enter No. 97 on Reader Service Card

SAE Noise Reducer

The Model 5000 impulse noise reduction system is designed to reduce the "clicks," "pops," scratches and other imperfections on the surface of records with no degradation of program. The claimed IM and THD are 0.1 per cent, the signal-to-



noise ratio is 90 dB, a frequency response is 20 Hz to 20 kHz ±1 dB, and rated output is 2.50 V rms. Price: \$200.00.

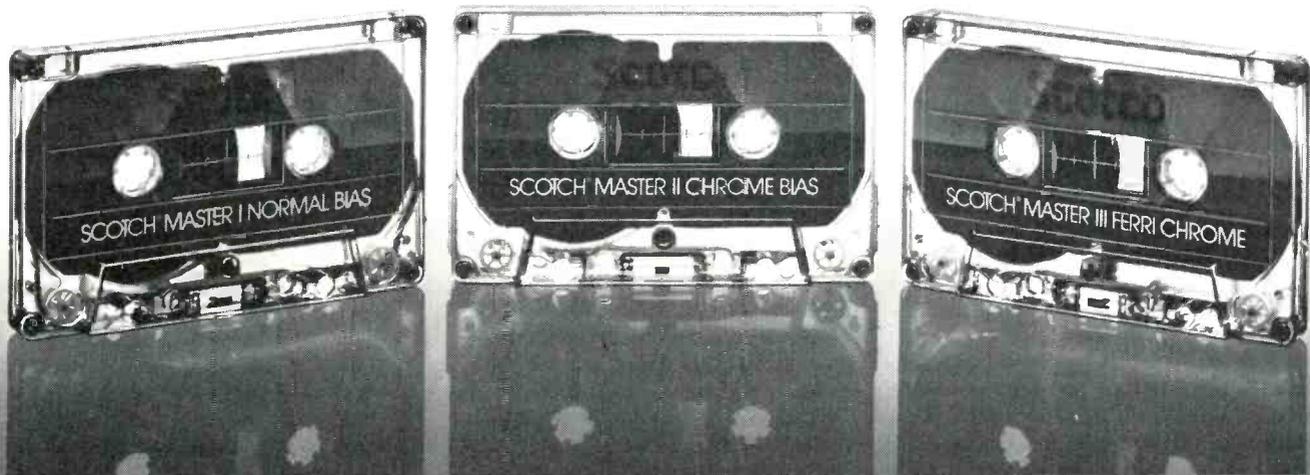
Enter No. 95 on Reader Service Card

Sony Speaker System

The Model SSU-4000 is a three-way, bass reflex loudspeaker system with a passive radiator, using a 10-in. woofer, a 9-in. passive radiator, a 3 1/4-in. midrange driver, and a 1-in. dome tweeter. With a rated power handling capability of 100 W, it is efficient enough to be driven with 20 watts and can accurately handle an amplifier rated up to 150 watts. The frequency response is 30 Hz to 20 kHz, with crossover frequencies of 600 Hz and 5.5 kHz. The cabinet measures 13 1/2 x 47 x 14 1/2 in. and weighs 70.6 lbs. Price: \$400.00.

Enter No. 96 on Reader Service Card

*Now we've mastered
a Scotch® cassette for every switch position.*



Introducing the Master™ Series. Three totally different tapes. Each developed to deliver the truest, clearest sound possible at each tape selector switch position.

Our Master I cassette is for normal bias recording. It features an excellent dynamic range, low distortion, uniform high frequency sensitivity and output that's 10 dB more than standard tapes.

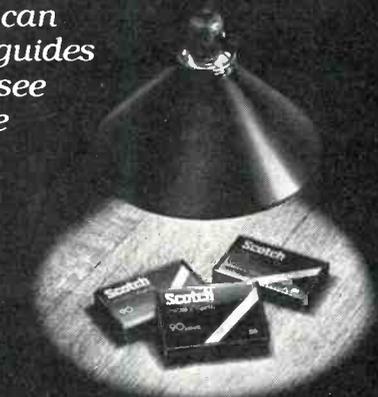
Our new Master II replaces chrome cassettes and is designed for use on hi-fi stereo systems with chrome bias (70 microsecond equalization). It features some spectacular performance characteristics, including a special coating that gives it a 3 dB better signal-to-noise ratio at low and high frequencies than chrome cassettes, yet it's less abrasive.

Our new Master III is for the ferri-chrome setting. It's formulated with the most advanced technology available, giving a 3 dB output improvement at low frequencies and 2 dB at high frequencies. And the unique dual layer construction increases both low and high frequency sensitivity over chromium dioxide and ferric oxides.

All this, plus unique inner workings you can actually see. Our new Master line has a special bonus feature. A precision molded clear shell that allows you to monitor the inner workings of the cassette. You can actually see the recorder head penetration and the unique roller guides in action. Look closely at the transparent shells above and you'll see the water wheels which were specially designed to move the tape evenly across the head, reducing friction and noise. And two radially creased shims insure smoother wind, improved mechanical reliability and reduced wow and flutter.

Enough said. Now it's time for you to take the true test. Match up the right Master cassette with the bias you prefer. Then just listen.

You'll find that whichever switch position you use, a Scotch Master is the way to get the most out of it.



**Scotch Recording Tape.
The truth comes out.**

Enter No. 59 on Reader Service Card

After people learn what we've done, no one will heckle our speakers.

We're as close to the impossible as possible.

Our new speakers color sound.

Anybody's speakers do.

Should someone tell you otherwise, they speak with forked frequency response.

We at Sony approached the development of our new speaker line with this grim reality in mind.

Thus our goal was to create speakers with a minimum of coloration. With a frequency response flat and wide. With low distortion. And with repeatability. Which is critical. Which means that each speaker we turn out will sound like the one before and the one after.

Searching and researching.

Our basic dilemma was that speaker specs don't specify much.

You can build two speakers with identical specs, and find they'll sound non-identical.

That's because your sophisticated ear can pick up differences our clumsy measurements can't.

Some examples:

You can hear how pure water is. The purity of the water in which the pulp for the speaker cone is pressed will influence the sound. (Spring water is the best.)

But water purity would hardly change the frequency response—or any other measurable characteristic.

Nor would the dye used to color the cone—or the glue used in gluing the cabinet.

But you'd hear the dye and the glue.

And there are dozens and dozens of elements that interact this way.

So our job was mammoth. To correlate these factors in order to reach the goal we outlined earlier. Changing one

changes the other and almost changed our minds about going into the speaker business.

But we stuck it out. And found the answer to the juggling of these variables thanks to a major technological innovation.

Trial and error.

That's why we labored for three years to bring you our speakers. While other manufacturers rushed frantically to market with theirs.

We keep the whole world in our hands.

Once we understood how to control the sound of our speakers, we realized we had to control what went into our speakers.

So we did the only logical thing.

We built a plant.

And pursuing that logic, we built it at a place called Kofu. Which is at the base of Mt. Fuji. Where we can get all the spring water we want.

This factory does nothing but produce—under outrageously close control—the components for our speakers.

Whatever we do buy, we specify so carefully that our vendors have nightmares about us. (It's unfortunate that we can't make *everything* ourselves, but only God can make a tree, and only wood can make a fine cabinet.)

Few companies make this effort.

So it's safe to say that when it comes to exercising this kind of control, our speakers are a voice in the dark.

Improvements that are heard and not seen.

As you can see, there's a lot that goes into producing a speaker that's not easily seen. (One beautiful exception—the handsome finish on our cabinets.)

That includes the carbon fiber that we mix into the speaker cone paper.

Carbon fiber is light and strong. (Why they don't use it in girdles we'll never know)

Light, so our speaker is more efficient. Meaning you need less power to operate it. Meaning you are closer to the ideal of converting electrical energy to mechanical energy without a loss of power.

Light, so our speaker cone reacts quickly to stops and starts in the signal. The result: improved transient response.

Strong, to prevent the cone from bending out of shape in the high frequency range.

Moreover, carbon fiber doesn't resonate much. It has what's called a low Q, and it took someone with a high IQ to realize it would absorb the unwanted vibration rather than transmit it down the cone.

We also cut down on unwanted vibration (as opposed to the wanted vibration, which is music), by using a cast aluminum basket rather than a stamped, shoddy cheap metal one.

We could go on, but at this point the best thing would be for you to move on to your nearest Sony dealer. And listen.

Because the results of our three years of labor will be clear after three minutes of listening.

At which point, far from heckling our speakers, you'll be tempted to give them a standing ovation.

SONY®

© 1977 Sony Corp. of America, Sony, 9 W. 57 St., N.Y., N.Y. 10019
SONY is a trademark of Sony Corp.

Suggested retail prices: SSU-3000, \$300 each; SSU-4000, \$400 each.

Enter No. 45 on Reader Service Card



**The SSU-3000 and SSU-4000.
Great speakers like these deserve an audience.**

TURNTABLES

Do Turntables Affect Sound?

Joseph F. Grado*

One of the questions I am consistently asked is "Which is the best sounding turntable?"

On the surface it would seem to be a rather silly question, since everyone knows that turntables are not supposed to make any sounds. It is the phono pickup which is designed to take the mechanical motions from a record groove and change them into electrical signals. These signals are then amplified and converted into sound via the amplifier and loudspeakers.

Well, then, it should be obvious that the turntable cannot possibly produce any sound of its own...or can it?

This is the first of a series of articles dealing with turntables, tone arms, phono cartridges, and the integration of these three into a system. These articles will also describe in depth the various good and bad design parameters of the three products and further deal with the advantages and disadvantages of the components individually and as an integrated system. We will also cover solutions to the problems encountered when setting up and using such a system. These articles will be written as far as is possible in simple, understandable layman's language.

Although it is imperative that the audiophile be made aware of the problems encountered as he attempts to assemble a phono system (turntable, tone arm and pickup), it is even more important he be advised of the solutions to these problems, both at

the time of physically assembling the phono system and earlier when making his initial purchase of the components which will comprise the phono system.

In the early days of high fidelity, we audiophiles were confronted with similar problems regarding the assembly and proper matching of components. At that time, it wasn't the phono system that was our dilemma, it was the loudspeaker system. The high fidelity industry was a fledgling industry 20 years ago and very few total speaker systems (completely designed and assembled by the manufacturer) were to be had. The path the audiophile took was to purchase individual drivers (speakers) and build himself a speaker enclosure. The reward for physical labor was good sound and knowledge.

It was not uncommon for the audiophile to build a "new and better" speaker box every week. Needless to say, it became a virtual contest between audiophiles as to whose speaker enclosure was the best. With a variety of shapes and sizes (finish was not a necessary criteria) being exhibited and discussed, it became a joyful delirium to be an "audiophile."

Today we have a similar situation in the audiophile market. A delirium, yes! A joy, hardly, unless of course you enjoy spending your dollars for a phono system that promises but doesn't deliver. But let's return to that question we asked above.

Do turntables affect the sound of a phono system? The answer is an absolute YES! The next question is, how?

Going back to basics, we know that a phonograph record has grooves

which are followed or tracked by the phono pickup. These grooves have a wiggly (how layman can one get?) shape which impart a mechanical motion to the pickup stylus and generating system. This mechanical motion becomes the sound you hear! This is an important key to the solution for understanding! The phono pickup senses a *mechanical* motion from the record, and this motion is changed into sound.

The pickup, however, cannot tell whether the mechanical motion it is sensing from the record is actually cut into the record or whether the turntable, for one reason or another, is adding mechanical vibration on the record surface. If the turntable has absolutely no vibration of any sort, then the pickup will play back only the recorded sound. Distortion will be at its lowest under these conditions. If the turntable adds mechanical vibration to the recorded sound of the phonograph record, the pickup will reproduce both. This will result in playback distortion.

Feedback

Distortion can and does exhibit itself in many different ways. You may hear it as obvious distortion which makes listening very unpleasant. You may hear it as an undesirable effect or objectionable resonant coloration. You may hear it as a subtle effect which may be somewhat annoying but not totally unpleasant. Then again, you may not hear it at all as identified distortion, yet find yourself constantly fatigued from listening to your system. The above variation in effects is governed by the types of

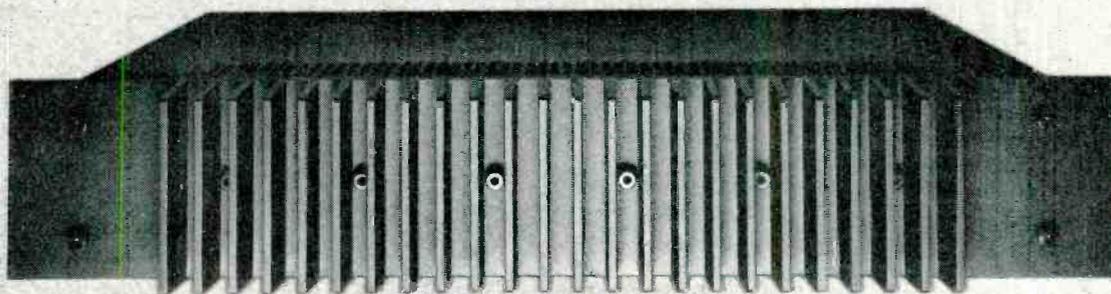
A New Dimension



Two new electronic products from Nakamichi may be just what you've been waiting for. The 410 Preamplifier and 420 Power Amplifier are incredibly compact, beautifully styled and decidedly affordable. Measuring less than 9" x 16" and barely 3/4" thick, both are timeless design expressions... pure Nakamichi in quality and performance.



The 410 approaches the theoretical limits of error-free amplification. A superb phono section, inherited from Nakamichi's amazing 610 Control Preamplifier, utilizes unique circuitry to minimize noise and distortion while maximizing dynamic range. Three phono input sensitivities accommodate a wide variety of cartridges. There is even a switchable active subsonic filter that keeps rumble and tonearm resonances from degrading sound quality. Additional features include fully defeatable tone control circuits, variable contour compensation, high-output headphone jack, and a 2 dB-stepped precision volume attenuator.



The 420 Power Amplifier is a neat, efficient unit for perfectionists with moderate power requirements. The unique output circuitry originally developed for the Nakamichi 620 virtually eliminates crossover and switching distortions without high idling current. The resulting low operating temperatures ensure long-term reliability. And, like the 620, the 420 employs a super-efficient toroidal power transformer, low negative feedback and foolproof protection circuitry—all of which add up to exemplary performance specifications and an effortless sound quality that belies its conservative power rating.

Let the 410 and 420 add new dimensions to your listening pleasure. See and hear them at a Nakamichi dealer soon. Your ears will thank you. For further information, write Nakamichi Research (U.S.A.), Inc., 220 Westbury Avenue, Carle Place, New York 11514



from Nakamichi

410 Preamplifier: Phono S/N (IHF-A): Better than 80 dB ref. 1 mV
R₁AA Deviation: Within 0.3 dB
Subsonic Filter: -45 dB @ 10 Hz
Distortion: Less than 0.003%
Frequency Response: 20-50,000 Hz ± 0, -1.5dB

420 Power Amplifier: Power Output: 50 watts per channel min. rms @ 8 ohms,
5-20,000 Hz, with less than 0.02% THD
S/N Ratio (IHF-A): Better than 110 dB @ rated output
THD @ 1 kHz: Less than 0.0008% at any power level below clipping
Frequency Response: 5-50,000 Hz ± 0, -1dB

mechanical vibration the turntable adds to the recorded music.

The basic causes for turntable mechanical vibration are many but they may be categorized as follows:

Design Parameters in the drive system (center drive, rim drive, belt drive, etc.);

Design Parameters in the rotor assembly (shaft and bearing, center motor drive, etc.);

Design Parameters in platter design (light weight, heavy fly wheel, type of material), and

Design Parameters in chassis design (rigid, light, rigid massive, material, etc.).

The above vibration sources can be minimized or avoided by the audiophile only through purchasing knowledge. This we hope he will have received after reading these articles. (*Editor's Note:* And our equipment profiles!—E.P.)

One of the major sources of mechanical vibration to the turntable is feedback, which is of two types basically, mechanical and acoustical. The loudspeaker creates sound by moving air. This air is pumped into the room in the form of low to high level pressures at multiple frequencies and in complex patterns and changing forces. The lower the frequency, the more obvious the mechanical force becomes until you reach a frequency so low that it cannot be heard. Although you cannot hear the loudspeaker at these very low frequencies, these sounds are still capable of creating enough energy to rattle windows and shake walls. If you examine the prior statement carefully, you will understand that the loudspeaker creates acoustical energy through the air with enough force to shake walls. It also creates mechanical energy in the turntable platter and chassis in the same way. This is acoustical feedback.

However, there are times when the acoustical energy will not have enough power to excite the turntable directly and yet still have enough energy to excite the table or shelf on which the turntable is sitting. The acoustical energy is changed into a mechanical motion to the turntable through the shelf or support. This is called mechanical feedback excited by acoustical energy (or the combination of acoustical and mechanical feedback).

Mechanical feedback is caused by the loudspeaker box sitting on the floor and vibrating through the floorboards into the wall beams and mechanically coupling the loudspeaker energy to the turntable support

and the turntable itself. The balance of this article will deal with the solutions of the above acoustical, acoustical mechanical and mechanical energy feedback problems. The turntable design problems will be explained in the next article since they are interrelated with tone arm function.

To understand the feedback problem, one must first of all be aware that everything surrounding us (pictures on a wall, drinking glasses, furniture, etc.) can be made to vibrate (resonate) if enough energy is applied to the item at some particular sound pitch (frequency). The heavier (more massive the object), the more energy is required to cause it to vibrate. The lighter (less massive the object), the less energy is required to cause it to vibrate. Therefore the picture on a wall will require less energy to cause it to vibrate than the amount of energy required to cause a piece of furniture to vibrate.

When the loudspeaker creates acoustical energy in a room (pulsating air pressure with constantly changing multiple frequencies), it will cause various objects to vibrate, the turntable being one of them. Different parts of a turntable will vibrate with varying amounts of acoustic energy in a room. The three basic parts of a turntable which will vibrate are shown in Fig. 1 and are A, the platter; B, the main board, and C, the base.

A church bell can be rung with a hammer, or it can be made to "hum" by blowing air into it and changing the sound pitch of the air. Similarly, the acoustical energy in a room from a loudspeaker changes pitch and intensity until the turntable platter (if you think of the platter as a bell) starts to hum. This acoustical energy may or may not be audible, yet this humming is a mechanical vibration that is added to the recorded sound. It is distortion that the audiophile can do nothing about.

If your turntable platter is properly designed, the acoustical energy in the room should not excite it, but then the main board on the turntable (B in Fig. 1) may be excited into vibrating. This also adds mechanical vibration to the recorded sound and creates distortion. There is nothing the audiophile can do to correct this situation.

If your turntable platter and your mainboard are not excited, it is still quite possible that the turntable base can be made to resonate. This will add mechanical vibrations to the recorded sound and will cause distortion. The distortion created by the above con-

ditions are quite different from each other. The distortion can range from frizzy highs to an overall muddy sound. Adding mass to the outer frame will reduce and/or eliminate this latter problem. Example: If a turntable has a flimsy or lightweight wooden base, made from wood ½-inch thick, the addition of a dense 2x4-inch wood frame glued as an outside frame (Fig. 2) will add mass and reduce the effects of acoustical energy (more energy is required to move the additional mass). If you were to use lead slabs instead of 2x4-inch wood, the mass would be increased considerably and the problem of the turntable base resonating would be eliminated. It is also important to know that there are turntables sold today that drastically reduce or eliminate any and all of these acoustical energy sensitivities.

Purchasing Hints

When you buy a turntable make sure that the platter is massive, dense, and rings as little as possible when tapping on the metal with your fingernail (under the rubber mat). Determine that the turntable mainboard is dense and makes as little noise as possible when you tap it with your fingernail. Be sure that the frame is not flimsy, but rather rigid and makes as little noise as possible when tapped with the fingernail. Many of the newer turntables utilize a granite epoxy material which comprises both the turntable mainboard and the frame. These generally are excellent and also tend to absorb the mechanical vibrations from the turntable drive mechanism before it reaches the tone arm.

The main cause of feedback disturbance in a phono system comes from mechanical energy directly coupled to the turntable through its standing supports (Fig. 4). It is a known fact that acoustical energy converted to mechanical energy (through walls or floor) can actually shake the total turntable and add mechanical vibration to the recorded sound and will thus create distortion.

Many attempts have been made to isolate or decouple the turntable mechanically from the room via springs or rubber mounts. Some have been moderately successful, others are a sham. Only in a very few cases have they been totally successful in properly decoupling the turntable from mechanical vibrations, and most have been unsuccessful in removing the previously described acoustic feedback problems.

Recently there have appeared on

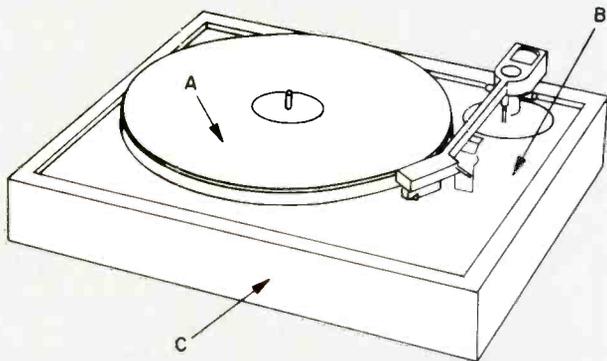


Fig. 1—The three basic parts of the turntable which vibrate are A, the platter; B, the main board, and C, the base. Each section will vibrate with a different amount of energy.

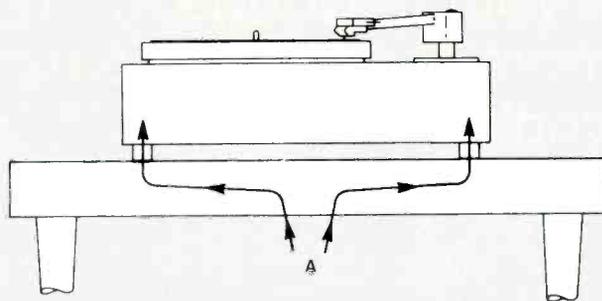
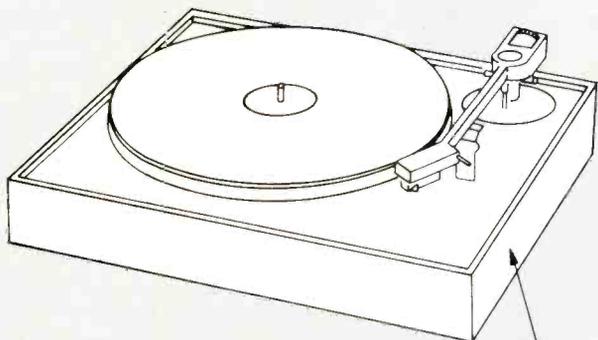


Fig. 4—Feedback disturbance comes through mechanical energy (A) directly coupled to the turntable through the standing supports, adding mechanical vibration to the recorded sound and creates distortion.



THIN FRAME BASE
RESONATES EASILY

Fig. 2—If the base of the turntable is lightweight or flimsy, it can easily be made to vibrate and produce distortion ranging from frizzy highs to muddy lows.

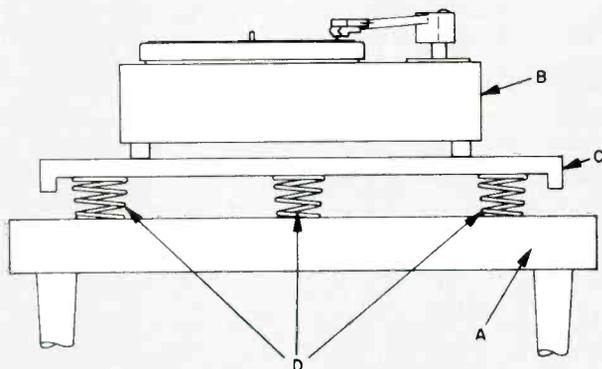


Fig. 5—The best approach to energy decoupling is to use a thick, dense, massive board (C) and a number of coil springs (D), about three-inches in diameter, between the platform (A) and the base of the turntable (B) so distortion is reduced to a minimum.



2" x 4" FRAME
FOR ADDED MASS

Fig. 3—The addition of a dense, 2x4-inch hardwood frame, glued to the base of the turntable, will add density to the frame and reduce the effects of acoustical energy.

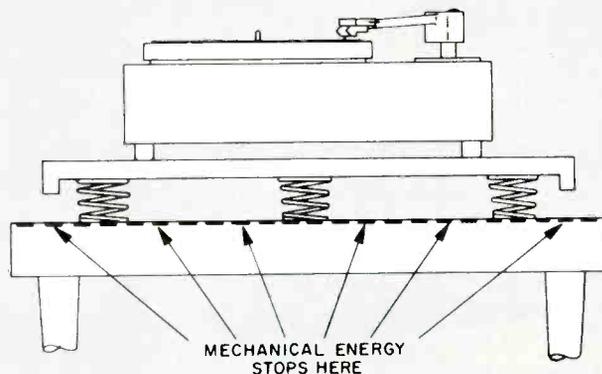


Fig. 6—When properly set up, with the turntable leveled, mechanical energy stops on the top of the platform at the base of the springs so the turntable plays back only the recorded signal with no added distortion.

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

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

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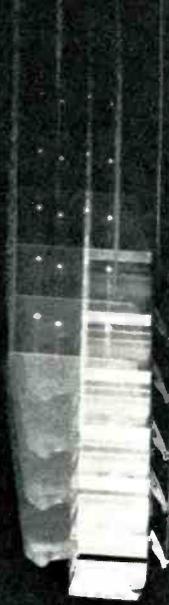
Are these new models worth the difference? Absolutely. You'll be amazed at what you hear from today's generation of phono cartridges. Improved frequency response. Lower distortion. Better separation. Less record wear. Truly better sound.

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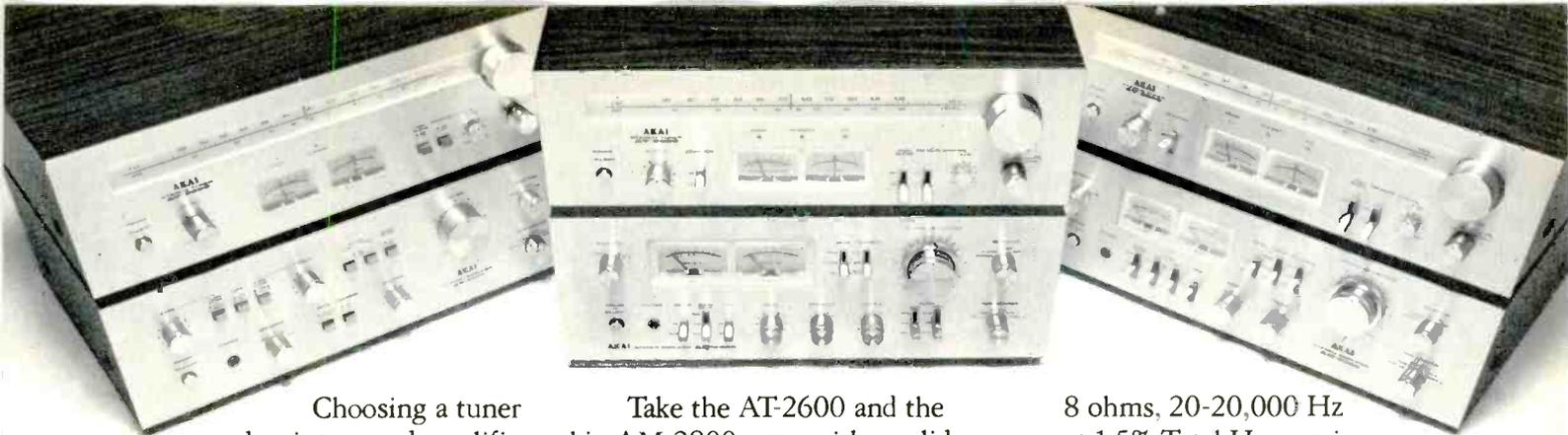


the market, products which are designed to decouple the turntable from mechanical vibrations. However, the need to design them as a quick solution for a universal application also usually makes them a compromise affair. They do, without a doubt, reduce the feedback problem but not optimally in every case.

One must understand that the frequency at which the energy decoupler resonates must be above the rotational (speed) of the turntable (33-1/3), which is approximately 1/2 cycle per second, and yet lower than the resonant frequency of the tone arm mass and cartridge compliance which is optimally 8-9 cycles per second.

The calculated frequency for optimum decoupling of mechanical energy to the turntable is 2-3 cycles per second. To achieve this in a device to be used on all turntables regardless of mass seems like an impossible task, and yet the solution is actually very simple. One of the best approaches to energy decoupling is to use a very dense, thick, massive board and a number of coil springs, about three inches in diameter. How these are arranged is shown in Fig. 5, and the theory behind this is fairly simple. If one spring will support four lbs. at a resonant frequency of 2-3 cycles per second, then use six springs if your turntable and board weigh 24 lbs. As you can see, the mechanical motion transmitted either by acoustical or mechanical energy to the main support A is absorbed by the decoupler springs D, so that the turntable plays back only the recorded signal and does so with minimum distortion. Properly set up, with the turntable leveled, even jumping on the floor will not make the arm skip. If you were suffering from feedback, the difference in playback sound with this system could be startling! At this time, obtaining such springs is not an easy task since most audiophiles don't have access to a quality spring-making shop. However, we will make available a device that uses such springs in the near future.

I have only scratched the surface of these problems, as you will see in the future articles, one of which will tell you how to set up your high fidelity system without any test equipment and as accurately as an engineer can utilizing thousands of dollars of test equipment. My next article will deal with the design and function of tone arms and a partial discussion on the interaction of the tone arm, turntable, and phono pickup when used as a system.



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8 ohms, 20-20,000 Hz at 1.5% Total Harmonic Distortion. And the AT-2400 tuner.

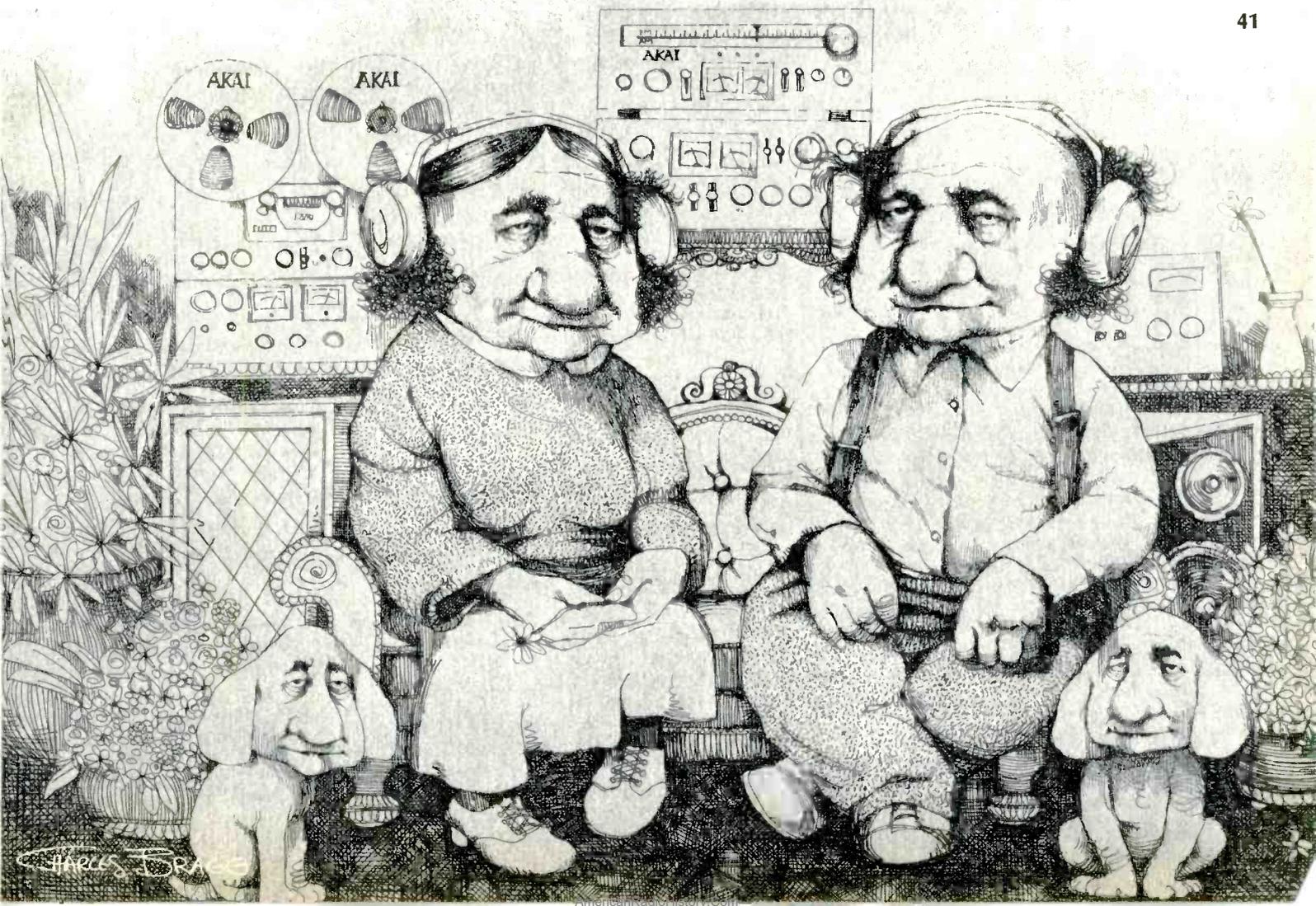
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Hiramatsu, you see, didn't just invent a better turntable. He actually created a whole new state of the art. Starting from the ground up. Probing areas that few people had ever looked into before.

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.

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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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IRON CURTAIN RECORDS

Greg Morrow

Anyone who collects classical records as a hobby is, in all probability, acquainted with the major West European record companies: *DGG*, *Philips*, *Decca/London*, *EMI/Angel*, and *Telefunken*. All of these labels are firmly entrenched in the American market place, and their products are widely distributed and well known. But, unfortunately, few U.S. collectors have a wide knowledge of the record firms in the other Europe—the socialist nations of Central and Eastern Europe. This article is intended to introduce the American classical buff to some of the Eastern European treasures within his reach.

Unlike the West European firms mentioned above, the Eastern European record companies and labels have had, until recently, only a small following in the United States. For several decades after World War II, Soviet and East European performances could only be heard on such labels as *Artia*, *Parliament*, *Urania*, *Concert Hall*, *Bruno*, and a few others. These labels were (and are) little known and unevenly distributed, and while the companies mentioned had good intentions, the recordings were often poor, both from the technical and musical standpoints. Obviously, a way was needed to distribute high quality pressings of Eastern bloc performances. Finally, in 1966, a positive advance in this direction was made when *EMI/Angel* was given rights by the Soviet government to press and distribute Soviet recordings in the United States. At long last, recordings from an Eastern bloc source were given the representation they deserved here. These new discs were up to the typically high standards of *Angel* and the American classical record consumer, and the creation of the *Melodiya/Angel* label was deemed an artistic and financial success. Since then, *DGG*, *Philips*, *Westminster*, *Turnabout*, *Columbia*, *London*, *Telefunken*, *Vanguard*, *Monitor*, *Musical Heritage Society*, and *Nonesuch* have

offered high quality performances from various Eastern European sources. In addition, the catalogues of several important Eastern bloc firms have been made available here through importers. Now the devoted discophile can choose from among the best of the Eastern bloc recordings.

Musically, much praise can be given to the majority of these recordings, for there are some wonderful things to be heard on these labels, both conventional and off-beat. One hasn't really heard Smetana's *My Country*, for instance, until you've heard the version on *Supraphon* with the Czech Philharmonic conducted by Karel Ančerl. To hear the music of Prokofiev, Chopin, Dvůřák, Penderecki, and Shostakovich performed by their own native countrymen is to gain a new insight into the works being played. Such ensembles as Leipzig Gewandhaus Orchestra, Bolshoi Opera, or Warsaw Philharmonic are fully the equal of their Western counterparts, and the outstanding recordings these and other groups have made should be heard by all music lovers.

Technically, the most recent East European recordings can hold their own with any Western discs. The Dolby system is now in use by most studios, and Western recording equipment is widely used. Eastern bloc pressings (produced for Western consumption) are generally of a high standard, and most discs can be purchased without any fear about low quality. Of course, there are some exceptions—some of the older Soviet mono items may have been big news in 1940, but by 1977 standards they suffer from poor surfaces, atrocious acoustics, and trite packaging. On the other hand, the most recent Soviet-produced discs are usually of very good quality, with relatively quiet surfaces. (One distinct advantage that East bloc discs enjoy over American ones is that they are thick and heavy—no Dynaflex here!) Those who purchase Eastern bloc recordings pressed by Western labels can expect the customary high quality of such firms as *DGG*, *Philips*, or *Vanguard*.

The labels discussed in this article are those that are believed to be of the greatest importance to the American classical collector. Czechoslovakia, Poland, the Soviet Union, Hungary, and the German Democratic Republic are represented. Romania, Yugoslavia, Bulgaria, and Albania are omitted since not enough information about them has been received to warrant their inclusion. Readers will also notice that, almost without exception, only one or two labels per nation are discussed. One has to remember that these are socialist nations with planned economies, and capitalist competition does not exist. In all cases, the State Ministry of



Culture in each nation is in control of the recording firms, and the government determines the production, advertising, artists and their repertoire, and distribution of all records. This system has its faults, but all major performing groups can record without worries about high recording costs or profit/loss statements hanging over their heads.

The labels are grouped by nation, and a general overview of each label is attempted. At the end of each group a selection of three recordings representing the finest work done by each firm is given.

Hungary

The *Qualiton* label has become well-known throughout the Western world for its technical quality and imaginative programming. *Qualiton* has been exporting to the West for years, and the pressings and packaging are up to Western standards, in virtually every case. Their most ambitious project to date has been the **Bartok**

Complete Edition, which endeavors to put every note the composer ever wrote onto microgroove. The project is virtually complete, and all Bartok freaks should definitely investigate the series. Kodaly is another featured composer given wide coverage, and especially interesting is a set of his works for chorus, in addition to his well-known orchestral compositions. Liszt's virtually unknown sacred choral pieces have also been recorded. For Hungarian musicologists, a three-record **Musica Hungarica** set traces the development of Hungarian music from its quasi-oriental roots to Franz Liszt, and a continuing (now 10 discs) **Musica Rinata** series chronicles the Baroque Age in Hungarian music.

A budget label, *Hungaraton*, numbers over 40 releases to date. This is the first budget label of any socialist nation, and the music of many composers is featured. On both the *Hungaraton* and *Qualiton* labels, conductors such as Janos Ferencsik, Antal Dorati, Vilmos Tatrai, Gyorgy Lehel, and others lead the Budapest Philharmonic, Budapest Symphony, Hungarian Chamber Orchestra, Hungarian State Orchestra, and the Orchestra of the Hungarian Radio and Television. Bartok's wife, Ditta Bartok-Pasztorzy, is pianist in her husband's



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Of our TX-4500, one test report said, "...one of the finest receivers available today at any price."

Of our TX-2500, another said, "...sounds a good deal better than the data suggest—and better than one has a right to expect at \$300."

If the data don't suggest the total quality, it may be we're too cautious in our claims. But, we have other equipment too new to have been reported on as yet. All are built to the same exacting standards, featuring exclusive Onkyo advances. We'll try to be a bit less modest as we tell about:

Quartz-Locked Tuning—This is the tuning system of which the most famous testing lab said, "...a new system that completely eliminates tuning errors in FM reception." This is done by using a quartz crystal oscillator which takes advantage of the unique capability of precisely ground quartz to maintain a fixed frequency.

The Quartz-Locked circuitry compares the tuner's IF frequency with the frequency generated in the Quartz-Locked oscillator, continually compensating for frequency differences that would cause distortion or poor reception, and additionally compensating the FM tuning meter at the same time.

Servo-Locked Tuning—An economy version of the Quartz-Locked system with similar characteristics in a different configuration. While essentially an automatic frequency control circuit, Servo-Lock is more sophisticated in design and performance and in actual lab tests has held stations for at least 24 hours without perceptible drift.

Quartz-Locked AM/FM Stereo Receiver

TX-8500—Power output 110 watts per channel, minimum RMS at 8 ohms, both channels driven from 20 Hz to 20 kHz with no more than 0.1% Total Harmonic Distortion.

Direct coupled differential pure complementary main amplifier with ultra wide frequency response, 2 Hz to 60 kHz \pm 1 dB at main amp. Total Harmonic Distortion less than 0.1% at rated output; 0.08% at 1 watt output. Rated FM sensitivity 1.7 μ V (mono), 4 μ V (stereo). 50 dB quieting sensitivity 3 μ V (mono), 35 μ V (stereo). Image rejection ratio 83 dB; alternate channel selectivity 70 dB; IF rejection ratio 100 dB. S/N ratio 70 dB (mono), 65 dB (stereo).

TX-4500—Power output 55 watts per channel, minimum RMS at 8 ohms, both channels driven from 20 Hz to 20 kHz with no more than 0.1% Total Harmonic Distortion.

Direct coupled differential complementary main amplifier with ultra wide frequency response, 2 Hz to 80 kHz \pm 1 dB at main amp. Rated FM sensitivity 1.8 μ V (stereo). Image rejection and alternate channel selectivity 70 dB. IM distortion 0.3% at rated power; 0.1% at 1 watt output.

Servo-Locked AM/FM Stereo Receivers

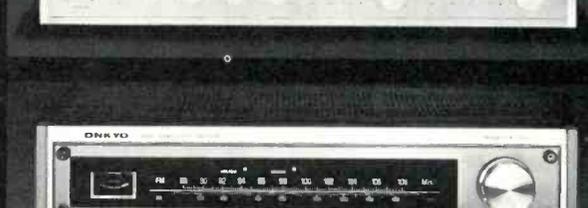
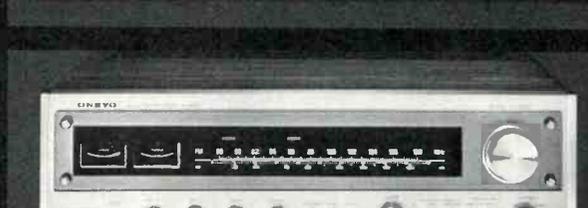
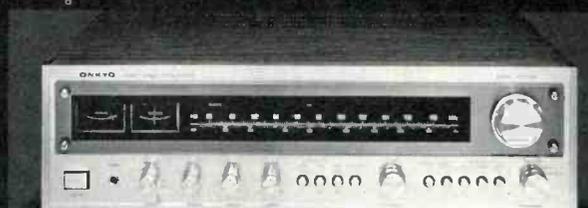
TX-2500—Power output 27 watts per channel, minimum RMS at 8 ohms, both channels driven from 40 Hz to 20 kHz with no more than 0.5% Total Harmonic Distortion.

Direct coupled differential main amplifier with frequency response of 2 Hz to 60 kHz \pm 1 dB. Total Harmonic Distortion no more than 0.5% at rated output; 0.2% at 1 watt output. IM distortion 0.5% at rated power; 0.3% at 1 watt output. Usable sensitivity in FM, 2 μ V (mono), 5 μ V (stereo). Image rejection 45 dB; alternate channel attenuation 60 dB; S/N 65 dB (mono), 50 dB (stereo). IF rejection 80 dB.

TX-1500—Power output 15 watts per channel, minimum RMS at 8 ohms, both channels driven from 20 Hz to 20 kHz with no more than 0.5% Total Harmonic Distortion.

Direct coupled differential amplifier with overall frequency response 20 Hz to 20 kHz \pm 1 dB. Total Harmonic Distortion no more than 0.5% at rated power; no more than 0.3% at 1 watt output. Usable FM sensitivity 2.3 μ V (mono), 5 μ V (stereo). 50 dB quieting sensitivity 4.5 μ V (mono), 50 μ V (stereo). S/N ratio 55 dB (mono), 60 dB (stereo). IF rejection 80 dB. Alternate channel attenuation 60 dB.

All of Onkyo's receivers feature multiple speaker outputs as well as multiple tape inputs and outputs including tape to tape dubbing. All are built to specification which often exceed their price ranges with special features, including Phase Locked Loop Multiplex.



of State-of-the-Art.

Quartz-Locked AM/FM Stereo Tuner

For those who are satisfied with their present amplifier but want the distinct benefits of Quartz-Locked tuning, Onkyo offers the T-9, the only component tuner in the world that has Quartz-Lock.

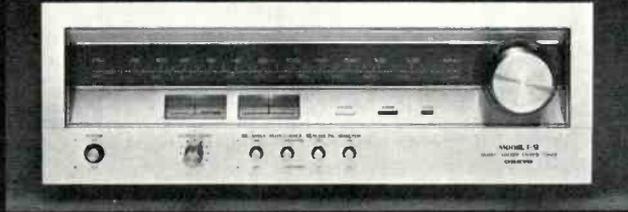
In addition to the precision tuning capabilities of the T-9, it features a dual gate MOSFET/4 gang-variable capacitor front end with usable sensitivity 1.7 μ V, 50 dB quieting sensitivity of 3 μ V, 83 dB Image rejection and 73 dB S/N in stereo.

The T-9 uses Phase Locked Loop Multiplex for low distortion, high separation stereo reception. At 1 kHz, stereo separation is 40 dB; at 100-10,000 Hz, separation is 35 dB.

Assuring continuous, drift-free tuning, the FM oscillator circuitry is hermetically sealed to prevent environmental influence on the components.

Other specifications include an IF rejection ratio of 100 dB and AM suppression ratio of 50 dB. In addition to Quartz-Locked tuning and exceptional performance characteristics, the Onkyo T-9 provides a special feature for tape recording directly from the tuner.

Known as the Tape Recording Level Check Switch, activation injects a 440 Hz tone, which corresponds to the 50% modulation of the FM signal and enabling the recording level of the tape deck to be accurately set, as well as preventing overloading and distortion. Onkyo's T-9 provides some of the cleanest tape recording possible.



Solid State Integrated Amplifiers

Having the only Quartz-Locked Tuner in captivity, Onkyo felt the need to provide amplifiers capable of delivering the same quality. There are, at present, two amplifiers in this series... A-5 and A-7. Both have been designed for their power handling quality, featuring reserve power for optimum sound reproduction with absolutely minimum distortion.

Because of this basic, very low distortion design, these amplifiers require exceptionally muscular and stable power supplies with more power than needed for normal operation, and a lot available when needed for peak demands. These needs are met through massive transformers and oversized electrolytic capacitors. Thus, an extremely stable power supply is assured for hours of continuous operation. Further, specially selected power transistors are mounted in oversized heat sinks and the entire unit is enclosed in a more than ample cabinet which allows for the flow of cooling air.

A final Onkyo touch for clear, clean highs and deep-down lows is design approach and construction that approaches the theoretical zero point in equivalent series resistance (ESR). Through circuitry which uses copper plates instead of wires called the bus feeder ground system, and unusually heavy gauge wiring to the power transformer the overall frequency response is greatly enhanced. Because of these and other considerations the following ratings are established conservatively:

A-5—Power output of 45 watts per channel, minimum RMS into 8 ohms, both channels driven, from 20 Hz to 20 kHz with no more than 0.1% Total Harmonic Distortion.

Onkyo avoids the primary distortion found in solid state amplifiers with Class A, push-pull driver stage differential direct coupled, pure complementary circuitry. The A-5 delivers exceptional frequency response of 2 Hz to 70 kHz \pm 1 dB with system square wave response showing less than 5% tilt at 50 Hz. S/N ratio is extraordinary at 110 dB (IHF A Network).

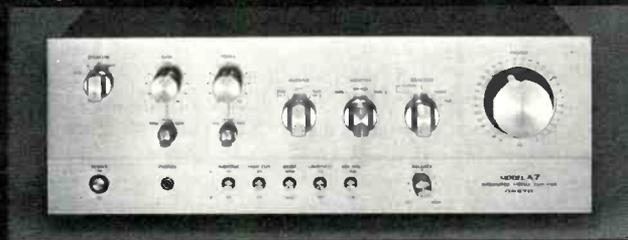
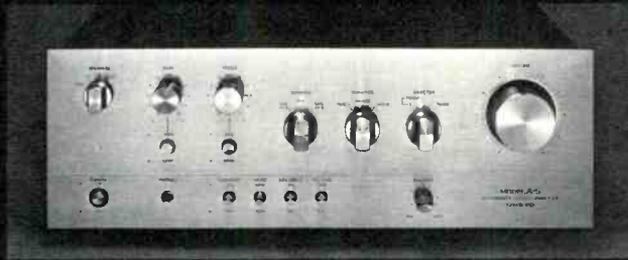
Features include two Phono inputs and two tape monitors and dubbing, as well as tone controls and defeat, muting and a subsonic filter plus transient killer circuitry.

A-7—Power output 65 watts per channel, minimum RMS at 8 ohms, both channels driven, from 20 Hz to 20 kHz, with no more than 0.1% Total Harmonic Distortion.

Onkyo's A-7 integrated amplifier also uses a Class A driver stage differential direct-coupled pure complementary circuitry. The A-7 frequency response is 2 Hz to 80 kHz \pm 1 dB with square wave response showing less than 5% tilt at 50 Hz. At no point does the A-7 exceed 0.1% Total Harmonic Distortion at rated power, and at 1 watt output, Total Harmonic Distortion is as low as 0.08%.

In the amplifier section the phono equalizers are based on Class A, differential push-pull circuitry with exceptionally low noise characteristics, e.g., the A-7 shows an impressive S/N ratio of 110 dB.

A number of special features are included, such as a subsonic filter and a high frequency filter as well as transient killer circuitry. Stepped tone controls are provided with two turnover frequency switches and tone control defeat. Phono overload is exceptional at 230 mV RMS at 1 kHz, 0.1% Total Harmonic Distortion, and the RIAA Curve Deviation of \pm 2 dB, 30 Hz to 15 kHz produces superb reproduction of your records.



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complete **Mikrokosmos**, and Imre Pallo and Eszterbet Hazy do operatic recitals. The complete *Qualiton-Hungaraton* catalogue is available from Qualiton Records, 38-39 58th Street, Woodside, NY, 11377. The discs are also available in most larger metropolitan record shops.

LIZST: Christus Oratorio. Nagy, Andor, Nemeth, etc. Hungarian State Orchestra, M. Forrai, conductor (stereo LPX 11506-8).

BARTOK: Scherzo for Piano and Orchestra, Kossuth, Scherzo from Symphony in E flat major. Erzsebet Tusa, piano; Budapest Symphony Orchestra, Gyorgy Lehel, conductor (stereo LPX 1033-35).

KODALY: Choral Works for Childrens' and Females' Chorus. "Kodaly Zoltan" Chorus, Ilona Andor conductor (stereo LPX 11409).

Poland

Muza issues records of Polish and international composers and performers, while carrying out exchange agreements with such firms as *Deutsche Grammophon*, *Philips*, and other western concerns. *Muza* has recorded every note Chopin wrote for piano, orchestra, vocalists, and chamber groups on a 25 disc set. Like several other East bloc record companies, *Muza* has its own old-music series, *Musica Antiqua Polonica*, which documents Polish music from medieval times. Extensive coverage of the music of such moderns as Lutoslawski, Baird, and Penderecki is provided, and a number of these items are quite outstanding. Among others, one item of interest is a four-record set entitled **The Stars of the Polish Opera, 1900-1939**, which features historical recordings of such luminaries as Brandowska-Turska and Roswaenge.

In the United States, the Chopin set was issued by the *Musical Heritage Society* (why was it deleted?!). Some of the Penderecki works are on *Philips*, and Rachmaninoff and Shostakovich compositions are available on *DGG*. Still, this is only a tiny bit of *Muza's* output, and fortunately the complete *Muza* catalog is available here via the Polish Record Center of America, 3055 Milwaukee Avenue, Chicago, IL, 60618. The quality of these records is quite good.

THE 8th INTERNATIONAL CHOPIN PIANO COMPETITION—WARSAW 1970: Chopin, *Piano Concerto in D minor*, various other works. Garrick Ohlsson, piano; Warsaw Philharmonic, conductor Witold Rowicki (stereo SXL 0678).

PENDERECKI: Psalms of David for Choir and Percussion; Sonata for Cello and Orchestra; Anaklasis for Strings and Percussion Groups; Stabat Mater for Three Choirs a cappella, Fluorescences for Orchestra. Siegfried Palm (cello), Warsaw Philharmonic Choir, Poznan Philharmonic Orchestra, Warsaw National Philharmonic Orchestra, conductor A. Markowski. (stereo SXL 0260).

RENAISSANCE MOTETS: Polish Radio Wroclaw Mixed Choir, S. Krukowski, conductor. (stereo SXL 0818).



Czechoslovakia

Two state recording organizations, *Supraphon* and *Panton*, deal extensively with classical music recording in Czechoslovakia. *Supraphon* is by far the largest of the two, with several hundred discs in its catalog, while *Panton* is much smaller and less well-known outside of the Czech lands.

The main focus of *Supraphon* is on Czech music from the earliest times to the present. Three special historical anthology series appear on *Supraphon*, the first two, **Musica Antiqua Bohemica** and **Musica Antiqua Slovaca**, cover Bohemian and Slovakian old music, with much baroque and madrigal music represented. At the opposite pole, **Musica Nova Bohemica et Slovaca** is a series of very recent works of all types. The regular issues cover the traditional works of Dvořak, Smetana, Janáček, and other Czech and foreign composers. *Panton* has several historical recordings (Talich conducting Dvořak tone poems) and many of Janáček's little-known works.

Supraphon's standards are uniformly high. The world-renowned Czech Philharmonic is conducted by such men as Ančerl, Baudo, Sejna,

Chalabala and Kletzki. The Vlach Quartet and Suk Trio are first-class chamber ensembles, while Janáček's operas are performed under the distinguished tutelage of Bohumil Gregor. Yvonne Loriod plays Messiaen, and Vera Soukopová is a featured vocalist in both operatic and solo works. More recently Leopold Stokowski has recorded under the auspices of the *Supraphon* studios.

Distribution of the *Supraphon* catalog in this country has had a checkered history. In 1966, *Columbia* created a special series, *Crossroads*, expressly for distribution of *Supraphon* recordings in the United States. This was a budget label, well annotated and tastefully packaged, and many excellent recordings were introduced to the American public via *Crossroads*. Inexplicably, in 1969, *Columbia* liquidated the series, thus leaving a great void in the published phonographic literature. *Artia*, another company that had earlier distributed the Czech catalog, also ceased production of its discs from *Supraphon* master tapes. Fortunately, such labels as *Musical Heritage Society*, *Vox*, *Nonesuch*, *Telefunken*, and *Vanguard* have gained access to *Supraphon* material. In the meantime, imported Czech discs have become more widely available in larger record stores, and the importer is the same one who handles *Qualiton*.

The technical quality of the Czech recordings is fine. *Supraphon* was the first Eastern European firm to produce stereo discs (1962) and is planning to introduce four-channel SQ encoded discs as soon as the proper manufacturing facilities are set up. It is to be hoped some of these recordings will be available to collectors in the United States.

JÁŇÁČEK: Music for Male Chorus. Moravian Teacher' Choir; Anton Tucapsky, director. (*Nonesuch* stereo 71288).

DARIUS MILHAUD and GIAN FRANCESCO MALIPIERO: Concertos for Violin and Orchestra. Andre Gertler, violin; Prague Symphony Orchestra, Václav Smetáček, conductor. (110 1120 stereo).

DVOŘAK: Concerto in a for Violin; Romance for Violin and Orchestra. Josef Suk, violin; Czech Philharmonic, Karl Ančerl, conductor. (*Vanguard* stereo SU-3).

German Democratic Republic

Of all the labels under consideration in this article, East Germany's *Eterna* is probably the least known of



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Alpha-1 specifications

Continuous power output of 220 watts per channel, both channels driven from 20 to 20kHz into 8 ohms with no more than 0.08% total harmonic distortion.

Intermodulation distortion:	no more than 0.08% (at rated output)
Frequency response:	10 Hz-100kHz +0dB -1dB
Input sensitivity/impedance:	1V/50Kohms
Signal-to-noise ratio (I.H.F.):	100 dB
Dimensions:	7" high, 11½" deep, 19" wide
Price:	\$599.95

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Beta-1 specifications

Input Sensitivity:	Phono 1 & 2: 2mV Tuner: 100mV Aux: 100mV
Input Impedance:	Phono 1 & 2: 22K/47K/100Kohm Aux Tuner: 50Kohm
Total Harmonic Distortion:	no more than 0.015% (at rated output)
Signal-to-noise ratio (I.H.F.):	Phono 1 & 2: 72dB Aux: 100dB
Frequency Response:	Phono 1 & 2 (RIAA equalization): 30-15kHz ±0.2dB Aux Tuner: 20-20kHz ±0.1dB
Phono Overload Level:	400mV RMS @ 1kHz
Output:	1V rated, 10V max
Power Consumption:	120V 25VA 50/60 Hz
Dimensions:	2½" high, 11½" deep, 19" wide
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all to American discophiles. It's a pity too, because this enterprising label is tops in both engineering quality and programming.

A division of VEB Deutsche Schallplatten, *Eterna* is the prime classical label in East Germany. As such, it endeavors to cover all aspects of the East German musical scene, and performs its task quite well. With the coming of socialism to East Germany, both musical education and performance received major attention from the state, and the Germans have engraved into microgroove hundreds of performances by symphony orchestras, string quartets, vocalists, opera companies, and chamber ensembles. The GDR, after the Soviet Union, probably has more classical discs to its credit than any other East European nation.

Even during the height of cold-war tensions, the East Germans realized the importance of maintaining ties and exchange agreements with Western firms. They have helped produce their share of prize-winning recordings, one of the best recent examples being Carlos Kleiber's **Der Freischutz** (available here on DGG). Possibly the best set of all the Brahms symphonies is that of Kurt Sanderling conducting the Staatskapelle Dresden (available through import shops on *Eurodisc*). A 130-disc Bach series is due for completion by 1985, while an extensive *Nova* series chronicles the work of contemporary East German composers. *Eterna* has recently started a *Melodiya/Eterna* series featuring Russian recordings and the firm has extensive exchange agreements with most socialist labels. Western recordings are really nothing new to *Eterna*—Solti's **Ring**, the Arrau/Haitink Beethoven concertos, a number of Stravinsky's readings for *Columbia*, and several of Mahler's symphonies as done by the Utah Symphony and Maurice Abravanel are to be heard on this label. Pianist Bruce Hungerford has even recorded several discs of Wagner piano music.

Technically, the recordings are equal to the best Western efforts. *Eterna* recordings released here on *Philips* and *DGG* excel in the pressing and packaging departments, although the domestic product is also quite decent in these respects.

Distribution of *Eterna* material on its own label has never existed on much of a scale in the U.S., but individual orders are filled by mail in East Berlin. A large number of these *DGG/Eterna* coproductions are found on *DGG*, and *Philips* has also released

a number of items in the past few years. It is hoped that more Western record firms will take advantage of the vast amount of material on *Eterna*—its vast and alluring catalog certainly has much to offer.

STRAUSS: **Don Quixote, Rosenkavalier Waltzes; Dresden State Orchestra**, Rudolf Kempe, conductor. (*Angel* quadraphonic S-37406).

BACH: **Tocatta and Fugue in d, Passacaglia and Fugue in c, 2 Preludes and Fugues**; E. Power Biggs playing the organ of the Thomaskirche in Leipzig. (*Columbia* stereo KM-30648).

ORFF: **Der Mond**; various soloists, Leipzig Radio Chorus and Symphony Orchestra conducted by Herbert Kegel. (*Philips* stereo 6700 083 two discs).

Catalogs and mail-order information are available from VEB Deutsche Schallplatten, Reichstager 4-5, 108 Berlin, German Democratic Republic for those who wish access to material not available in the U.S.

Union of Soviet Socialist Republics

Melodiya is the state recording agency in the Soviet Union and is a branch of the Ministry of Culture of the USSR. *Melodiya* is a large enterprise, the sole classical label in the USSR, with insignia appearing on discs produced for both domestic consumption and export. In the United States, *EMI/Angel*, *ABC/Westminster Gold*, *Monitor*, and more recently, *Columbia* are all *Melodiya* licensees. *Melodiya/Angel* has the largest number of releases, and scores of recordings are available on stereo disc, cassette, and cartridge. Annotation, packaging, and sound quality are up to the usual standard of *Angel* excellence. Several years ago, *ABC Records* also became a licensee of *Melodiya*, and several score of the Soviet-derived recordings have been released on the budget *Westminster Gold* label. Some of the items are mono, some stereo, but all are of at least adequate quality sonically, their only drawback being the somewhat trite and corny album covers. More recently, *Columbia* contracted for a reciprocal exchange of master tapes with the Soviets. Not very many *Melodiya/Columbia* discs have been released yet, but those that have point the way to a fruitful collaboration between *Columbia* and the Russians. (Incidentally, *Melodiya* will release recent *Columbia* recordings of such artists as Miles Davis and Igor Stravinsky for domestic Soviet consumption.)

Melodiya has left no stone unturned in its representation of the classical music of the USSR. The big romantics such as Tchaikovsky, Rimsky-Korsakov, and Rachmaninoff are represented by a profusion of recordings, as are such moderns as Prokofiev and Shostakovich. Much interesting material of Baltic, Central Asian, and Ukrainian composers has been given wide coverage. *Melodiya* is recording the complete works of such composers as Bach, Haydn, Brahms, and Beethoven for domestic consumption, in much the same vein as *DGG's* "The Symphony" editions. Such Westerners as von Karajan, Cliburn, Michelangeli, Klemperer, and Walter are available on the *Melodiya* label, and a group of Furtwangler performances, taken from captured German wartime tapes, are to be had only on *Melodiya*, although a few are available on *Vox Turnabout*, via *Pye* of England. One item of esoterica is a two-record set of Igor Stravinsky conducting his own works with Soviet orchestras while on his historic visit to Russia in the autumn of 1962. All the famous Soviet performers, from Chaliapin to Rostropovich, have had their careers documented from the earliest days by *Melodiya*. The Russian operaphile will find riches galore on the Russian label, with virtually every piece in the Slavic repertoire engraved in microgroove.

One can plainly see that much material is not, and never will be available to discophiles in the West. Much of the stuff mentioned above has been released only in the USSR, but the collector need not despair, as there is a source of this material available in the U.S. The Four Continent Book Corporation, 156 Fifth Avenue, New York, NY 10010 has the most comprehensive stock of imported Soviet-pressed discs in the country, and they will be glad to send you lists of what items they have available. The cost is about five dollars per disc, and English liner notes are provided.

RACHMANINOFF: **Vesper Mass**. USSR Choir, Sveshnikov conducting. (*Melodiya/Angel* S-4214 stereo two discs).

PROKOFIEV: **War and Peace**. Vishnenskaya Kibkalo, other soloists; Bolshoi Opera Orchestra, conducted by Alexander Melik-Pashayev. (*Columbia/Melodiya* M4 33111 stereo four discs).

SHOSTAKOVICH: **Symphony no. 15**. Moscow Radio Symphony Orchestra, Maxim Shostakovich conducting. (*Melodiya/Angel* S-40213 stereo). ♪

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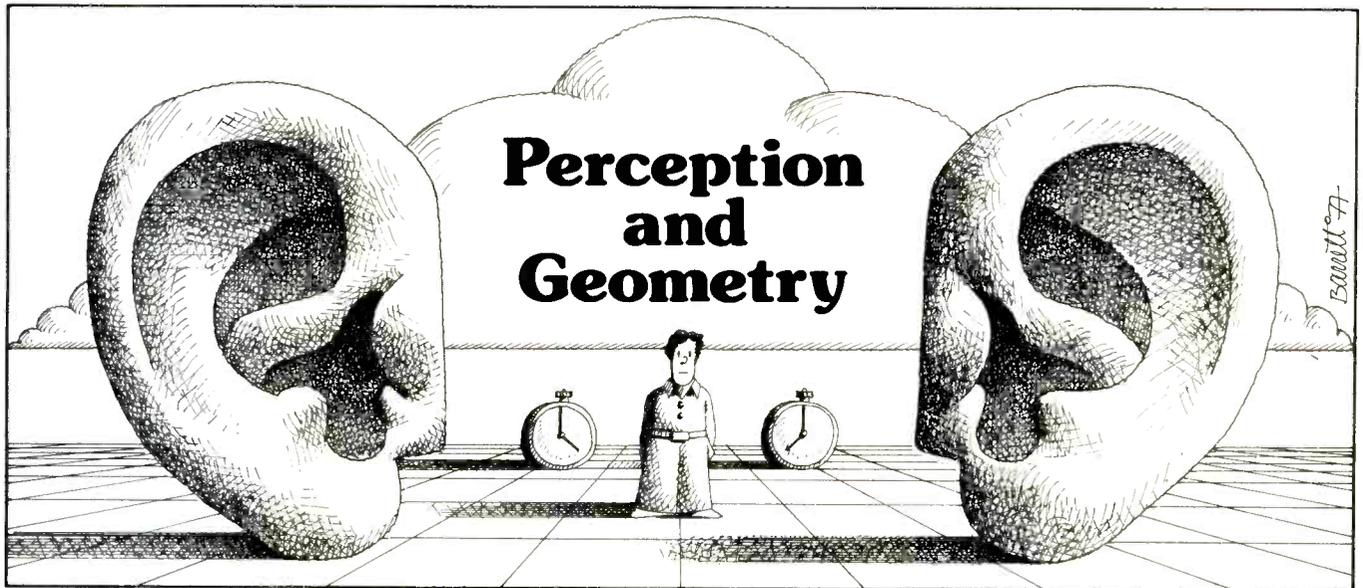
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Richard C. Heyser

The perception of sound is a highly personal experience. It is neither art nor science, but our own private view through one of the windows of the senses.

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We can share that view through words and actions, so we know that others experience it also. But it is left for fools like myself to dare sift and quantify the ingredients of that experience in some hope of understanding what it is and how to make it more enjoyable.

I have wondered, as we all have, how we might be able one day to put numbers on the stuff of perception. We are a long way from doing that. But in my own personal way I have been working on an allied problem. The problem of developing closer ties between what we measure in the physical world and what we seem to perceive of that same physical set of stimuli. I have come up with a few answers and I would like to share them with you. The results are applicable to audio analysis.

The technical details of what I am about to describe have been presented in a number of papers in the *Journal of the Audio Engineering Society*. In this article, I want to present the reasoning behind the technical details.

The basic idea is extremely simple. If we write down the most commonly used words which we all use to describe what we hear, we find that there is a definite structure to those words. We can arrange the descriptive terminology into categories

which are reminiscent of a geometric framework. The words have a gestalt basis and are linked to relationships in the totality of our sense experience, including vision, taste, and touch. I therefore suggest that we should use geometry to probe the interplay of these word concepts.

Here, I feel, is a link between subjective perception and objective analysis. Rather than use numbers, we should invoke form, texture, and the relationships among things. Model perception with gestalt, and use abstract geometry to analyze gestalt.

The term abstract, as I use it here, refers to the analysis of "things" which are not named and quantified in the general analysis, but which can be named and numbered when we are ready to do so.

I would like to state that my approach was greeted with great excitement. I would like to state it, but I cannot. For one thing, the use of abstract analysis is in far left field, as far as most technical persons are concerned, if not outside the ball park altogether.

For another, the type of analysis that is required for even the simplest example in audio is pretty much uncharted. Among other things, we have to develop geometric tools for changing the dimensionality of an expression. And that's just for starters.

The Problem of Frequency

OK, where do we start if we want to apply the idea to audio? Well, I think the answer is easy. Start by cleaning up the mess we call frequency.

Let me state the problem. And in the statement I will give some of the answer. Then we can go on and develop the answer more fully.

The frequency description of a signal and the time description of that signal are tangled up with each other in a very fundamental way. The parameter that we call "time" and the parameter that we call "frequency" are not independent of each other. And no amount of Band-Aid engineering with running transforms or things called instantaneous frequency is going to change that fact.

Yet in subjective audio, we know darn well there is the property of pitch which is frequency-like, and that pitch can change with relative time. So if we want to apply the existing high power mathematics of time domain and frequency domain to what we hear, we seem to need a joint frequency-time description. Ultimately, when we try that trick, we run into the fundamental relationship between time and frequency, a relationship which we ourselves created from the definitions we gave these things.

But rather than blame ourselves, we choose to imagine that nature has intervened and somehow, magically, put a limit on the precision with which a codetermination of these parameters can be established. We even give that a name, the uncertainty principle.

What leads us to this rather strange action is a very real need for some kind of math that has a time-like and a frequency-like (and a space-like, and so on) set of properties which can all be used in the same description. Up to now our tool box of math relationships has only contained the parameters related by Fourier transformation. So we've been stuck.

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History of the Term

So much for the problem. Now for a little bit of history. In 1862, Helmholtz completed one of the finest texts on music and sound ever written. Highly successful, "On the Sensations of Tone as a Physiological Basis for the Theory of Music" was translated into English in 1885 and remains, even to-

day, one of the finest discussions of the topic. It is still in print. To my knowledge, this is one of the first books to use Fourier series as a basis for analyzing complicated periodic signals.

The English translation used the phrase "vibration number" in the first edition to identify the number of vi-

Geometry Of Fourier Transformation

The appearance of anything depends upon the frame of reference we use to observe it. Geometrically, the Fourier transform is nothing more than a method of changing the frame of reference in such a way as to keep the number of dimensions the same but invert the units of measurement.

The Fourier transform is used in audio as the basis for converting time response to frequency response. In this case, the two frames of reference are one-dimensional. The unit of measurement of time is the second and

of any particular line passing through a point in x-y, say x_0-y_0 , into a specific line in a-b.

The parameter θ thus acts as a spreading operator that doesn't govern "how much" but does govern "where." If we want to find out how the point x_0-y_0 in system x-y appears to someone using the a-b system, we can pass a straight line through x_0-y_0 and rotate it like a propeller. This will sweep out all possible points in x-y, but only the common point x_0-y_0 will build up to the highest possible con-

tribution. That is not magic, but a result of the way we defined the a-b alternative view of x-y. If we say that something appears precisely at a single place along the x axis, we cannot then turn around and insist that it also be located at a precise position along the a axis.

Everything involving Fourier transformation must submit to this point-wave duality. It makes no difference whether we started out defining things in terms of Fourier transformation, or discovered well along the

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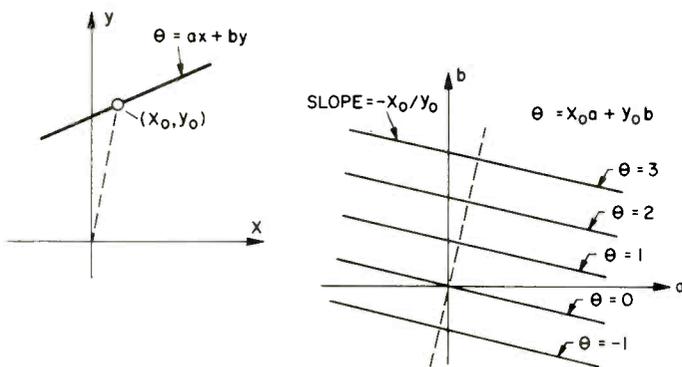


FIGURE 1

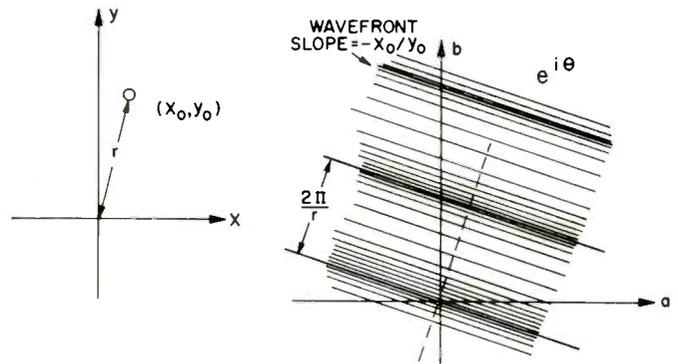


FIGURE 2

the unit of measurement of frequency is the Hertz, which is an inverse time measurement.

This novel geometric approach to the meaning of Fourier transformation can be more readily visualized in a two-dimensional example, as shown in these figures. In this example, a two-dimensional system, shown with coordinates a and b, is a Fourier transformed version of the two-dimensional system with coordinates x and y.

The requirement that the units of a-b and x-y be the inverse of each other shows up as the equation of a straight line, illustrated in Fig. 1. The parameter θ acts to spread the value

tribution in the a-b system when we add everything up.

When we do that, we find that a point in the x-y system appears as the wave $e^{i\theta}$ in the a-b system. This is shown in Fig. 2.

The geometric requirement shows no partiality. The x-y system and the a-b system are duals of each other. So a point in a-b will appear as a wave in x-y.

The x-y system and a-b system are different ways of looking at the same thing. Each part of a thing as described in the x-y frame of reference will appear everywhere as waves to a person looking at it in the a-b frame

road of other analysis that some of our parameters were Fourier transforms of each other. The fact remains that if Fourier transformation is involved, we will find that some of our parameters cannot be precisely codetermined. When this happens, and when other experience tells us that such parameters should be codeterminable, or appear to be codeterminable under other conditions, then we probably made an improper identification. The parameters are not what we thought they were. That is true of what we call time and frequency, as well as some other mysterious victims of the uncertainty relation.



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brations a sound completes in a fixed period of time. The second edition changed that to "pitch number" so as to align it with the sensation of pitch as a numerical quantity. Fourier series were stated in terms of pitch number. The pitch number was also called "frequency" by the translator in that second edition, "...as it is much used by acousticians. ...".

Prior to that translation, 100 years ago in 1877, Rayleigh completed volume one of his equally famous *The Theory of Sound*. Two giant contributions to the knowledge of sound. Helmholtz preceded Rayleigh like a flash of lightning precedes the roll of thunder.

Rayleigh also needed a word to denote the number of vibrations executed in a unit of time. So Rayleigh called it frequency, stating that this word had been used for this purpose by Young and Everett. It is clear that Rayleigh equated the concepts of pitch and frequency, at least on a numerical scale.

Thus, while Helmholtz only used the term pitch number, his translator introduced the terminology "frequency". And since the translation occurred after the publication of Rayleigh's *The Theory of Sound* (which cited Helmholtz' German text in a

In my opinion, the best advice on this matter was given by Albert Einstein who said, "It is the theory which decides what we can observe."

For one thing, it is the theory that determines the frame of reference we are going to use for the observation. A typical frame of reference for audio measurements is the passage of time, measured in seconds.

Having established this frame of reference we can set up instruments responsive in that system. An oscilloscope might be considered such an instrument. So we make oscilloscope measurements.

This next step is a big one. There is an infinity of frames of reference we can use. Each frame of reference is complete in itself and is a legitimate alternative for the description of an event. I call that the Principle of Alternatives.

If the passage of time is a legitimate frame of reference, then it is only one of an infinite number of alternatives. What might we be able to say about some of these alternatives?

In order to answer that, we need to take an even bigger mental step. We need to accept the fact that the alternatives may differ in the number of dimensions as well as the way in which the units are measured.

There is an infinity of frames of reference we can use. Each frame of reference is complete in itself and is a legitimate alternative for the description of an event. I call that the Principle of Alternatives.

number of places), it is possible that it was Rayleigh who really got this word started as applied to sound.

So what's wrong? Isn't it possible for a tone to change pitch with time? Of course, pitch can change with relative time. But frequency cannot!

The Fourier Transform

Now, let's do a wild thing. Let's use geometry to *derive* the mathematical relationship known as the Fourier transform. Then, from this geometric base, let's determine what the word "frequency" really means. And you won't find this in text books, at least not yet.

Let us begin to look at things geometrically. Suppose we want to measure something. How do we start?

Dimension? Yes. Consider the conventional waveform presentation of the signal coming out of an amplifier, volts as a function of time. Time in this sense generates what is geometrically called a "one-dimensional manifold." Each place in the dimension of time has a signal value associated with it. The distance between two places in time is measured in units we call seconds.

Suppose we want to change our frame of reference to come up with some alternate system of measurement. There are rules for changing the form of presentation from one frame of reference to another. The process of doing this is called a transformation.

If we transform in such a way that

we do not change the number of dimensions, but have a new reference system measured in units which are the inverse of what we came from, then this very special transform is called the Fourier transformation. So it should be possible to transform our one-dimensional time measurement into a one-dimensional thing measured in inverse time, somethings per second. If we perform a measurement in this new frame of reference, we will call it the frequency response measured in Hertz.

For those who feel I am trying to pull the wool over their eyes, let us now actually derive the mathematical expression of the Fourier transform from these first principles of geometry.

I like to use pictures, so let me show how to derive the equation from considering the problem for some two-dimensional frame of reference.

In Fig. 1 let us assume we have a two-dimensional coordinate system, shown as x and y. This two-dimensional frame of reference is complete in characterizing something of importance. For example, it may be the reference system for a photograph with the distance between coordinate points measured in units of millimeters.

The Fourier transform of this will be another two-dimensional system in which the distance between two points corresponds to inverse millimeters. This is the a-b system.

The question is, how do we go from x-y to a-b?

We know the units are such that their product is a "dimensionless" value. (Millimeters times constant per millimeter is constant.) So let us say that the axis x will bear a special relationship to the axis a such that if we mark off some distance along x we will find that the thing that happens along a is a corresponding distance such that,

$$x \cdot a = \text{constant.}$$

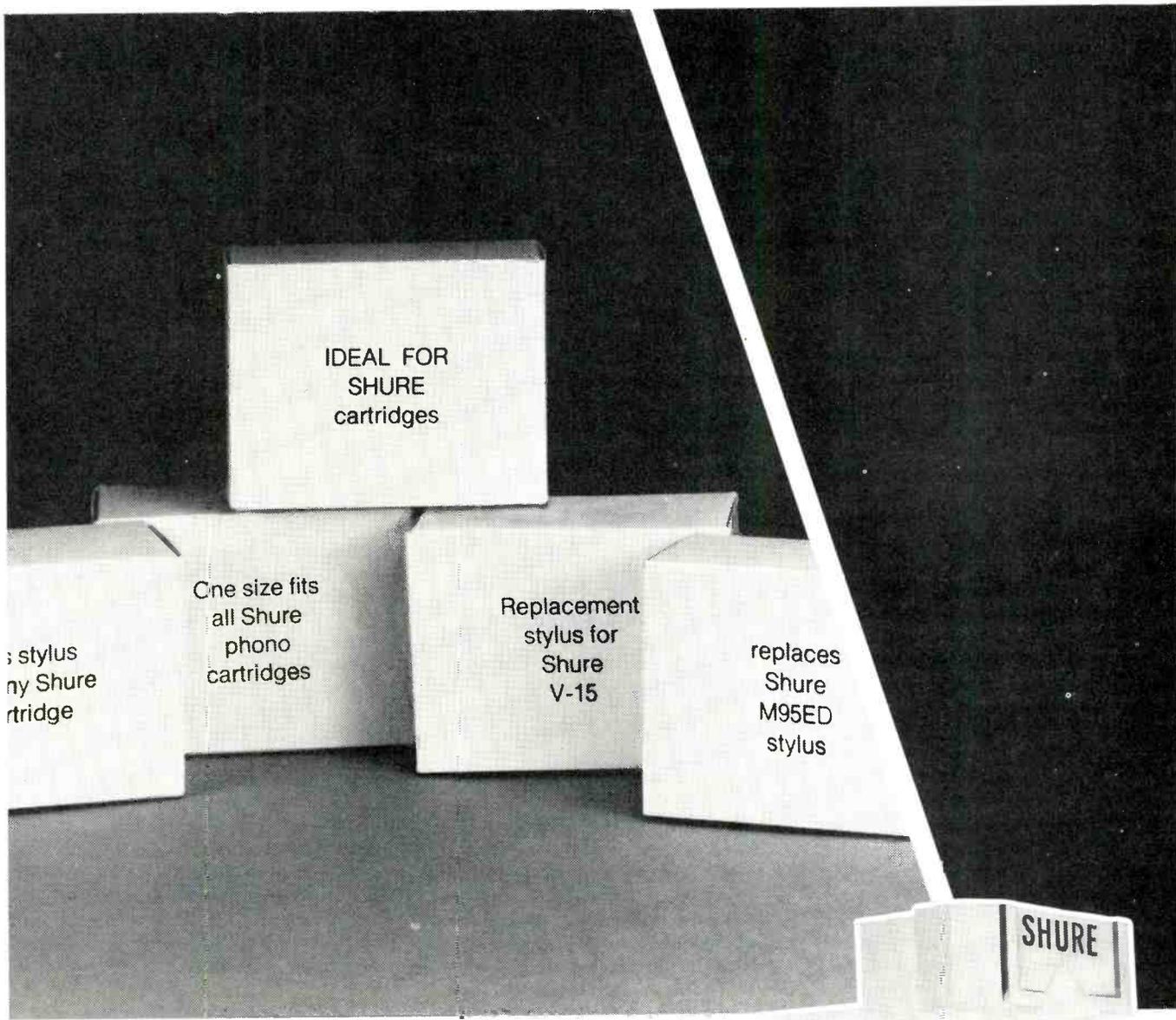
And the same thing will happen between y and b.

What we have required is that the relationship between x-y and a-b be dimensionally reciprocal such that,

$$\theta = ax + by$$

The Greek letter θ stands for a fixed number, and it can be any number we choose it to be. I use the symbol θ because we are going to make that equal to the angle of something.

Look at this equation as some geometric curve in the x-y system. This is the equation of a straight line. The coefficients a and b in that equation



Needle in the hi-fi haystack.

Even we were astounded at how difficult it is to find an adequate other-brand replacement stylus for a Shure cartridge. We recently purchased 241 random styli that were not manufactured by Shure, but were being sold as replacements for our cartridges. Only ONE of these 241 styli could pass the same basic production line performance tests that ALL genuine Shure styli must pass. But don't

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determine the angle which the straight line makes with the x-y axes, and the constant θ determines where the line cuts across the axes.

There is a deep geometric significance to this relationship. The need for not changing dimension, but inverting measurements, leads to a zero curvature surface having one less dimension than the space in which it is imbedded. In two dimensions, this is a straight line. In one dimension, it is a point, and in three dimensions, it is a plane. Since most of our geometric thinking is done in three dimensions, this type of surface is called a plane when we are in three dimensions, and

in the x-y system as it passes through x_0-y_0 , the result will be a straight line in the a-b system which has a constant slope.

If we want to find out how x_0-y_0 (and only x_0-y_0) appears in the a-b system, there is only one thing we can do to the straight lines passing through x_0-y_0 —we can rotate them around x_0-y_0 like a propeller about its shaft. And that's where we find the angle θ . We take the value of the signal at the point x-y and multiply it times the angle of all lines passing through that point to find out how that point is smeared over the a-b system.

If we write down the most commonly used words which we all use to describe what we hear, we find that there is a definite structure to those words. We can arrange the descriptive terminology into categories which are reminiscent of a geometric framework.

58 a hyperplane when we are in other dimensions. A straight line is a hyperplane in a two-dimensional system.

The general equation of a hyperplane is always the sum of products of coefficients and coordinates as we have written down. In three dimensions, there are three terms equal to θ . In one dimension, there is only one term equal to θ .

When we are comfortably seated in any frame of reference, the way we see the coordinate axes of the alternate Fourier transform view is as coefficients of hyperplane surfaces passing through our space. After all, the Fourier-transformed view is another way of looking at the same thing we observe, so we should be able to see the structure of the other frame of reference as something in our view.

Now, let's go back to our two-dimensional example and ask how we could take any place in the x-y system, x_0-y_0 for example, and find out how it is distributed in the a-b reference system.

The relationship is in terms of straight lines (hyperplanes) passing through x_0-y_0 . Each line passing through x_0-y_0 tells what a and b coordinate locations will contain the information of all x and y values along that line. A neat thing happens. No matter what the angle the line makes

The mathematical expression for this is,

$$e^{i\theta}$$

If we write that out and see what it corresponds to in the a-b system, we find a startling fact. Each point in the x-y system is represented by a wave uniform over the whole of the a-b system. The period of this wave is the reciprocal of the distance from the point to its origin, and the angle of the wave in the a-b system is such that the wavefront is perpendicular to the angle the original point has with respect to its x-y axes. This is shown in Fig. 2.

I hope this rings a few bells, if not setting off sirens. The geometric relationship inherent in Fourier transformation is such that a point (particle) in one frame of reference will be manifest as a wave in the alternate frame of reference, and conversely.

Therefore (underline, exclamation point, big arrow), Fourier transformation is a local-to-global map, in which each point in one becomes everywhere in the other.

Now suppose we try a dumb-dumb and attempt to describe the same thing in terms of the x-y and the a-b system. Here is what happens. We can codetermine the location of a point in x and y, or in a and b, or along x and

along b, or along y and along a. But we are going to run smack up against our own definition if we attempt codetermination along x and a or along y and b. Not because nature stepped in and pulled a curtain over our results. But because we are trying to violate the very conditions we set down to derive this particular transformation.

What form will that codetermination be stymied at? The form is determined by the equation of the hyperplane (which is another way of saying the equation of a wave) and is,

$$\begin{aligned} \Delta x \cdot \Delta a &\geq \text{number} \\ \Delta y \cdot \Delta b &\geq \text{number} \end{aligned}$$

where the triangle means the extent of the range of parameter where most of the value of the same thing is concentrated.

Oh yes, the equation of the Fourier transformation.

We add up the contributions of each point in x and y, which is called integration. In two dimensions this becomes,

$$g(a, b) = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} f(x, y) e^{i\theta} dx dy$$

If you're not into math, don't worry about this equation. The equation is not important. The ideas that led us to the equations are what are important. And the principal idea, that can never be repeated too often, is that expressions joined by transformation are nothing more than *different* ways of describing the *same thing*.

The Meaning of Frequency

Now! What the devil does frequency mean? Frequency and time are *alternate* coordinate systems for describing the *same thing*. Frequency *cannot* change with time because frequency and time are different ways of describing the same thing.

In our haste to match sense experience with some *existing* mathematics, we have found a thing called frequency which has a pitch-like behavior, and we found another thing which has a time-like behavior and we use them. The greatest majority of the cases we encounter in audio have number values such that the interrelationship between frequency and this time-like parameter does not cause any trouble. And that is a soporific because we have lulled ourselves into the belief that there could not be anything else needed, or available, to handle any problem.

The concept of harmony, the agreeable combination of sounds, got its first mathematical treatment in the



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We realize no sane person ever puts their turntable even close to their speakers, but we did it to prove a point.

Which is, it's now possible to build turntables that effectively deal with that unbearable "howl" known as mechanical and acoustic feedback.

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We put the turntable right on the speaker box. The worst place for vibrations. Then we turned up the music.

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*Suggested resale price. Actual prices are established by Kenwood dealers.

Cartridge not included.

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days of ancient Greece when the Pythagoreans observed certain numerical relationships in musical sounds. Two equally taut plucked strings harmonize only when their lengths are in certain ratios to each other. The musical intervals of unison, octave, fourth, and fifth are related to the numbers 1, 2, 3, and 4.

When Helmholtz and Rayleigh analyzed sound, they did so in an age-old frame of reference that tied sound to the passage of time. Fourier's theorem that any repetitive function could be generated by proper combination of sine waves, the shape of the purest tones in music, made everything fall

into place. Nothing could be more natural than to use this mathematics for the analysis of complex sounds.

I do not believe that either Helmholtz or Rayleigh had visions of replacing the parameter of time with frequency. Frequency was a convenient expression that made a lot of sense in the analysis of tones.

Helmholtz and Rayleigh, and almost everyone after them, used some ready-made mathematics as a model that fit perception pretty well. We experience a thing we call time. We give it a symbol, t , and write equations using t . Juggling the equations produces a new parameter, which we call fre-

quency. If we do not look too hard, this parameter called frequency seems to behave analogous to another thing we perceive, which we call pitch.

Here is the catch. The parameter t is not the time of our perception. Nor is the parameter ω the pitch of our perception. t and ω are mathematical entities that are different versions of each other. The theory decides the observation. If we set up an observation in the parameter t , we will get measurements in the parameter t . We can transform the mathematics in t to a mathematics in ω . If we set up observations in the parameter ω , we will get measurements in the parameter ω .

We can transform the mathematics in t to a mathematics using four parameters if we choose. And if we set up observations in those four parameters we will get measurements in those four parameters. That is the significance of the Principle of Alternatives.

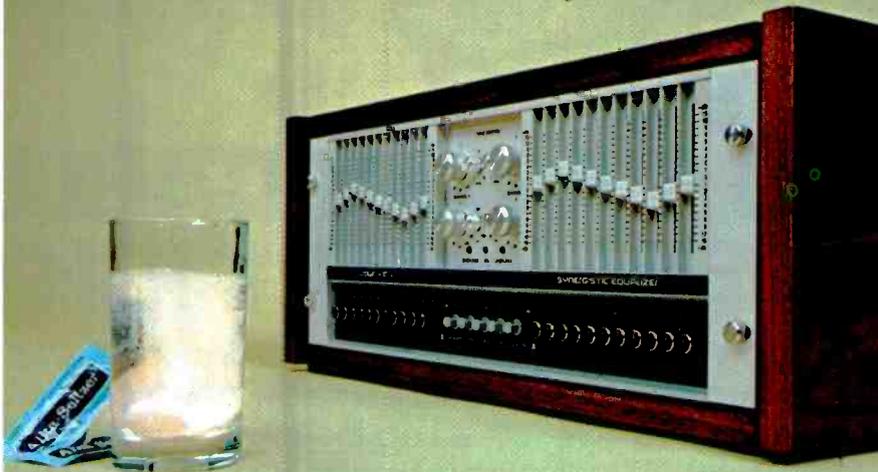
The fact that we can break out of the t -to- ω -to- t loop, which we call Fourier transform, is what is brand new in this theory.

It happens that the representations in t and the representations in ω do a pretty good job of modeling most of the things we need to analyze in audio. There are higher-dimensional versions of the t and ω representation, an infinity of them. Some of these versions have coexistent time-like and pitch-like parameters. The difference between the representation of a signal using these higher-dimensional parameters and what we get from glueing together a t and an ω axis to pretend we have higher-dimensionality is lost in the noise for most of what we do. For that reason, we might as well continue using the impulse response and steady state frequency response for loudspeakers, amplifiers, and the like. After all, the impulse response and the frequency response do have a meaning and they are legitimate measurements. It just happens that in detail the meaning is not what we thought it was.

But where we need to recognize the limitations of t and ω representations is when we get involved in the interpretation of these measurements with perception, which has a higher-dimensionality. It is then that the geometry is important.

Let me put this another way. You out there, Golden Ears, the person who couldn't care less about present technical measurements but thinks of sound in gestalt terms as a holistic experience. You're right, you know. Δ

Both of these are made in Elkhart, Indiana



The one on the right provides permanent relief from the pain of headache caused by poor room response

The good sound that comes out of your speakers can be different by the time it gets to wherever your ears are. Air, walls, rugs, drapes, furniture — can all affect frequency response.

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includes the Crown EQ-2 eleven-band, octave-center, stereo equalizer; plus the Crown equalization record, room response chart paper, and a manual which tells you how to make it happen.

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solid, well thought out...
right up there with the best...
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High Fidelity Magazine, Dec. 1976

"SANSUI Model 7070, a stereo FM/AM receiver... under \$520."

"Here is yet another receiver in what we have come to think of as the Sansui tradition: solid, well thought-out, neither barebones nor feature-encumbered, delivering performance that is 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 tuner section is excellent — at least good in every respect and near-superlative in many..."

"The amplifier section is rated at 18dBW (60 watts) per channel and actually will pump out 1/2 dB (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, exceeding 0.5% in few

measurements... 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."

In every power and price range, Sansui offers you a receiver in their tradition of excellence. Visit your nearest franchised Sansui dealer today and select the model that is right for you — from the new luxury Model 9090D3 with full Dolby™ capability, at less than \$750* to the no-frills Model 221, at less than \$180.

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and LED readout to let you control
pitch perfectly.**



in what leave out.



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Our most amazing features appear on our unlimited-class QL-10: A totally unique LED readout system that lets you change the exact, quartz-locked pitch of music up or down with a touch of the appropriate button. Certainly a remarkable innovation for serious audiophiles, musicians, broadcasters and recordists.

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Of course, you'll find our wow and flutter and S/N ratio specs equal to or better than other turntables costing much more.

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Equipment profiles

Scott Model R-376 AM/FM Stereo Receiver



MANUFACTURER'S PUBLISHED SPECIFICATIONS

FM Tuner Section

Usable Sensitivity: Mono, 4.9 dBf (sic), 1.8 μ V; Stereo, 24 dBf (sic), 18 μ V. **50-dB Quieting:** Mono, 10 dBf (sic), 3.5 μ V; Stereo, 36 dBf (sic), 70 μ V. **S/N:** Mono, 68 dB; Stereo, 65 dB. **THD:** Mono, 0.2%, 1 kHz; Stereo, 0.3%, 1 kHz. **Capture Ratio:** 1.2 dB. **Selectivity:** 70 dB. **Image Rejection:** 70 dB. **Spurious Rejection:** 85 dB. **AM Suppression:** 60 dB. **Stereo Threshold:** 7 to 15 μ V. **Muting Threshold:** 2 to 10

μ V. **Stereo Separation:** 35 dB @ 1 kHz, 38 dB at 100 Hz, 34 dB @ 10 kHz.

AM Tuner Section

Usable Sensitivity: 100 μ V (internal ant.). **Selectivity:** 36 dB. **S/N:** 50 dB. **THD:** 1.0%.

Amplifier Section

Power Output: 75 watts min. continuous per channel, 8 ohms, 20 Hz to 20 kHz. **Rated THD:** 0.2%. **Rated IMD:** 0.1%. **Damping Factor:** 35. **Frequency Response:** Phono, RIAA \pm 1.0 dB, AUX: 15 Hz to 35 kHz \pm 1.0 dB. **Input**

Sensitivity: Phono, 2.5 mV or 6.0 mV, selectable; High Level, 150 mV. **Phono Overload:** 120 mV. **S/N, Weighted:** Phono, 75 dB; Mike, 80 dB; High Level, 85 dB. **Bass & Treble Control Range:** \pm 10 dB at 100 Hz and 10 kHz; mid-range, \pm 6 dB at 1 kHz. **High Filter Cut:** 10 dB @ 10 kHz. **Low Filter Cut:** 10 dB @ 100 Hz.

General Specifications

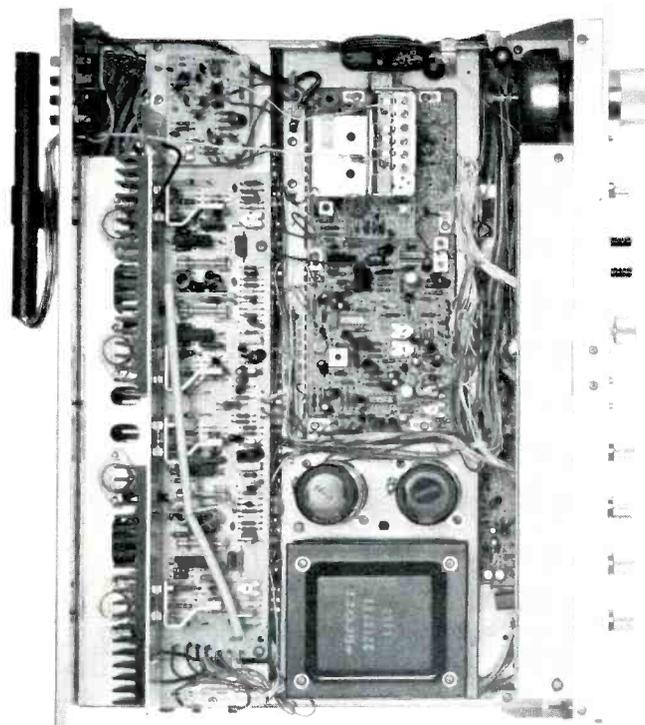
Dimensions: 19 3/8 in. (49.1 cm) W x 5 11/16 (14.4 cm) H x 15 7/8 (40.3 cm) D. **Weight:** 30.8 lbs. (14 kg). **Price:** \$549.95.

While on one hand we certainly commend Scott for being one of a handful of manufacturers who, so far, have adopted the new power designations for signal strength, we do have a minor gripe with the tuner sensitivity and quieting specifications given above, in that every dBf figure is off by a factor of two to one. (Editor's Note: Scott tells us that they caught the error just as the literature was coming off press and that they are in the process of revising this material.)

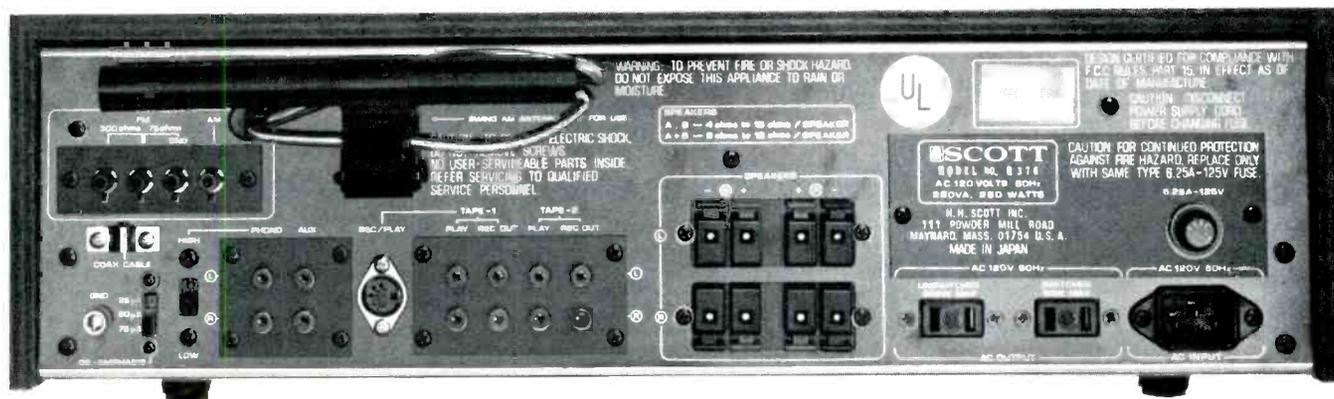
With that aside, let's examine what, to date, is Scott's highest powered integrated receiver. Its front panel resembles those of many other units which have abandoned the "black-out" dial area format in favor of an all light-colored treatment in which dial scale numerals are screened in a dark color on a light, well illuminated sloped background. FM calibration is in MHz increments, with no intermediate markings, and is almost linear from end to end, while AM markings are compressed at the high end of the scale. Five indicator lights above the right section of the dial scale show the program source selected, while a single light at the left of the dial opening is illuminated in the presence of a stereo signal. Signal-strength and center-of-channel tuning meters (the former calibrated in numerals from 0 to 5) are illuminated separately and positioned above the frequency scales between "88 MHz and 99 MHz." A large tuning knob, coupled to an effective flywheel, is located to the right of the dial area opening. The lower section of the front panel has a stereo headphone jack at the left, adjacent to a speaker selector switch which also serves as a power *On/Off* switch in its extreme counterclockwise position. An *Off* position is included for headphone-only listening, as well as settings for *Main*, *Remote*, or *Both* sets of speakers which might be connected to the receiver. Bass, midrange, and treble controls, each controlling both channels simultaneously, come next, followed by low- and high-cut filter pushbuttons, a dual concentrically mounted volume and balance control, three position tape-copy and tape monitor switches (lever type), a program selector switch, stereo/mono and loudness push-button switches, an FM muting on/off push button, and a microphone input jack. Unlike many other receivers sporting a mike input jack, this mono microphone circuit is selectable by means of the main program selector switch and can therefore not be used to mix live voice sounds with other program sources. We think that few users are likely to use a piece of equipment such as this as a mono P.A. amplifier, since microphone facilities (in stereo at that) are available on just about any piece of tape equipment likely to be used with this receiver.

The rear panel of the Scott R-376 has antenna terminals for external AM, ground, 300-ohm and 75-ohm FM antenna connections. Strangely, the cable clamp provided for 75-ohm retention is mounted beneath the 300-ohm pair of terminals rather than below the 75-ohm and ground terminals,

where it should have been, and it is necessary to make a tight bend in the coax cable to use this clamp properly. Adjacent to a chassis ground terminal is a three-position de-emphasis switch with settings for 25, 50, and 75 microseconds. (Scott makes this unit for worldwide use, not just for the U.S. Thus, the 50 microsecond de-emphasis is for Europe and South America, and the 25 microsecond de-emphasis for Dolby encoded FM. The owner's manual is printed in French and English.) A phono sensitivity switch, marked *Low* and *High*, alters input sensitivity of the phono jacks from 2.5 mV to 6 mV; the position marked *High* provides the lower sensitivity. A record/play DIN socket parallels the pin-jack *Tape 1* inputs and outputs, which are followed



65



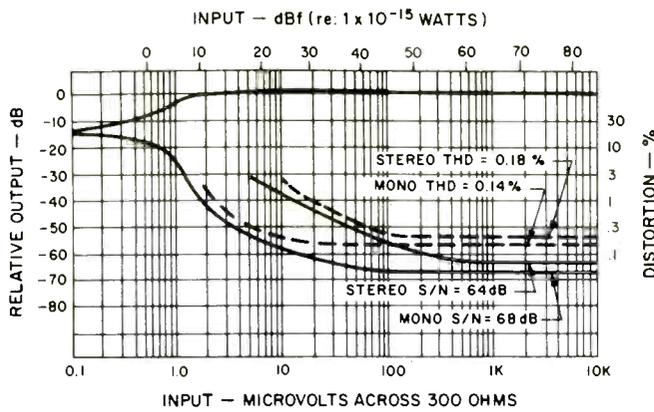


Fig. 1—FM quieting and distortion characteristics.

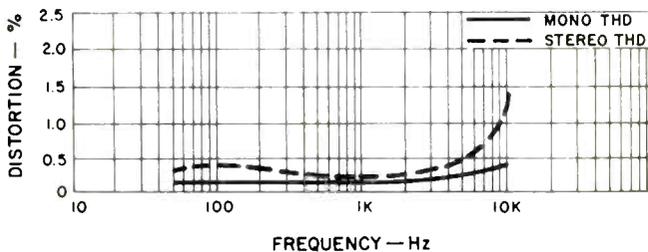


Fig. 2— FM distortion vs. frequency.

66

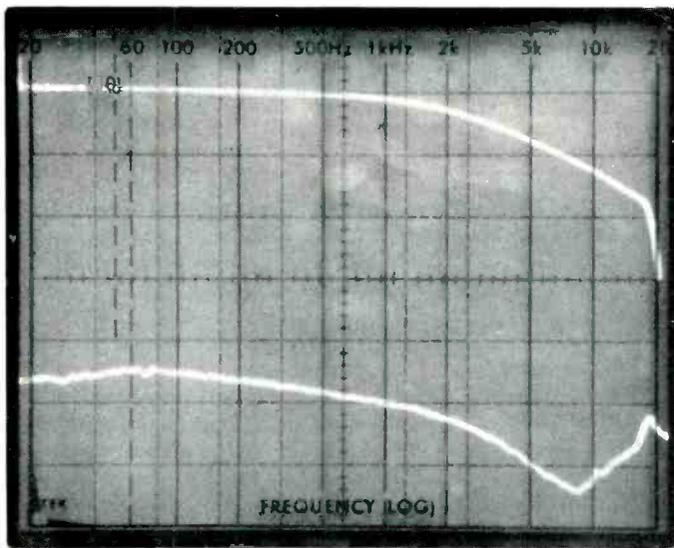
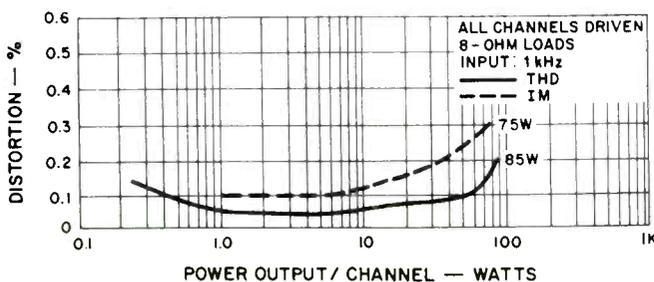


Fig. 3—FM tuner section stereo separation vs. frequency. (Note that no de-emphasis compensation has been applied.)

Fig. 4—Harmonic and intermodulation distortion characteristics.



by in and out jacks for a second tape deck, spring-loaded speaker terminals which handle either vertical or horizontal insertion of the stripped ends of speaker wires, unswitched and switched a.c. receptacles, and a line fuse-holder. A heavy-duty line cord is packed separately so that the proper one can be shipped for different countries here and in Europe. A swing-down AM ferrite bar antenna completes the rear panel layout.

Since no circuit information or schematic diagram was available, because this particular unit was one of the first off the production line, we're not able to discuss circuitry except to say that, upon examination of the internal construction of this receiver, we found it to be well fabricated, with a minimum of hand wiring between circuit boards. Beyond that cursory observation, we relied on our bench measurement tests and listening tests for the rest of this evaluation and report.

FM Tuner Section Measurements

Usable sensitivity in mono measured $1.7 \mu\text{V}$ (9.8 dBf), while for stereo the figure obtained was $7.0 \mu\text{V}$ (22.1 dBf), the latter considerably better than claimed by Scott (assuming the microvolt figures are the correct ones and not the "dBfs" listed alongside). The 50-dB quieting point in mono measured $3.5 \mu\text{V}$ (20.8 dBf), exactly as claimed, while in stereo, again the sample did better than claimed, reaching 50-dB quieting with an input signal strength of $36 \mu\text{V}$ (36.3 dBf). Ultimate S/N in mono reached 68 dB as claimed, but fell just a bit short of the 65 dB figure for stereo, with readings of 64 dB. Quieting characteristics and distortion (at 1 kHz) curves for mono and stereo operation are plotted in the graphs of Fig. 1. Mono distortion was 0.14 per cent, while in stereo, for a 1-kHz modulating signal, it was only a little poorer at 0.18 per cent. Distortion characteristics in mono and stereo FM versus modulating frequencies are graphed in Fig. 2, and, at the highest required test point in stereo (6 kHz), THD measured 0.5 per cent. We measured a capture ratio of 1.4 dB, while selectivity measured exactly 70 dB, as claimed, and image and spurious rejection were somewhat better than claimed, with readings of 73 dB and 90 dB respectively. AM suppression measured 57 dB, a bit poorer than claimed. Both stereo and muting threshold were set at $5.0 \mu\text{V}$ (19.2 dBf), a reasonable figure considering the quieting and THD capabilities of the receiver. Frequency response was a bit down at the high end, about 1.5 dB lower than the usual 75 microsecond de-emphasis curve would require, and a slight rising characteristic amounting to about 0.5 dB was noted down around 50 Hz.

Stereo separation was plotted using our spectrum analyzer to depict output versus frequency for the modulated and unmodulated channels, and the results are shown in the 'scope photo of Fig. 3. The consistency of separation across the entire frequency spectrum of interest was among the best we have seen, with separation readings of 50 dB at mid frequencies, 51 dB at 100 Hz, and 40 dB at 10 kHz. (Note that we have not compensated for de-emphasis here.)

AM Tuner Section Measurements

Usable sensitivity in AM, referred to the external antenna input, measured $20 \mu\text{V}$, while selectivity measured 38 dB, a bit better than claimed, while THD (for 30 per cent modulation) was 1.0 per cent, as claimed.

Amplifier Section Measurements

In suitably small type (in conformance with FTC requirements) Scott claims a power output of 80 watts per channel



LUX

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...resolving elusive problems of distortion with innovative new techniques.

Current and future LRS products are shown in this rack.

- 1) 5T50 frequency-synthesized digital stereo FM tuner, with Dolby and 7-station memory. \$1,495.
- 2) 5C50 DC control preamplifier with linear equalizer, but without tone controls. \$845.
- 3) 5G12 twelve-band stereo parametric graphic equalizer with switchable range and frequency contours. \$645.
- 4) 5E24 LED peak indicator. \$295.
- 5) 5M21 direct-coupled DC power amplifier; 100 watts per channel continuous power, with no more than 0.008 per cent total harmonic distortion, both channels driven into 8 ohms, 20 to 20,000 Hz. Transient intermodulation distortion: 0.05 per cent. \$1,195.

Below the 5M21 are seen additional peak indicators and power amplifiers without meters. These amplifiers, a crossover network, switching facilities and tone controls are among future LRS products. All LRS models have metal enclosures designed for compact stacking. Optional vinyl-clad, wood-grain enclosures are also available.

The newly developed Laboratory Reference Series comprises a coordinated system of components whose performance characteristics represent a significant step forward in the state of the audio art.

Consider, for example, just two specifications of the direct-coupled DC power amplifier. At full rated power, intermodulation and total harmonic distortion are no more than 0.008 per cent, a figure previously associated only with the finest preamplifiers.

Even more significant, the various sources of the elusive—but audibly crucial—transient intermodulation distortion (TIM) have been isolated and dealt with. As part of the LRS research program, LUX audiophile/engineers developed an innovative technique for precise measurement of TIM. With the LRS amplifier, it is 0.05 per cent.

THD and IM distortion are conventionally measured with sine waves, which are inherently symmetrical and repetitive, unlike musical signals which are irregularly shaped, rapidly changing transients.

The large amounts of negative feedback normally used to reduce THD and IM distortion actually worsen TIM.

Negative feedback involves returning a portion of the output signal—out of phase—to the input. When the signal is a sine wave, generated and measured by test instruments, this technique is effective.

However, with the constantly changing transients typical of music, the feedback signal returns to the input too late for the desired effect. It either "corrects" the wrong part of the waveshape or—far worse—fails to provide the instantaneous reduction of the signal required by the feedback-controlled circuits.

Result: the amplifier is driven into momentary clipping and overload—the aspect of TIM that is most audible and disturbing.

A reduction of the feedback and signal transit time so that TIM distortion effects would be significantly reduced is precisely what LUX sought, and has now achieved, with the LRS amplifiers.

LRS vs. TIM.

Capacitors are necessary in conventional circuits to avoid bias-upsetting DC. However, they slow the audio signal

(appearing as phase-shift lags), particularly in the lower bass range. A new type of solid-state device developed for the LRS amplifier—a Dual Monolithic Linear Integrated Circuit—has enabled LUX to eliminate all capacitors from the signal path.

The transistors commonly found in even the finest amplifiers are too slow (usually 4 microseconds) to cope adequately with transients. The recently developed (and very expensive) transistors in the LRS amplifier can switch in 0.5 microsecond.

Class B and Class A amplifiers have well-recognized limitations: Class B introducing "crossover" distortion; Class A with power limitations and gross inefficiency. The LRS amplifier, is able to employ a bias point (in effect, Class AB) that achieves the best of both operating modes.

For more on LRS

All of the above are just high points of one LRS component, the Luxman 5M21 power amplifier, shown above with other current and future models.

We invite you to write for the new LRS literature. In the near future only a few audiophiles are likely to own these newest LUX achievements. But all can appreciate what they represent.

LUX Audio of America, Ltd.

200 Aerial Way, Syosset, New York 11791 • In Canada: White Electronics Development Corp., Ontario

It's time for everybody else to

From the very beginning, Yamaha receivers have set new laboratory standards. Our achievements in low distortion engineering, superb signal-to-noise, as well as high sensitivity and selectivity throughout the line have yet to be duplicated by any other manufacturer.

Now we've raised our standards even higher, beyond the laboratory and into the home. The result is the CR-2020: the pinnacle of a new line of advanced performance Yamaha receivers, rated to meet the more critical demands of real life.

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.

For example, in the lab, each receiver component is tested separately. At home, you hear them together as a single unit.

In the lab, distortion is measured at full-rated amplifier output. At home, you rarely, if ever, use the amplifier's full-rated power.

In the lab, power and distortion measurements are made with the volume control at maximum. At home, maximum volume would be painfully loud to listen to.

In the lab, noise and distortion are measured separately. At home, you hear them together.

Clearly a new standard is needed for evaluating overall receiver performance under real life conditions. Yamaha's new standard is 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. 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.

Component-by-Component Excellence. By all conventional laboratory standards, as well as Yamaha's more stringent standards, the CR-2020 offers a new level of receiver performance.

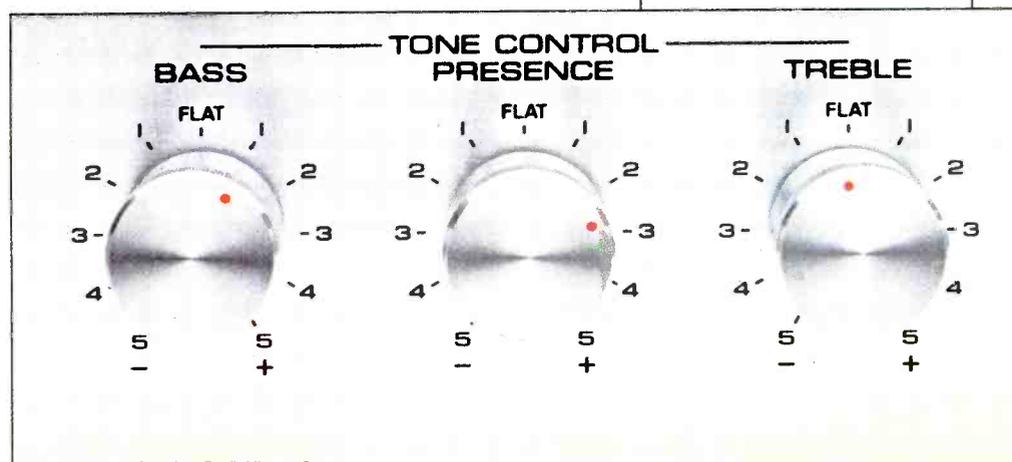
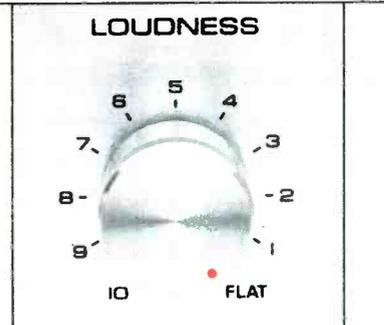
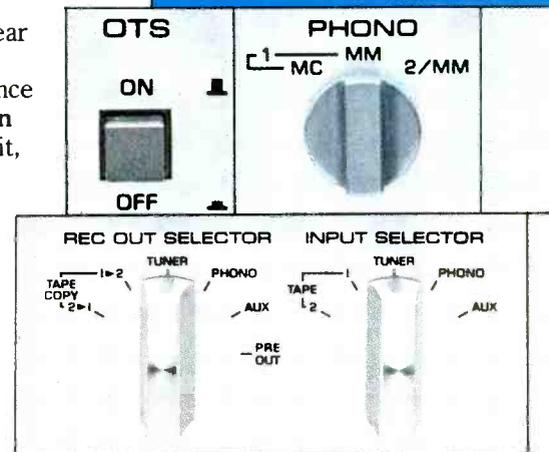
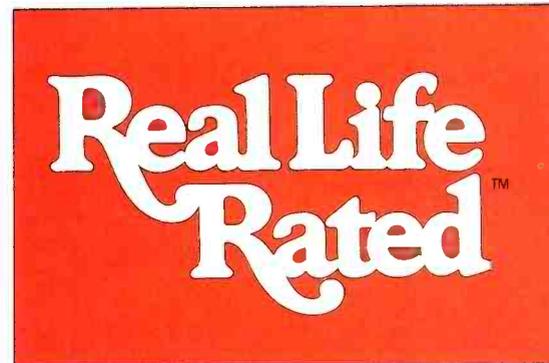
At full-rated output, the 100 watt-per-channel power amplifier reduces total harmonic and intermodulation distortion to a new absolute low—a mere .05% from 20Hz to 20kHz into 8 ohms.

The CR-2020's exceptionally fine preamplifier is largely responsible for an incredible -95dB signal-to-noise ratio, from moving magnet phono input to speaker output.

The CR-2020's tuner makes FM reception up to 18kHz possible for the first time with unique negative feedback and pilot signal cancellation circuits (patents pending).

What's more, Yamaha's patented use of special ceramic and LC filters (developed for our revolutionary CT-7000 tuner) provide the highest selectivity and lowest distortion available.

Built-In Moving Coil Head Amp. Today, more and more people are discovering the superior performance of the moving coil phono cartridge. While



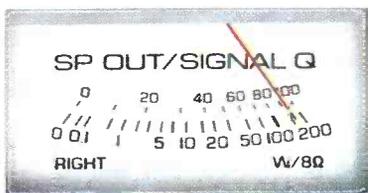
start playing catch-up. Again.

other receivers require an expensive preamplifier or step-up transformer, which can compromise sound quality, the CR-2020 already provides for it—the same solid-state device first developed for our superlative C-2 preamplifier.

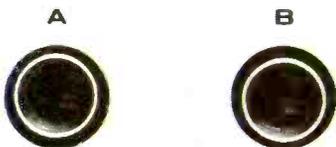
Input/Rec Output/Pre Out Selectors. Here's extra convenience for tape recording enthusiasts. Record any source while listening to another. For example, copy a tape or disc at the same time you're enjoying an FM program. When you're in the mood to play recording engineer, you can use all the tone controls and filters to compensate for poor quality sound sources.



METER



PHONES



Fast Rise, Slow Decay Power Meters. The CR-2020's large, accurately calibrated power meters, with fast rise, slow decay characteristics, make accurate readings possible from 1/10th watt to 200 watt peaks without switching ranges.

Multi-Function Signal Quality Meter. When tuning, the right channel power meter automatically converts to a signal quality/strength meter. Needle oscillation indicates the degree of multipath present, while the meter calibrations indicate the strength of the signal. After tuning, the needle automatically reverts to power reading.

Optimum Tuning System. Yamaha takes the problem of inaccurate tuning out of human hands. After you manually locate the desired station, OTS automatically fine tunes it to the single point that gives maximum stereo separation and minimum distortion. A defeat switch is provided for special applications.

Built-In Equalizer. Think of the CR-2020's tone control circuitry as a small multi-band equalizer. Feedback bass and treble controls have selectable turnover frequencies. A midrange presence control adds more flexibility. Two-position low and high filters have 12dB/octave slopes. For the purist, a defeat switch removes the effect of the tone control circuitry entirely.

The Best Is Yet To Come. Now that you know about Real Life Rated, you'll want to hear a real life performance. At your Yamaha Audio Specialty Dealer, you'll find uncommon dedication to faithful music reproduction and genuine customer service.

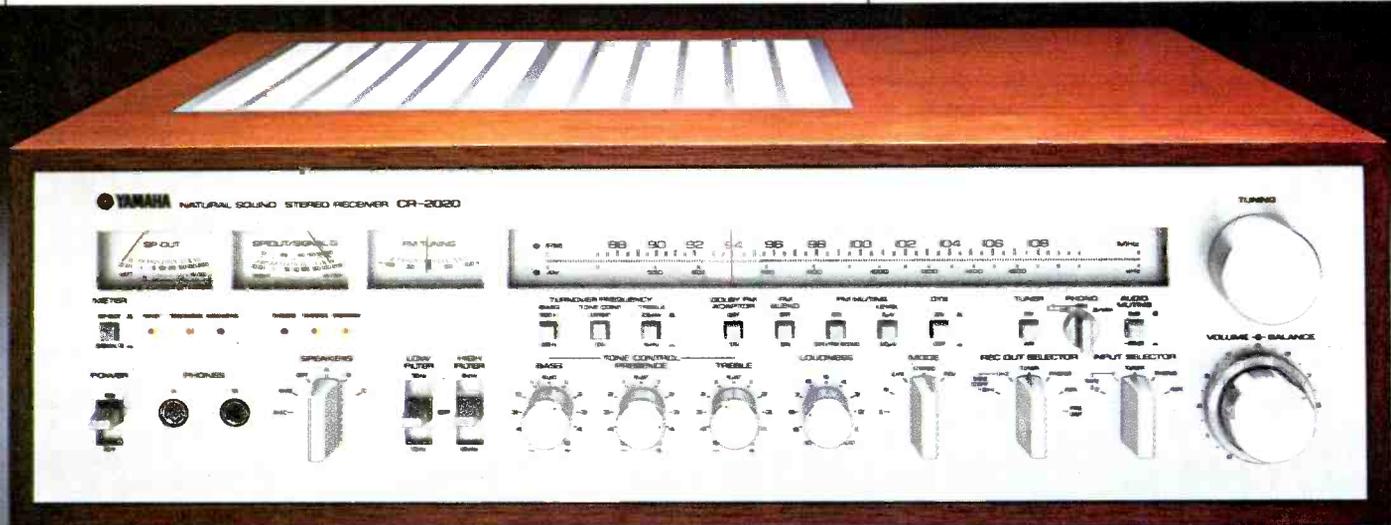
If your Yamaha Audio Specialty Dealer is not listed in the local Yellow Pages, just drop us a line. Along with his name, you'll get complete details about this unprecedented receiver.

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YAMAHA

Audio Division, P.O. Box 6600, Buena Park, CA 90622



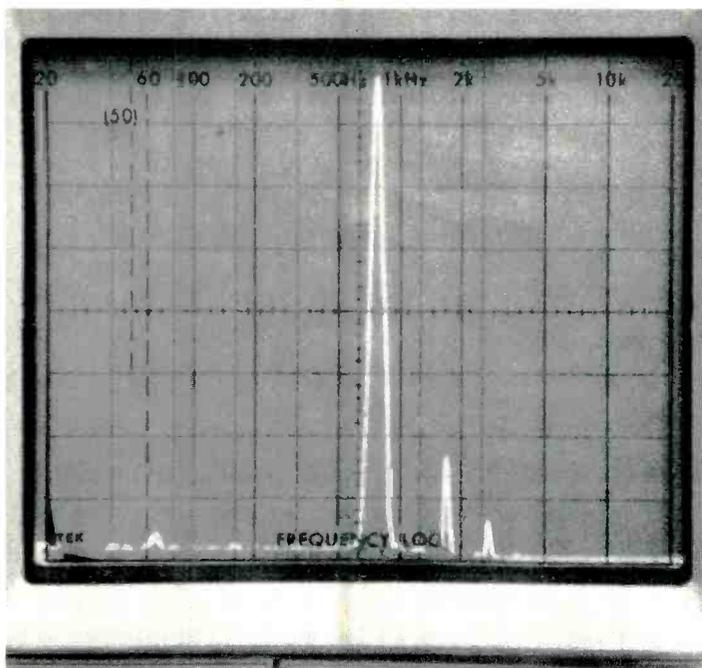


Fig. 5—Spectrum analysis of THD at 75 W output @ 1 kHz.

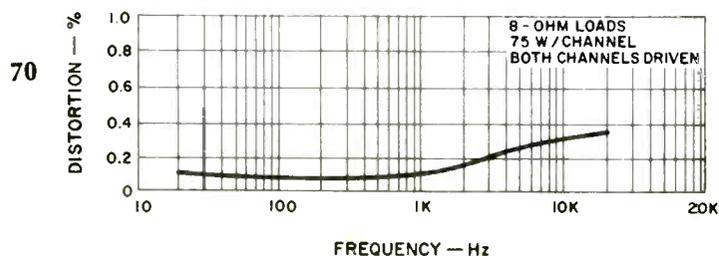
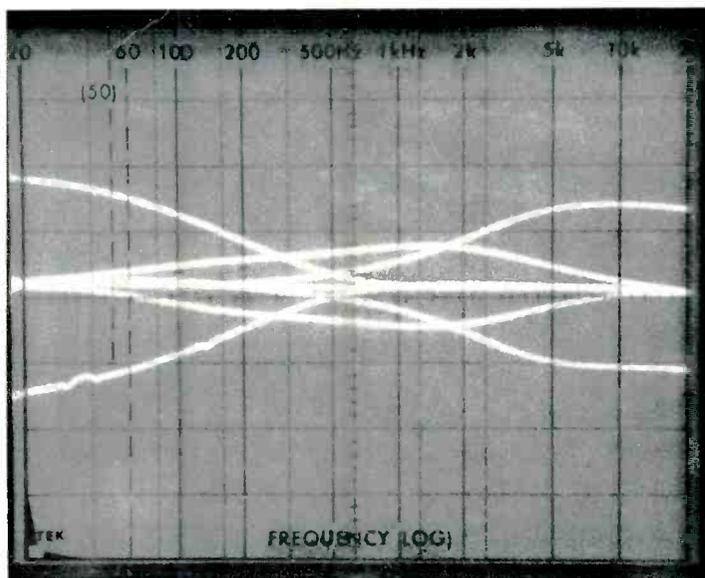


Fig. 6—Distortion vs. frequency of the amplifier section with both channels driven at 75 W into 8 ohm loads.

Fig. 7—Bass, treble, and midrange control ranges.



for 1 kHz signals; we measured better than that, 85 watts per channel for the rated 0.2 per cent THD figure. As for the power rating from 20 Hz to 20 kHz, Scott gives us a figure of 75 watts per channel, a power output level easily met at low frequencies (where THD for that output level was a very low 0.075 per cent), though the unit fell short at the 20 kHz extreme, where we measured 0.35 per cent THD. As for IM distortion, it crossed the rated 0.1 per cent level at 10 watts or so and increased very gradually to 0.3 per cent at full rated output of 75 watts per channel. Distortion and IM versus power output for a 1-kHz test signal are shown in the graphs of Fig. 4, while a spectrum analysis of an output 1-kHz signal at 75 watt level (Fig. 5) discloses that the residual THD consists almost entirely of low level second and third order harmonics, the worst of which is down a bit more than 60 dB below the fundamental, in good agreement with our single THD reading of 0.12 per cent for the 75 watt level.

Preamplifier measurements showed phono input sensitivities of 2.5 mV and 6.0 mV for the two switch settings on the rear panel, exactly as claimed. Overload in phono measured 125 mV for the most sensitive input setting and 285 mV with a 6.0 mV input sensitivity. Hum and noise, unweighted, measured a very good 71.5 dB referred to actual input sensitivity and full output. While the low frequency end of the RIAA equalization characteristic was virtually a carbon copy of the prescribed curve, roll off at the high end was insufficient by about 2.5 dB which, in our later listening tests, resulted in a somewhat brilliant high end.

Hum and noise for the high level inputs measured 86 dB below rated output, and the same figure applied for minimum volume settings. Frequency response at the high level inputs was within 1 dB of flat from 10 Hz to 53 kHz, rolling off by 3 dB at 63 kHz.

Range of response of bass, mid-range, and treble controls is depicted in our 'scope photo of Fig. 7. While bass range was as expected, we were surprised and pleased to see the "shelving" of the treble control's maximum boost and cut range above about 5 kHz. Unlike some treble controls which continue to boost output more and more with increasing frequency, the levelling off of the maximum boost in the Scott R-376 is sure to save the life of a few tweeters which belong to those who insist upon cranking up their treble controls all the way. In our view, the mid-range control affects a bit too much of the audio spectrum, though its peak effect, at just below 2 kHz, is just about where we like to see maximum action from this type of control.

Filter responses, plotted in the 'scope photo of Fig. 8, have desirable 12-dB-per-octave slopes for both low cut and high cut, though we would have preferred to see the turnover points a bit closer to the frequency extremes since only one turnover point for each type of filter is available.

Loudness control action is typical of the breed, with varying degrees of both bass and treble emphasis introduced as volume control settings are lowered. Response at various levels with the loudness circuit "in" is shown in the multiple traces of Fig. 9.

Summary—Use and Listening Tests

Overall, we feel that the Scott R-376 is conscientiously designed and is easy to use. Certainly, it has all the control features and much of the flexibility demanded of a modern all-in-one stereo component. We encountered no evidence of overheating in continued use. Power output was ample enough to drive medium to moderately low-efficiency speaker systems, though the manner in which the amplifier section approached clipping levels left something to be desired, sonically speaking. In terms of the so-called

The speakers
that speak for themselves.
All you have to do is listen.



SPECTRUM III

The new Audio Spectrum series.

Speakers are not just a matter of specs. Or features. Or "revolutionary new" design. What matters is how they sound. Those who appreciate fine music reproduction will surely love the sound of the SAS Audio Spectrum speakers, designed with the high-fidelity connoisseur in mind.

The super-efficient Audio Spectrum speakers meet the demands of today's high power amplifiers, yet they easily perform with precise response to lower power equipment. Your system will sound better than ever before.

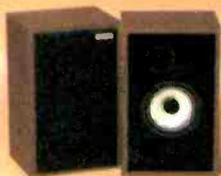
The top-of-the-line Audio Spectrum III, a 4-way system, is enclosed in a vented, solid cabinet of walnut veneer, and features a 15" woofer to supply rich, satisfying bass; a 5" driver for smooth uncolored mid-range; a 1.75" tweeter and a piezo-electric super-tweeter for a crisp high end.

The Micro Spectrum, although housed in a small cabinet, delivers an impressive sound level, tonal clarity and a rich bass. The SAS line is completed with the Mini Spectrum, Audio Spectrum I and Spectrum II — all designed, engineered and produced with the same care and high quality standards as the Spectrum III. The entire series features automatic self-resetting circuit breakers.

Visit your nearest SAS Electronics franchised dealer today. Look for the Audio Spectrum line. Then listen to THE SPEAKERS THAT SPEAK FOR THEMSELVES.



MICRO SPECTRUM



MINI SPECTRUM



SPECTRUM II

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New York, NY 10001, (212) 736-8633



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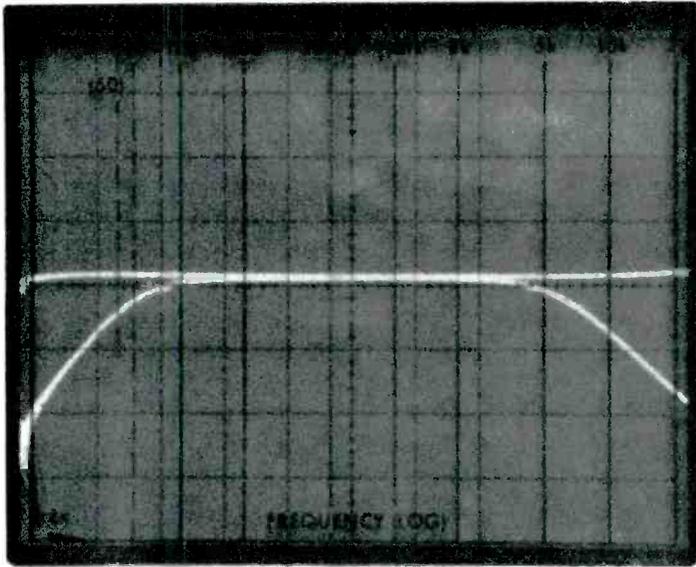


Fig. 8—High- and low-cut filter response.

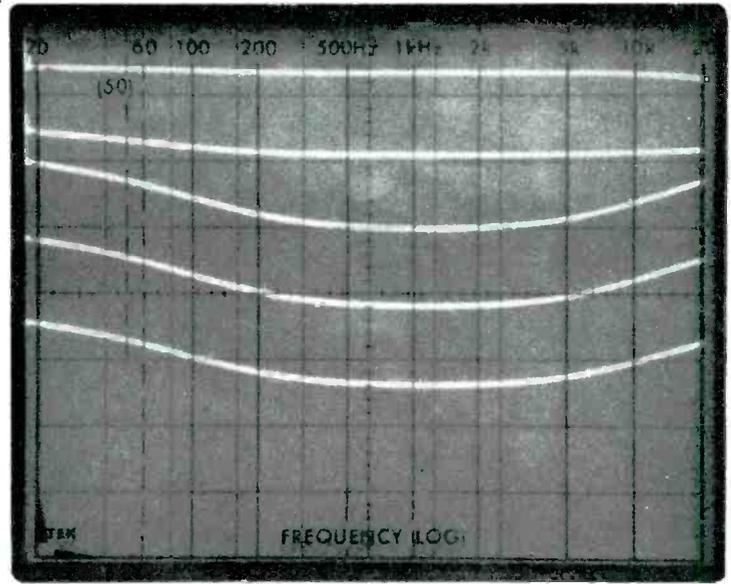


Fig. 9—Loudness compensation of the Scott R-376 Receiver.

cost/performance ratio, power output level is consistent with the suggested retail price of the R-376. Other specifications, both claimed and met, suggest that the receiver is priced at about the same level compared to other receivers in the same general category. FM reception was good, with all our usual station signals received without difficulty. In one or two instances (where signals broadcast are known to be exceptionally noise free and low in distortion), we were able to detect just a little residual noise and a bit of hum. An

outdoor antenna used with these stations should bring up signal levels to produce the full 68-dB S/N performance (64 dB in stereo) of which this receiver was capable on the bench. The receiver does earn high marks on styling and control layout and is well dimensioned for shelf or table-top installation, as well as for incorporation into a custom-designed piece of furniture.

Leonard Feldman

72

Enter No. 70 on Reader Service Card

Hartley Model Zodiac '76 Speaker System

MANUFACTURER'S SPECIFICATIONS

Speakers: One 10-in. woofer; one 1-in. dome tweeter.

Frequency Response: 35 Hz to 25 kHz.

Crossover: 2 kHz.

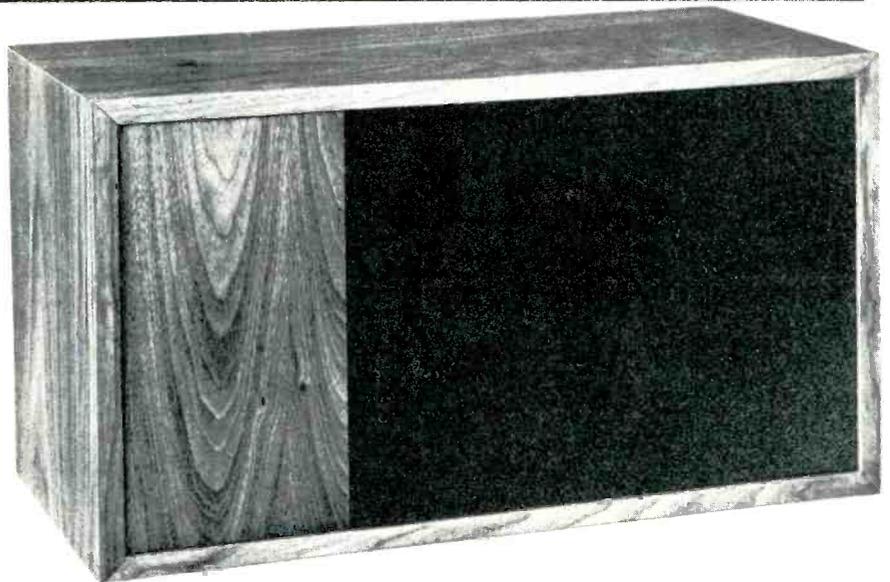
Impedance: 8 ohms.

Minimum Power Requirements: 10 watts.

Cabinet Size: 30 in. (76.2 cm) H x 15 in. (38.1 cm) W x 12 in. (30.5 cm) D.

Shipping Weight: 50 lbs. (22.7 kg).

Price: \$140.00.



The Hartley Zodiac 76 is a full-range loudspeaker system using two drivers. A 254 mm (10 in.) woofer is used in an infinite baffle to cover the frequency range from 35 Hz to the crossover at 2 kHz. A 25.4 mm (1 in.) dome tweeter is used to carry the frequency range from 2 kHz upward. (Editor's Note: Hartley informs us that systems produced after March 1 have a tweeter with greater power handling ability.)

Housed in an attractive oiled walnut cabinet measuring 381 mm by 305 mm by 762 mm (15 X 12 X 30 in.), the system is not too large to be classed as a bookshelf speaker, but at 22.7 kg (50 lb.), I would suggest that this speaker principally be

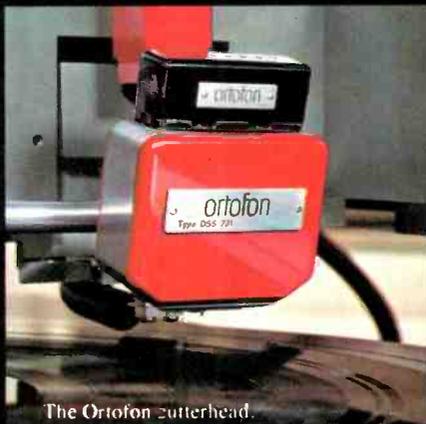
used as a floor-standing system.

One of the interesting features of the Zodiac series of speakers by Hartley is their deliberate design of systems in asymmetrically matched pairs for stereo. Thus, there is a left speaker and a right speaker, and their identity is clearly marked on the rear of the speaker. The intent of this asymmetry is to provide a greater sound dispersion, and Hartley recommends the normal left-right configuration when the speakers are 10 feet apart or less, and a reversed configuration for wider speaker spacing to improve the spread of sound.

We made the first Ortofon cartridge for us.

As far back as 1945, Ortofon was making the cutterheads used throughout the world to cut the grooves in master phonograph records. But the phono playback cartridges then available could not put our cutterheads to the test for sensitivity and capacity.

So we made our first phono cartridge. For us.



The Ortofon cutterhead.

Since then our cutterheads have moved ahead—with a quality we couldn't even imagine in 1945. So have our phono cartridges.

The new MC20 moving coil phono cartridge is the best we've ever made. We believe it is the finest available for professional or home use.

The MC20 has the lowest stylus tip mass ever attained on a phono cartridge. A flawless, fine line diamond stylus is fixed directly (without the usual sleeve) to a stepped, low mass cantilever. Beryllium filling enables the cantilever to attain rigidity despite its minute dimensions. The moving coils are wound with wire one-fifth the thickness of a human hair.

The moving coil principle, with its low inertial mass, wider frequency response, low distortion as well as low tracking force, has clearly established its sonic superiority over any other phono cartridge system. Our new pre-preamplifier, the MCA-76, is also available to process the signal of the MC20 or any other moving coil cartridge. The MCA-76 features low-noise circuitry, a subsonic filter and a by-pass switch which accommodates all magnetic cartridges.

We'll be pleased to forward data on the entire Ortofon line. We suggest that you write to us directly. Ortofon, Dept. C, 122 Du Pont Street, Plainview, New York 11803.

ortofon

Enter No. 31 on Reader Service Card

You've never heard anything like it. Not from us. Not from anyone. JBL's new L212: a totally new picture of high performance sound, from the people who wrote the book.

You hear the whole sound first. And when you catch your breath you search for words to describe the depth, the detail, the etched precision of the music.

That stunning pair of three-way speakers is sending clean, undistorted sound to every corner of the room. At every frequency. At every level. Loud or soft. High or low. It doesn't matter. The energy is constant.

You're experiencing three-dimensional imaging: Vocal up front. Lead guitar two steps back and one to the left. Drums further back. The piano closer, almost off the right edge of the sound.

Suddenly you're aware of a fullness in the music that you've heard before but never associated with recorded sound.

The bass! You've been hearing all of the bass, all of the fundamental tones you couldn't bring home from the concert. It's not only everything you've heard before. It's everything you haven't. The music is rich with sound at the lowest limit of your hearing.



Then you see the third speaker. The hero of the piece: The Ultrabass.

The Ultrabass is a system in itself—woofer, amplifier, equalizer and enclosure—designed, mated, blended to do one thing perfectly: reproduce sound at the threshold of sub-sonic frequencies.

It brings all the low frequency music within audible range, balancing it perfectly with the rest of the music. Without boominess. Without resonance. It also electronically sums left and right signals below 70 Hz—virtually eliminating turntable rumble and record warp noise. And, because of the non-directional character of the low frequency sound, the Ultrabass can be placed almost anywhere in the room. Without any loss of three-dimensional imaging.

The Ultrabass pays one final dividend: it allows the two three-way speakers to be specialists, too.

They can concentrate on the top 95% of the music. (Listen to the whole system, and you'll hear what that means. Even at a rug-curling, rock concert loudness, you'll get a clarity, a smoothness, an enthusiasm for detail you've never heard before.)

Finally, you look for the monster amplifier that's driving all that sound. There isn't one. The L212 takes one fourth the power you'd need with a conventional low efficiency loudspeaker.

That's the story. What you've been reading about is, essentially, a no-trade-off loudspeaker system. Now we'll tell you the trade-off: The price is \$1740. (The L212 may take a little while becoming a household word.)

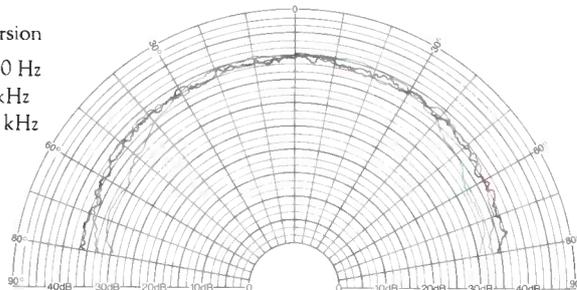
In the meantime we have two suggestions:

If you'd like a lot more technical information, write us and we'll send you an engineering staff report on the L212. Nothing fancy except the specs.

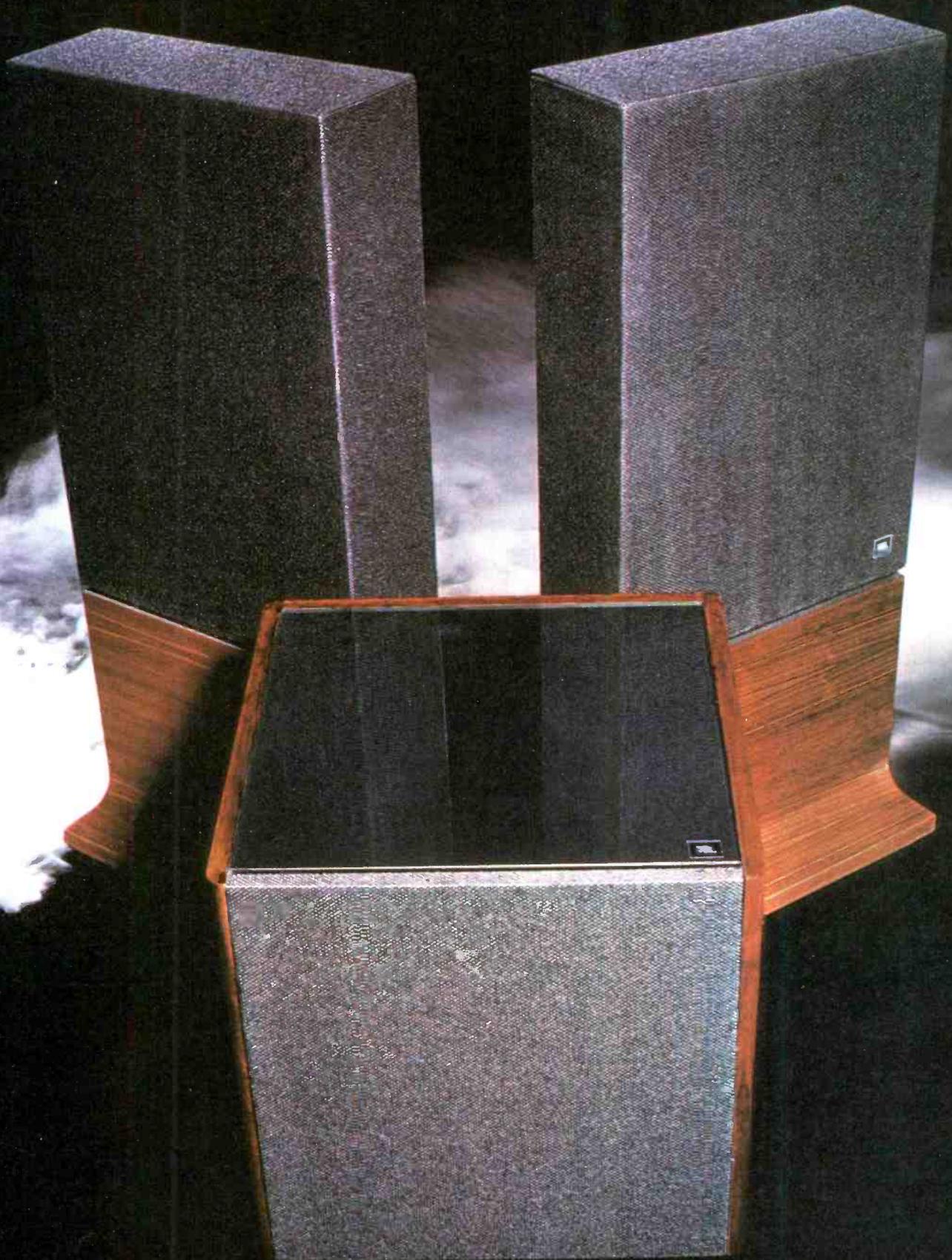
Or call your JBL dealer and ask him when you can hear the L212. You've never heard anything like it. Not from us. Not from anyone.



Frequency Dispersion
 ~~~~~ at 400 Hz  
 ~~~~~ at 2 kHz  
 ~~~~~ at 10 kHz



JBL CHANGES THE  
PICTURE OF SOUND.



Rated at 8 ohms, a minimum of 10 watts is required to produce normal listening level, according to Hartley. Connection is made to spring-loaded binding posts mounted in a recessed cavity at the rear of the enclosure.

I must give Hartley bad marks on a technicality that is a personal gripe of mine. Other than the suggestion concerning the effect of speaker spacing on which left-versus-right enclosure to set up to use, there is absolutely no information to help a new owner set up his Zodiac speakers for best performance. Nor is there any warning about the maximum safe amplifier power or other operating conditions that could get a user into trouble with the warranty, which is prominently displayed on the rear of one system. A purchaser does get a very attractive piece of printed material extolling the virtues of the speakers, but I assume a purchaser is already sold on the merits of the loudspeaker and now he should be told how to use it.

The warranty, my gripes to the contrary, is excellent and good for five years.

### Technical Measurements

The measured terminal impedance of the Hartley Zodiac 76 is shown in Figs. 1 and 2. The bass resonance peak occurs at 55 Hz, with a minor subsidiary impedance peak at 850 Hz. While rated at a nominal impedance of 8 ohms, the lowest measured value is approximately 5.5 ohms. This means that

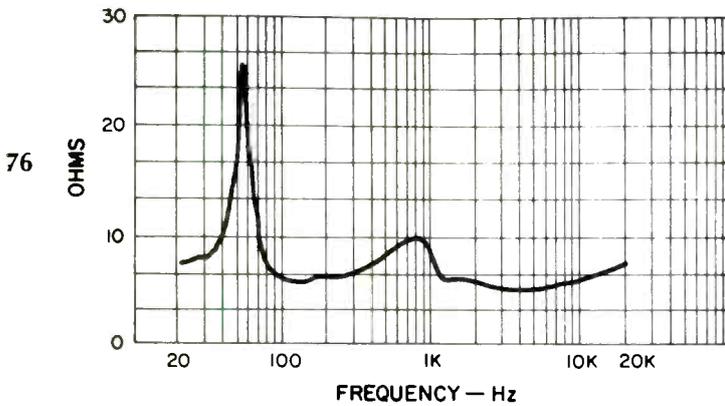


Fig. 1—Magnitude of impedance.

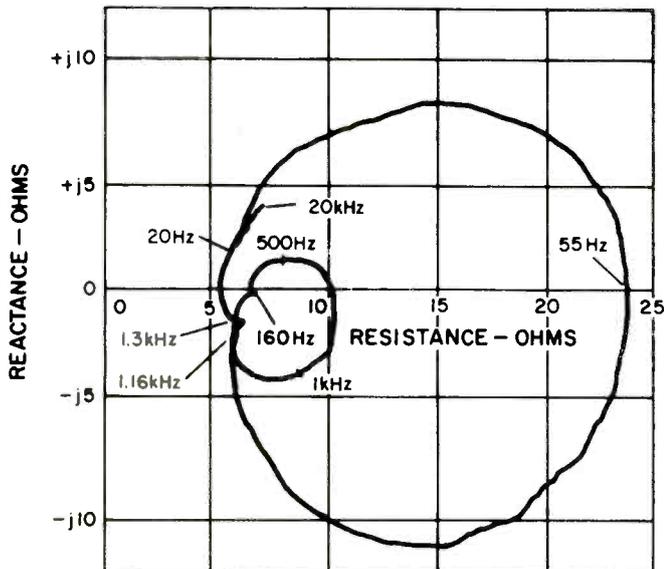


Fig. 2—Complex terminal impedance.

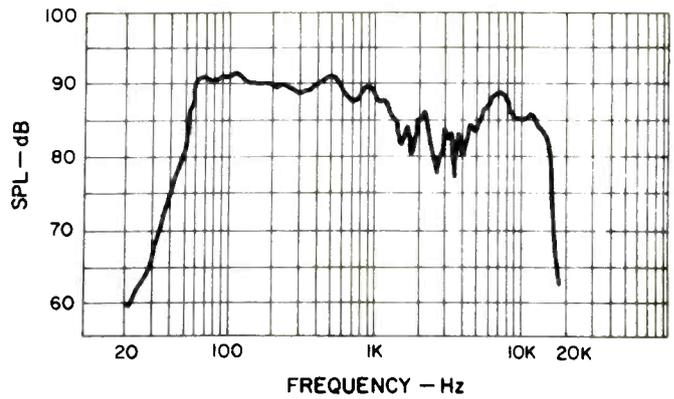


Fig. 3—Amplitude of one-meter anechoic sound pressure level with one-watt average drive.

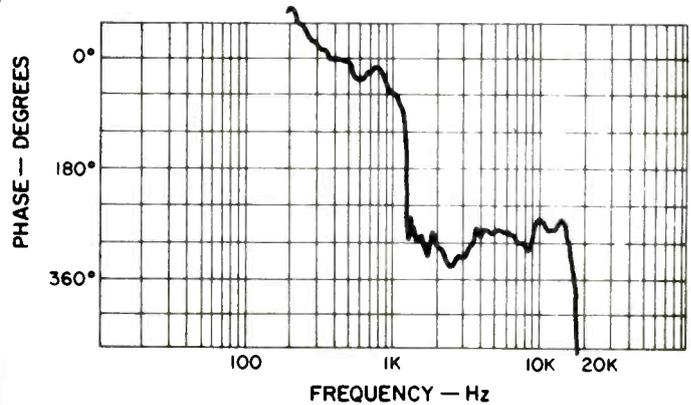


Fig. 4—One-meter axial anechoic sound pressure level phase response corrected for acoustic position of the tweeter.

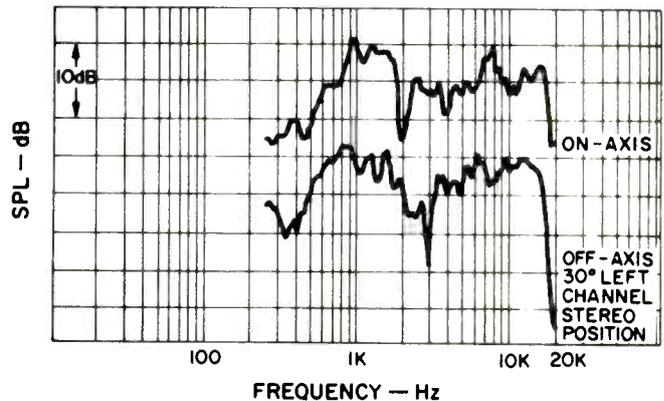


Fig. 5—Three-meter room response.

reasonably large hookup wire should be used when employing long runs of speaker lead.

The detail nature of the complex impedance plot indicates that there is a small amount of interaction between the two speakers and the enclosure in which they are housed. These glitches occur at 160 Hz, 1.16 kHz, and 1.3 kHz. Their nature is not severe but they do show some possibility of cabinet resonances.

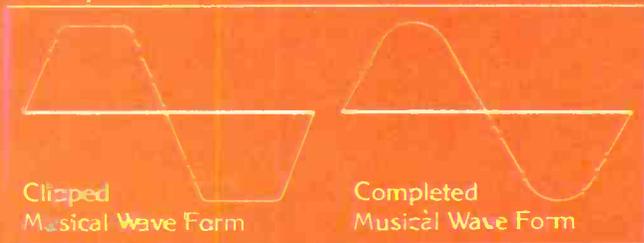
It is an unusual, and fortunate, circumstance that the lowest value of impedance is slightly in the inductive reactive side. Thus, while the value is low and occurs at a frequency of 5 kHz where strong human presence vocal peaks can place strong demands on an amplifier, the amplifier is not

# Only Hitachi's SR/903 Receiver has Class G, "the very newest class in amplifier operation."

Stereo Review  
January, 1977



Stereo Review went on to explain that this exclusive circuitry "uses...a low power and a high power output stage operating together.. At low signal levels the lower power stage drives the speakers. The transition to the more powerful output transistors ...takes place smoothly at the point where it becomes advantageous to do so."



The point they're talking about, of course, is where certain portions of the music you listen to demand more than the rated output to sound like they should. (Rated output on the Hitachi SR/903 is 75 watts continuous power per channel, both channels driven into an 8 ohm load, 20 to 20,000 Hz with no more than 0.1%

total harmonic distortion.) So when your music really gets thrilling, Class G cuts into a standby amplifier. Then, for just a moment, the SR/903 can pump out a lusty 160 watts per channel—without clipping.

One look at comparison wave forms will show you what we mean. See how the sound from the conventional amplifier has the top of its natural arc clipped off. That's

when you'd get clipping distortion. But the same musical peak graphed on the Hitachi SR/903 is complete. So the sound you'd hear would be clean and crisp.

As a wrap-up, Stereo Review said Class G delivers "much higher overall efficiency than a conventional device, and this brings immediate dividends...in reduced weight, size and power consumption."

All they neglected to mention was that Class G doesn't cost you any more.

## Hitachi SR/903 Typical Specifications

| Amplifier                                       | Rating                |
|-------------------------------------------------|-----------------------|
| Power, minimum RMS, at 8 chms. 20 to 20,000 Hz  | 75 watts              |
| Total harmonic distortion at rated power output | 0.1%                  |
| FM Tuner                                        | Rating                |
| Usable sensitivity (IHF) 300 OHMS               | 1.6 $\mu$ V (9.3 dBf) |
| 50 dB quieting sensitivity                      | 3.1 $\mu$ V (15 dBf)  |
| Signal/noise ratio 100% mod                     | 74 dB                 |



**HITACHI**  
When a company cares,  
it shows.

under the strain of a capacitive reactive load. In short, most amplifiers should drive the Hartley with ease.

The Hartley Zodiac speakers are designed for stereo. There is a left speaker and a right speaker. In order to perform our standard tests, we picked the left channel speaker for all measurements. This means that a one-meter axial anechoic sound pressure test might not look so great for a speaker intended for off-axis listening, and that was indeed the case. Figure 3 shows the amplitude of measured sound

pressure for one watt average drive, and Fig. 4 is the measured phase response.

The on-axis amplitude response shows a pronounced dip in the 2- to 5-kHz voice presence range. Rotating this speaker in azimuth and elevation revealed that this response smooths out for a microphone position to the left and slightly above the geometric speaker axis, precisely where a listener should be for a left channel speaker placed on the floor. But the axial response is what we use as standard for this particular test.

The anechoic phase response has several unusual features. The Hartley Zodiac 76 is nonminimum-phase in the 2 to 5 kHz range for any of the orientations we tested. The on-axis response has a full 360 degree phase lag at 1.3 kHz. The phase measurement indicates that the acoustic position of the woofer and tweeter are approximately aligned. But even more unusual is the 90 degree phase lead of the tweeter. Thus the tweeter pressure is neither in phase nor out of phase with the terminal voltage, but leads by 90 degrees. This unusual characteristic was also verified from observation of the sound pressure impulse response. I do not know what the general subjective effect of this might be, but I do know I liked the sound of this tweeter in the earlier listening test.

But the anechoic test is a measure of a specific type of technical perfection. When it gets down to listening, the three-meter room test ought to be a better indication of how the speaker sounds. I was glad, therefore, to find that the response, shown in Fig. 5, was much closer to my earlier listening impressions than the anechoic response.

I tested the Hartley where I heard it. Twelve inches from a wall and placed on the floor. The measurement position was the listening position, three meters away and one meter above the carpeted floor. I listened 30 degrees off axis, the lower measured curve. The upper curve is what we get when we sit directly in front of the speaker, or rotate it so it points to our listening position. For clarity, these two measurements are displaced 10 dB on this plot.

In my listening, I had thought the top end was great, vocals needed a mild 3-kHz lift for most accuracy, and there was a slight mid-bass bump around 200 Hz. Oh well, two out of three isn't bad. Actually my spectrum analyzer showed a bump at 100 Hz, but because of the 13 millisecond time gate used in this test, I cannot honestly show measurements below 200 Hz. Sounds great, and measures good.

The measured dispersion of sound energy is shown in Fig. 6 for horizontal spread and in Fig. 7 for the vertical spread. The Zodiac definitely has left-right asymmetry, just as Hartley claims. However, this left-channel speaker would be hotter as a right channel source, since more energy is launched away from nominal listening position. The Hartley also launches more energy upward, which is a proper design for such a floor-mounted system. These plots indicate that large objects should not be closely positioned either outboard or above the speaker location.

The Hartley woofer has problems in handling large amounts of super low bass, as there is a definite tendency to crunch on Low E (41.2 Hz) if driven at high levels. This is shown in the harmonic distortion measurement of Fig. 8 and the intermodulation distortion measurement in Fig. 9. In the case of intermodulation, the nature of the modulation of low E on A above middle C (41.2 Hz on 440 Hz) is that of amplitude modulation up to about 10 watts, then a progressive increase in phase modulation above that level. At 10 watts there is five degrees peak-to-peak phase modulation on A4.

The Hartley fared much better in the crescendo test. A reference tone of 440 Hz is reproduced at a test power level and its energy observed in a one-Hertz filter centered about

78

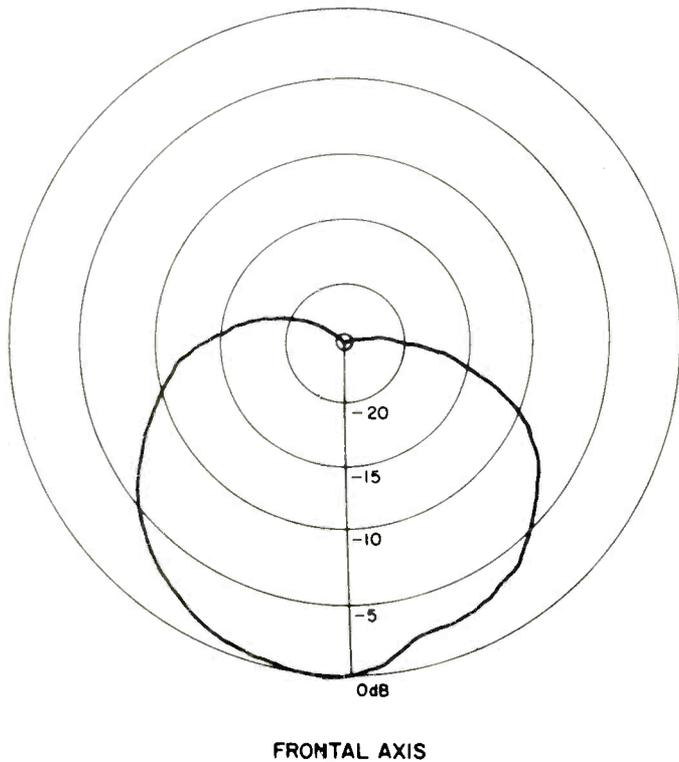
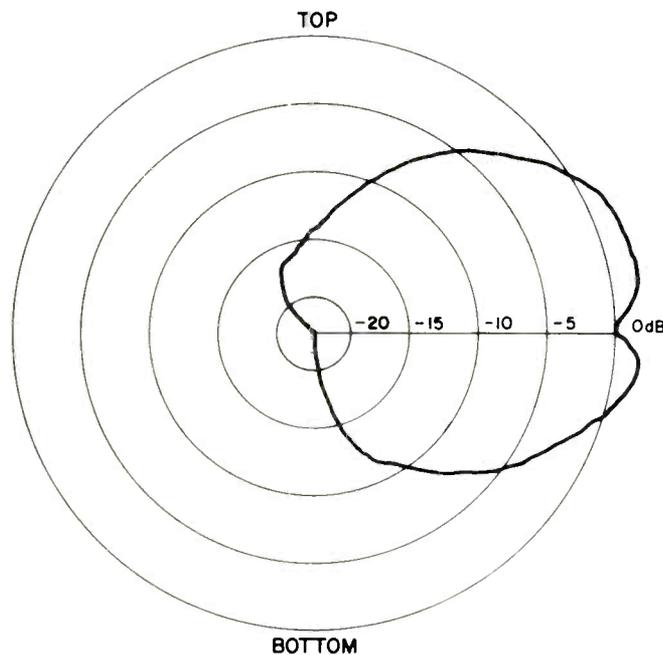


Fig. 6—Horizontal energy response, left channel speaker.

Fig. 7—Vertical polar energy response.



# HOW NOT TO RUIN YOUR RECORDS

## PART II

### *Avoid sticky coatings*

#### THE PROBLEM:

No vacuum device, duster machine or wonder cloth can remove fingerprints, jacket particles or dust containing smog/smoke from your records. Yet such contamination ruins records.

A chemically correct fluid can pull these ruinous contaminations into solution, but record preservation requires lifting both fluid and problems off the record without leaving residues.

#### COMMON ERRORS:

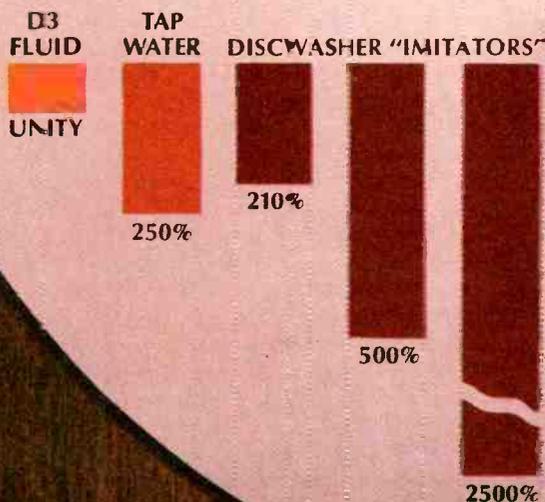
In spite of much written advice and wild claims, most disc cleaning liquids (also soap and water) gum up record grooves. This sticky problem has two origins: high dry weight residue in the fluids; plus the actual chemical affinity of most cleaners for vinyl. Even the use of tap water causes a deposit on vinyl and a loss of high frequency definition.

#### AN ANSWER FROM RESEARCH:

Use a system that cleans and removes contamination safely. The most researched and chemically non-adhering fluid is D3 by Discwasher, which includes an anti-static formulation that does not stick. See the table for actual dry weight residues of tap water and "record cleaners" costing over \$11 each. D3 is chemically "active" only against common record contaminants—not the vinyl, and D3 literally lifts contamination off the record surface without coating.

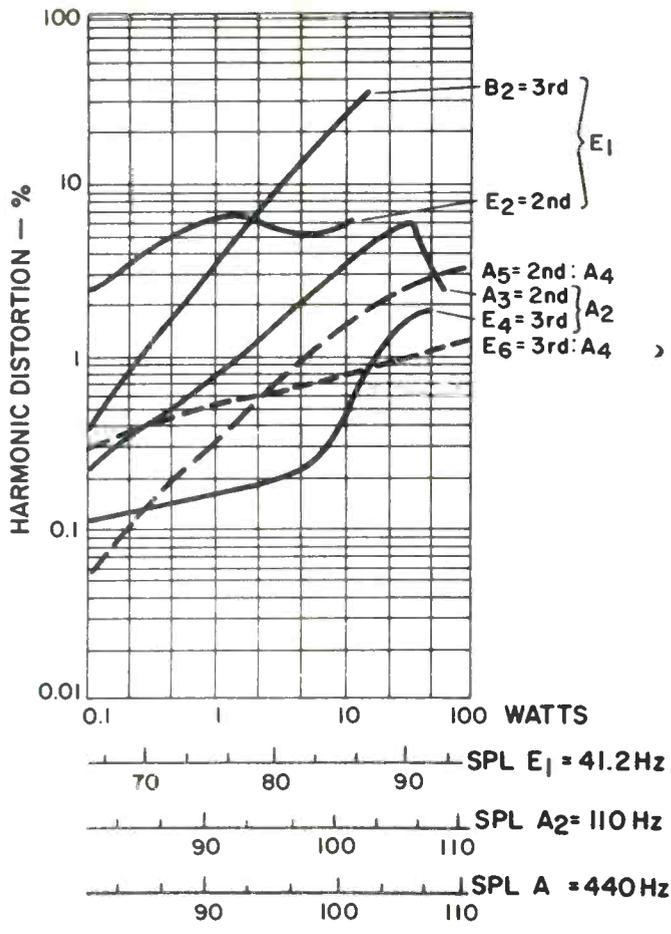
Properly used as a system, D3 and the Discwasher brush draw all contaminants and fluid off the disc by the capillary action of micro-fibers into the absorbent fabric backing. Nothing is left on the record except encoded sound.

#### COMPARATIVE DRY WEIGHT RESIDUES



 Discwasher Group

1407 N. PROVIDENCE RD.  
COLUMBIA, MISSOURI 65201



instrumental blurring should not be experienced even when cymbal crashes and brass peaks are encountered.

In yet another type of distortion test, the Hartley showed a smooth general drop of acoustic transfer gain with an increase in drive level. At 10 watts average power, tones are reproduced at one half dB lower sound level than would be expected from the pressure-versus-drive volts transfer gain measured at 0.1 watt drive level. This is similar to a mild compression in dynamics as the sound level is raised. A good feature about the Hartley is that this compression is not dependent upon frequency. Thus the sound should have a slight softening in dynamics with increased drive, but suffer no change in timbre.

The measured energy-time curve is shown in Fig. 10. The first peak of energy at 3.15 milliseconds is due to the tweeter. The second peak at 3.3 milliseconds appears to be due to the first sound components of the woofer, which for this axial one meter microphone position means that they are closely aligned in time. The energy fall off is at a rate of about 50 dB per millisecond until small diffraction peaks are encountered at around 4 milliseconds. Further scattered energy arrives after 4.7 milliseconds.

This is actually a very good transient response and the only indication of technical difficulty is the fall off of energy following the first tweeter peak, which hints of slight super top end ringing on sharp percussive sounds.

### Listening Test

As pointed out earlier, the Hartleys are supplied as a left and right matched set. These are upright floor-mounted

Fig. 8—Harmonic distortion for tones E<sub>1</sub> (41.2 Hz), A<sub>2</sub> (110 Hz), and A<sub>4</sub> (440 Hz).

# The Beauty



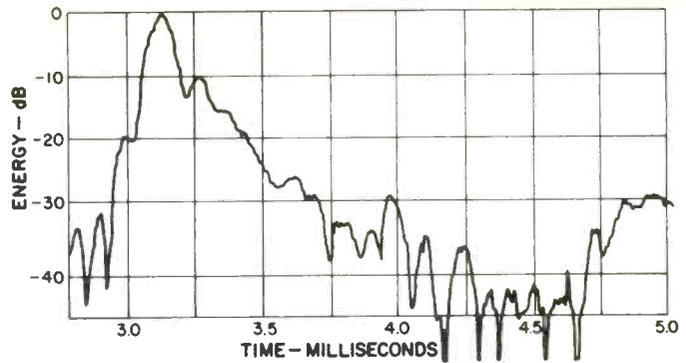
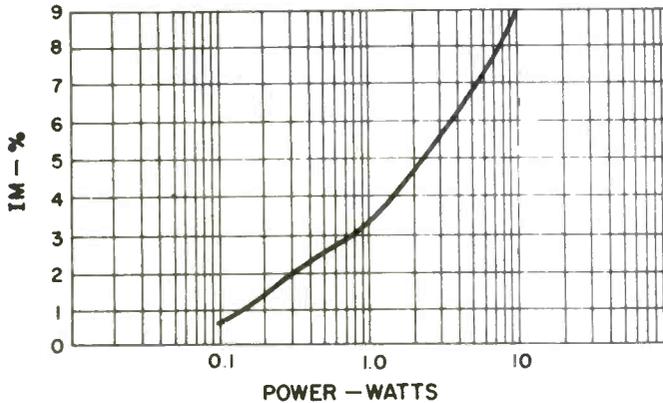
AIWA's AD-1250 is so beautifully built it makes the other decks look flat. Its new ultra-modern slant backed deck with its 20° angle stands out in a crowd. And up. So you can see what you're doing. And of course underneath all this streamlined beauty, lies the pride and joy of our AIWA engineers. The technical genius that has made AIWA famous for quality worldwide. Our built-in Dolby\* and interlocked Dolby-MPX filter switch have a 60dB S/N ratio. The 30Hz to 16kHz (Fe-Cr tape) fre-

quency response insures vividness and clarity of sound. The oil-dampened cassette elevation and ejection feature, pioneered by AIWA, handles your cassettes with kid gloves. The AIWA AD-1250. The body beautiful.

speakers. After some experimentation I found that I preferred these speakers about 12 inches away from a wall and pointed straight outward.

I am favorably impressed with the sound of these speakers. Then random noise is added at a level 20 dB higher than the single tone when averaged over a 20 kHz spectrum and the change noted in the property of that tone. This process is repeated at increased test power levels, always at the same ratio of tone to noise. Any modulation of the tone by the superimposed random signal indicates that peak program bursts may distort lower level musical voices. The Hartley showed no measurable modulation on up to a peak-to-peak test level of 80 volts. Since this is well above the recommended peak power of this speaker, it can be inferred that

**Fig. 9—IM distortion on A4 (440 Hz) when E1 (41.2 Hz) and A4 are mixed one-to-one.**



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

ers. The super lows are down, but not out. I thought there was a slight mid-bass bump and felt that the range around 3 kHz needed a small lift. But, for the money, the rest of the spectrum is good. The tweeter in particular is a star performer and has a good bite on brass instruments.

The left-right and stage center stereo illusion is good, in my opinion. The illusion of depth, however, is somewhat lacking.

This speaker is quite efficient and puts out a lot of sound. At high sound levels, approaching the 250 watt/chan. limits of our Marantz 510 amplifier, there is a mild crunch in mid-range which sounds a bit like cone cry, but this occurs well above the levels of anything reasonable in home listening.

It also sounds pretty good at low levels. At \$140, I think this speaker is a good sound bargain. *Richard C. Heyser*

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# & The Best

AIWA's AD-1800 is the cassette deck that other machines are trying to measure up to. Check our extra large flywheel which no other deck this size has, and our special oil-dampened cassette elevation and ejection feature. Along with our Solid Stabilized Transport System (SST) and AC hysteresis synchronous motor, the wow and flutter is kept

inaudible at only .05% WRMS. Our biggest competitor can only claim a .07% wow and flutter level. Our built-in Dolby\* and DNL noise reduction systems have a better than -65dB S/N ratio. The 30Hz to 18kHz (Fe-Cr tape) frequency response insures that the multitude of sound colors reproduced are kept vivid and alive. Every sound, from a violin to a drum roll is definitive. The AIWA AD-1800. The superior one.

# AIWA®

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82 **Technics by Panasonic  
SL-1350 Automatic Changer/Turntable**

**MANUFACTURER'S SPECIFICATIONS**

**Speeds:** 33 1/3 and 45 rpm.  
**Motor:** Ultra low-speed d.c. motor.  
**Drive Method:** Direct.  
**Platter:** 13 in. (33 cm) diameter.  
**Speed Change Method:** Electronic.  
**Variable Pitch Controls:** Individual for

each speed, 10 per cent range for each speed.  
**Wow and Flutter:** 0.04 per cent, W rms.  
**Rumble:** -45 dB, DIN A; -70 dB, DIN B.  
**Tracking Force Range:** 0 to 3 g.  
**Tracking Angle Error:** With +3° at a

point 5-1/8 in. (150 mm) from the center; with +1° at a point 2-3/16 in. (55 mm) from the center.  
**Dimensions:** 17-3/4 in. (45.3 cm) W by 14-3/8 in. (36.6 cm) D by 7-7/8 (19.9 cm) H.  
**Weight:** 20.7 lbs. (9.4 kg).  
**Price:** \$349.95.

The Technics SL-1350 can be considered as being the automatic version of the SL-1300 direct-drive, single play machine, and is one of the first (if not *the* first) automatic turntable to have direct drive. The diecast, dynamically balanced platter has the motor's rotor ring at the center of the chassis plate and the stator coils on top. The motor itself is a d.c. brushless type with switching for 33 1/3 and 45 rpm. The platter has an angled edge on which the strobe markings are located—the illumination provided by a neon lamp mounted below a prism. Each speed has variable adjustment and the two controls are located on the left, at the front with a rotary speed change switch.

On the right hand side are three controls—the front one with the lever is the *On/Off* switch, and behind it is a three-position record size selector. The third switch is marked "Memo-Gram" with positions from 0 to 6 to select the number of records to be played in the automatic mode, or the number of times a single record is to be played. The turntable includes two center spindles, one for manual play and the longer one for automatic. The multi-play spindle is the umbrella type, with a larger "umbrella" for 45 discs. Behind the "Memo-Gram" control is the cue-lift lever and a small knob to adjust the anti-skating force. The tonearm balance

is controlled by a calibrated weight at the rear of the S-shaped arm measuring just over nine inches.

The turntable is finished in black and dark gray, and is mounted on four large resilient feet. The unit comes with a detachable, hinged dustcover. The various accessories are packed away in a neat container. Styling is clean and functional with the angled platter edge giving it a streamlined effect, and making a pleasing contrast with the base which, incidentally, is made of cast aluminum.

**Measurements**

A very accurate cartridge mounting template is supplied, and a Shure M24H CD-4 cartridge was used for most of the tests, as the capacity of the connecting cable was below 80 pF. Wow and flutter was a low 0.04 per cent (DIN 45-507), and rumble measured -62 dB using the ARRL (formerly RRL) weighting. A DIN B figure of -70 dB is quoted, but that particular weighting curve rolls off at 12 dB per octave below 315 Hz compared with the ARRL's 6 dB per octave attenuation from 500 Hz. So if the rumble is concentrated in the lower frequencies there could be more than a 10 dB difference between the two measurements. It must be noted that the ARRL figures are taken at a 3.54 cm/sec reference

# The new Bose 901 Series III. Life-like, spacious sound unmatched by any other speaker.

The original Direct/Reflecting® Bose 901® has been described by music critics as "the only speaker to pour forth in true concert hall fashion" and "the speaker system to own, regardless of price, if one wants the ultimate in listening pleasure."\*

Now, in the new 901 Series III, Bose has introduced a speaker that clearly surpasses, in all important performance characteristics, the high standards set by its legendary predecessor.

## Spaciousness and Realism

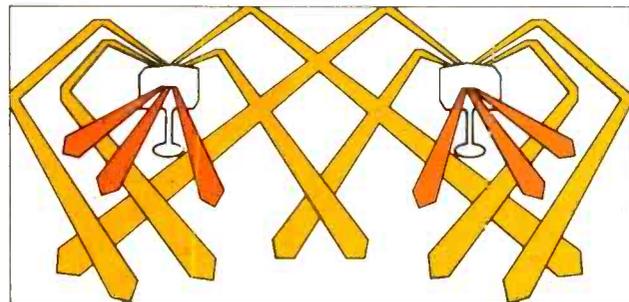
The spaciousness and presence so characteristic of the original 901 are even more extraordinary in the 901 III: sound seems to come, not from the speakers, but from a space in

## Efficiency and Power

At the same time, the 901 Series III is so efficient it requires less than 1/3 as much power as the original 901. It approaches the impact of the live performance with an amplifier with as little as 15 watts of power per channel. In fact, we suggest that anything over 70 watts per channel is simply unnecessary.

## Concepts and Technology

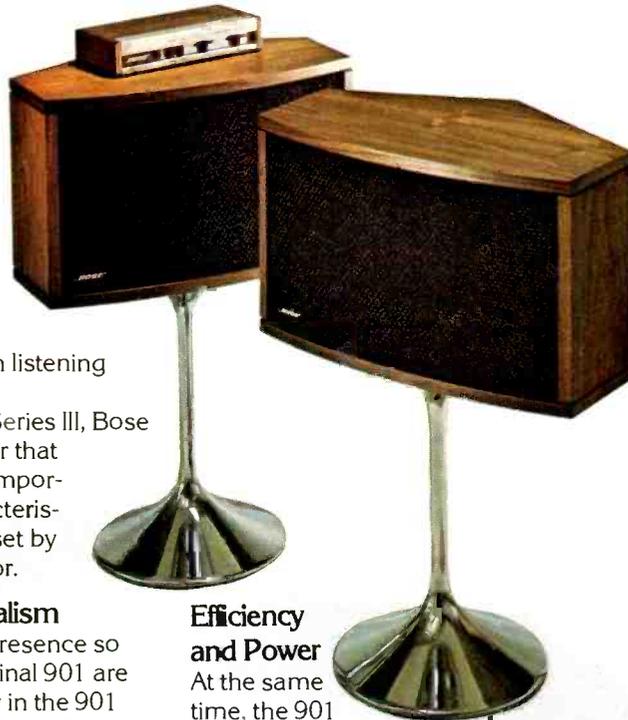
The spectacular performance of the 901 Series III results from combining proven concepts with new technology.



To achieve its extraordinary spatial properties, the Direct/Reflecting 901 Series III reflects most sound off back and side walls of the listening room, re-creating the balance of reflected and direct sound heard at a live performance.

front of you that actually seems deeper and wider than the room. Each instrument is easily localized, and the stereo effect is dramatically life-like almost anywhere in the room. Equally startling are the realism and accuracy with which the 901 III reproduces the unique details, textures, and sonic impact of each instrument.

The unique injection-molded Acoustic Matrix™ enclosure forms a semi-isolated air cell behind each driver, along with three reactive air columns. The result is dramatically reduced cone motion at low frequencies, yielding clean, undistorted deep bass, even at very high volume.



Like the original 901, it utilizes a balance of reflected and direct sound, active equalization, and nine matched, full-range drivers. Beyond this, it incorporates major technological innovations, including the unique Acoustic Matrix™ enclosure and a new ultra-high-efficiency driver.



A new high-performance driver with injection-molded frame and all-aluminum, helically wound voice coil is the key to the efficiency of the 901 Series III.

No advertisement can describe fully 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,"



The electronic active equalizer assures more accurate frequency balance and wider range than are possible with conventional speakers.

reprinted from *Technology Review*. To receive this literature, send \$1.00 to Bose, Dept. AU6, The Mountain, Framingham, Mass. 01701.

Even better, visit a Bose dealer and ask him to play the 901 Series III in comparison to any other speaker—regardless of size or price. That should tell you everything you need to know.



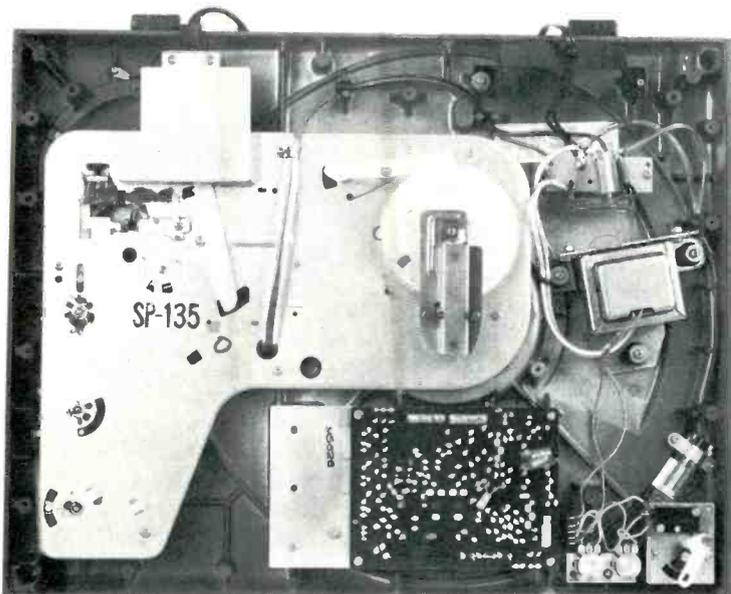
**BOSE**®  
Better sound through research

\*Copies available on request. Patents issued and pending. Cabinets are walnut veneer. Pedestals are optional at extra cost.



level, while the DIN B (and the DIN A for that matter) use a 10 cm/sec level so these figures will come out some 9 dB higher at the outset. As the rumble components are mostly in the 25 to 40 Hz band, the DIN B figure would be around 75 dB—in other words 5 dB better than the specifications. (If you think this sounds like a plea for standardization, you would be right!)

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The arm resonance with the Shure cartridge was between 7 and 8 Hz, showing a rise of about 3 dB. Arm friction was less than 20 mg in both the lateral and vertical modes, and the tracking error was slightly lower than average at less than 0.4 degrees per inch. The calibration of the tracking force scale was found to be extremely accurate—well within 5 per cent over the range from one gram to 3.5 grams. The speed control range was somewhat greater than usual, with

a variation of +8 to -5 per cent for 33 1/3, and +6 to -5 per cent for 45 rpm. Speed was not affected by variations in the line voltage as the d.c. motor is servo-controlled. However, fluctuations in frequency could affect the neon strobe, although this is not likely.

In the automatic mode, the change cycle took about 10 seconds and the motor reached its correct speed three seconds after being switched on. The optimum tracking angle is obtained when three records are on the turntable, but the maximum error either way was judged to be insignificant—certainly less than that between the cartridges and the record cutting heads.

### Listening Tests

For manual operation, it is only necessary to lift the arm off the rest and the motor starts—the arm can then be gently lowered onto the record by the cueing lever. Optimum tracking for the Shure M24H was found to be 1-1/4 grams, with the anti-skating dial set at just over 1-1/2 grams for best results.

The instruction manual recommends that the dustcover be lifted off if acoustic feedback occurs, but I didn't find that necessary. I did have to stand the turntable on a rubber mat since the mounting feet did not give sufficient isolation. However, it must be noted that my loudspeakers are quite close, so in most cases this precaution would be unnecessary. (*Editor's Note:* Quite another installation, one with loudspeakers a minimum of five feet away and with rather trampoline-like floors, gave radically different results. There was no difficulty with feedback, and the SL-1350 was, in fact, the only turntable tried to that point which sufficiently damped normal footfalls so that the stylus was kept in the groove. No, I'm not that fat!—E.P.)

Summing it all up, the Technics SL-1350 has all the basic performance and top quality of a direct drive, single play turntables, but it is worth considering if you, or a member changer. It costs about \$150.00 more than most automatic turntables, but it is worth it considering if you, or a member of your family, occasionally wants to play several records at one time.

George W. Tillett

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# LOUD. SPEAKER.

The Cerwin-Vega S1 is the most elegant and exotic shelf speaker currently available. The rare Yucatan rosewood<sup>1</sup> facade only hints at the marvels inside. A sophisticated sixth order Butterworth vent tuning, integrated with an active equalizer filter, increases the effective bass performance to surpass much larger enclosures. The wave of the future in quality shelf speakers surely will be such a system.

Even this is not good enough for the S1.

We have developed an elegantly simple improvement in bass enclosure technology; we call it Thermo-Vapor Suspension.<sup>2</sup> By filling the S1 cabinet with a soft, inert gas which is more

compressible than air, a lower system response and more controlled damping is achieved.

The drivers are precision aligned die-cast units having the highest magnetic motor drive efficiencies in the industry. The low crossover of 300 Hz to a 6" midrange driver assures low intermodulation at loud levels. A damped dhorm, high frequency unit (moving mass, .1 gram), operates at a low pressure density extending response to 20 kHz with vanishing coloration.

The S1 has impeccable technical credentials too numerous to detail here so write Cerwin-Vega for full performance specifications or see it, hear it, Feel it, at a selected dealer.



**Cerwin-Vega!**

Cerwin-Vega! 12250 Montague Street, Arleta, California 91331, 213/896-0777  
In Canada: Cerwin-Vega Canada Ltd., 19 Malley Road, Scarborough, Ontario, 416/752-7530

<sup>1</sup>Walnut is standard

<sup>2</sup>Patent Pending

Enter No. 9 on Reader Service Card

## SAE Model 5000 Impulse Noise Reduction System



### MANUFACTURER'S SPECIFICATIONS

**Rated Output:** 2.5 volts rms.

**Frequency Response:** 20 Hz to 20 kHz  
±1 dB.

**Output at Clipping:** Greater than 9.0  
volts into 10 kilohms.

**Input Impedance:** 75 kilohms.

**Output Impedance:** 600 ohms.

**Insertion Loss:** Less than 1.0 dB.

**S/N:** Greater than 90 dB below rated  
output.

**THD (at any level up to rated output):**  
Less than 0.1 per cent.

**IM Distortion:** Less than 0.1 per cent.

**Power Requirements:** 120 V a.c., 50/60  
Hz, 7 watts.

**Dimensions:** 10 3/4 in. (26.7 cm) W x 3  
in. (7.62 cm) H x 9 1/4 in. (23.5 cm) D.

**Weight:** 8 lbs (3.6 kg).

**Price:** \$200.00.

Don't throw away those scratched records, dear readers, at least not before you read about an incredible new "black box" developed by Scientific Audio Electronics, Inc. of California. As the descriptive name of the Model 5000 suggests, it is a device designed to eliminate impulse noise (or to reduce it significantly). Impulse noise should *not* be confused with random hiss, surface noise of a wideband nature, hum, or other disturbances that plague our audio systems and interfere with our listening pleasure. Impulse noise, in reference to phonograph discs, means those clicks and pops which arise through the mishandling of discs, inadvertently allowing the stylus to scrape across a disc after you drop the tone arm, etc.

The SAE Model 5000, then, was designed (invented, would really be a more apt term) to reduce the audible effect of those infamous pops and clicks. It not only works, but works so amazingly well that we find ourselves still sort of shaking our head in disbelief. More about why and how it works in a moment. First, let's examine this newest "add-on" box which, as you might have guessed, can be easily plugged into any hi-fi component system via those ever-handy tape monitor out and in jacks, or between your preamp and power amp, if you happen to own such separate components.

The front panel of the 5000 is, appropriately enough, finished in black, with white lettered control designations. The three pushbuttons at top center are labeled *Tape Monitor* (for duplicating that function which may have been used up on your present equipment when you connected the device itself), *Defeat* (which allows for easy comparison between pop-laden and pop-free reproduction results), and *Invert*, a button whose function will be described shortly. A slider control, calibrated from 0 (the "off" position) to 10, is identified as a sensitivity control and its setting is adjusted under actual listening conditions for the most effective impulse noise reduction.

The rear panel is fitted with pairs of input and output jacks plus the tape-out and tape-in jacks mentioned earlier. A fuseholder is also mounted on the rear panel.

### Design Approach and How It Works

According to the SAE 5000 inventor, Jack Sacks, several properties of impulse noise were first investigated and those unique to impulse noise were isolated. Impulse noise was found to have an extremely fast attack and decay time. While some music also contains fast attack times, decay is usually slower. Impulse noise was also found to contain essentially out-of-phase information. A logic circuit was developed, based upon this research, which can detect the presence of impulse noise even under the most demanding musical conditions that will minimize false "triggering" of the noise elimination circuits.

Since the noise pulse occurs during such a short time, the noise removal circuit of the 5000 actually shuts down the music during its occurrence. But, to ensure program continuity (the human ear would readily detect even such short absences of sound), a "reconstruction" circuit is also activated. Program material prior to and after the impulse noise is evaluated, and extrapolated prior-impulse program material replaces the impulse noise that was removed. Through this approach, musical continuity is maintained and impulse noise is removed without dynamic enhancement or bandwidth modification techniques. The entire process described takes less than one-thousandth of a second from deterioration to complete removal.

### Use of The Sensitivity and Invert Controls

In actual use with a phonograph record that has impulse noises in its grooves, one pushes the *Invert* button on the front panel. One then hears not the music, but the pops and clicks that the unit is "removing". The sensitivity control is then moved towards the right until some of the peaks of the music begin to be heard (as a sort of rasping, break-through kind of sound). The sensitivity control is then backed off slightly, the *Invert* button is released and presto! The music comes through and the pops and clicks don't. The operation is truly uncanny! In our tests, we took a pocket knife and deliberately "laid down" a gouge across the entire radius of a

**No components have ever been so  
extravagantly engineered.**

**And so extravagantly praised.**

**What they said.**

*Stereo Review:*

"These components show no sign of the cost-cutting techniques that are routine even in the best mass-produced audio equipment . . .

"We see the Accuphase line as occupying a place in audio analogous to that of the Rolls Royce among automobiles."

*Hi Fi Stereo Buyer's Guide:*

"One new item in the hi fi marketplace we feel certain will join the list of legendary greats is the Accuphase P-300 Power Amplifier."

"Firstly, there's the P-300s sound quality, so good it left our listening panel arguing over who would borrow it from the test lab."

*Popular Electronics:*

"This preamplifier has the widest dynamic range of phono of any preamp we've ever measured.

"In its ruggedness and mechanical construction, the preamp resembles a laboratory instrument rather than a hi-fi product . . .

"With tone controls and filter bypassed, this preamp comes as close to the proverbial 'straight wire with gain' as anything known to us."

**Why they said it.**

Accuphase components have been literally handcrafted with a devotion to excellence that borders on the fanatic.

Only aerospace quality component parts are used, with

each part hand-selected and tested for performance.

The P-300 amplifier has a heavy-duty stable power supply—regulated: 200 watts per channel RMS (both channels driven) from 20 Hz to 20,000 Hz  $\pm 0.2$  db into 4 ohms, with no more than 0.1% total harmonic distortion.

It has modular construction for simple access; complimentary push-pull symmetry in all input and output circuits; 3 meter ranges and power-limiting switches to protect your speakers. And more.

With its design overkill, the Accuphase amp can loaf through the most demanding and complex musical passages, maintaining exquisite precision, delicacy and warmth without sacrificing strength or power.

The Accuphase C-200 Control Preamplifier has versatility beyond belief: 10 back and front inputs, 7 outputs, 28 controls; yet it is simple in operation and appearance. (A small sample of its versatility: you can use 4 tape decks in combinations of simultaneous and independent recording, dubbing and listening.)

The motivation for all the extraordinary care and craftsmanship that produces each Accuphase amplifier, preamp and tuner is really very simple. A loving devotion to music.

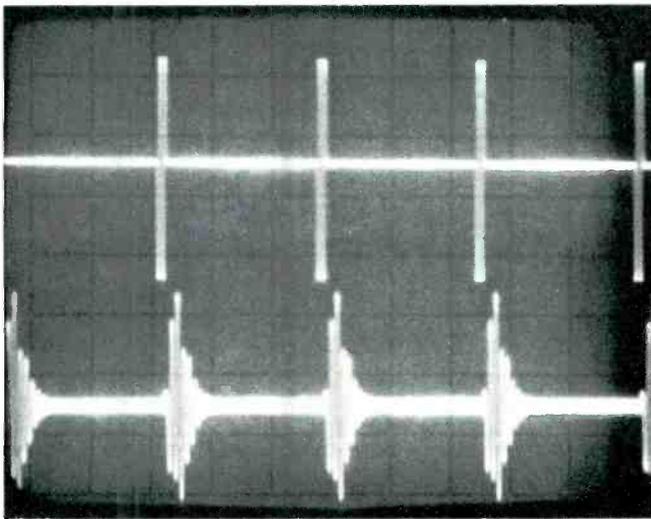
If you share that devotion, please see an Accuphase Showcase dealer.

You'll enrich your life.

# Accuphase

When you're really serious about your music.

**Fig. 1—**With the sensitivity control in the *Off* position and pseudo-impulse noise fed to the input, the Model 5000 produces signals shown in the lower trace at the outputs.



record (one which we were ready to discard because of its musical content anyway). All we can report is that after playing this disc through the SAE 5000 we have had second thoughts about relegating it to the trash can, and the disc remains part of our record library!

88

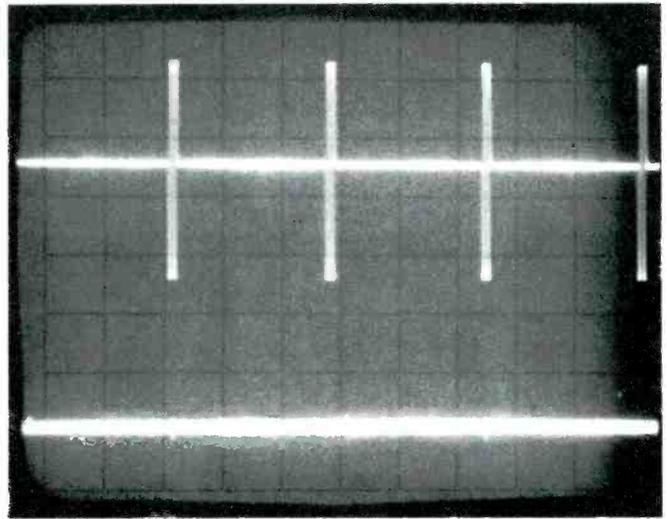
In reporting about this unit, we thought it would be nice if we could demonstrate graphically (rather than by our verbal description) how effectively it does the job for which it was designed. After some experimenting, we developed a repetitive signal which came close to that of impulse noise and which the unit would recognize and process as such. The signal consisted of two cycles worth of 25 kHz bursts, repeated several times per second, as illustrated in the top trace of the 'scope photo of Fig. 1. Interestingly, trying to use lower frequencies than 25 kHz to represent impulse noise failed, suggesting that the 5000 cannot be easily fooled when presented with high frequency musical content within the audio range.

In any event, with the sensitivity control set to its "zero" position (noise impulse reducing circuit not operating), the output waveform from the unit looked as shown in the lower trace of Fig. 1. However, when the sensitivity control was advanced beyond the "3" setting, suddenly the output all but disappeared, as shown in the lower trace of Fig. 2 (the upper trace still represents our artificially created "impulse" signal). If you examine the lower trace very carefully, you will see very tiny "glitches" where the pulses would have come through to the output. With the very same setting of the sensitivity control, feeding in even 20 kHz of continuous sine wave signals resulted in an output that was identical to the input.

### Basic Measurements

All the advantages of a unit like the SAE Model 5000 would be of little use if the unit itself introduced high levels of distortion, altered frequency response of the total system with which it is used, or degraded system signal-to-noise ratio. Our remaining test measurements were therefore concerned with some of the more basic performance parameters of the unit. Since rated output for the unit is listed as 2.5 volts rms, our THD and noise measurements were made

**Fig. 2—**After proper adjustment of the sensitivity control, noise signals are effectively eliminated at the output.



with respect to that output level.

Total harmonic distortion with an input signal of 1 kHz measured a very low 0.005 per cent. At the frequency extremes of 20 Hz and 20 kHz, THD was 0.01 and 0.05—all considerably lower than the 0.1 per cent claimed by the manufacturer. IM distortion for the same equivalent output level measured 0.019 per cent. Frequency response was flat within 1 dB from 18 Hz to 21.1 kHz. There is a sharp drop-off beyond that high frequency extreme, however, no doubt a requirement of this device which must not "mistake" music for impulse noise. Insertion loss on our sample measured 0.5 dB, while signal-to-noise ratio, referred to 2.5 volts output, measured 96 dB.

It should be noted that a relatively high input level is required if such high S/N ratios are to be maintained, and it seemed to us that a user would be better advised to insert the unit between a preamp and an amp (or, if one's receiver is equipped with preamp-out/main amp in terminals, at that point) rather than at the usual tape-out/monitor in jacks. Levels at most tape out jacks are of the order of 100 to 150 mV, and while the unit would operate perfectly well at these lower input levels, S/N ratio capability would be degraded from its high reading of 96 dB to around 71 dB or so and might, in some systems, become a "limiting factor." (Editor's Note: SAE comments that when the unit is placed between preamp and amp, adjustment of the preamp's volume control makes necessary further adjustment of the 5000's sensitivity control. Their data shows that typical rms levels for tape outputs are between 0.5 and 1.0 V, so that S/N would not be so seriously degraded. They therefore recommend the unit be placed in the tape loop.)

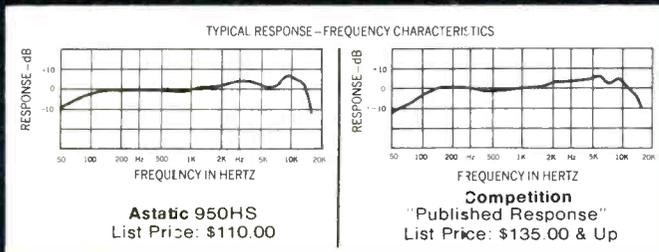
Whether or not a serious audiophile is prepared to spend an extra \$200 to restore "pop and click" laden records to usability will, of course, depend upon how many such records are owned and how important they are in a record collection. We, however, having heard the SAE 5000 in action, can only compliment its designer and the company that manufactures the device for having come up with a truly innovative and effective solution to an age-old problem that besets all disc collectors.

Leonard Feldman

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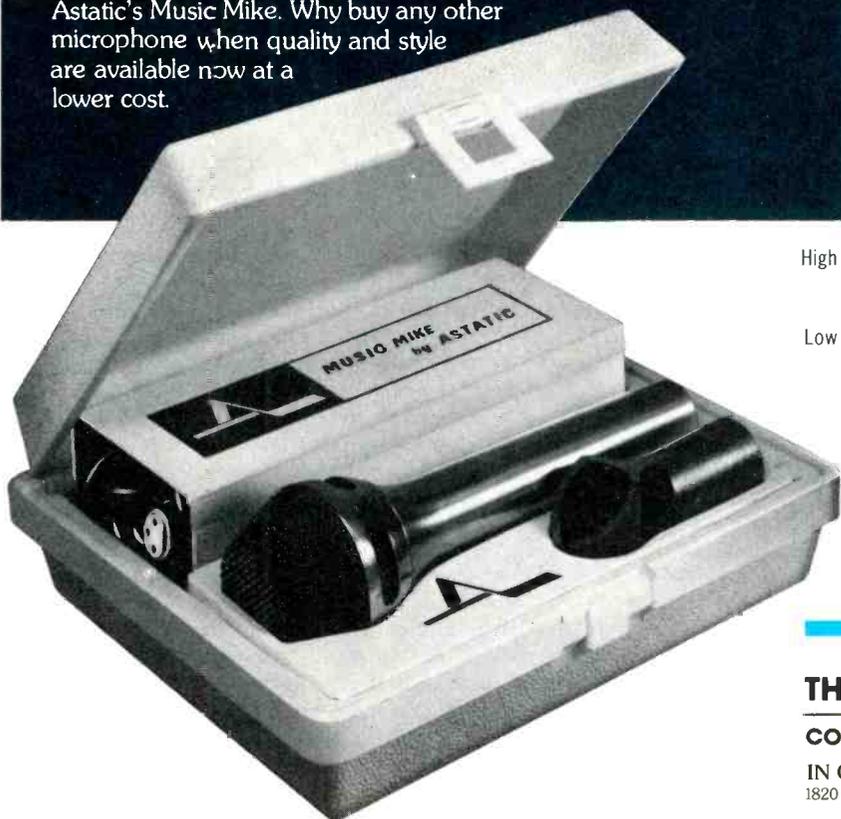
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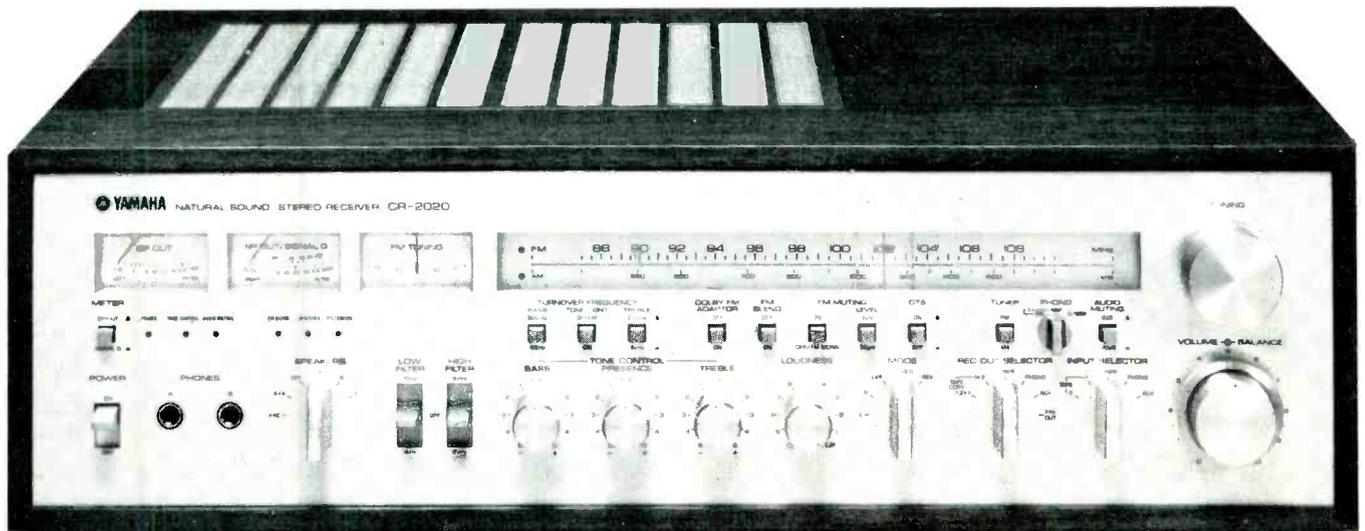
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## Yamaha Model CR-2020 Stereo Receiver



### MANUFACTURER'S SPECIFICATIONS

#### FM Tuner Section

**Usable Sensitivity:** 1.8  $\mu\text{V}$  (10.3 dBf).  
**50-dB Quieting Sensitivity:** Mono, 3.2  $\mu\text{V}$  (15.3 dBf); Stereo, 40  $\mu\text{V}$  (37.2 dBf).  
**Image Rejection:** 85 dB.  
**I.F. Rejection:** 90 dB.  
**Spurious Response Rejection:** 100 dB.  
**AM Suppression:** 65 dB.  
**Capture Ratio:** 1.0 dB.  
**Selectivity:** 80 dB.  
**S/N:** Mono, 77 dB; Stereo, 73 dB.  
**THD:** Mono, 0.08 percent @ 1 kHz; 0.08 percent @ 100 Hz; 0.15 per cent @ 6 kHz; Stereo, 0.1 per cent @ 1 kHz; 0.15 per cent @ 100 Hz; 0.2 per cent @ 6 kHz.  
**Stereo FM Separation:** 50 dB @ 1 kHz, 35 dB @ 50 Hz, 45 dB @ 10 kHz.  
**Sub-Carrier Suppression:** 60 dB.  
**Frequency Response:** 30 Hz to 15 kHz,  $\pm 0.5$  dB.  
**Muting Levels** 30  $\mu\text{V}$  (34.8 dBf) and 3.0  $\mu\text{V}$  (14.8 dBf).

#### AM Tuner Section

**Sensitivity:** (Internal antenna), 300  $\mu\text{V}/\text{m}$ .  
**Selectivity:** 30 dB.  
**S/N:** 50 dB.  
**Image Rejection:** 40 dB.  
**THD:** 0.4 per cent.

#### Amplifier & Preamp Section

**Power Output:** 100 watts min. continuous per channel, 8 ohm loads, 20 Hz to 20 kHz; 120 watts into 4 ohms.  
**THD:** 0.05 per cent.  
**Damping Factor:** 40 @ 8 ohms.  
**Input Sensitivities:** Phono 1&2, moving magnet, 2.0 mV; moving coil, phono 1, 50  $\mu\text{V}$ ; AUX & tape 1 & 2, 120 mV.  
**Phono Overload:** MM, 230 mV; MC, 5 mV.  
**Frequency Response:** Phono RIAA  $\pm 0.2$  dB; high level inputs, 10 Hz to 100 kHz,  $\pm 2.5$  dB.  
**S/N Ratios:** IHF "A" weighting, MM phonos, 95 dB; MC phono, 85 dB;

high level inputs, 100 dB. **Residual Noise:** Min. vol., 0.045 mV.

**NDCR for 0.1 per cent THD, 8 ohm @ 1 kHz** (See text for explanation): 100 mW to 100 W.

**Bass Control Range:**  $\pm 15$  dB @ 20 Hz.  
**Treble Control Range:**  $\pm 12$  dB @ 20 kHz.

**Presence Control Range:**  $\pm 6$  dB @ 3 kHz.

**Low Filter Cutoff:** 15 Hz & 70 Hz (12 dB/octave).

**High Filter Cutoff:** 8 kHz & 12 kHz (12 dB/octave).

**Tone Control Turnover Frequencies:** Bass, 125 & 500 Hz; treble, 2.5 & 8 kHz.

#### General Specifications

**Power Requirements:** 120 V, 60 Hz, 480 watts.

**Dimensions:** 21  $\frac{1}{4}$  in. (54 cm) W x 6  $\frac{9}{16}$  in. (16.67 cm) H x 16  $\frac{15}{16}$  in. (43 cm) D.

**Weight:** 42 lb. 7 oz. (19.25 kg).

**Price:** \$700.00

90

If you scanned Yamaha's published specifications for their newest top-of-the-line receiver, Model CR-2020, too quickly, you may have missed a new term which they have decided to use for all their new receiver products. It is called NDCR (which stands for "Noise-Distortion Clearance Range"—and it tells us much about the design philosophy of this magnificent receiver and about Yamaha's avowed approach to audio product design. The NDCR spec is intended to convey the maximum and minimum powers (and therefore, the useful dynamic range) of the product for a quoted percentage of noise and distortion. Thus, in addition to quoting the power and distortion at maximum output (and, usually, with the volume control turned all the way up, a condition seldom used in practice), the NDCR number tells you the power range (usually for a more typical volume control setting) that you can achieve for a given figure of noise plus distortion. Furthermore, the value is quoted as measured from the phono input and right on out to the speaker terminals (instead of for the main amp section only, or

from preamp to record out, as is often the case with many "spec sheets"). A highly meaningful spec, we think, and one that other manufacturers would do well to emulate.

Examining the front panel of the new CR-2020, one cannot help but wonder how Yamaha's engineers were able to cram so many features and controls onto a single component. At the upper left are three meters, set behind uniform cutouts in the panel. The central meter of this trio serves a dual purpose, either combining with its left companion to display power output levels (from around 0.05 watt to 200 watts) or serving as a signal strength and "quality" indicator. When used in the latter mode, the meter needle will fluctuate as well as indicate signal strength when there is multipath interference. The third meter is the usual center-of-channel indicator for FM tuning.

A smoothly gliding "slide-rule" type pointer moves along the well-calibrated linear FM and conventional AM frequency scales, with the scale in use denoted by an illuminated LED at the left and a large fly wheel-coupled tuning

# “..a pair of 66’s may sound unspectacular, even disappointing..”

This is not the sort of quote that manufacturers usually select from equipment reviews. However, we did it for one reason: to get your attention. That’s not an easy task, considering the hundreds of other speaker manufacturers clamoring for your ear and your dollar.

The complete excerpt (from *Canadian Stereo Guide*) reads: “To the untrained ear, a pair of 66’s may sound unspectacular, even disappointing. There’s no thump and sizzle which many equate with good frequency response. No spectacular effects, just the neutral sound of musical instruments playing with nothing added by the speakers. Purity of tone and cleanness of reproduction is particularly noticeable.”

The Ditton 66 was in fact developed by Celestion to serve as an authentic monitor speaker, which means

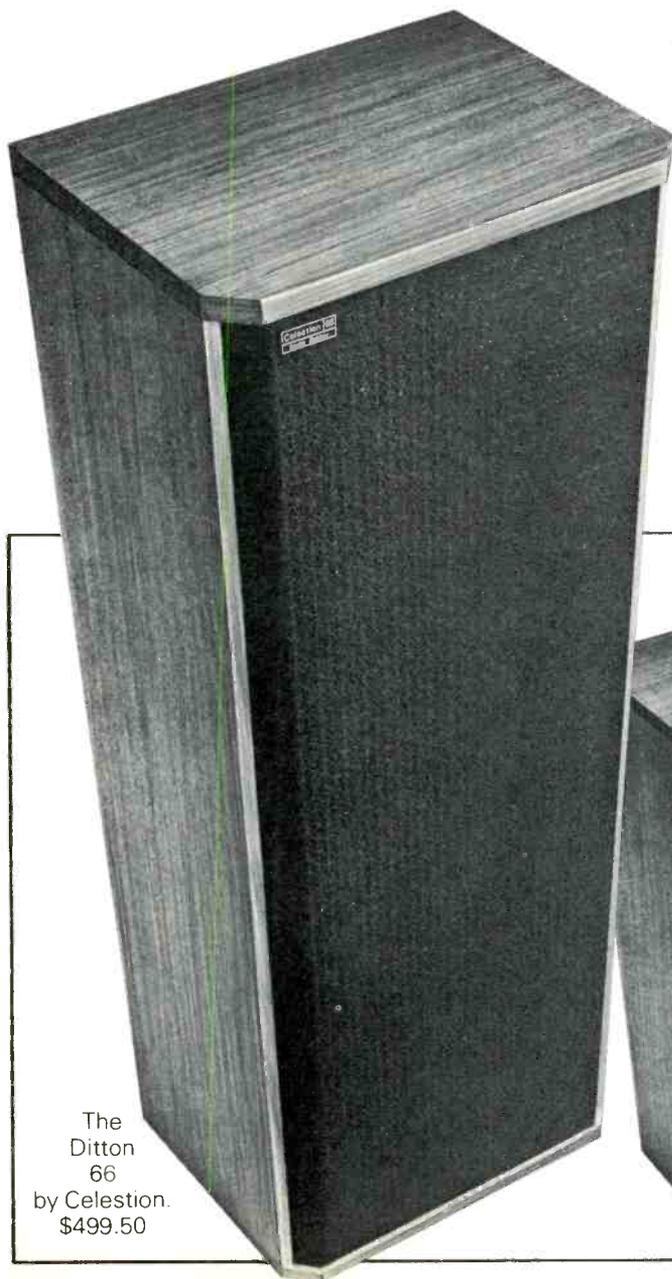
that it was designed to neither add nor subtract anything from the original program material. Recording engineers aren’t interested in “hi-fi effects”—they want to hear exactly what’s on the master disc or tape with minimum sonic contribution by the speaker.

When the British publication, *Hi-Fi Answers* needed a concert monitor they found the Ditton 66’s “... sufficient to cope with the loudest orchestral climaxes available (or even required) ... when we wanted to provide concert levels in a large hall, 110 feet x 55 feet with a 25-foot ceiling. A most impressive performance ...”

Since most listening rooms are somewhat smaller, the shape of the Ditton 66 should be of special interest. Though its internal volume is three cubic feet, it needs only 1.2 square feet of floor space. It is 15” wide, 11” deep and 39½” high.

Another thoughtful aspect of the enclosure: the drivers are mounted on a finished baffle board. So those who like to operate their speakers with the grille off, for whatever reason, can do so happily.

Now, if you’ll drop us a card, we’ll send you a list of our carefully selected dealers by return mail. We believe you’ll be impressed by the exceptionally “unspectacular” sound of the Ditton Monitor 66.



The  
Ditton  
66  
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The HF-2000 soft-dome tweeter operates from 5,000 to 20,000 Hz. Its exceptionally smooth extended response and wide dispersion achieve an open, airy quality and accurate stereo imaging.

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The FC-12 woofer has a heavy plasticized diaphragm that effectively suppresses resonances. The neoprene roll suspension permits considerable cone excursions without non-linear effects. A massive Feroba II magnet provides critical damping.

The Auxiliary Bass Radiator (ABR) is a highly effective proprietary Celestion device that operates in conjunction with the woofer/enclosure acoustic circuitry. The critically-damped moving system of the ABR has a carefully chosen mass and compliance, acoustically coupled to the woofer and enclosure to control the lower range of the woofer excursion. It takes over completely at the very lowest frequencies. Result: exceptionally smooth reproduction to well under 40 Hz.

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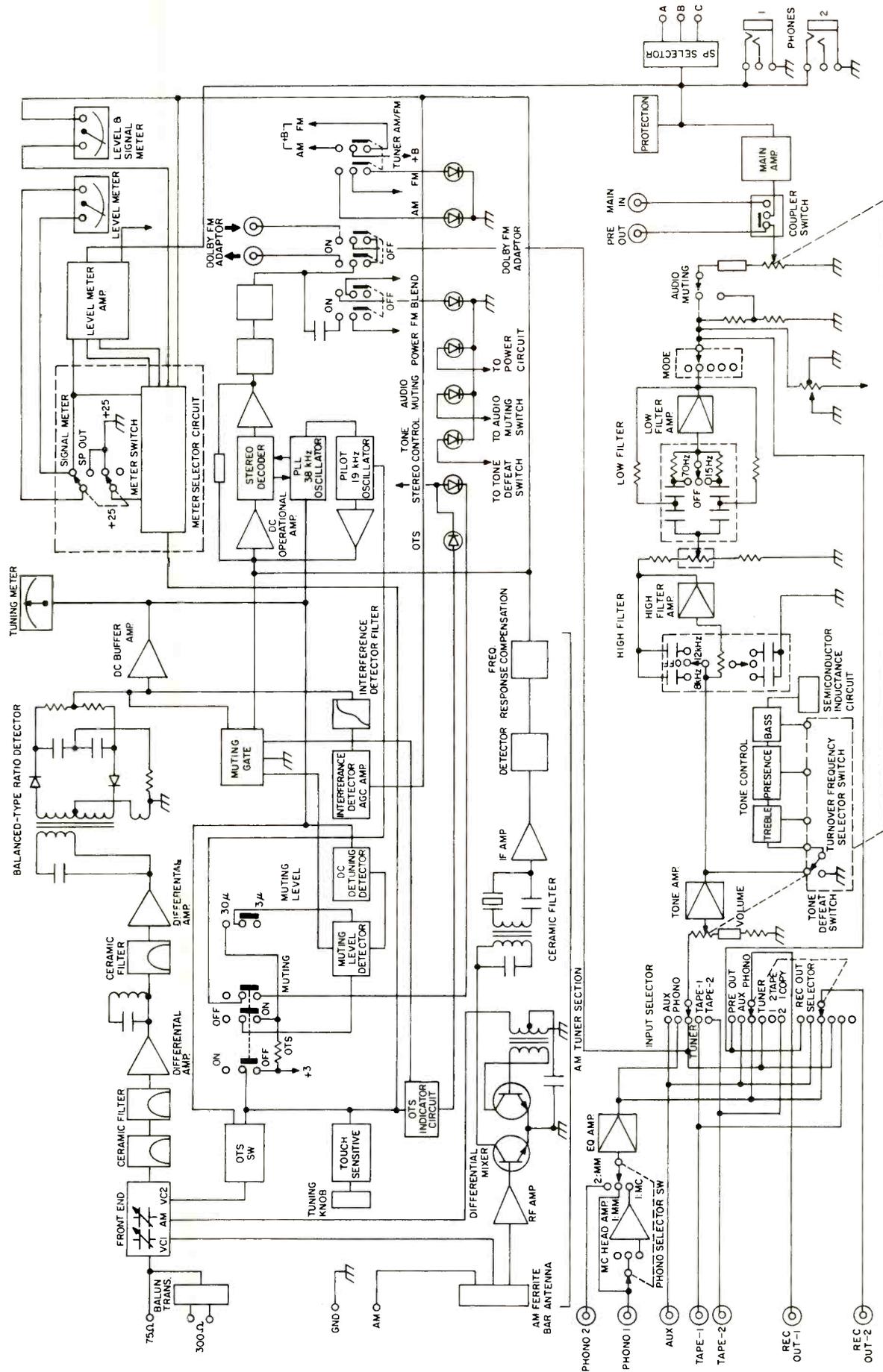
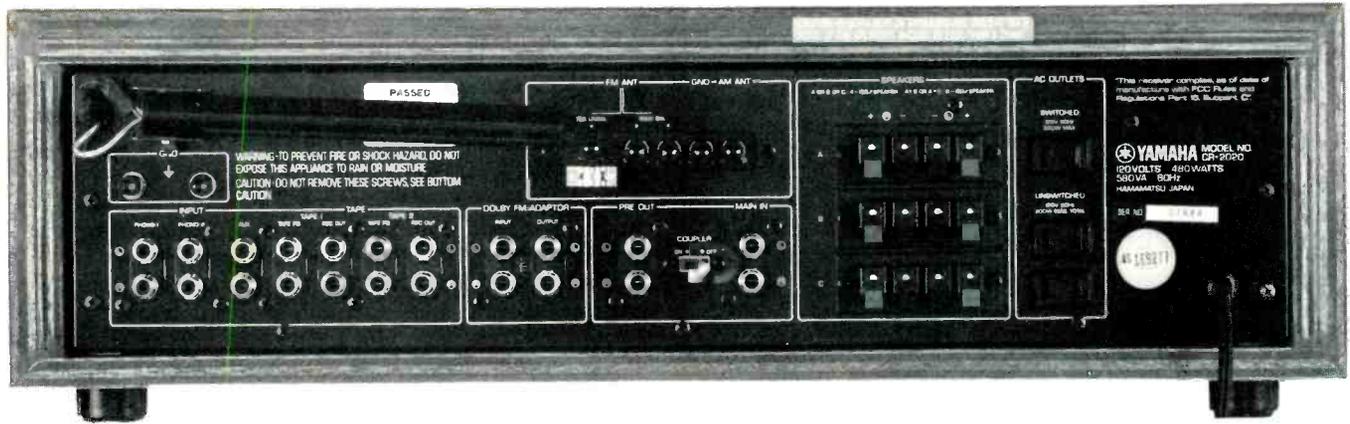


Fig. 1—Block diagram of the Yamaha CR-2020 Receiver.



knob is located at the upper right of the panel. Below the meters are a selector switch which chooses the function of that central meter and six LEDs which give visible indication of power-on, tone control activation, audio muting, FM blend, FM stereo reception, and whether Yamaha's special AFC circuit (which they call OTS, for Optimum Tuning System) is activated. This mild AFC circuit, incidentally, is automatically disabled the moment your fingers touch the tuning knob. Tiny square pushbuttons just below the dial cut-out select bass and treble turnover frequencies, defeat the tone circuits altogether, introduce a Dolby adaptor connection circuit (a separate adaptor must be connected at the rear panel for reception of Dolby FM programs), FM blend, FM muting, selection of muting threshold levels (3 or 30  $\mu$ V), the aforementioned OTS (or AFC) feature, AM/FM selection, and fixed audio muting of 20 dB. A three-position rotary switch located between the last buttons named selects either of the two pairs of phono inputs and determines whether moving magnet or moving coil circuitry will be employed in the *Phono 1* circuitry.

The lower bank of controls and features along the panel include a toggle *On/Off* power switch, two pairs of stereo phone jacks, a speaker selector switch (up to three pairs of speakers can be connected to the CR-2020, but simultaneous listening is restricted to any two pairs), three position low- and high-cut filter switches, bass, presence (mid-range) and treble tone controls, rotary loudness control (about which more in a moment), mode switch (with settings for stereo, reverse, L, R, and L+R), a novel six-position

"record out" selector (which works completely independently of the program selector and permits tape dubbing as well as recording of all other program sources, regardless of what program source you happen to choose using the adjacent input selector switch), and a dual-concentric volume & balance rotary control pair.

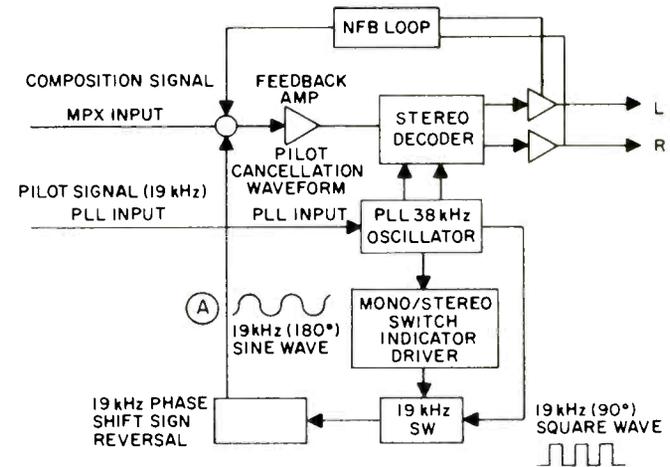
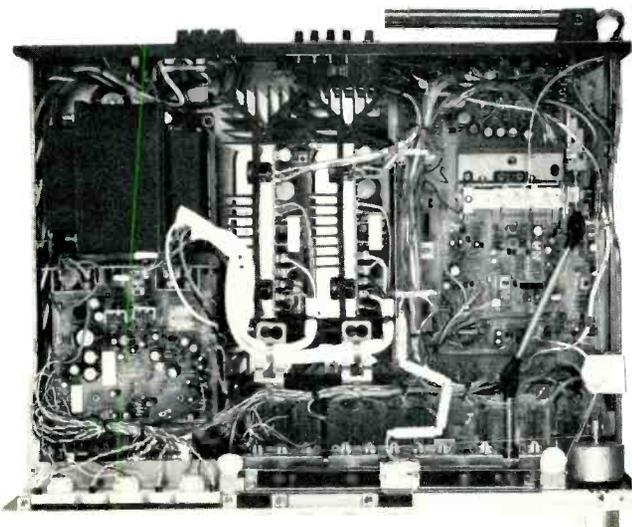


Fig. 1a—Block diagram of the multiplex decoder section.

The usual pivotable AM ferrite bar antenna on the rear panel is positioned above a pair of chassis ground terminals and the phono, AUX, tape in, tape out, and Dolby adaptor jacks. Centered on the rear panel are 75-ohm, 300-ohm, AM, and ground terminals for antenna connections, just below which are preamp-out and main-amp-in jacks which are internally switched together or apart by means of a "coupler" switch which comes retained in the "coupled" position to prevent accidental separation of the two sections of the receiver and resulting loss of sound. Three quartets of spring-loaded "piano-key" type speaker terminals, flanked by two unswitched and one switched convenience a.c. receptacle, complete the rear panel layout.

A look within the chassis of the Yamaha CR-2020 discloses a layout which is as well thought out as the front and rear panels. A block diagram of the entire receiver circuit is shown in Fig. 1, and examination of the complete schematic of the unit (which is supplied in the owner's manual) discloses so many new circuit innovations that space does not permit discussion of more than a few of the more important ones.

Of particular interest to us was the unusual FM multiplex decoder circuit, a block diagram of which is shown in Fig. 1a. The input enters the 38 kHz sub-carrier generator in the



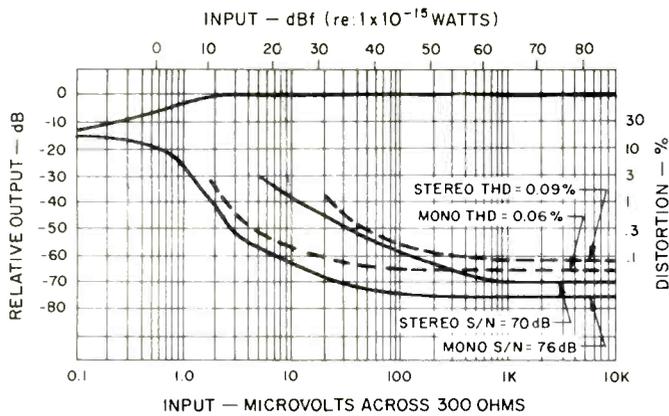


Fig. 2—FM quieting and distortion characteristics.

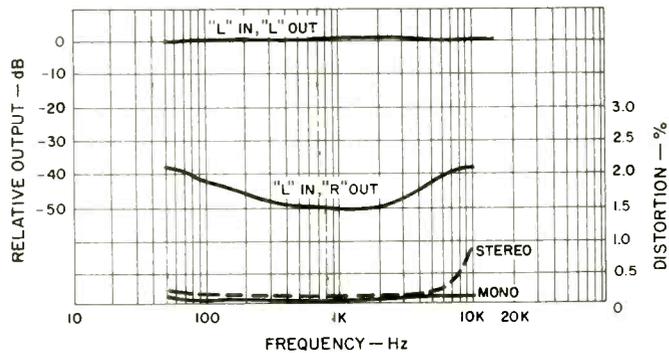


Fig. 3—Separation and distortion vs. frequency.

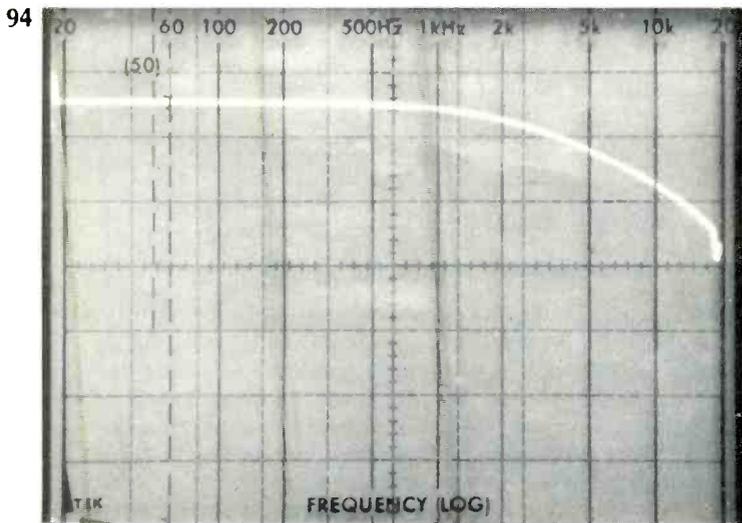


Fig. 4—FM response including the Dolby 75  $\mu$ S de-emphasis.

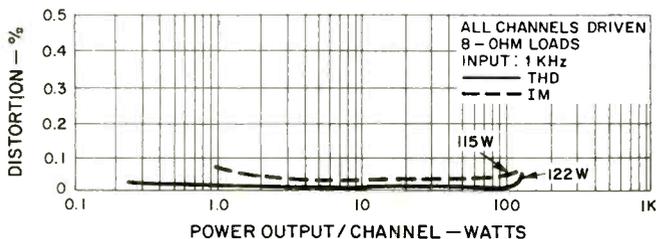


Fig. 5—Harmonic and intermodulation distortion characteristics.

phase-lock-loop IC, passed through the circuit which generates a 10 kHz square wave and then feeds sine-wave cancellation of the 10 kHz pilot signal into a negative feedback amplifier located before the demodulator. This system obviates the need for low-pass filters which restrict FM frequency response in attempting to reduce sub-carrier output. Yamaha claims an FM frequency response which extends to 18 kHz.

Also of interest to us was Yamaha's use of dual volume control sections for each channel, one section inserted before the tone control amplifier, the other following the filter amplifier. This arrangement provides improved signal-to-noise ratios at all volume settings and, when volume control settings are at minimum, noise is effectively reduced to that of the power amplifier section only.

The Yamaha CR-2020 is the first receiver we have tested which is equipped with a "head amp" or pre-amplifier, making it possible to connect moving-coil phono cartridges directly to the unit without requiring step-up transformers or other separate "black box" add-ons. The circuit of the equalizer-amplifier features a PNP input, feeding a constant current load and single-ended, push-pull output. The output circuit operates in class A at all frequencies up to 20 kHz.

A novel aspect of the tone control circuitry (besides the inclusion of a presence control) is the use of a semi-conductor circuit to duplicate the action of inductors in the bass section.

The power amplifier section of the receiver consists of a differential-amplifier first stage with constant-current bias and current mirror circuitry, a constant-current load pre-drive section, and Darlington-connected fully complementary single-ended, push-pull direct-coupled driver/output stages, with power consumption-limiter-type transistor protection circuitry. The limiter protection circuitry detects the resistance at the speaker terminals, and if that drops to an abnormally low value (or, if a short circuit occurs), signals reaching the output transistors are limited.

### FM Tuner Section Measurements

Mono usable sensitivity measured 1.7  $\mu$ V (9.8 dBf) in the tuner section of the CR-2020. The 50-dB quieting point in mono required a signal strength of only 2.6  $\mu$ V (13.5 dBf), while maximum quieting reached a very high 76 dB in the mono mode. Stereo sensitivity was limited by the stereo switching threshold, which was set at 20  $\mu$ V (31.2 dBf), by which time stereo signals were received with more than 43 dB of quieting, reaching the 50 dB quieting point with an input signal strength of exactly 40  $\mu$ V (37.2 dBf), as specified. Distortion as well as quieting characteristics for a 1-kHz test signal in mono and stereo are plotted in Fig. 2. THD in mono and stereo were among the lowest we have recorded for any receiver, let alone higher priced separate tuners. Consistently lower than specified, mono THD measured a mere 0.06 per cent, while in stereo, the figure obtained for a 1 kHz signal was a low 0.09 per cent.

Stereo FM separation measured 50 dB at mid frequencies, and even at 10 kHz the separation was still a very impressive 38 dB, though not equal to the 45 dB claimed. Separation and distortion versus frequency are shown in Fig. 3. Other specifications confirmed in our lab tests included a 1.0 dB capture ratio, selectivity at 83 dB, AM suppression at exactly 65 dB as claimed, image and i.f. rejection at 90 dB, and sub-carrier rejection in excess of the 60 dB claimed. To verify the action of the 19-kHz "feedback" rejection system and the effectiveness of the filter which follows, we applied a sweep-frequency to the external modulation terminals of

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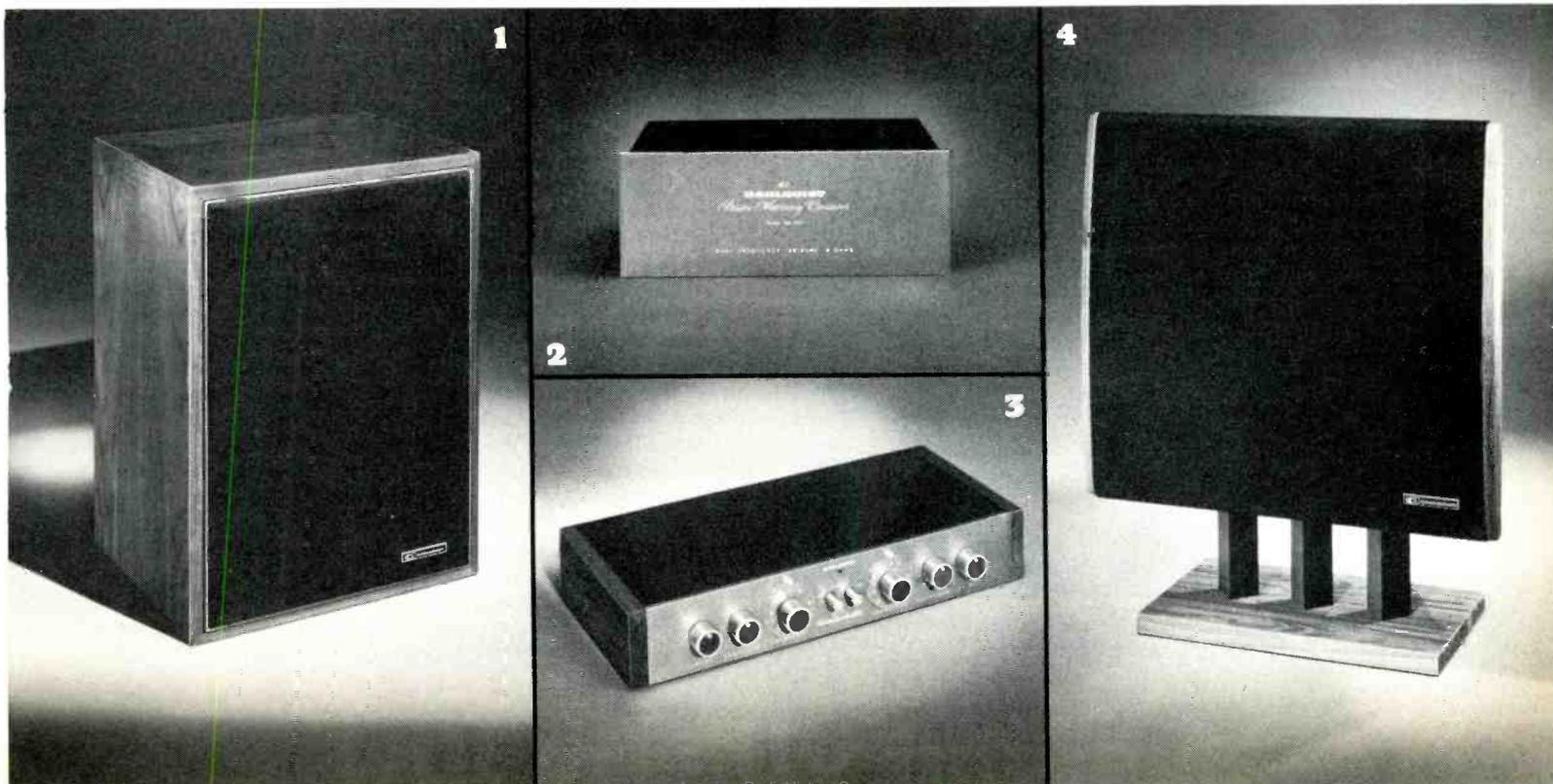
bi-amplified system. Features: continuously variable crossover settings from 40 to 400 Hz, @ 18dB/octave; bass level adjustments with up to 15dB gain; 0 to +5dB equalization at 20 Hz; bypass switches silence subwoofer and restore full-range response to main speakers; separate outputs for stereo and mixed-center-channel subwoofers; A unique combination of active low-pass and passive high-pass sections prevents any degradation of high frequency performance quality.

**4** **ST-10 OPTIONAL STANDS.** For owners of our Dahlquist DQ-10 speakers. Improve radiation characteristics, especially noticeable in the lower-midrange/upper-bass regions. Packed two to a carton. Assembles with six screws.

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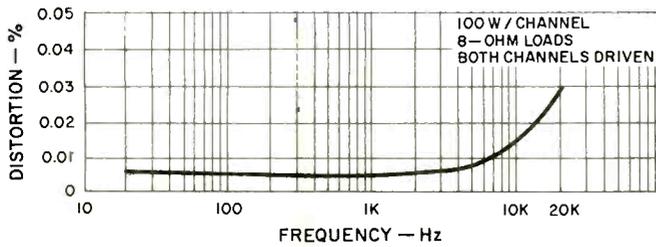


Fig. 6—Distortion vs. frequency (note expanded vertical scale).

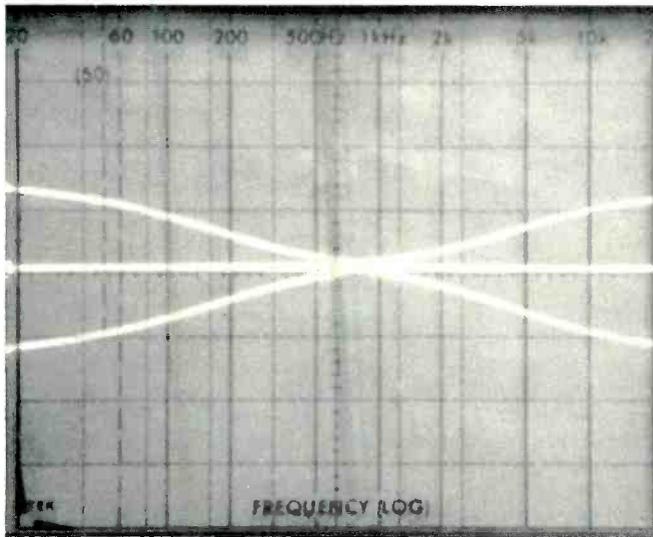


Fig. 7—Bass (500 Hz) and treble (2.5 kHz) turnover range.

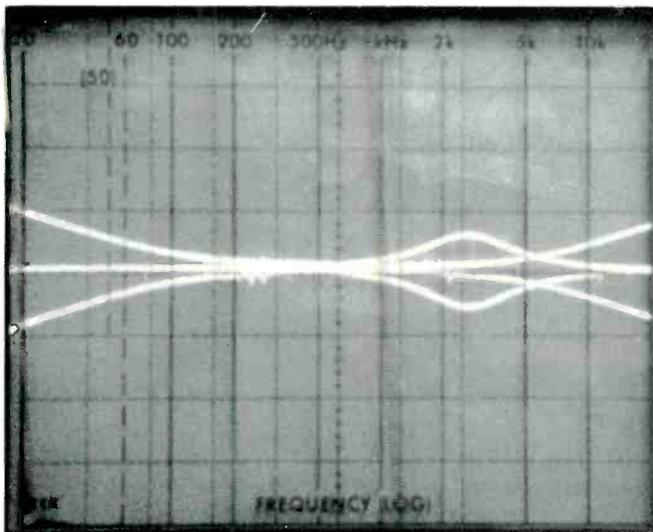


Fig. 8—Bass (125 Hz turnover), treble (8 kHz turnover), and presence control range.

our FM generator and plotted the response by means of a spectrum analyzer from 20 Hz to 20 kHz. A scope photo of the resultant response is shown in Fig. 4, and the smooth, 6 dB/octave de-emphasis characteristic extends way out to 18 kHz (beyond the required 15 kHz limit) before taking its steep dip at the 19 kHz rejection point.

Though employing only a two-section variable capacitor for the AM section, that circuit does include an untuned r.f. stage as well as a differential mixer and a peak detector circuit. Sensitivity (via the external antenna connection) measured 25  $\mu$ V, while selectivity was 32 dB, S/N reached the 50 dB claimed, and THD (for 30 percent modulation) measured a very low 0.38 per cent.

### Power Amplifier Section Measurements

The power amplifier section of the Yamaha CR-2020 delivered 122 watts per channel at mid-frequencies into an 8-ohm load with both channels driven. At 4 ohms, 145 watts per channel was obtained for the rated THD level of 0.05 per cent. At the conservatively rated power output level of 100 watts (8 ohms), THD at mid frequencies measured only 0.005 percent and, even at the frequency extremes of 20 Hz and 20 kHz, THD measured only 0.006 per cent and 0.03 per cent—well below the already extremely low rated THD of 0.05 per cent. On the basis of our measurements, the sample unit we tested could have been rated at 113 watts per channel from 20 Hz to 20 kHz with no more than 0.05 per cent THD, using 8-ohm loads. At the 120 watt per channel continuous rating for 4-ohm loads, THD measured 0.006 per cent. IM and THD measurements with respect to power output are plotted in Fig. 5, and while we normally measure "down" to 0.25 watts, the trend of the THD curve is such that we can confirm Yamaha's new NDCR claims down to 0.1 watts. No filters or spectrum analysis were necessary to obtain these readings even at the low levels, where noise normally takes over in many receivers and amplifiers. Thus, the curves shown really represent the sum of noise plus distortion, rather than THD alone.

Distortion versus frequency (for a 100-watt-per-channel output level) is graphed in Fig. 6, and readers are cautioned to observe the expanded scale which had to be used to get a meaningful curve.

### Preamplifier Section Measurements

Phono input sensitivities measured exactly 2.0 mV (for the "moving" magnet setting) and 50 microvolts for the moving coil setting which interposes the pre-preamplifier in the circuit. Phono overload was 290 mV for the higher sensitivity reference and 8.0 mV for the moving-coil configuration. Unweighted signal-to-noise measurements, referred to the above input sensitivities, measured 82 dB and 68 dB respectively. The former reading is actually better than Yamaha's claimed "A" weighted figure. Using a weighting network, we obtained readings of 86 dB for the MM input. Frequency response in phono was accurate with respect to the RIAA curve within 0.1 dB from 30 Hz to 20 kHz, while in high level program inputs it extended from 8 Hz to 100 kHz,  $\pm 2.5$  dB.

Figure 7 illustrates the range of the bass and treble controls when turnover points are set at their positions closest to mid-band, while in Fig. 8 we have plotted the action of these controls when the alternate turnover points are selected. Also superimposed in the scope traces of Fig. 8 is the action of Yamaha's presence control, whose center frequency is set somewhat higher than that of other mid-range tone controls which have been appearing recently on better amplifiers and receivers. Our subsequent listening tests re-

# A significant step backward.

**It's shaped this way to correct a problem – time/phase distortion.** In conventionally shaped loudspeakers, the voice coils of the high and low frequency drivers are not vertically aligned. The sounds you hear from each driver must travel unequal lengths to reach your ear and the result is time/phase distortion. You don't hear the music reproduced in the same order it went into the speaker.

**The step back design is a definite step forward in making the music you hear, clear.** Ultralinear's Synchronic Time Array ST550 corrects time/phase distortion by positioning the low and high frequency drivers in the proper vertical alignment and fine-tuning the frequency-dividing network with intricate

circuitry refinements. Music fundamentals and overtones reach your ear in the proper order, sharply defined, spacious and faithful to the original.

**This three-way system is also three-way tuneable.** Most quality loudspeakers provide mid and high frequency level adjustments, but the Ultralinear ST550 goes one step further with Dual Tuned Ports. Each port is fitted with a removable aluminum blocking plate, allowing you to adjust bass output to your own musical preferences or room acoustics. With ports open, bass response is optimized, complementing today's now sounds.

Closing the ports creates a tighter, more controlled bass, often preferred for classical listening.

The Ultralinear ST550; a dynamic musical step forward.



## Ultralinear®

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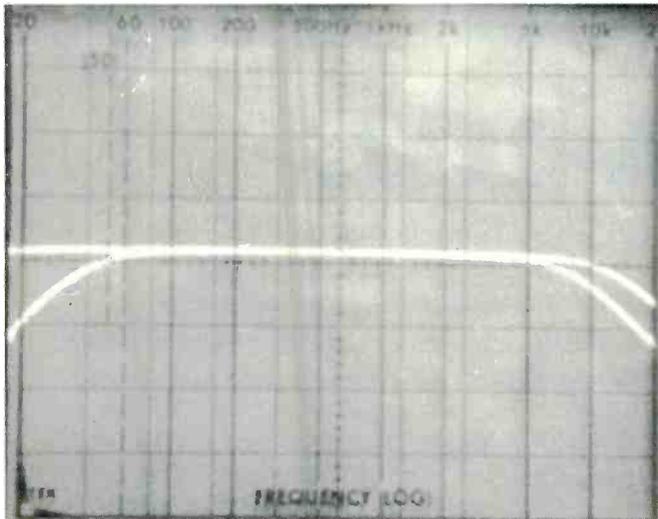


Fig. 9—Low- and high-cut filter response (the 15 Hz sub-sonic filter is not within the range of this sweep).

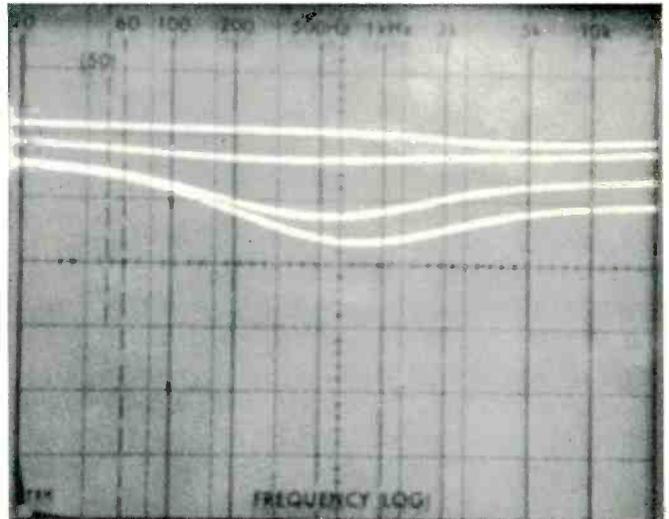


Fig. 10—The variable loudness compensation for the fixed master control volume setting of the Yamaha CR-2020.

vealed that this higher setting actually does deliver more of a "presence" effect than does the mid-range control whose center frequency is set closer to the 1-kHz mid-frequency.

The response characteristics of Yamaha's two step low- and high-cut filters are shown in the 'scope photo of Fig. 9. Although we activated the 15-Hz filter cut in the upper trace of these two sweeps, the cut action obviously occurred below the low frequency extreme of our sweep-frequency generator (20 Hz) and therefore does not show up on the 'scope presentation. The 12-dB per-octave slopes of the other filter positions, as well as the cut-off points chosen by Yamaha, show clearly how much music is retained while filtering out high and low frequency noise and rumble.

Figure 10 shows the action of Yamaha's unique loudness control arrangement and requires a bit of explaining. Yamaha is one of the very few manufacturers of receivers and amplifiers who incorporate a loudness/volume control arrangement that is truly effective and meaningful. Rather than supply a switch, which introduces arbitrary degrees of Fletcher-Munson loudness compensation, regardless of program source levels, speaker efficiencies, etc., Yamaha provides a continuously variable loudness control. Proper setup of this control requires that the listener first set a given program source to naturally loud or life-like levels by means of the regular master volume control. Then, if more moderate listening levels are desired or required, the user simply lowers the setting of the separate rotary "loudness" control and, as this is done, the exact required amount of loudness compensation is introduced. In this way, correct compensation is achieved for any program source, and the setting of the master volume control has no bearing on this compensation amount. In Fig. 10, then, the different curves were plotted for a *fixed* setting of the master volume control simply by varying the setting of the completely separate loudness control knob. As can be seen, the attenuation range of this separate control is something of the order of 20 dB (each vertical division on the 'scope face of this and other 'scope presentations in this report equals 10 dB of amplitude variation). In our opinion, if you're going to use any loudness control at all, this is the way it should be configured (unless separate input level controls are provided

for every single program source, including the built-in AM and FM audio outputs of a receiver).

#### Listening and Use Tests

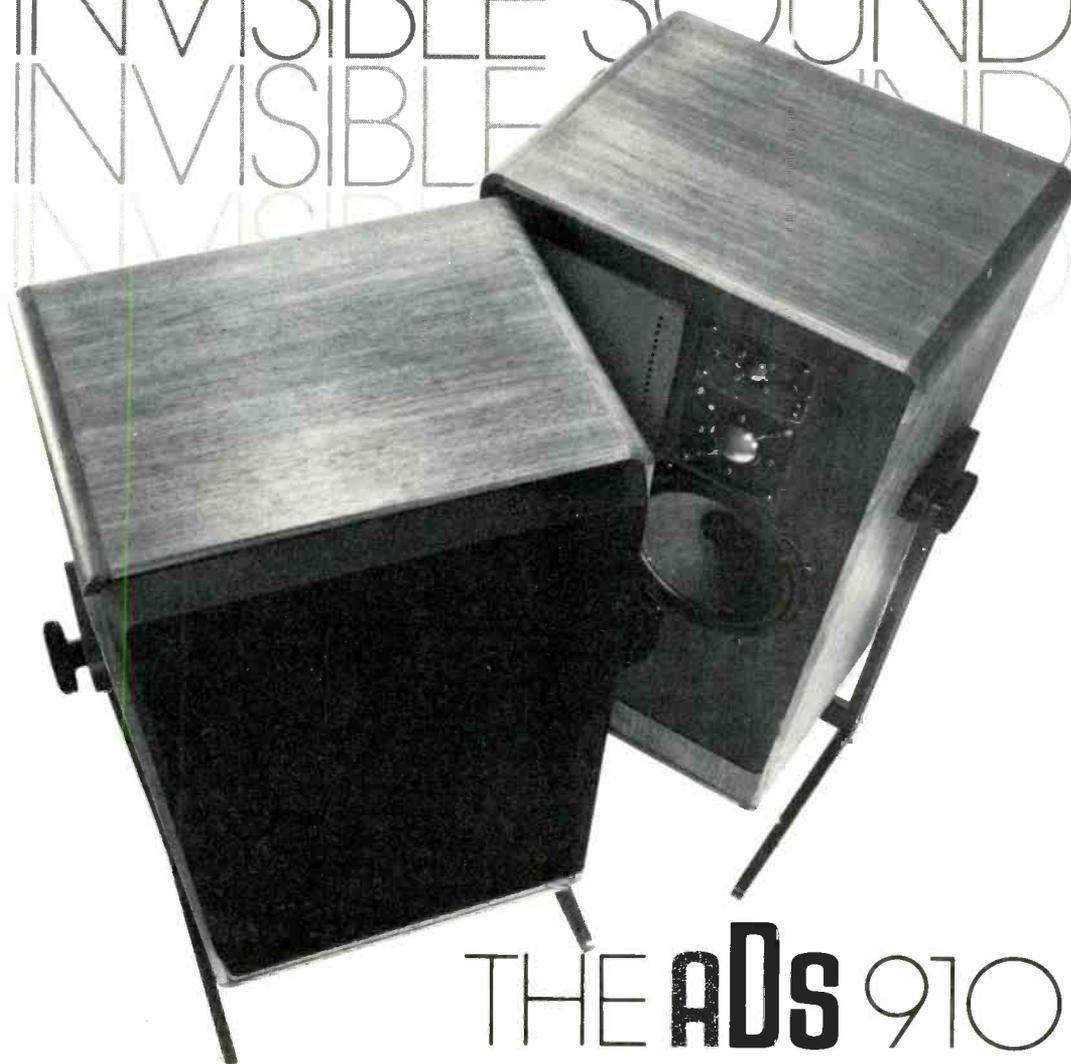
Despite the seeming complexity of the Yamaha CR-2020's front panel, familiarization with its features and controls takes only a few minutes. Once one realizes the degree of control at hand, the Yamaha CR-2020 becomes a joy to use and, more importantly, a joy to hear. Residual noise (both in phono and high level) is audibly lower than on just about any receiver we have tested. Like so many readers of *Audio Magazine*, we have been turning our attention of late to some of the better moving-coil cartridges which are becoming popular once more. Being able to "plug in" such cartridges directly to the receiver (without matching transformers, separate pre-preamps, or worrying about location for least hum pickup and you name it) is a delight, and the signal-to-noise ratio obtained even with such low-level outputs is incredible. There is no longer any need to "accept" higher hum levels in order to enjoy the transparent uncolored output which some of these newer cartridges are able to deliver.

We have always maintained that power output is only one (and not a terribly important one) of the criteria by which a high quality stereo receiver should be judged. In terms of musical definition and clarity, the Yamaha CR-2020 surpasses many of the higher powered receivers we have recently tested. It offers enough power to even drive some of the more inefficient speaker systems around (remember, 180 watts is a mere 2.55 dB more than 100 watts), is manageable in terms of its size and weight (after, all, that is supposed to be the argument in favor of an all-in-one audio electronic component), and, unless someone can come up with a control or switching feature which Yamaha (or we) haven't thought of, provides all the sophistication asked for by the seasoned audiophile without intimidating the neophyte. This is one receiver that just should not be judged on a "dollar per watt" basis. However, if that measure is applied, you may well conclude that the Yamaha CR-2020 is *underpriced!*

Leonard Feldman

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Tasteful, functional design, expressed through choice woods and a meticulous furniture finish, elevates the ADS 910 to a showpiece in the well-appointed home of the discerning music lover. The speaker system's integrity and built-in flexibility appeal to the dedicated audiophile.

A new cost/performance ratio has been established by which all future studio speakers will have to be measured.

Coast to Coast, the skilled and carefully selected team of ADS dealers will proudly demonstrate our new 910, as well as any of our other eight, smaller precision speakers. Listen to the ADS 910 reference system; listen to music - the way it was recorded: Live, authentic, real!



ADS 910's shown in the recording studio of Deutsche Grammophon Gesellschaft at Symphony Hall, Boston. ADS speakers range in price from \$100 to \$600. ADS 910 Dimensions 33½" (H) x 19" (W) x 15¼" (D) 910C - 76PG

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## Pickering XSV/3000 Stereo Cartridge

### MANUFACTURER'S SPECIFICATIONS

**Stylus Description:** Stereohedron.

**Tracking Force:** 1 gram, + ½ - ¼ gram.

**Frequency Response:** 10 to 30,000 Hz.

**Nominal Output:** 5.0 mV.

**Channel Separation:** 35 dB.

**Inductance, Each Channel:** 350 mH.

**Resistance, Each Channel:** 700 ohms.

**Load Resistance:** 47 kilohms.

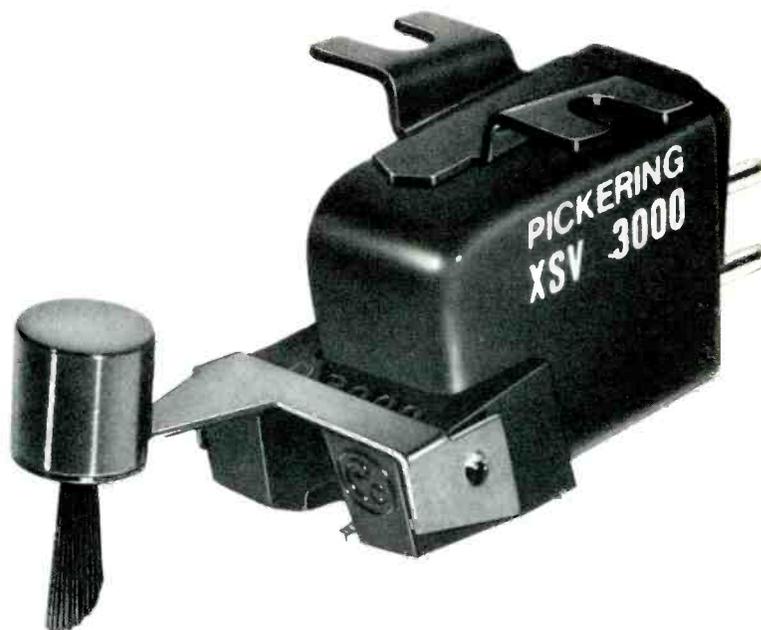
**Load Capacitance:** 275 pF.

**Accessory Stylus for Monophonic LP**

**Records:** D4541.

**Accessory Stylus for 78 RPM Records:** D4543.

**Price:** \$99.95, with "Dustmatic" brush attached.



100

Pickering introduced the second American-made CD-4 cartridge, preceded only by their sister company, Stanton Magnetics. Experience and continuing research with these very special cartridges led to the design of the remarkable XUV/4500Q cartridge for playing the CD-4 and UD-4 discrete records, as well as stereo and matrixed records. At the time we reviewed the XUV/4500Q, we wondered if a stereo cartridge could be made with an equivalent stereo fidelity using this advanced technology. Physical examination of the XSV/3000 cartridge and its Stereohedron stylus showed the outward appearance to be identical to the XUV/4500Q, and the Stereohedron stylus to be a modified stereo version of the Quadrahedron stylus, but apparently less expensive to produce. The first stereo record we played with the Pickering XSV/3000 cartridge bore out the fact that this was indeed a superb stereo cartridge and a worthy relative of the XUV/4500Q. Subsequent listening confirmed our original reaction—the Pickering XSV/3000 is a perfect match, in stereo, for the established quadraphonic XUV/4500Q cartridge for those not wishing to spend the additional sum for a four-channel cartridge.

### Measurements

As is our practice, measurements are made on both channels, but only the left channel is reported. During the test period the average room temperature was 70°F ± 1° (21°C) and the relative humidity 45 per cent ± 3 per cent.

Frequency response, using the B & K QR-2009 test record and our reference tone arm, an Audio-Technica AT-1009, is flat within 1 dB from 20 Hz to 7 kHz, then slowly rises to a peak of ±3.5 dB at 12.5 kHz, descending to ±1 dB at 20 kHz. The optimum tracking force for the cartridge we tested was 1.2 grams, with an optimum anti-skating force of 1.5 grams. Separation was 21.5 dB at 1 kHz, 25 dB at 7 kHz, and 17.5 dB at 20 kHz. The load resistance and capacitance, respectively, was 47,000 ohms and 278 pF. Square waves show some ringing that dies rapidly, indicating that the ripples are well damped. The light spacing of the ripples establishes the resonant peak to be well beyond 20 kHz.

The following test records were used in making the reported measurements: Micro-Acoustics TT2002; Shure TTR-

101, TTR-103, TTR-109, TTR-110; Columbia STR-100, STR-112, SQT-1100; Stereo Review SR-12; B & K QR-2009; Deutsches Hi Fi No. 2; Ovation OVQS/4000; and Nippon Columbia Audio Technical Records (Pulse Code Modulation) XL-7004-6.

Wt. 5.3 g.; d.c. res. 600 ohms; ind. 266 mH; opt. tracking force, 1.2 g.; opt. anti-skating force, 1.5 g.; output, 1.09 mV/1 cm/sec; IM dist. (4:1) + 9 dB lateral, 200/4000; 0.9 per cent, + 6 dB vertical, 200/4000; 5.4 per cent; crosstalk, -28 dB; ch. bal., 0.25 dB; trackability; high freq. (10.8 kHz pulsed), 30 cm/sec; mid-freq. (1000 + 1500 Hz lat. cut), 25 cm/sec; low freq. (400 + 4000 Hz lat. cut), 24 cm/sec; Deutsches Hi Fi No. 2: 300 Hz test bands tracked to 43.1 microns (0.00431 cm) horizontal and 43.1 micron (0.00431 cm) vertical; passed all bands of the Shure TTR-110 (Era III) test record; tracks warped records without difficulty. Passed all bands of the Micro-Acoustics Transient and Tracking test record, TT2002. Using the Denon Pulse Code Modulation Audio Technical Record XL-7004A, we measured the arm-cartridge (Audio-Technica AT-1009 arm and the Pickering XSV/3000 cartridge) resonance of 8 dB at 6.5 Hz.

### Listening Evaluation

We had our first opportunity to run an A-B test between an established quadraphonic cartridge (XUV/4500Q) and a stereo derivative (XSV/3000), playing identical records. Both appeared to sound identical, which is truly remarkable. Neither cartridge exhibited any difficulty in reproducing recorded glass bells or the 23 Hz organ pedal note on the Advent 5009 recording: *Lemmens • Viernè • Dupré • Widor* played by Michael Murray on the organ at the Grace Cathedral, San Francisco. The XSV/3000 also reproduced beautifully some super organ music with Michael Murray playing the *Marcel Dupré Organ Recital*, Advent 5014. On occasion we noted a minor sibilance on certain voices in the singing mode, e.g., Orff: *Carmina Burana*—Columbia M33172 and Orff: *Catulli Carmina*—Philips 6500 815 as well as on some pop records.

We used the identical stereo playback equipment that we listed in the April, 1977, issue of *AUDIO* on pg. 71 for evaluating the XSV/3000 cartridge. As is our practice, a rigorous

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**2.**



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Each Synergistic loudspeaker, from our smallest two-way model S-12 to our six-element, four-way model S-72 has been engineered to more perfectly compliment the other components in a stereo system. This "synergistic coupling" results in greatly improved total system sound quality. The chart below shows you the Synergistics model we recommend in various total system price ranges. All seven Synergistics models are true "audiophile" loudspeakers capable of reproducing wide dynamic range and musical clarity previously associated only

with "monitor-type" speaker systems; yet, all Synergistics models will realize optimum performance when operated with low-to-medium powered receivers and amplifiers. What does all this mean to you? Simply stated, it means that whether you're spending under \$450 or as much as \$1,500 for your system,

there's a Synergistics loudspeaker specifically designed to enhance the overall sound quality. **SYNERGISTICS:** cooperative inter-action in a system where the total effect is greater than the sum of its component parts.

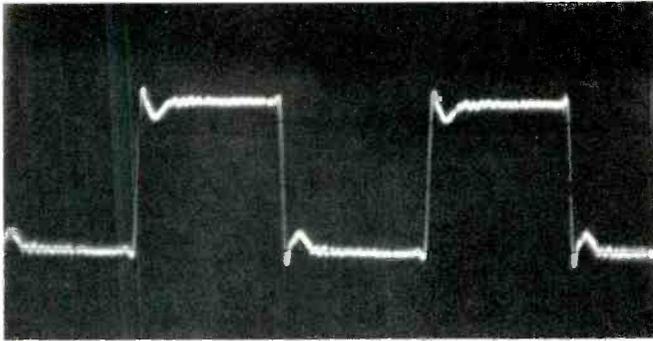
| Total System Price | Recommended Synergistics Loudspeaker |
|--------------------|--------------------------------------|
| Under \$450        | Model S-12                           |
| Under \$500        | Model S-22                           |
| Under \$600        | Model S-32                           |
| Under \$700        | Model S-42                           |
| Under \$850        | Model S-52 (Tower)                   |
| Under \$1,100      | Model S-62 (Tower)                   |
| Under \$1,500      | Model S-72 (Array)                   |



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listening evaluation was conducted utilizing many of the records listed in our previous reports, e.g. *AUDIO*, April, 1977, pg. 71. The following additional recordings, which demonstrate quite effectively the ability of the Pickering XSV/3000 cartridge to reproduce them faithfully, were also used. All records were cleaned with the Discwasher and de-staticized with the Zerostat.



**Fig. 1—1-kHz square-wave response of the Pickering XSV/3000 cartridge.**

**Stereo**

Stanley Clarke: *Journey to Love*—Nemperor Records NE433  
 Prokofiev: *Lieutenant Kije* and Kodaly: *Háry János*—Netherlands Radio Philharmonic-Dorati-London SPC21146.  
 J. S. Bach: *Suite No. 1 in G Major*—Roy Christensen, cellist-Gasparo GS102.  
 Beethoven: *Symphony No. 5* and *Leonore Overture No. 3*—The Chicago Symphony - Solti-London CS 6930.  
 Stokowski Conducts Beethoven - *Symphony No. 7* and *Egmont Overture*—New Philharmonic Orchestra—London SPC21139.

**Pulse Code Modulation (PCM) Stereo**

Zoltán Kocsis Plays Bartók—Denon PCM OX-7044-ND (Su-

perb piano sound. This is the most realistic recorded Steinway we've ever heard.)

**Direct-to-Disc Recording (Stereo)**

*The King James Version*: Harry James and His Band—Sheffield Lab-3. (Although the sound is good, we regret that this is not the big band sound of Harry James of early fame. Perhaps the arrangements are not written in the same manner as those of yore. His most famous numbers are missing on this record.)

**Mono**

*Caruso—A Legendary Performer*—RCA CRMI-1749 (A digital restoration developed by Dr. Thomas G. Stockham, Jr. It is quite gratifying that my suggestion to Dr. Stockham that the laboratory curiosity be put to commercial use, has come to fruition. We introduced Dr. Stockham to RCA Records where he demonstrated the original three Caruso restorations to Peter Munves, Rex Isom, and John F. Pfeiffer; the rest is history.)

**SQ**

J. S. Bach: *The Six Organ-Concerto Sinfonias*—E. Power Biggs—Columbia M34272.  
 Tower of Power: *Ain't Nothin' Stoppin' Us Now*—Columbia PCQ34302.

**QS**

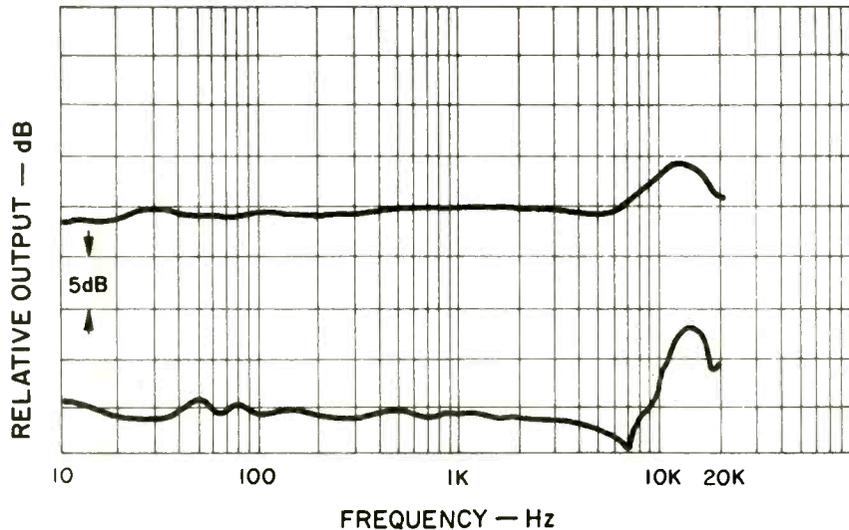
Hayden: *The Creation*—Orchestra of the Ludwigsburger Schlossfestspiele-Gönnenwein-Vox Productions, Inc.—QSVBX5214.  
 Stokowski *Overtures*—The National Philharmonic Orchestra—PYE Records PCNHX6.

The XSV/3000 played all the records with consummate ease, which certainly speaks well for the Stereohedron stylus principle. The Stereohedron has a large bearing surface which is distributed over a larger portion of the modulated groove, and at the stated optimum tracking force of 1.2 grams, the actual force per unit area is, of course, much less and should significantly contribute to the longevity of recordings  
 B. V. Pisha

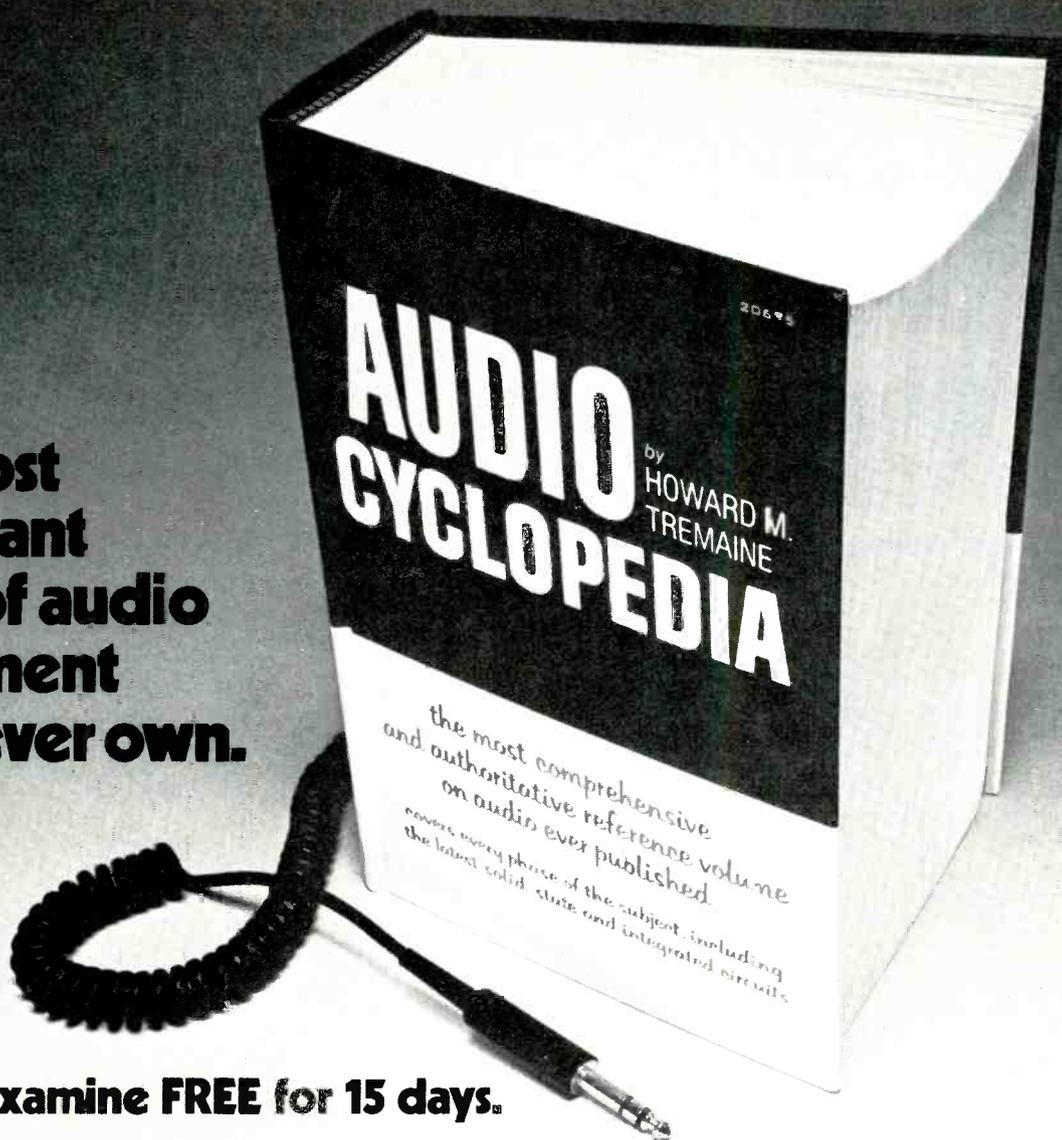
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**Fig. 2—Amplitude-frequency response and separation from 20 Hz to 20 kHz using the B&K QR-2009 test record.**



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and packed with 1,757 illustrated pages. It features 3,645 questions and answers and a 50 page "instant-find" index for subject identification. It is truly the big one in audio electronics and it puts all the information you'll ever need right at your fingertips, chapter by chapter.

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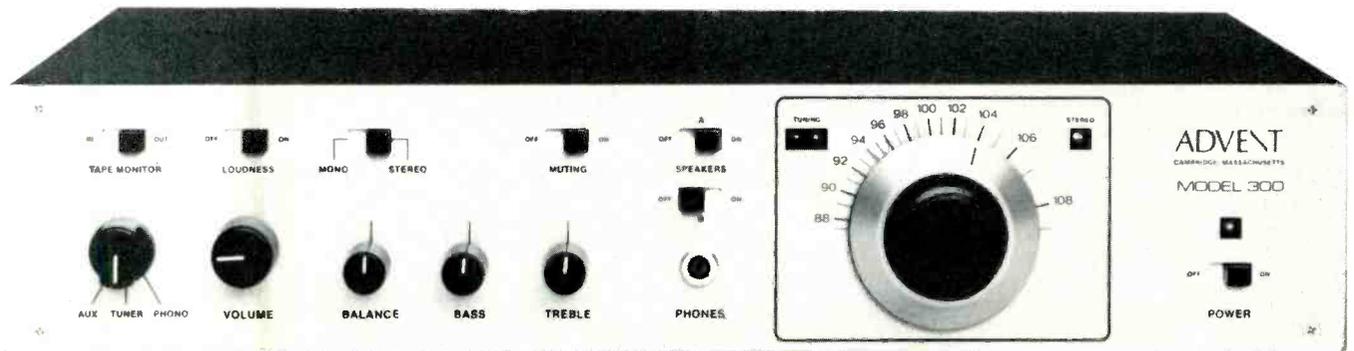
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Indianapolis, Indiana 46206  
A Division of Howard W. Sams & Co., Inc.

CT30

# Advent Model 300 Stereo FM Receiver



## MANUFACTURER'S SPECIFICATIONS

### FM Tuner Section

**Usable Sensitivity:** Mono, 2.5  $\mu$ V (13.2 dBf).

**50-dB Quieting:** Mono, 3.5  $\mu$ V (16.1 dBf); stereo, 35  $\mu$ V (36.1 dBf).

**S/N:** Mono, 73 dB; stereo, 70 dB.

**Frequency Response:** 30 Hz to 15 kHz  $\pm$ 1 dB.

**THD:** Mono, 0.15 per cent @ 1 kHz; stereo, 0.2 per cent @ 1 kHz.

**Stereo Separation:** 40 dB @ 1 kHz; 28 dB from 30 Hz to 10 kHz.

**Image Rejection:** 46 dB.

**I.F. Rejection:** 70 dB.

**Spurious Rejection:** 70 dB.

**AM Suppression:** 60 dB.

**Capture Ratio:** 1.6 dB.

**Selectivity:** 70 dB.

### Amplifier Section

**Power Output:** 15 watts per channel, minimum continuous power into 8 ohms, 40 Hz to 20 kHz.

**Rated THD:** 0.5 per cent.

**Rated IM Distortion:** 0.3 per cent.

**Input Sensitivities:** Phono, 2.0 mV; high level, 100 mV.

**Phono Overload:** 100 mV.

**S/N Ratios:** Phono, 80 dB below 10

mV input, "A" weighted; Aux & Tape, 80 dB.

**Tone Control Range:** Bass,  $\pm$ 10 dB @ 100 Hz; treble  $\pm$ 10 dB @ 10 kHz.

**Infrasonic Filter Response:** -1 dB @ 20 Hz, -31 dB @ 4 Hz.

### General Specifications

**Power Requirements:** 120 V, 60 Hz, 100 watts max. (optionally available for 12 V "portable" operation).

**Dimensions:** 15  $\frac{3}{4}$  in. (40 cm) W x 3 in. (7.6 cm) H x 9 in. (22.86 cm) D.

**Weight:** 12 lbs (5.4 kg).

**Price:** \$259.95.

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Anyone familiar with Advent Corporation's history in the electronics business will recognize that this company is not one which introduces products by the dozen every couple of years. The Advent loudspeaker and the Advent "smaller" speaker, both introduced several years ago, still stand as excellent examples of acoustic-suspension, sealed-box speaker design and are still selling as briskly as ever. Advent's dedication to their large-screen projection TV system has also been well publicized. And now, Advent brings to the audio industry its version of the stereo receiver.

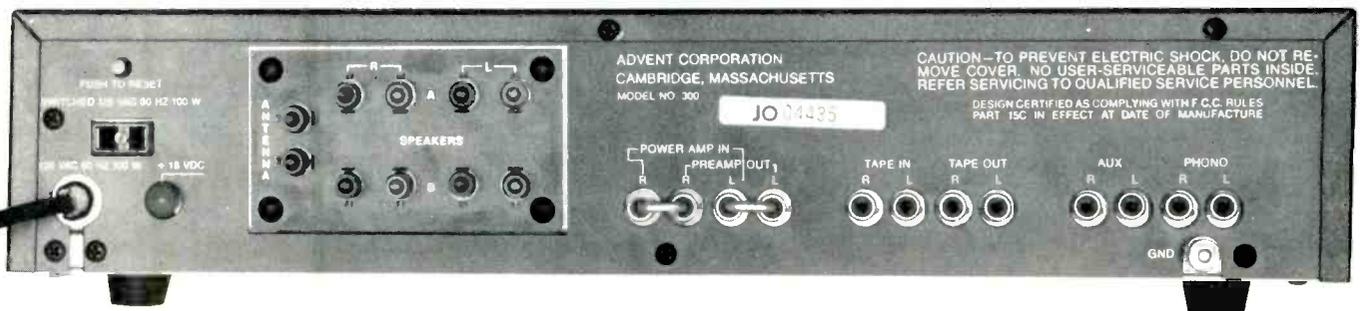
Advent's Model 300 is low in power capability (by today's standards at least), has no bright lights or dial scales, uses about as simple a front panel control layout as might be imagined, and could conceivably be regarded by style-conscious audio buffs as something of an "ugly duckling". Still, behind that black front panel Advent has packed quite a bit of good audio performance capability and made it available at a reasonable price. There are a few aspects of the Model 300's design with which we take issue, but by and large, the accomplishments within the 300 are considerable.

Visually, the most outstanding difference between this receiver and others is the absence of the usual dial-scale/pointer arrangement. A simple, smooth-acting vernier

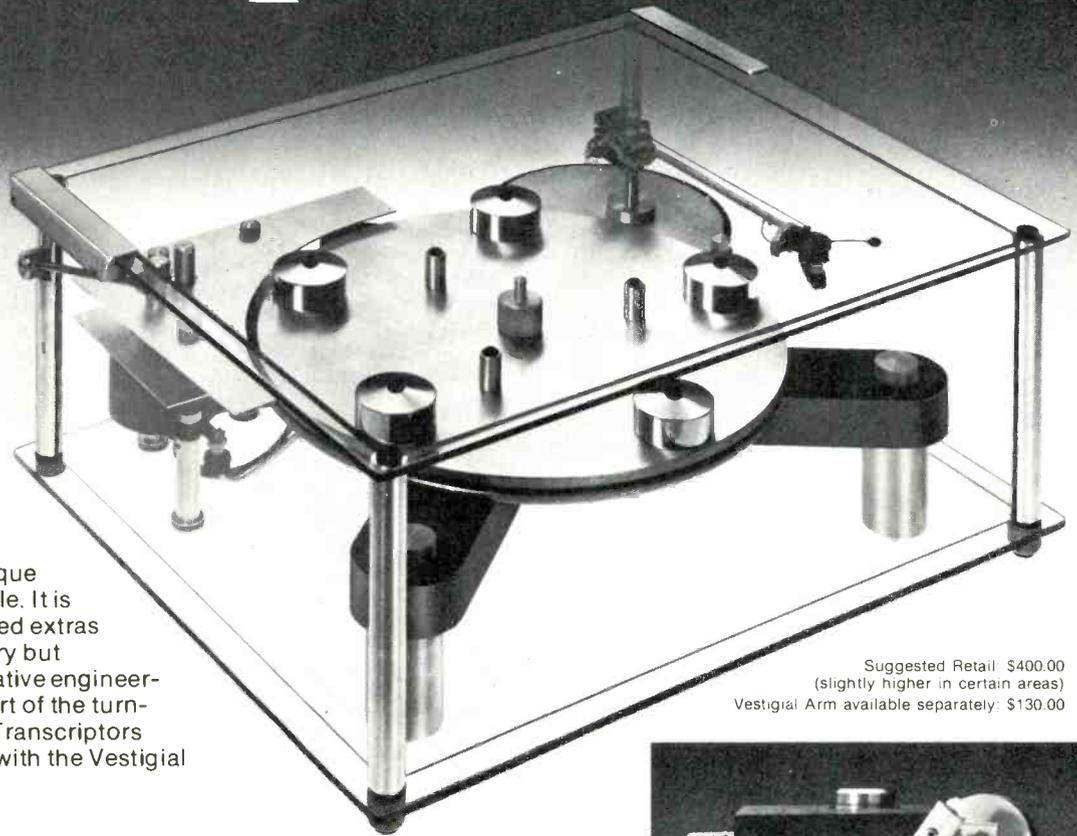
tuning knob, fitted to a slower turning rear knob etched with a single thin line, selects frequencies which are calibrated at every MHz. An LED indicator to the right of this elemental tuning arrangement denotes the presence of a stereo signal, while a pair of LEDs to the left are used in lieu of a center-of-channel tuning meter. When both lights glow equally, you are correctly tuned to the station. To the right of this tuning-indicating arrangement is a simple slide-type power on/off switch, with a pilot light indicator just above.

Along the upper left of the front panel are six slide switches, of simplest possible construction. These take care of the single tape monitor circuit, loudness control switching, mono-stereo mode selection, FM interstation muting, speaker "A" on/off, and speaker "B" on/off. The usual stereo 'phone jack is positioned below the last pair of speaker switches. Rotary knobs along the bottom left of the panel take care of program selection (*FM*, *Phono* and *AUX*), master volume, balance, bass and treble. That's all there is on the front panel.

The rear panel is equally simple in layout, containing the usual array of input and tape output jacks; a preamp-out, main amp-in jack and wire jumper arrangement; a simple screw-terminal speaker connection points (for two pairs of



# Anatomy of a great performer.



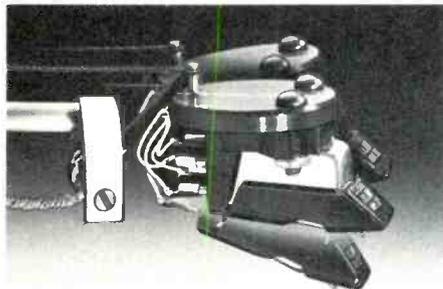
In view of the many recent developments in upgrading turntable performance, there is one that shines out from the rest. It is a truly revolutionary concept that is both unique and effectually simple. It is not the result of added extras or electronic wizardry but application of innovative engineering into the very heart of the turntable. We call it the Transcriptors Skeleton Turntable with the Vestigial Tone Arm.

Suggested Retail \$400.00  
(slightly higher in certain areas)  
Vestigial Arm available separately: \$130.00

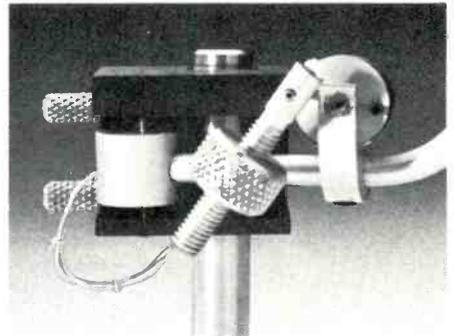
105

The heart of the matter is the unique design of the Vestigial Arm. The length of the arm, from stylus to its vertical pivot, is only 1-3/8". That is, the length of the arm is the headshell itself.

Because of its shortness, which allows the use of a counterweight 1/3 the weight normally required, it's one of the lowest vertical mass arms you'll find.



And for its performance? Close your eyes and imagine yourself, in just the right spot, in front of your favorite orchestra. Listen as every nuance in sound and every moment of music is being reproduced with absolute clarity and definition. You feel as though you're there, right up front. As you open your eyes, you'll realize that you've been listening to the superb quality of the incomparable Skeleton Turntable.



The arm's main bearings provide for horizontal but not vertical movement. Because the counterweight is mounted behind the vertical bearings and controlled by a string and roller mechanism, it allows virtually no resistance in the arm's horizontal swing.

The Skeleton Turntable with its Vestigial Arm, when equipped with the finest low mass cartridges, will track with state of the art precision.

The Skeleton Turntable . . . it has no gadgets, no anti-skating devices, heavy counterweights, or cueing mechanisms . . . because it doesn't need any.

## Skeleton Turntable

with the Vestigial Arm  
by Transcriptors of Ireland

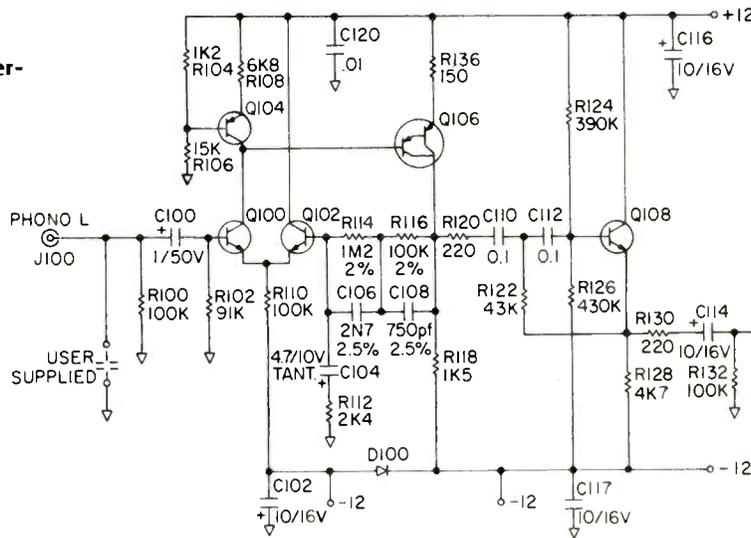
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**Fig. 1—Phono preamplifier-equalizer circuit.**



speakers); a resettable circuit breaker button; a chassis ground terminal; a single switched a.c. convenience receptacle, and a jack which provides a d.c. voltage of +18 volts to power such accessories as the MPR-1 mike preamplifier.

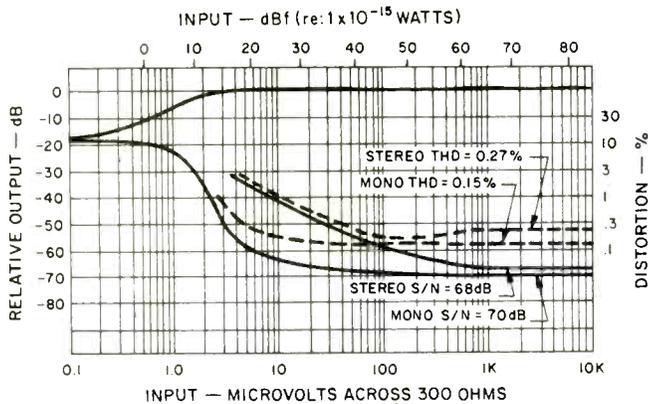
**Internal Layout**

Two major circuit boards are used for most of the parts of the Model 300. The tuner PC board is isolated from the am-

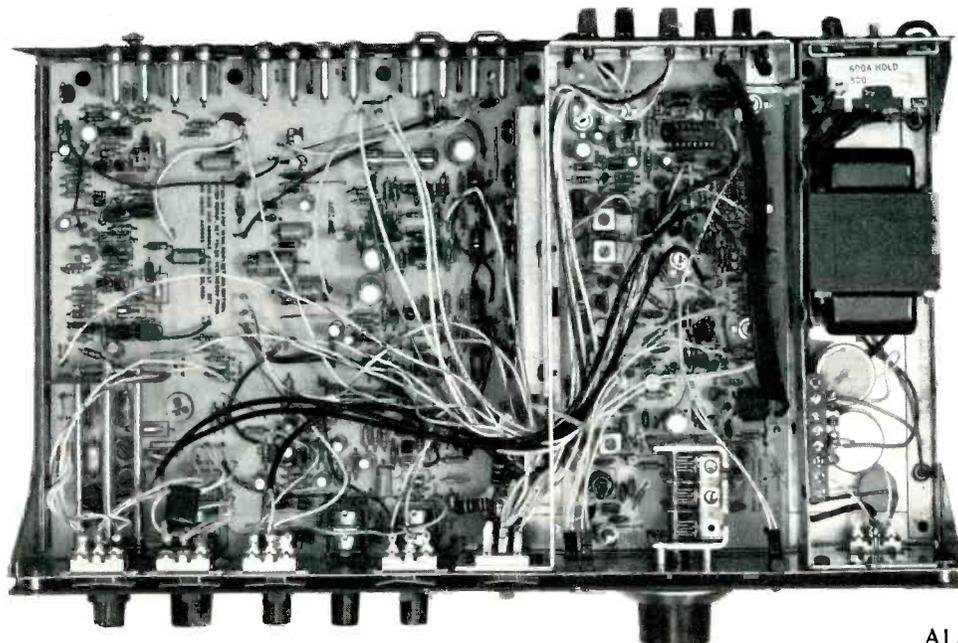
plifier and power supply sections by chassis dividers, one of which serves as a heat sink for the small output transistors used in this receiver. A three-section tuning capacitor, plugged directly into the r.f. PC board, is directly coupled to the vernier tuning knob, the outer section of which goes through a bit more than three revolutions to get from 88 MHz to 108 MHz. The i.f. circuitry seemed to be conventional (at least visually, since no schematic was on hand), and a phase-lock-loop multiplex decoder section is employed for stereo decoding.

All parts relating to the audio PC board are mounted directly to it, with the exception of the slide switches referred to earlier. The unique preamplifier-equalizer circuit developed for this receiver is positioned near the left-rear of the chassis. In a paper presented by the circuit's inventor, Tomlinson Holman, at the 52nd AES convention in October, 1975, the author published the basic schematic of this preamp. Advent's adaptation is shown here in Fig. 1. A bi-polar differential-input configuration was chosen for its inherent non-saturating quality, its good isolation between the feedback loop and input (which contributes to non-interaction with cartridge source impedance), and greater freedom of choice of impedances in the feedback loop so that high frequency load (and slewing performance) can be optimized.

106



**Fig. 2—FM quieting and distortion characteristics.**





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The use of current source loading of the first stage produces high stage gain, which results in high open-loop gain. This in turn results in large closed-loop, RIAA-feedback loop gain which keeps input impedance high and distortion low. In this design, an active filter network is used to obtain a complex pole pair which, when combined with a real axis pole produced by C104 and R112 yields an 18-dB-per-octave high pass filter which Advent calls its infrasonic (or sub-sonic) filter. It's virtually flat down to 20 Hz, then down as much as 31 dB at 4 Hz (the worst record-warp frequency) without audible side effects. Chief considerations in the design of this pre-amp were how it would perform when fed signals from a “real, live” cartridge, rather than from signal generators.

### FM Performance Measurements

Usable sensitivity of the FM tuner on the Model 300 was 2.1  $\mu\text{V}$  (11.6 dBf) in mono, 3.5  $\mu\text{V}$  (16.1 dBf) in stereo, while the 50-dB quieting points were reached with signal input strengths of 2.5  $\mu\text{V}$  (13.2 dBf) for mono and 30  $\mu\text{V}$  (34.74 dBf) for stereo. As graphed in Fig. 2, best quieting in mono was 70 dB, while in stereo it measured 68 dB. Lowest distortion (with a 1-kHz audio signal modulating the carrier 100 per cent) was 0.15 per cent for mono and 0.2 per cent for stereo, though at the required 65 dBf test point, THD in stereo was a bit higher than for either lower or greater signal strengths. It should be noted that stereo S/N and THD readings had to be made using the IHF approved 15-kHz low-pass filter, without which excessive amounts of carrier output appeared at the output of the receiver and would have given false (and high) indications of noise and distortion. Stereo threshold (switching) occurred at 2.0  $\mu\text{V}$  (11.2 dBf), while muting threshold was set at 4.0  $\mu\text{V}$  (17.2 dBf); both should be

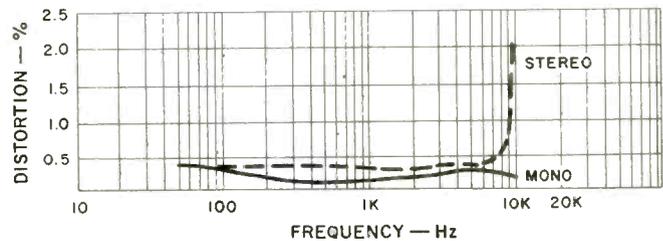
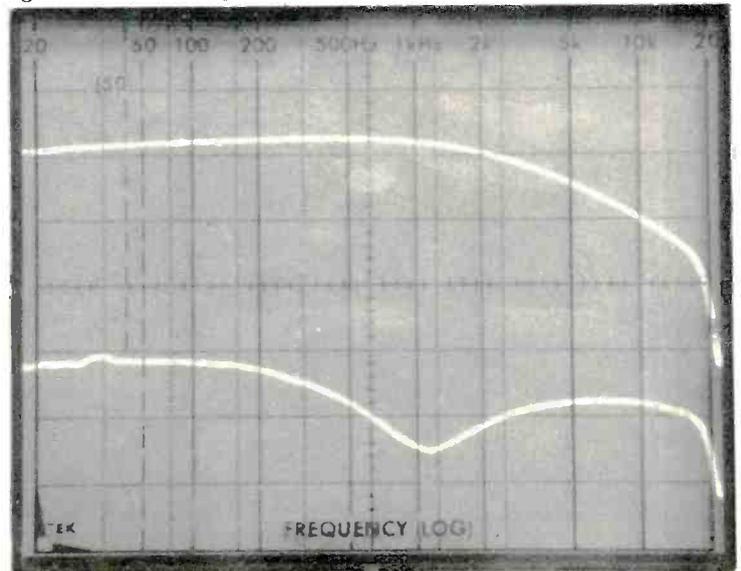
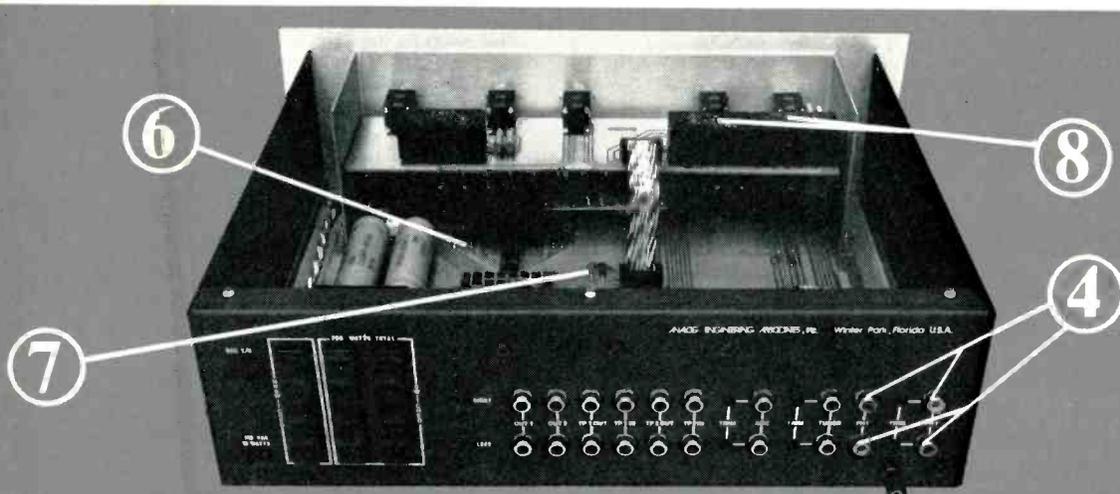


Fig. 3—Distortion vs. frequency for FM.

Fig. 4—FM stereo separation characteristics.





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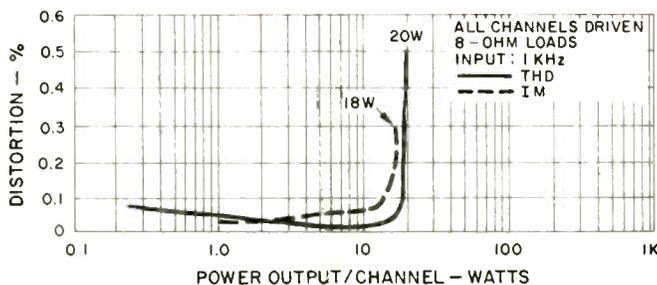


Fig. 5—Harmonic and intermodulation distortion characteristics.

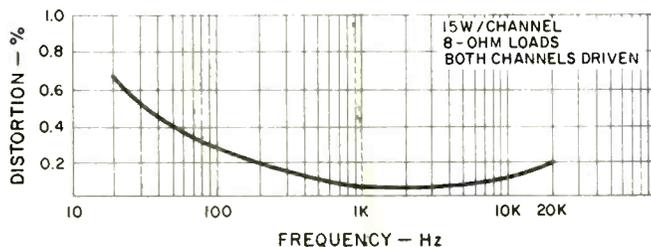


Fig. 6—Distortion vs. frequency.

considered excellent choices in terms of the other capabilities of the tuner section. Selectivity measured 75 dB, capture ratio was 1.5 dB, image rejection was 50 dB, and i.f. rejection measured 73 dB. Frequency response was just about perfect (based upon 75 microsecond de-emphasis) all the way out to 15 kHz but was down by about 1.5 dB at 30 Hz. Dial calibration was perfect from one end of the dial to the other, though equal indication of the two tuning LEDs did not correspond exactly to lowest distortion points—probably a case of slight misalignment of the detector circuit. (Editor's Note: Advent says that drift in the regulator for the LED display, a problem since solved, is more probably responsible for the non-correspondence.)

Distortion versus frequency of the modulating signal for mono and stereo is plotted in Fig. 3. Stereo separation was plotted by means of our spectrum analyzer, with the "desired" channel shown as the upper trace of Fig. 4 and the cross-talk shown as the lower trace. Separation measured in excess of 40 dB at both 1 kHz and 100 Hz. (Note that the de-emphasis of the receiver has not been compensated for.)

### Amplifier Section Measurements

With a 1-kHz test signal input, the Model 300's amplifier sections were able to deliver 20 watts per channel into 8-ohm loads before the output reached a distortion level of 0.5 per cent. Rated IM distortion of 0.3 per cent was reached at a power output level of 18 watts per channel. Advent's claimed power band is from 40 Hz to 20 kHz, instead of the more common frequency extremes of 20 Hz and 20 kHz used by most amplifier and receiver manufacturers. Had they wished to specify the broader band limits, the receiver would have had to be rated at around 12 to 13 watts per channel.

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★ **WIDE RANGE PICKUP RESPONSE TEST RECORD STR 120** Makes possible the measurement of pickup response at frequencies far beyond the audible range, where elusive distortion elements can cause audible distortion. The low-frequency range includes glide-tones at twice normal level for the detection and elimination of arm resonance, loudspeaker cone and cabinet rattles. Other tests include: silent grooves for measuring rumble and surface noise characteristics; and standard level bands at 0 dB for overall system S/N measurements. This record is suitable for use with a graphic level recorder to provide permanent, visible records for precise evaluation.

★ **BROADCAST TEST RECORD STR 151** Developed especially to meet the needs of broadcast engineers, audiophiles, and other professionals seeking a convenient signal source for the testing and adjustment of all audio equipment. Tests include: phonograph pickup response and separation, speed accuracy at 33 1/3 and 45 rpm, wow and flutter, rumble and hum detection, ballistic test of V.U. meters and many others."

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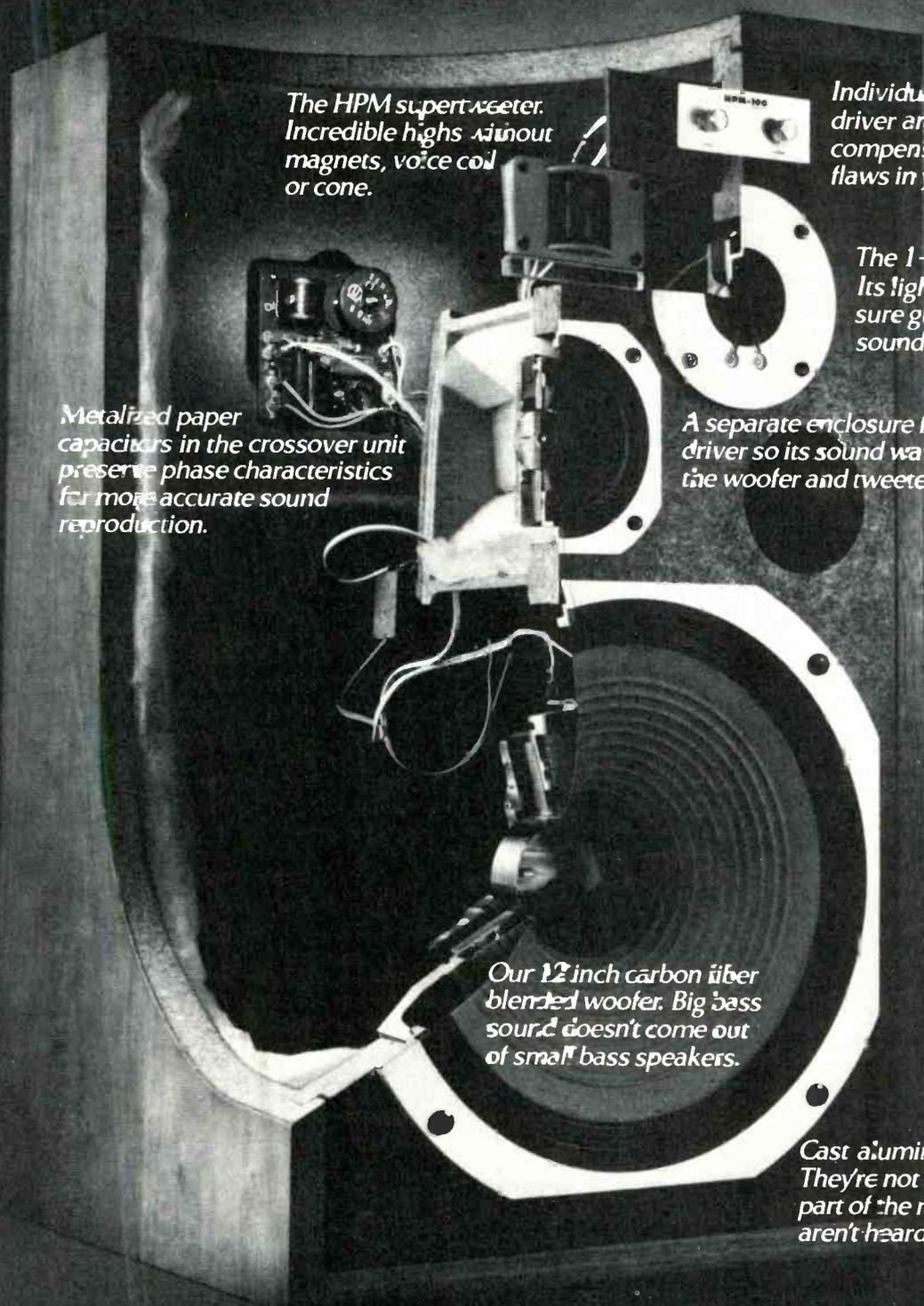
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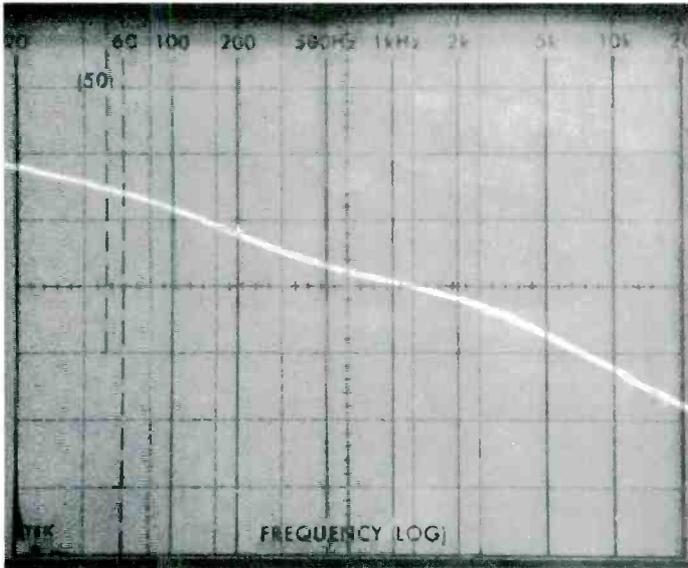


Fig. 7—RIAA response of the preamp section is within  $\pm 0.5$  dB.

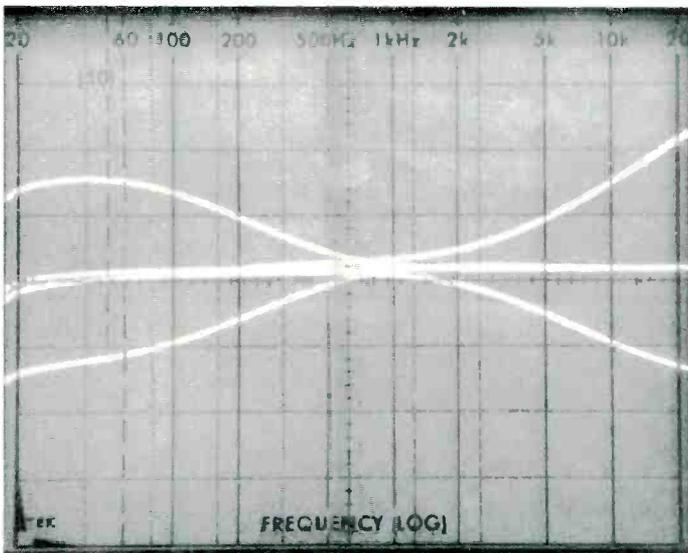
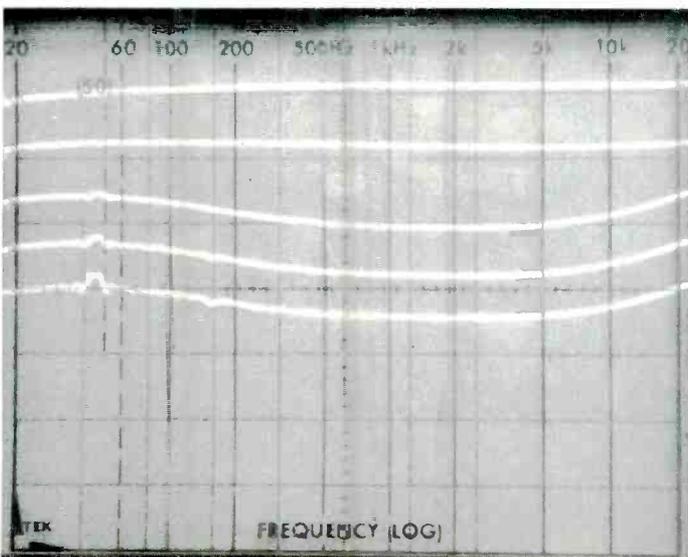


Fig. 8—Tone control range.

Fig. 9—Loudness compensation characteristics.



The Advent 300 amplifier circuit is obviously designed primarily for music reproduction and not for "sine-wave testing". During the course of our tests, the circuit breaker interrupted output upon several occasions when we operated at or near maximum power output. No such interruptions occurred during subsequent listening tests, even when the amplifier was driven into momentary overload or clipping. IM and THD versus power output are plotted in Fig. 5, while harmonic distortion, at the rated 15 watts per channel output versus frequency, is graphed in Fig. 6.

Phono equalization (RIAA) was accurate to within  $\pm 0.5$  dB from 30 Hz to 15 kHz, and signal-to-noise in phono measured 80 dB unweighted (referred to a 10 millivolt input, in conformance with Advent's published specifications) or 85 dB using an "A" weighting curve network. Phono overload measured 100 mV at 1 kHz. Overall RIAA response is shown in the 'scope photo of Fig. 7 referenced to a 1-kHz "0 dB" point.

Tone control range (plotted in Fig. 8) provided a bit more boost than cut for both the bass and treble controls, but was otherwise typical of tone control action with mid-frequency "hinge points." Loudness compensation circuits incorporated in the Advent 300 provide both bass and treble emphasis at progressively lower master volume settings, as illustrated in Fig. 9. Unweighted signal-to-noise ratio at the high-level (AUX) inputs measured 81 dB below rated output, while residual noise at minimum volume measured 84 dB below rated output.

### Listening and Use Tests

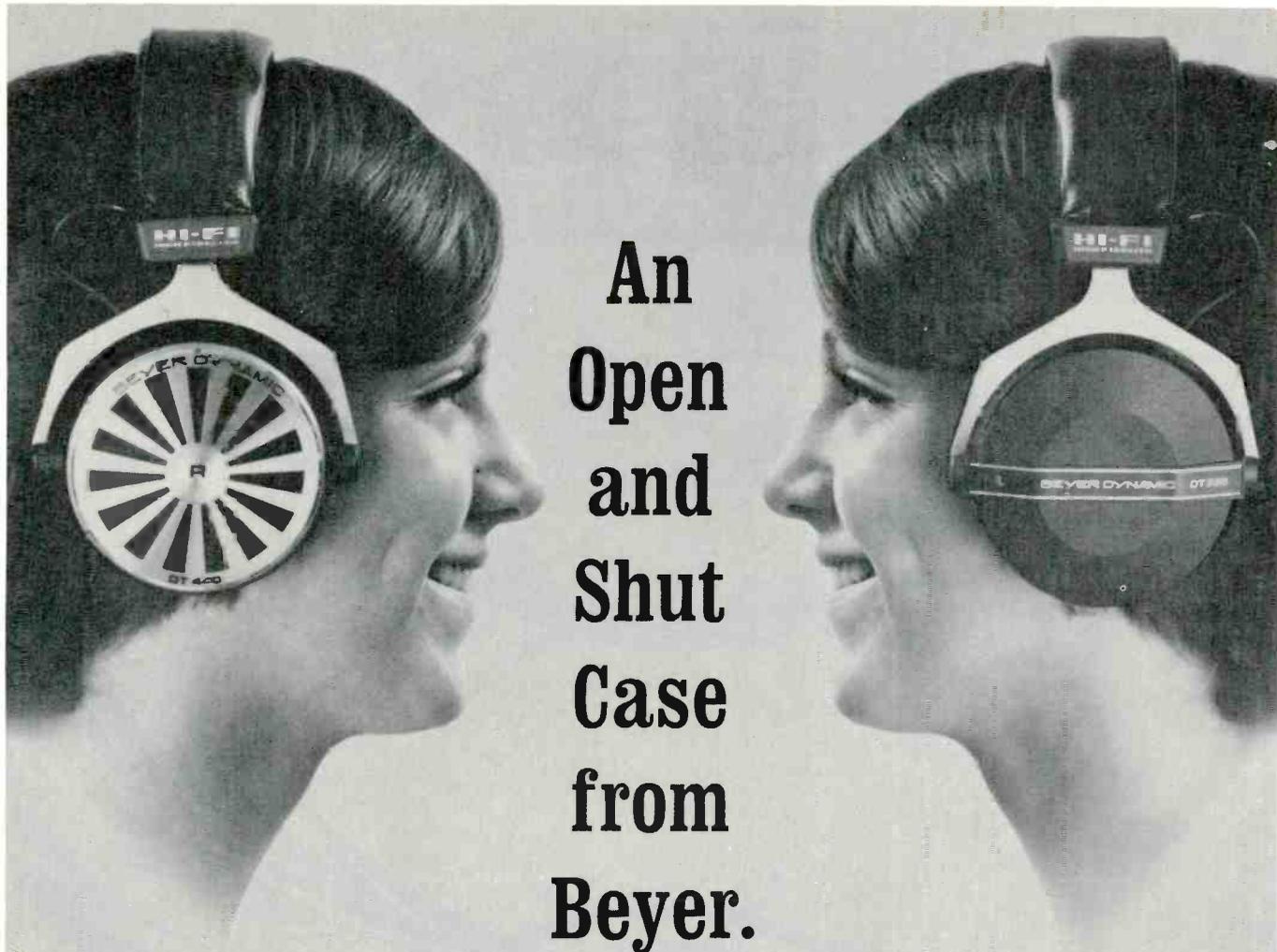
If one had to rate the three sections of this little receiver in order of merit, the preamp-equalizer section would win first place. So long as listening levels were kept within bounds, the performance of this newly engineered preamp-equalizer is superb. There was no feeling of "peaked" response between 10 and 15 kHz, where improperly loaded cartridges normally tend to exhibit distinctly audible resonances. Transient response during phono playback seemed limited entirely by the cartridge being used rather than by the preamp-equalizer electronics of the receiver, and we were able to detect greater differences between cartridges using this preamp section than is typically the case. To realize the full potential of this preamp section, it is important that a high quality pickup be used—even if its cost seems out of balance with respect to the cost of this receiver or your other matching components.

Next in order of preference we would rank the FM tuner section. Advent has managed to balance the elements of this tuner circuit (front end, i.f., and stereo decoder) to obtain the best performance possible within the constraints of the receiver's selling price.

While we would agree with Advent that the low power output of the Model 300 produces greater "loudness" than the numbers would suggest, we do not agree that the power output is truly adequate for use with low-efficiency acoustic suspension speaker systems if you seek truly big sound. Fifteen watts or a bit more, power band limited to 40 Hz at the low end, still sounds like just about that power level, and big sound lovers are urged to couple the receiver to high-efficiency speaker systems which are reasonably plentiful these days.

Since, so far as we know, the preamplifier circuitry contained in the Model 300 is not available elsewhere, perhaps the best way to enjoy big sound with the 300—if this is your aim—is to follow one of Advent's own suggestions: Use the Advent 300 as a tuner-preamp to feed its fine phono and FM signals to a more powerful basic amplifier! *Leonard Feldman*

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# The Column



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**One of Those Days in England (Bull-inamingvase):** Roy Harper  
 Chrysalis CHR 1138, stereo, \$6.98.

Roy Harper's second Chrysalis album is a beautiful, intricate, and lofty production. Recorded on a remote truck at his sheep farm in northern England, the album is an examination of old values in a changing world where they might or might not apply. The title track (in 10 parts) completely covers side two as well as the beginning of side one. (Editor's Note: I always knew musicians couldn't count!) It is a love story both of a woman and a country with a great history of tradition. It is a rambling, picaresque epic with bright, dynamic production.

The other four songs on the first side are among Roy's finest. The theme of harmony with one's sur-

roundings runs throughout them. *These Last Days* is dreamy and drifting. *Cherishing the Lonesome* alternates between acoustic and electric metal passages with the greatest of ease. *Naked Flame* is a lovely piece that hints both musically and lyrically at *Bob Dylan's Dream*, one of the very best songs of lost friendship. To close the side, *Watford Gap* is a giggle, a welcome break from the intensity of the rest of the set.

Harper has long been a musician's favorite in England. The likes of Led Zeppelin, Pink Floyd, and Paul McCartney's band Wings (who put in a cameo appearance) have all publicly paid tribute to him. Here his singing is at its strongest ever, production techniques at their peak, and his songwriting at its most inspired, both incisive and touching without the bitter-

ness that has sometimes characterized his work in the past.

Roy Harper will challenge you and soothe you. He is an artist of considerable substance. M.T.

Sound: A Performance: A

**In The Falling Dark:** Bruce Cockburn  
 True North ILTN 9463, stereo, \$6.98.

Among the myriad songwriters, some few matter as poets: Dylan, Joni Mitchell, Leonard Cohen, and Van Morrison immediately come to mind. Canadian Bruce Cockburn is another. Throughout his six previous albums is a consistently high level of personal commitment and quality, and provocative music. At present none of these first six are available in the U.S., although two did appear here about five years ago.

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Today, U.S. Patent 3,424,873 is embodied in the Ohm F coherent sound loudspeaker. (Incidentally, a second U.S. patent, no. 3,935,402, has recently been issued for the voice coil used in the Ohm F).

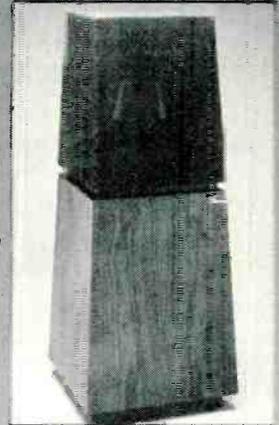
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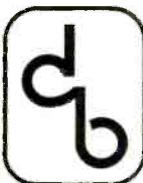
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The seventh, **In the Falling Dark**, has been issued here. It is, at least, the equal of any of the others. For starters, take *Lord of the Starfields* which moves from a riveting "whoosh" phase effect opening into a little cosmic psalm that others have told me reminds them of Gordon Lightfoot. It sounds like Cockburn to me.

*Vagabondage* written and sung in French is an exuberant number about drifting. *In the Falling Dark* is itself an evocative poem that features a brilliant and concise acoustic bass solo. One line won't quit running around inside my head—"The world fades away like an overheard remark." *Little Seahorse* is a lot like those little nature songs Donovan used to make up but without a shred of his cloying coyness. *Water into Wine* is a dazzling acoustic guitar solo workout which closes out the first side. That kind of number tends to appear at least once on a Cockburn album.

*Silver Wheels* opens side two with a kaleidoscopic declamation and a melody similar to Dylan's *It's Alright, Ma. Giftbearer* is another instrumental featuring the album's ensemble, particularly trumpeter Fred Stone, in a wispy Jobim groove nicely layered. It also features some of the album's trickiest production. *Gavin's Workpile* is an eight-minute song, performed solo, about Bruce's lifestyle—he has paced his career in Canada where he is quite popular so that he can travel from gig to gig with his wife Kitty and dog Aroo in their camper. The song is a landscape under a gray sky. The lively, optimistic *I'm Gonna Fly Someday* follows. Last is *Festival of Friends*, an opening farewell.

Eugene Martynec, long a musical associate of Cockburn, is the album's producer, and his work is classy, as personal as the artist, yet warm and open, greeting the listener and gently carrying him to that special place.

One word I don't throw around lightly is "art." Bruce Cockburn is one of the very few writer/musicians who deserve the title "artist." He is a superb wordsmith and guitarist who knows what he wants and how to get it on his records. That he is an unknown south of Canada is almost criminal. But **In the Falling Dark** is fine enough to change all that. M.T.

Sound: A — Performance: A+

**Islands:** The Band

**Capitol SO-11602**, stereo, \$7.98.

The Band has always been one of those groups whose music got me

emotionally involved, and now their last studio album together **Islands** is out (hark the soft sound of an era ending), their music becomes a cherished memory, the album a legacy.

**Islands**, however, is not likely to be a very significant part of the legacy. It's pretty average stuff. The once fiery poetry of Robbie Robertson is more like glowing coals slowly dying.

Technically, **Islands** is not terribly bright, on my review copy the second side is shoddily done with a serious amount of hiss and noise.

So The Band ends with a whimper and not the bang you might have hoped for. And the last words are "Livin' in a Dream." M.T.

Sound: F — Performance: C+

**Thunderbyrd:** Roger McGuinn  
**Columbia PC 34656**, stereo, \$6.98.

After the commercial failure of his excellent **Cardiff Rose** album, Roger McGuinn has returned to the comfort and security of the stripped-down airflow rock & roll band which he is currently gigging with out on the road. They are called Thunderbyrd, but they are not that different from the later Byrds or the pre-Rolling Thunder outfit called Roger McGuinn & Band. In short, your basic band.

Their album includes a Peter Frampton song *All Night Long*; the obligatory, previously unheard, Bob Dylan song *Golden Loom*; four originals, and assorted other covers. Thunderbyrd never approaches the full-throated sound of **Cardiff Rose**. The passion that fired that album is a mechanical off-handedness on **Thunderbyrd**. Even the Dylan song *Golden Loom* pales next to **Rose's Up to Me**.

Only the parting shot *Russian Hill* really connects. That song about a San Francisco love story seems to reflect directly on McGuinn with its final words, "It's not the singer, it's the tune." Sorry but **Thunderbyrd** sounds predoomed to obscurity. M.T.

Sound: B — Performance: C —

**Sleepwalker:** The Kinks  
**Arista AL 4106**, stereo, \$6.98.

With **Sleepwalker** the Kinks have put behind them (at least for now) the series of concept albums that occupied most of their energy during their stay at RCA. Again they are a song band. **Sleepwalker** doesn't even have a lyric sheet, it does have the fullest sound they have ever had on record, something nearing an Electric Kinks Orchestra kind of sound.

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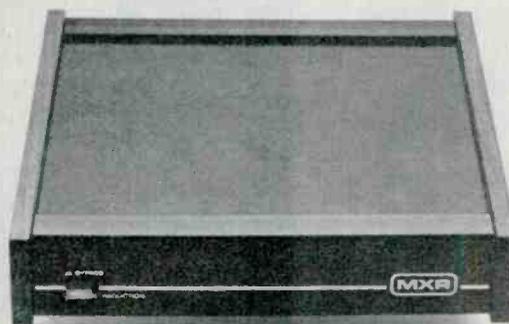
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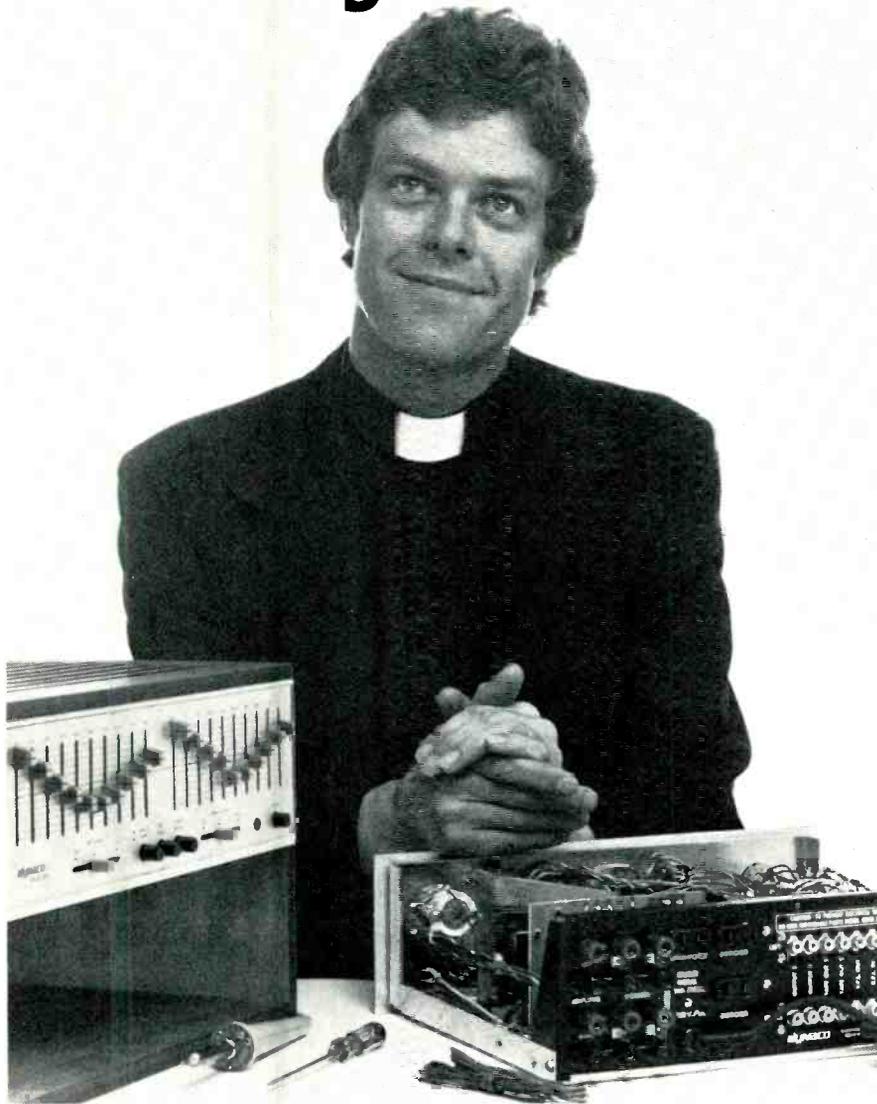
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Certain of **Sleepwalker's** songs echo earlier Ray Davies' songs. After nearly 25 Kinks albums, though, you can put that down to style, for Davies' songs are distinctively his own. We've heard the menace of *Sleepwalker* and *Full Moon*, the anxiety of *Brother*, and *Life on the Road* many times in Kinksongs, but rarely so guilelessly, so utterly lacking pretense.

**Sleepwalker** is a refreshing album. The Kinks nearly ended from the strain of coming up with fresh concept albums and live shows. Now, more than ever, they are a band of survivors stripped down to lean essentials, and they have drawn new strength and joy from the experience.

M.T.

Sound: B

Performance: B+

**I Came to Dance:** Nils Lofgren  
A&M SP-4628, stereo, \$6.98.

Exactly a year ago in these very pages I predicted that **Cry Tough** would be the album to put Nils Lofgren over the top and graduate him from a cult hero to a star. Didn't happen though. Sad to say, if **Cry Tough** couldn't do it, **I Came to Dance** is not very likely to make the big dent either.

The album's a good one though. The title track is a solid rocking intro, if a trifle hokey. It sets the album's pace and re-establishes Nils' arch punk persona, that "Okay, step over this line" attitude. *Jealous Gun* may step out with classy criss-cross backing voices, and it may be hard to ignore the cover of the Stones' *Happy*, but as a whole **I Came to Dance** is samey and monolithic. It lacks **Cry Tough's** dimension.

M.T.

Sound: B

Performance: C+

**Right Place, Wrong Time:** Otis Rush  
Bullfrog 301, stereo, \$6.98.

Why it took six years for this great Otis Rush session to appear on record is way beyond me. Otis has rarely been in such exuberant form. The set ranges from blues like *Tore Up* and *Natural Ball* through some Rush originals to a straight R&B song *Rainy Night in Georgia*, which Otis does beautifully. Throughout Otis Rush gives a passionate performance and pushes the band to some serious cooking. **Right Place, Wrong Time** is an exemplary blues album; if you can't find it, write to Bullfrog Records at P.O. Box 635, La Habra, CA. 90631.

Michael Tearson

Sound: B+

Performance: A

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# The bookshelf

Bert Whyte

**Sound Recording** by John Eargle  
Van Nostrand Reinhold, 1976, 327  
pages, \$22.50.

**The Recording Studio Handbook** by  
John M. Woram  
Sagamore Publishing Co., 1976, 496  
pages, \$35.00.

**Sound Recording Practice** edited by  
John Borwick  
Oxford University Press, London,  
1976, 440 pages, Approx. \$28.00.

Because of the phenomenal growth of the audio and recording industries in the past decade and the intensive coverage of their activities in various media, recording engineers and record producers have become glamour symbols in today's society. A glance in any issue of the *Journal of the Audio Engineering Society* will verify the large influx of student memberships from young people who have aspirations of becoming recording engineers. For the most part, these young people are students enrolled in audio courses in the Institute of Audio Research and the Recording Institute of America; the British equivalent is the recording course offered by the University of Surrey. One has to admire the diligence of those who put together these school curriculums.

Anyone familiar with the literature of Audio can appreciate how difficult it must have been to extract suitable subject matter from the vast body of audio information. To my knowledge, up to now there have been no comprehensive textbooks on the art and science of sound recording. This lack has undoubtedly imposed certain strictures on the faculties and, more importantly, severely limited the student's supplemental reading. By sheer coincidence, the three books listed above were all published within a few months of each other during 1976, and I am sure they will quickly be incorporated into the curriculums of these and similar institutions.

While these three books will no doubt bring aid and comfort to the beleaguered students, the tutorial as-

pects of the books are more by-products than the main works of the authors. These volumes are intended as source books, as comprehensive references covering the complete spectrum of sound recording and engineering, and, as such, they are directed to the practicing recording engineer and to the more enlightened, inquisitive, and intelligent record producer. I want to particularly emphasize that these books are not all that technically formidable and can be read to great advantage by the growing numbers of amateur recordists and, of course, by that ubiquitous group, the "advanced audiophiles." I hasten to add that these books are not "cookbooks." Be you a student, graduate, or audiophile...there are no "pat" formulae here, and no matter how assiduously you study these books, they won't turn you into a recording engineer. Those who aspire to this estate must still go through the time-honored ritual of serving an apprenticeship in a recording studio. If you are lucky enough to make such a connection, you'll start out as a "floor sweeper" and "go-for" (the British call them "tea-boys"). Then if you're bright enough and have a kind and indulgent mentor, you'll make progress.

Okay, this has been enough of a preamble. Because of format and orientation, I will review the Eargle and Woram books together, and then get on to the British volume.

First off, a look at the credentials of the authors. John Eargle holds several degrees in engineering and music, was with the quality control department of RCA Records, and then went on to become Chief Engineer for Mercury Records. For his activities in the audio and recording industries, he was elected a Fellow of the Audio Engineering Society and is a past president of the AES. He is presently Vice-President of Product Development for JBL. John Woram is also an alumnus of the quality control department of RCA Records, held several other posts with that company before joining the recording department where he

made albums with such artists as John Denver, The Guess Who, and Neil Sedaka. After a period as Chief Engineer for Vanguard Records, Mr. Woram formed his own company, Woram Audio Associates specializing in recording and studio systems design. Mr. Woram is also a Fellow of the Audio Engineering Society and a former regional vice-president of that group. He is Associate Editor of *db* magazine and lectures extensively on audio subjects in such universities as Brigham Young, Syracuse, and Miami. Quite obviously, both Mr. Eargle and Mr. Woram are eminently qualified experts in their field.

Both authors write in a clear, concise, easy-to-read style, and their books are especially well organized. Illustrations are plentiful and well chosen. John Eargle begins his book with a discussion of the physical aspects of sound, and then goes on to the best exposition of psychoacoustics I have ever read. In his extensive survey of stereophonic sound, the theoretical and operational aspects of this subject are so well done, it should be required reading for every recording engineer and will be a real eye-opener for the audiophile. His dissertation on quadraphonic sound is equally rigorous, with especially lucid descriptions of all the matrix systems, as well as discrete CD-4. John Woram also starts out with the basic aspects of sound, with a particularly well done in-depth study on the mysteries of the decibel and its applications in recording with VU and peak reading meters. Both authors explain the various type of microphones, aspects of their design, especially their coverage as shown by excellent polar pattern diagrams. It could be said that John Eargle takes a more theoretical approach to this subject, while John Woram gives more on applications and recording set-ups. John Woram's review of microphone placements for recording various groups and instruments is especially valuable. It should be noted that Mr. Woram describes the microphone types that should be

used in a particular recording situation, but he avoids any hard and fast "cookbook" ideas. He has a decided aversion to such notions as "take one Neumann, mix in some AKG, and season lightly with Sennheiser."

Both books give extensive coverage to the various types of loudspeakers and their suitability as recording room

monitors. John Eargle goes into the importance of monitor room equalization. The authors' sections on recording consoles are very explicit, with good block diagrams showing signal flow from input, through the myriad processing techniques, to output. All control functions are explained, with John Woram's perhaps the

more detailed, while on the other hand, John Eargle guides us through the complexities of automated mix-down techniques using the Allison and Quad-8 Compu-mix systems.

At this point, someone is sure to say that since both of these books cover the same subjects, won't one book suffice? It goes without saying that making such a choice is up to the individual. Most certainly there are inevitable areas of overlapping information and redundancy. But there are not as many as you might suppose, and essentially these books are complementary. It is also very valuable to have two such expert opinions and the differing treatments of various subjects. There is also the matter of emphasis which each author gives to a certain subject. Eargle goes deeply into stereo theory and quadrasonic sound, Woram touches lightly on stereo theory and not at all on quadrasonic sound. Woram is very strong on microphone set-ups, Eargle is less so. Eargle has a section on disc cutting which reveals the complexities of this subject, and this portion should be read by every audiophile who wants a clear exposition of this process. John Woram does not cover disc subjects. On the other hand, Woram furnishes a superb glossary, which is very detailed and an education in itself. Eargle does not furnish a glossary. And so it goes....

Both books provide in-depth coverage, according to each author's viewpoint, on virtually every aspect of recording science. Signal processing, through the use of compressors, limiters, expanders, equalizers, digital delay, Dolby, and dbx noise reduction systems, and the use of echo and reverb, are all clearly presented. Magnetic tape as a medium and the inner workings of tape recorders are also explored. In this respect, John Eargle covers such esoterica as automatic indexing and address codes for electronic editing, while John Woram gives an invaluable detailed procedure for tape recorder alignment. Actual recording session set-up and practices are given a most thorough treatment by both writers. The techniques of over-dubbing and the use of "sel-sync" are made clear. The complexities of multi-channel recording, switching and bouncing of tracks, and track alignment are explained. John Woram concludes his book with how to handle the mix-down session. John Eargle ends his book with a detailed run-through of record processing. Eargle's book has appendices of useful equations and

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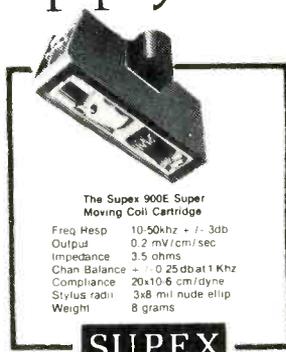
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mathematical relationships, and tables of absorption coefficients. Woram's appendices include the aforementioned glossary, the complete NAB magnetic recording standards, tables of conversion factors (i.e. Maxwells to Webers), and tables of logarithms. In summation, both authors have written fine books, each a much needed addition to audio literature and invaluable source books which can be read with profit by anyone interested in the field of sound recording.

The British book, **Sound Recording Practice**, edited by John Borwick, the esteemed audio writer for the *Gramophone*, is quite different in format from the Eargle and Woram books. It is actually a collection of essays on the various aspects of recording practice by experts in a particular audio discipline. It was compiled by the British organization, the Association of Professional Recording Studios. As you might expect, there is a certain amount of British orientation that might seem strange to us Yanks, but it is not any particular detriment to the overall usefulness of the book. The book covers much of the same ground as the Eargle and Woram books, but in greater or lesser degree of detail or emphasis. It is perhaps inevitable that with the multiplicity of authors, some subjects fare better than others. However, there is some formidable talent here...certainly no one can dispute the expertise of the redoubtable Angus McKenzie in matters of magnetic tape and tape recording. There are things in this book not covered by the American volumes, for example the use of mobile recording trucks, on-location recording, tape duplication, and electronic and synthesized music recording. There is good coverage on disc cutting and more especially disc processing from the British viewpoint. The allied mediums of broadcasting, TV, and film recording are also covered. There is a good section on acoustics and studio sound treatment. There is also a most interesting section on classical recording, and a discussion on the use of the Blumlein technique of co-incident pair microphones for stereo versus the spaced-array technique. All in all, this is a book with many virtues, but without the personal approaches of the Eargle and Woram books.

With such a general paucity of books on sound recording, all three volumes will probably grace the shelves of most recording engineers; and for the audiophile who really wants to be "in the know," the Eargle and Woram books are indispensable.

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# Folk bag

Tom Bingham



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**Chulas Fronteras:** Original soundtrack recording  
**Arhoolie 3005**, mono, \$6.98.

Chulas Fronteras ("Beautiful Borders") is a documentary film, produced by Arhoolie's Chris Strachwitz and directed by Les Blank (whose previous credits include films on blues and Cajun music), which shows Norteño music in its social context.

This soundtrack album contains 46 minutes of music from the 58-minute film, by several of the Texas-Mexican border area's "living legends." Apart from its inherent entertainment value, the album presents a panoramic view of South Texas Chicano music from the string-band roots to the present-day electrified conjuntos.

Included are new recordings by two of the greatest accordionists of the late 1930s and 40s, Narciso Martinez and Santiago Jimenez. Jimenez plays a short German-style polka, *Cotula*, while Martinez performs the aptly-titled *Muchachos Alegres* and a lovely

mazurka, *Luzita*, with all the spirit of his early classics, his fingers having lost only a little of their dexterity through the years. The ever-popular singer-guitarist Lydia Mendoza, a regional superstar for over 40 years, is heard in a powerful, emotion-packed club performance, in which no attempt has been made to filter out the crowd chatter, shouts, applause, etc. which occasionally drown her out—talk about authenticity!!

The compact Norteño conjuntos which sprang up in the late 40s and dominated border music throughout the 50s are represented by Los Alegres de Teran and Los Pingüinos del Norte. It was Los Alegres who first developed the conjunto format some 30 years ago.

In the film they sing two soulful (no pun intended) rancheras, *Prenda Del Alma* and *Volver, Volver*. Los Pingüinos, a long-time Strachwitz favorite (their album of corridos, LP 3002, was Arhoolie's entry into the Norteño

market), are one of the finest groups in Texas, spotlighting springing accordion by Ruben Castillo over a very infectious rhythm backdrop—Hilario Gaytan on guitar and Ricardo Escalante on bass. Besides their own three contributions to the album (including their *Corrido de Cesar Chavez*), they also accompany Rumel Fuentes in an uninhibited workout on Doug Sahn's *Chicano*, a salute to "brown pride."

The ongoing corrido tradition is symbolized by Ramos y Ramirez 1920's string-band 78, *Corrido de Texas* (also reissued on Folklyric 9004, **Texas-Mexican Border Music, Vol. 2**) and the more recent *Rinches de Texas* (not the famous "Texas Rangers" cowboy song, but a ballad concerning a 1967 melon strike), by Duetto Reynosa.

Norteño music is brought up to date by Flaco Jimenez (the son of Santiago Jimenez), the dominant figure on the modern conjunto scene. Flaco's masterful interpretation of La

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Nueva Zenaida helps to explain his current position; between verses, he spins out imaginative lines which stretch the limits of Norteño music far beyond an outsider's expectations. On *Un Mojado Sin Licencia*, he takes risks a rock musician would consider much too chancy, and makes them sound perfectly logical.

Considering that most of the tracks were cut not in a studio but *in situ*, at cantinas, dances, barbecues, homes, and the like, the mono recording is admirably clear and atmospheric. The pressing is quite noisy, though it affects the music only on rare occasions.

Tom Bingham

Sound: B — Performance: A — to A

**Had Your Gritz Today?:** George Gritzback

**Kicking Mule KM 126**, stereo, \$6.98.

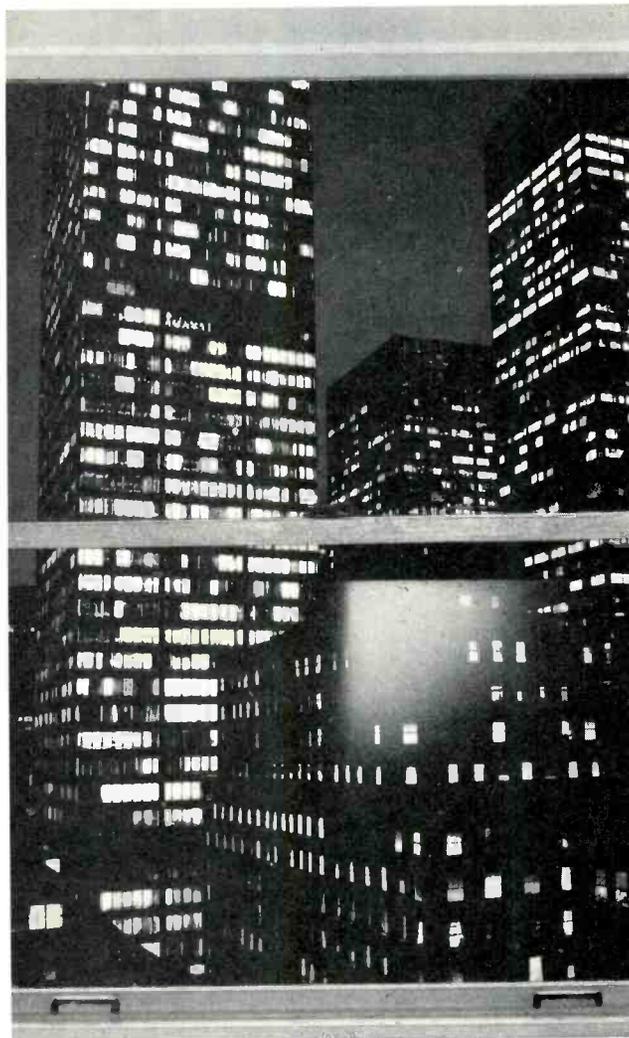
George Gritzback is a Cape Cod-based singer-guitarist working in the jaunty East Coast raggy-blues vein of Rev. Gary Davis, Blind Blake, Blind Boy Fuller, and their ilk.

Unlike most young neo-country-bluesmen who are content to reproduce songs they learned from old 78s, Gritzback writes most of his own material. Much of it falls into the "off-beat novelty" category *Great Green Bees*, *Georgia Town*—lightweight, but humorously likeable and with a decidedly unique perspective. His best songs are *Audition Blues*, a clever rag concerning the travails of a non-commercial performer trying to make it in showbiz ("the police are the only ones booking me"), and a more serious impressionistic tribute, *Ballad for Reverend Gary Davis*, with a laid-back, jazz-tinged air, featuring the moaning harp of Mike Turk.

Gritzback also shows good taste in picking outside material, such as Rev. Davis' *She Ain't Crazy*; John Miller's blues-based, Fahey-esque guitar solo, *Skippin' Thru the Tall Grass In the Moonlight*; and the infectious *Charlie Stone*, complete with trombone imitation. Best of all is a hard, pungent interpretation of Robert Johnson's Delta classic, *Kind Hearted Woman*, a far cry from the cheerful North Carolina blues-rags that dominate the album.

Gritzback's finger-picking on both six- and twelve-string is very impressive; full-textured yet not flabby, agreeably melodic without unnecessary frills, and with firmly pumping bass rhythms propelling tracks like *Tired of Being Mistreated* and a toe-tapping original instrumental, simply entitled *East Coast Blues*. While he

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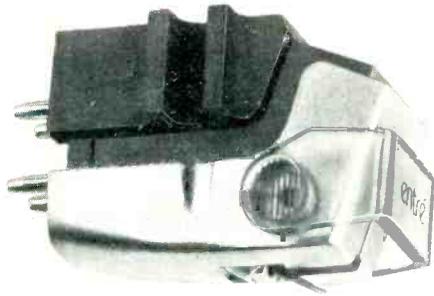
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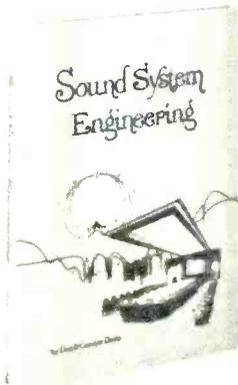
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**Sound System  
Engineering**

by Don and Carolyn Davis

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isn't exactly the world's most thrilling singer, his highish, gritty voice is quite effective in its sportive context.

The recording is acceptable enough, though it would have benefited from a greater spread of the guitar sound. There's some surface noise, but nothing prominent enough to worry about.

All in all, George Gritzbach is a highly entertaining performer, and this debut album is a satisfying and tasty platter of harmony Gritz. Available from Kicking Mule Records, Box 3233, Berkeley, CA 94703.

Sound: B — Performance: A —

**Bunk and Becky Pettyjohn  
AFF 33-4, stereo, \$7.00.**

While much time and effort have been expended in documenting the music of the rural south, the Anglo-American traditions of the rest of the U.S. have only recently begun to be explored to any large extent. For example, if the average person gives any thought to nonethnic folk music in Arizona, it is most likely in connection with cowboy songs (itself a genre currently under exhaustive re-examination).

But on this disc we have 75-year-old ex-Texan Bunk Pettyjohn, who has spent the last 48 years in the tiny community of Clay Springs in the White Mountains of east-central Arizona. A substantial portion of Pettyjohn's repertoire coincides with that of his Southeastern counterparts, but his five-string banjo style has no exact parallel in the south or anywhere else that I know of. His playing is so unusual, it makes one wonder whether he's an isolated one-of-a-kind case or a part of a larger, perhaps even flourishing tradition that has somehow escaped researchers who automatically equated Arizona with cowboy lore.

Unlike Appalachian clawhammer banjoists, who add auxiliary notes, chords, and fills to a tune until it often becomes difficult to distinguish the melody from the "extras," Pettyjohn spotlights the melody upfront—picking rather than frailing, letting the auxiliary notes fall out softly, almost as an afterthought. One could almost believe there were two banjos playing, not because of the quantity of notes (which isn't large), but because of Pettyjohn's unusually clear-cut differentiation between lead and secondary parts. It's also worth noting that several of his banjo pieces are adaptations of songs not normally asso-

ciated with the instrument, such as *Blind Girl*, *Little Joe*, *the Wrangler*, and the popular gospel tunes, *Uncoloudy Day* and *When The Roll's Called Up Yonder*. On *Soldier's Joy*, Bunk plays in a style halfway between his normal picking and the more common frailing technique.

Pettyjohn also plays guitar in a very personal variation on the Maybelle Carter finger-picking style. (This is easily explained, as the Carter Family became quite popular and influential in the Southwest because of their popularity on border radio stations.) Note the Carter favorite, *Wildwood Flower* and the somewhat stiffer *Little Sod Shanty* (for all intents and purposes the same tune as *Little Joe*, *the Wrangler*). He is also heard playing a frisky mandolin with dissonant high-pitched splashes on *Texas Belle* (a brisk-trot version of the tune Bob Wills slowed down and popularized as *Faded Love*) and on *Battle of New Orleans*, where he shifts to a style based on his banjo picking. On most cuts, Bunk is joined by Irene Jones, who supplies a simple yet appropriate backup, alternating a picked counter-melody with crisp strumming.

Though primarily an instrumentalist, Bunk sings on a handful of tracks in a relatively strong, flexible voice for a man in his 70s. Of particular interest is the odd way he has of almost humming the last part of a held note at the end of a phrase. The album also contains three unaccompanied vocals by his late wife, Becky Pettyjohn, who sings the famous Child ballad, *Who's Gonna Shoe Your Pretty Little Foot* and two tragic songs of the type associated with the Blue Sky Boys. Her singing includes the same sort of falsetto upsweeps employed by Arkansas ballad singer Almeda Riddle (*Ballads and Hymns From the Ozarks*, Rounder 0017). Unfortunately, Becky died before a planned second session.

The recording is very clean and bright, with an excellent balance that allows both Bunk and Irene Jones to be heard clearly. The surface is generally quieter than many major-label releases, but with occasional ticks on side two.

Available from the Arizona Friends of Folklore, Northern Arizona University, Box 5905, Flagstaff, AZ 86011.

Sound: A — Performance: B+

**Hey La Bas Pas Partout**  
Goldband GRLP-7771, part mono, part stereo, \$6.98.

**Hey La Bas Pas Partout**, a solid an-

AUDIO • June 1977

thology of Cajun recordings originally issued on 45s, covers a variety of post-1950 styles.

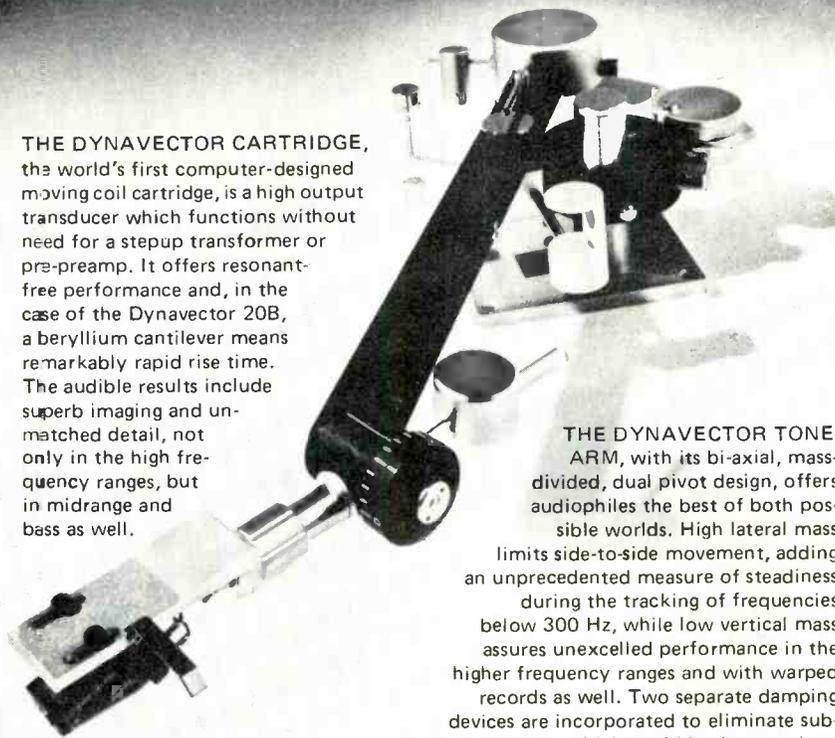
The opening *Hey La Bas* is actually an r&b/country mix, sung by one Rockin' Uncle Potts in Cajun dialect, rather than "Cajun music" per se. Apparently recorded live, it's a rough-and-tumble shouter that effectively communicates the rowdy atmosphere of a bayou barroom. *It's Me Again*, *Therese* is commercial-Cajun trivia, by ex-rock 'n' roll singer Johnny Jano. I

don't understand the language, but it seems to be a novelty tune; it's not very good in any event.

The rest of the album surveys several approaches to the "real thing." Joel Sonnier, "The Cajun Valentino," is one of the major practitioners of the modern Cajun sound, retaining the undulating French accordion and vigorous waltz rhythms of the older styles and applying them to melodies derived from country music. *I'd Like To Forget* is an excellent example,

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with a melancholy tune and mellow vocal. Sonnier's *Monkey Played Fiddle* is a strange track, as he scats along with the accordion line and injects what sounds to this non-Cajun-speaking listener like a nonsense refrain. *Cross Cut*, by Sonnier and Sidney Brown, is a relative rarity, an instrumental two-step with two accordions, one playing lead, the other a rhythmic harmony line.

Robert Bertrand is likewise a modernist, though he prefers to employ traditional melodies. *Musicians Two Step* is actually a quick-paced version of Joseph Falcon's *Allons a Lafayette* (or *Allons a Grand Basile*, as Bertrand puts it), while *Turtle Tail* is a driving update of the Hackberry Ramblers oldie. On the other hand, Bertrand's *Catch My Hat* is very contemporary, using what sounds like a clarinet in the rhythm section, while eschewing the accordion. Nonetheless, with its hard-waltz rhythm, double-stopped fiddle, and Bertrand's strident, sustained-note vocal, it remains recognizably Cajun.

Joe Bonsall (*Wedding Waltz, Tite Fille*) is much more ethnic, with the thick steel guitar lines, corrosive fiddle, crying vocals, and primitive bass-guitar whomping associated with the Cajun dance halls of the 50s and 60s. Nolan Cormier is equally unvarnished, with an old-style song, *La Valse de Meche*, full-bodied accordion, and a triangle jangling away in the background. The last track, *La Valse de Grande Chemin*, is a highly emotional performance by the late Iry LeJune, a definitive accordionist and a rough, intense singer who was one of the fathers of current Cajun music.

The sound quality is tightly restricted for the most part; if they sound like they were cut in a one-man hole-in-the-wall studio, it's only because they were. Producer Eddie Shuler, for all his valuable work in documenting the music of Southwestern Louisiana, paid too little regard to balance, clarity, or even consistency of tone (Bonsall's *Tite Fille* is the worst offender in the last regard) for too long. Tape noise, sharp trebly fiddles, and distorted vocals are not uncommon. In all fairness, it should be noted that the more recent tracks by Sonnier and Bertrand (in particular, *Catch My Hat*) are vastly improved sound-wise. Also, it's not fair to point out Shuler alone, since until quite recently Cajun music was the victim of the lowest-fi extant (believe it or not, I've heard worse than

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this!), so please bear with it.

Available from Goldband Records,  
P.O. Box 1485, Lake Charles, LA 70601.

Sound: F to C

Performance: C — to A —

**Heritage, Vol. II: Soul Stirrers  
Jewel LPS 0113, stereo, \$3.98.**

The Soul Stirrers have been at or near the top of the gospel-quartet field for 30 years, although J. J. Farley is the only original member still with the group (at least I believe he is as the group is unidentified here).

They first came to prominence as a superb a cappella group during the 1940s, achieving their most spectacular success after a young lead singer named Sam Cooke joined them in the early 50s (**The Gospel Soul of Sam Cooke With the Soul Stirrers, Vol. 1**, Specialty SPS 2116, and **Vol. 2**, SPS 2128, are essential items for any record collection). Following Cooke's departure for an even more fabulous (if ill-fated) career as a pop and soul singer, the Stirrers continued to dominate gospel behind such leads as James Phelps and Johnnie "Disco Lady" Taylor, both of whom eventually followed Cooke into the soul field. During the late 60s and early 70s, the Soul Stirrers hit their lowest point, releasing a long series of supremely ordinary LPs. Their switch to Jewel a few years back served to revitalize their music and bolster their sagging popularity as well.

The Soul Stirrers' latest album, **Heritage, Vol. II (Vol. 1** was issued about three or four years ago), is undoubtedly their best in years. At present, the lead vocals are split between a fervently growling baritone, who sparks uptempo rockers like *Resting Easy* and *The Lord Will Make A Way*, and the best Sam Cooke-style singer to emerge in years.

While this pseudo-Sam (whose name is unfortunately unknown to me) has a gruffer, deeper voice than his model, his mannerisms and soulfulness can't help but revive dormant memories of the Stirrers' greatest years. He zealously bewails *We Shall Be Free* with a carefully building and finally, a barely contained frenzy. His *Praying Ground* is an extended string of blue notes, passionately keened over a mournful harmony by the group. *He Cares* is more subtle, as pseudo-Sam intelligently toys with the song's flow. *Nearer My God To Thee*

(not the well-known hymn) sounds so much like the Soul Stirrers of old, once can almost hear the ghost of Sam Cooke singing *Touch The Hem of His Garment*, after which the present song is patterned.

*He'll Welcome Me* has the set's most traditional vocal arrangement. The melody is first sung in group harmony with succinct commentaries by the baritone growler, who proceeds to take over the lead. Halfway through, pseudo-Sam assumes the lead briefly until the growler returns over a cusion of "yes, he will"s softly chanted by the group. It's a masterful performance of a type too little heard in this day and age.

The instrumental backing (two guitars, keyboards, bass, drums) is simple, tight, and propulsive. But it's the lead singers who are most responsible for the album's success. To be sure, as professional entertainers their flaming religious ecstasy could very well be a controlled, calculated effect, but it certainly *sounds* convincing. The best gospel music has always been that which expressively communicates basic emotions, and **Heritage, Vol. II** is a display of emotions, plain and simple.

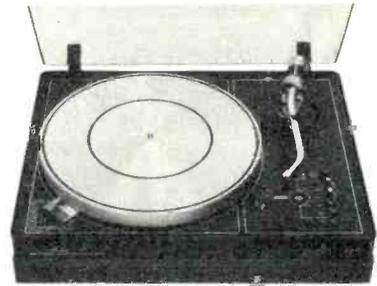
The backing harmonies have been mixed somewhat distantly. The rhythm tracks—while generally loud and clear—suffer from a fuzzy distortion at odd moments, while there's a slight flutter to the cymbals. On *He'll Welcome Me*, the vocals are similarly affected. The record surface has numerous ticks and scratches, plus a little static as well.

Like all gospel records, this may not be available in all areas, so write to Jewel Records, P.O. Box 1125, Shreveport, LA 71163.

Sound: C+ Performance: A

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# Classical reviews

Edward Tatnall Canby



128

**Gershwin: Blue Monday; Madrigal and Songs; Choral Scene from "Let 'Em Eat Cake."** Gregg Smith Singers. Vox Turnabout TV-S 34638, stereo, \$3.98.

**Scott Joplin's Treemonisha.** Original Cast Recording, Gunther Schuller. Deutsche Grammophon 2707 083, (2 discs) stereo, \$15.96.

The creation of an American opera style out of that highly European genre has always been traumatic and, for that matter, still is. Scott Joplin's black *Treemonisha* came long before Gershwin's black *Porgy*; Gershwin himself tried to write a semi-pop opera long before he made it with *Porgy* just before he died. **Blue Monday**, a "chamber opera," is a pretty sad and naive attempt and even the resourceful Gregg Smith Singers have a tough time making it believable on records. It *isn't* believable. On the other hand, it *is* Gershwin. Need more be said? Corny, dramatically dismal,

yet full of pep even so. Thank the Lord, the singers don't try to sound Metropolitan Opera but veer towards standard musical comedy style, which is much more appropriate. The date was 1922, two years before *Rhapsody in Blue*, and this was Gershwin's first try at something bigger than straight Broadway show biz.

Also on the record are some real curios, two "madrigals," sounding like Gilbert & Sullivan or something, two arty art songs, a big, talky chorus scene. All in all a worthwhile record to have around—and try your friends on those madrigals and songs!

**Treemonisha** is too famous for any big words from me at this point, but let's note that this is an all-American original cast, even on D-G, under Gunther Schuller, the Joplin man. I find this too-early black opera almost pathetically naive in its attempt to be "classical" in a big way and, as might be guessed, the best parts are those

which don't try to be anything but good black. In the very early 1900s, that idea would have been incomprehensible—not even white "folk music" was getting very far in those days, even Indian themes were made to sound like Wagner—or Dvorak—before they could get a hearing. So Joplin did his best towards a classical compromise, and who can blame him?

It's obvious from the pictures (in case you haven't seen the show) that a great deal in this production depends on the eye. After all, Joplin didn't intend it for the ear alone. So the album is best for those who know what the show looks like. Happy memories.

**Rough Trade, Live!** (Limited ed. direct-to-disc). **Umbrella UMB DD 1**, stereo, \$12.95. Available through Audio-Technica dealers.

When technical breakthroughs

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come along, barriers between classical, pop and what-have-you music just vanish. We have *recording*.

This is a note from the Classical department to say that even the classical ear can tell the difference here. I would not have believed it. The direct-to-disc sound is startlingly cleaner, sharper, more factual, than anything I have heard before, no matter what. I like this kind of kinky music, too, which helps. Classical samples in similar technique will soon be along.

I must add that "direct-to-disc" goes back to the 19th century, and was preceded by "direct-to-cylinder" on Dec. 6, 1877. The sonics may now be superb—they are—but the technique reverts to a clumsy and inflexible system that was necessary throughout the acoustical and 78-electrical eras, some seventy years, until tape came along to revolutionize our means for putting music on records. I am not criticizing the immediate goal of the direct-to-disc people. It works! It is worth it in sound. But do not forget the enormous advantages that non-direct tape recording has brought us over these years. We are not about to give them all up at this point—not, at least, in the places where music itself matters.

**Mendelssohn: Quartet in D Major. Schumann: Quartet in A Minor.** The Budapest Quartet (1959, 1961). **Odyssey 34603**, mono, \$3.98.

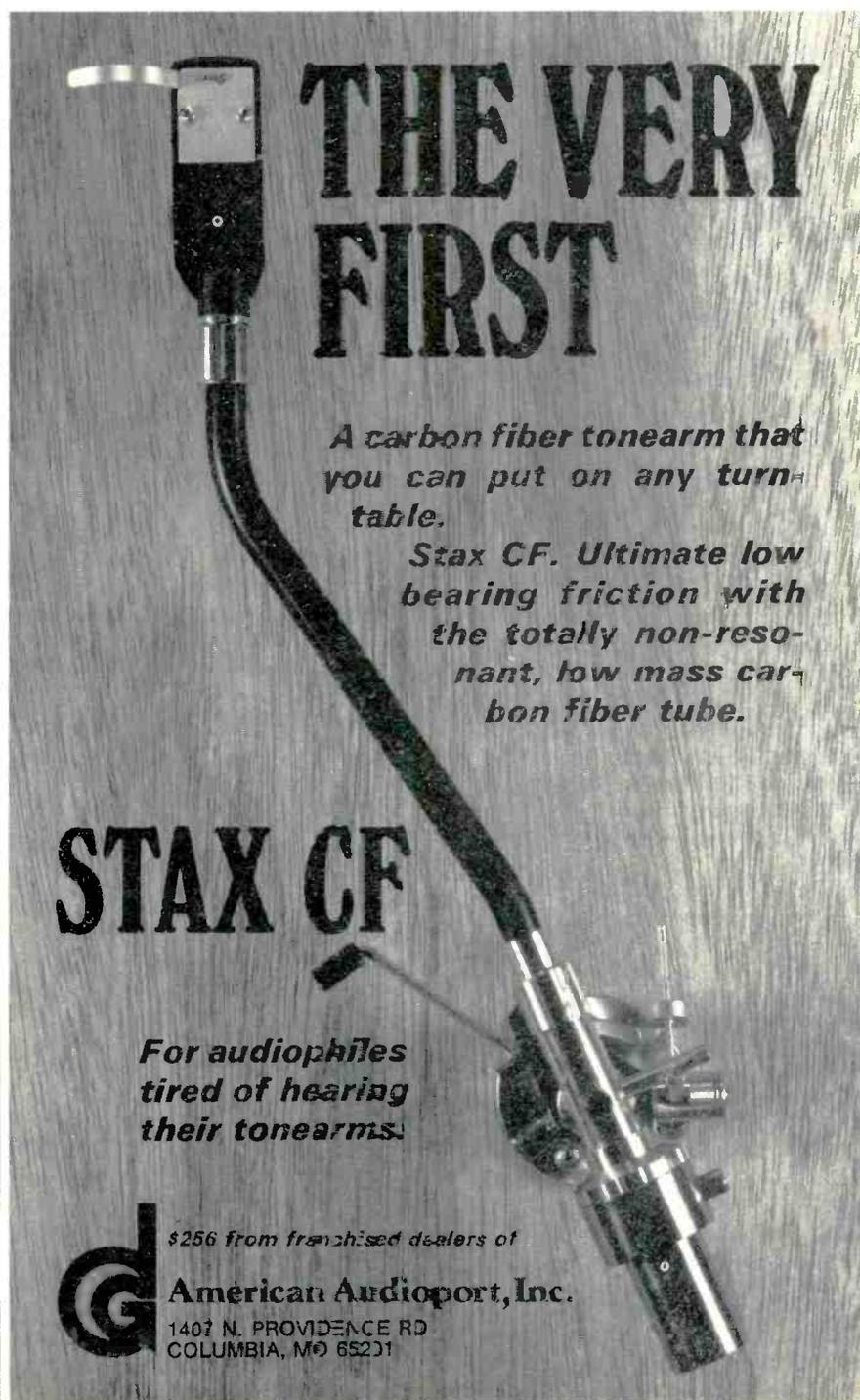
Amazing how the dead keep returning to life via records. The Budapest Quartet was surely the most powerful group of four strings to play in the last half century—though some might cite earlier groups such as the famed Lener. The performances the BQ gave, whether for records or live, still have an impact that no other group can touch. Witness this pair of live performances at the Library of Congress, taken down by the Library's equipment. (Not, if I am right, by Columbia.) This is the real Budapest, if late in the game. Such fire, such tearing intensity, and with the fire the old consummate beauty of ensemble and phrasing. All that the Budapest ever lost as the result of increasing age was a superficial accuracy. They were often strident in their later years—out of sheer continuing power of expression, the fingers unable to keep up with the minds. It made precious little difference, for those who heard music, not fingers. And it makes little difference here.

Recording? Another story. I heard the Budapest myself, earlier on, in this

very spot. The L. of C. has been negatively famous for its recording conservatism, considering what it could do if it felt like it, being, after all, the U.S. Govt. It stuck dismally to 78s long after LP; its field recordings of folk music were made on Methuselah-ancient disc recorders even when there was tape around, if I date things right. Here we have the Library in the post-stereo period. Well, to be sure, they do seem to have had tape by this time. The sound is clean enough. But stereo? Heavens—nothing as radical as

that, in 1961 as in 1959.

Moreover, the acoustics of the L. of C. hall were of the sort considered proper for the elegance of "chamber music" back in the twenties and thirties—that is, totally dead. OK for live performance, if you liked it that way (I never did). But hopelessly lifeless for any sort of recording, and especially in mono. So the Budapest plays here against considerable sonic odds and it is a wonder that even so they come through with all the old, authentic power.



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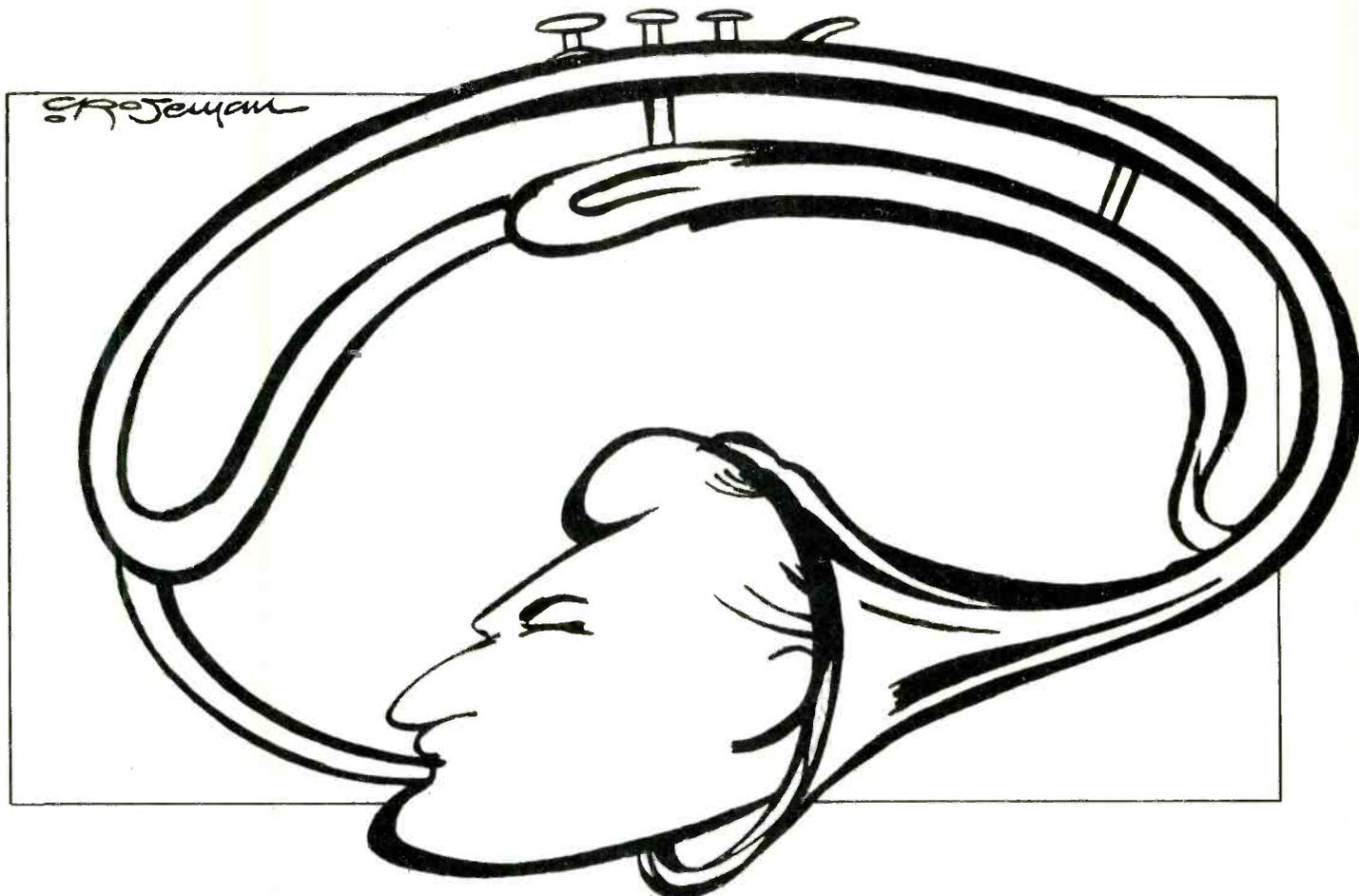
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# Jazz & blues



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**Texas Chatter: Harry James 1937-38**  
Tax m8015, mono, \$7.98.  
**The Young Harry James: 1939-41**  
Jazz Archives Ja 31, mono, \$6.98.  
**One Night Stand with Harry James:**  
1944  
Joyce 1034, mono, \$5.98.  
**Harry James & His Music Makers 1945-49**  
First Heard 9, mono, \$7.98.  
**Harry James & His Orchestra: 1954**  
Sunbeam SB-217, mono, \$6.98.  
**Radio Discs of Harry James**  
Joyce 2002, mono, \$5.98.

Harry James' boisterous, vociferous trumpet was a phenomenon of the flashy 40s. During the first five years of that decade, it was, indeed, a horn of plenty for the Columbia label. But today Columbia sits on its splendid storehouse of James recorded material, letting it gather dust in the vaults because, according to Columbia executives, James' music is no longer commercial. Yet there is a market for

James memorabilia among collectors. And when we say memorabilia we don't mean *Sleepy Lagoon* and *You Made Me Love You* which have been reissued *ad infinitum* on the many "big band greatest hits" collections. We mean true collectors items like *B-19*, *The Duke's Mixture*, *Mr. Five by Five*, *Tango Blues*, *Jeffries Blues*, *Cross Country Jump*, *Prince Charming*, *Blues in the Night*, *Let Me Up*, *You've Changed*, and *Roll Em* which could be repackaged into modestly profitable albums. But until Columbia shows some sense of obligation to collectors, this writer welcomes the "unauthorized" specialist labels like Joyce, First Heard, and Tax that are providing us with many big band rarities by James and other memorable Swing Era musicians.

Except for the few months in 1946 when he briefly disbanded, Harry James has led a big band for close to four decades. During the late 40s and

early 50s, when big bands went out of style, James hung on by cutting his price and by playing a man-killing schedule of one-nighters. Gradually he established a prosperous base in the Las Vegas-Lake Tahoe circuit. Up until the early 70s his music continued to show great vitality and a modest evolution in style. The six recordings reviewed here offer an excellent guidepost to Harry James' lengthy career.

The Horn first attracted attention as a Benny Goodman sideman. His compelling force made him stand out in a trumpet section which included Ziggy Elman and Chris Griffin. In 1938, BG encouraged his 23-year-old star to break away and start his own band. But James' first recording dates for Brunswick as a leader were made while he was still with Goodman. The Tax reissue contains all the rare Brunswick sides plus alternate takes. (These Brunswick sessions, cut in De-

ember of 1937 and January of 1938, immediately preceded the Goodman Carnegie Hall concert where James was in top form.) The James ensemble on the Brunswick dates was a pick-up band which included three quarters of the Count Basie sax section (Earl Warren, alto, Jack Washington, alto/baritone, and Herschel Evans, tenor), Basie's trumpet star Buck Clayton, Basie trombonist Eddie Durham, part of Basie's rhythm section (Jo Jones, drums, and Walter Page, bass), Basie's singer, and the sedately swinging, Helen Humes, plus Goodman's ebullient pianist, Jess Stacy. The ambience is definitely Basie-ish, utterly relaxed. Numbers like *Texas Chatter*, *When We're Alone*, *Song of the Wanderer*, *Jubilee*, and *It's The Dreamer in Me*, feature James and Herschel Evans playing lovely bursts of melody propelled by free-flowing rhythm and buoyant riffs. Humes' light, high voice is paired beautifully with Stacy's piano. A driving *Life Goes to a Party* offers ripe, mellifluous choruses by James and Evans, and *One O'Clock Jump* has never sounded so loose and flowing. Tax (it's a Swedish label) has done a splendid job of finding mint copies of the original 78 rpm's, transferring them intact, allowing us to hear the music as originally recorded with all its immediacy and clarity.

Jazz Archives' **Young Harry James: 1939-41** is not as well recorded as the Tax album, but producer Jerry Valburn, a recording engineer, has re-balanced the sound to the best of his ability. He has succeeded reasonably well with these ancient airchecks. Between 1939 and 1941, when these broadcasts were taken off the air, James and his men were scuffling, playing hungry, exciting music. Numbers like *Cross Country Jump*, *Two O'Clock Jump*, *Jeffries Blues*, and *Flying Home* are performed with tremendous precision and compelling enthusiasm. These airshots also show James attempting to broaden his appeal, first with the hiring of young Frank Sinatra (two Sinatra selections are included) who breathed ballads to impressionable young ladies, and then with the addition of a string section and singer Helen Forrest. (Later the James/Forrest/strings combination resulted in such monster hits as *I Don't Want to Walk Without You* and *I've Heard That Song Before*.) On the Jazz Archives broadcasts, we are treated to Forrest's sensitive readings of *The Man I Love*, *Will You Still Be Mine*, and *I Got It Bad*.

**One Night Stand with Harry James: 1944** shows that an aircheck can be a

wonderful thing if it is taken of the right band at the right time. The well-recorded Joyce release showcases the James band at the peak of its success. The fierce, virtuoso power of the leader's horn and the sledgehammer drive of the ensemble are caught beautifully on *Back Beat Boogie*, *Two O'Clock Jump*, *Jump Town*, and *Jiggers*. On the sweet side, ballads like *Wrap Your Troubles in Dreams*, *I'll Walk Alone*, and *I'll Get By*, are handled tastefully by Kitty Kallen and Buddy DeVito.

There are more jolts of excitement on First Heard's **Harry James and His Music Makers: 1945-49**. During this

period, one of decline for most bands, James dumped his strings and worked his way back into the graces of the jazz critics. This collage of west coast airchecks shows why. By 1945, the James orchestra boasted such soloists as altoist Willie Smith, trombonist Juan Tizol, and, of course, James' long-time tenor man, Corky Corcoran, it's brass section was second to none, and drummer Buddy Rich was soon to join the rhythm section. The pulsing selections heard here—*King Porter Stomp*, *Eight Bar Riff*, *Six, Two, and Even*, *Snooty Fruity*, *Bluebeard Blues*, *'Cept February Which Has 28*, *Block Party*, and *There They Go*—

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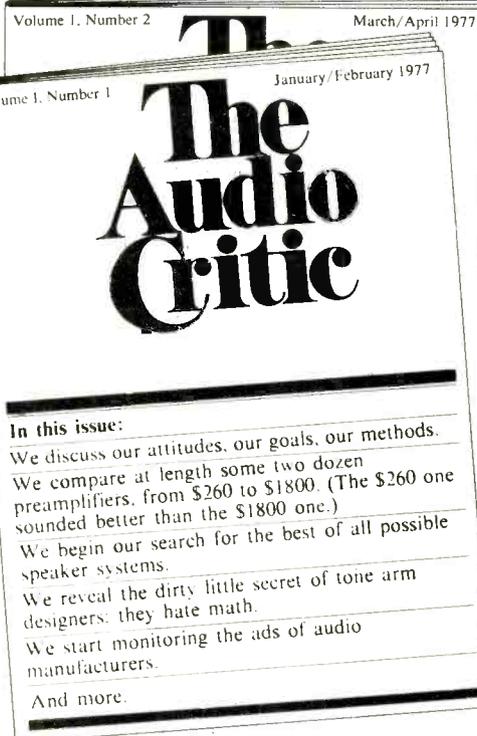
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represent a roaring reaffirmation of James' jazz roots. His intense solos now feature boppy runs and flourishes, and as always, have great agility and drive.

The later tracks on the First Heard Lp also reveal a Basie touch that was beginning to assert itself. Beginning in the early 50s and through the 60s, James began to utilize Basie arrangers like Neil Hefti, Quincy Jones, and Ernie Wilkins so that his band had, and still has, a contemporary Basie ensemble sound. Unfortunately Sunbeams's dismally-recorded **Harry James and his Orchestra: 1954** barely hints at the power and excitement of James' 50s band. Joyce's **The Radio Discs of Harry James**, on the other hand, made up of transcription material from the 50s, offers decent sound and vigorous performances of *Sugarfoot Stomp*, *Easy, Six, Two & Even*, *Flash*, and *Caxton Hall Swing*. Since these transcriptions were cut as radio filler material, James had to record an obligatory set of ballads, and tunes like *Embraceable You*, *Autumn Leaves*, and *How Deep is the Ocean* are smoothly played. There's a singer, Paula Gilbert, and, like most post-Swing Era band vocalists, she is quite ordinary, certainly no Helen Forrest.

John Lissner

### Texas Chatter

Sound: A Performance: A

### The Young Harry James

Sound: B Performance: A

### One Night Stand with Harry James

Sound: A - Performance: A -

### Harry James & His Music Makers

Sound: A Performance: A+

### Harry James and His Orchestra: 1954

Sound: D Performance: B+

### Radio Discs of Harry James

Sound: B+ Performance: A

**Carnival:** John Handy  
**Impulse AS-9324**, stereo, \$6.98.

The hit single and album **Hard Work** ended years of self-imposed exile from the commercial recording world. Imagine my dismay when its successor **Carnival** appeared with Handy, one of my 60s jazz heroes, dressed for the cover shots in court jester regalia, posing quite literally as a grinning fool.

Now, dig, I was at one of Philadelphia's rock radio stations working on a tape when one of the jocks came

in bearing the album which I had not yet heard. He says it had this song *Watch Your Money Go* which was a ringer for **Hard Work**. I reply, "Denny, I've not heard it yet, but does it go, 'Watch your money go, bum bum bum, watch your money go, bum bum bum?'" "That's it exactly," he says.

The lack of surprise or innovation is consistent. **Carnival** is an excellent example of pop jazz, mellow and diverting if not shattering. But you really can't fault the guy for wanting to eat better.

Michael Tearson

Sound: B - Performance: D+

**My Spanish Heart:** Chick Corea  
**Polydor PD-2-9003**, two discs, \$9.98.

**My Spanish Heart** is Chick Corea's first released work since the break-up of his fabulously successful group, Return to Forever. Most directly, the disc is the successor to last year's solo album **The Leprechaun** both in form and direction. As on that album, Chick utilizes a whole battery of keyboards but bases the disc on his acoustic piano work for unity.

Within the striking cover shots of Corea of matador garb is music inspired by a recent vacation in Spain. Touches of flamenco are nearly everywhere and are matched to truly evocative melodies. Effortlessly Chick moves from solo piano pieces, reminiscent of his classic ECM **Piano Improvisation** album, to horn-driven synthesizer showcases. The first side alone includes such diverse elements as acoustic solos, a string quartet, flamenco dance effects, ever-brilliant acoustic bass work by Stanley Clarke, and even a Ricky Ricardo style brass arrangement. Later **Armando's Rhumba** features Stanley and Chick with Jean-Luc Ponty's expressive violin work.

Chick Corea has been recognized as a premier keyboard artist for over a decade. **My Spanish Heart** is clearly one of his very finest works. It covers the full spectrum of his talents and interests perhaps better than ever before in one album. Even played all the way through, four sides end to end, the album never flags interest or bogs down into mire.

One additional note, the recording has an especially crisp sound, catching every acoustic nuance, never muddying up the album's swooping dynamics. Early as it is, **My Spanish Heart** is sure to be judged among the best albums of 1977.

Michael Tearson

Sound: A+ Performance: A+

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AU/6/77

# European records

John S. Wright

There has been a notable lack of worthwhile new recordings in the past few months, with much of the lists being occupied with reissues. Nevertheless, Philips has issued a brand-new recording of the complete Tchaikovsky **Nutcracker** in a two-record set, and at a bargain price. It is another Concertgebouw of Amsterdam recording, this time conducted by Antal Dorati (6747 364). Again, I have nothing but admiration for the warm and spacious bloom that typically surrounds these Concertgebouw performances. Dynamic range is real, rather than merely apparent. It is entralling to play those lesser known passages, starting with distant pianissimo and rising to a full crescendo, since throughout, delicacy of detail is preserved without sense of strain, even at the climaxes. Particularly

noteworthy is the crispness of the treble, exemplified by the brass and percussion sections. My only reservation is that on some occasions certain solo instruments, particularly woodwind, stand forward of the general ambience, as though they had been spot microphoned. Exactly why this should be I am not sure, as this is not typical of the series. This recording's main competition lies in the Andre Previn performance on EMI (SLS 834), which is splendid by any standards and does not suffer from these occasional contradictions. Overall, I would find it difficult to choose between the two recordings and would not like to be without either. Musically, I find a preference for the Previn interpretation, particularly of his handling of the grand theme at the end, which I feel Dorati has rushed. These personal idi-

osyncrasies aside, it is impossible for me other than to declare this new Philips recording as currently the "best buy."

It has become customary for Handel's *Messiah* to be performed as a grandiose work, employing full orchestra and massed choirs. This approach was epitomized by the recording of Sir Malcom Sargeant in the mid-1960s. Indeed, so commonplace is this type of presentation that many are unaware that the work was originally intended for performance by a comparatively small number of artists, in an almost chamber-like fashion. I remember hearing such a performance in the intimacy of the recital room at the Festival Hall, London, and have ever since considered the more spectacular presentations as being in somewhat bad taste. Thus, even before receiving Neville Mariner's recording with the Academy and Chorus of St. Martin-in-the-Fields based on the first London performance of March, 1743, I was convinced that it would be to my liking. In this respect, I was not disappointed. Recording by Argo (D18D3) is essentially light and airy, suggesting a slight tendency to be bass shy. Notably the texture of inner detail varies between sides, as I discovered to my embarrassment when I chose to play in demonstration

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Anna Reynolds/*Handel's Messiah*.



Neville Mariner conducting *Handel's Messiah*.

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of its quality a poor part that I had not yet heard. I can only suppose that this might be related to there having been two separate recording sessions, one in January and the other in July of last year. Surface noise revealed more graininess than is customary of Argo, but at its best this is an exceptionally fine performance and recording.

With uncanny timing Argo chose to reissue Benjamin Britten's **Noye's Fludde** at around the time of his death (ZK 1). The original recording in 1961 was Argo's first, then on ZNF1, and heralded a milestone. This Chester miracle play, set to music, encompasses the story of the flood from the First Testament, and the work is written with young children as performers, very much in mind. Space does not allow a full dissertation so I can only recommend the music as being eminently enjoyable and immediately appealing. The recording was made on location, using basically simple techniques and thus captures the atmosphere of the live performance at the Aldeburgh Festival. It is rare that one can enthuse over a reissue in terms both of musical appeal and of a recording quality that puts many recent releases to shame.

Out of the normal context for this column, I mention that at the time of writing the top record in the U.K. charts is Leo Sayer's *When I Need You*. Containing more original musical ideas than many such discs, together with a fine recording, it deserves its position. The whole album, titled **Endless Flight** (Chrysalis CHR 1125), is extremely clean with an unusually wide dynamic range for pop material. It demonstrates great expertise in the mix-down techniques where the final performance becomes one that can only exist in a recorded format. Indeed it reminds me technically of the fine work that went into making **Bridge Over Troubled Water** and the Neil Diamond **Serenade**. Perhaps the musical ideas are over exploited, becoming repetitive in a way that would make me wish to shorten the tracks, but overall this must technically rate as one of the best pop albums currently available.

Having often criticized Decca unmercifully, it is a pleasure to be able to thoroughly recommend their new recording of the ballet music of Massenet's **Le Cid** and the Meyerbeer **Les Patisseurs** on SXL 6812. Engineering is by Kenneth Wilkinson. It is a zipped-up recording, in the best of taste, is ideally suited to the music, and above

all is exciting. With pin-point stereo, clean transients, and a deep bass drum one can forgive the occasional traffic rumble. If you enjoy this, an even more spectacular (but more phoney) recording of **Le Cid** is that on the EMI Studio 2 label (TWO 350). All great fun....

Quite correctly, Sir William Walton's best-known work is his humorous **Facade Suite**. Being most fitting for his 75th birthday, EMI has issued a magnificent new record by the City of Birmingham Symphony Orchestra conducted by Louis Fremaux (ASD 3317). Both the performance and the recording have impact, being warm yet crisp with a good sense of the reverberant sound field. Only some slight upper bass coloration (which dulls the midrange) can fault this superb recording, but this could well be the acoustics of the Bedworth Civic Centre. In any case, the plentiful depth of the bass drum well compensates for this, providing a full-blooded sonic experience. Coupled with the lesser known ballet suite *The Wise Virgins* (intriguingly based on themes of Bach), the record has a high recommendation.

Ending up where we came in, with the Concertgebouw Orchestra, Bernard Haitink conducts **Schubert Symphony No. 5** coupled with **No. 8 "The Unfinished,"** and **Symphony No. 9 "The Great,"** on Philips 9500 099 and 9500 097 respectively. My pressing of the ninth symphony proved faulty, a most unusual event for this label. Both records embody the attributes previously discussed in the **Nutcracker** recording, front-to-back perspective, bloom, and a dynamic range actually more extended than any subjective evaluation alone would lead one to suspect. Of the two discs I technically preferred the two *Symphonies Nos. 5 & 8*, which had marginally better defined ambience and general attack, with *Symphony No. 9* being slightly veiled. (Perhaps aspects of the pressing fault could have contributed to this.) The difficulty with evaluating records of this status is that since they promise so much, one's critical faculties rise above the normal commercial considerations. Music such as this which embodies one glorious melody after another needs a sympathetic treatment, which is precisely what Philips and Haitink have given it. These recordings are not for hi-fi show-offs who require something more obvious, but rather for the purist who also has the calibre of equipment to really appreciate them. **A**

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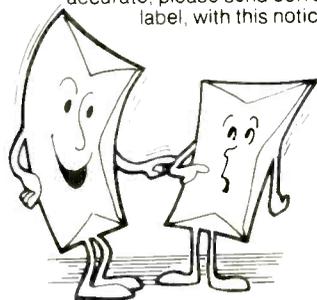
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# The Revolutionary

Wow & flutter: .04%\*. Signal/noise ratio: 62 dB.\*\*

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- 1.** The Elcaset tape is as wide as reel-to-reel tape:  $\frac{1}{4}$ "
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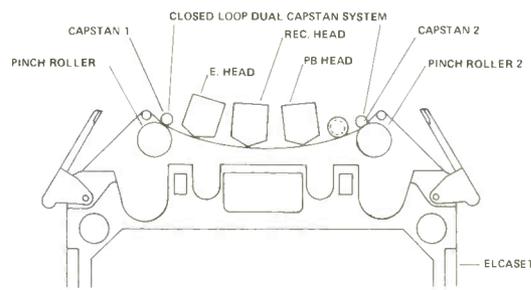
- 3.** The tape is lifted out from the cassette and guided across the heads by a stabilizing pin in the deck

itself — just as in reel-to-reel.

Result: lowest wow and flutter, superior tape/head alignment, even better frequency response. (See diagram).

- 4.** All-new tape formulation with thicker oxide coating and thicker polyester for highest quality sound.

- 5.** Automatic tape formulation adjustment. Small holes encoded on the cassette case "tell" the Elcaset deck what type of tape is being used (SLH, FeCr). The Elcaset then automatically adjusts both bias and EQ for optimum performance.



**Tape** (Actual Size)



# Sony Elcaset System

Frequency response: 25 Hz-22 kHz,  $\pm 3$  dB.\*\*

An engineering triumph, the Sony EL-7 Stereo Elcaset Deck was designed exclusively for the new Elcaset tape.

**1. Closed-loop dual capstan tape drive.** One of the most advanced tape drive systems now available, it assures constant tape-to-head contact pressure, low wow and flutter and virtually nonexistent modulation noise.

**2. The 3-motor system** starts with a **DC servo motor** for utmost reliability. A sophisticated feedback circuit corrects for line voltage fluctuations, and other speed-altering factors. This is the finest tape recorder motor system money can buy. Proof? Wow and flutter of only .04%.

**3.** Sony's 3-head system offers the most precise tape/head alignment possible. All three heads are made of ferrite and ferrite—a super-strong formulation that lasts up to 200 times longer than standard perm-alloy. Head surfaces are mirror-smooth for friction-free tape travel and optimum tape/head contact. Incredibly close tolerances in the head gap assure widest frequency response.

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Also available: The Sony EL-5 Stereo Elcaset Deck. Includes many of the same high performance features of the Sony EL-7, at a lower price.

## Deck

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**SUPERSCOPE**



Memory tape counter provides automatic sequential rewind and playback immediately after recording from a specific spot on the tape.

Timer activating capability, in conjunction with an external timer, turns on/off playback or record mode unattended.

Illuminated "feather-touch" solenoid operation. Logic-controlled system allows instantaneous mode change, bypassing stop.

Air-cushion eject slowly, softly opens tape compartment door, thus minimizing wear on eject system.

Dolby Noise Reduction System includes 25  $\mu$ S de-emphasis circuit for Dolby FM, as well as controls for standard Dolby applications.

\*WRMS \*\*FeCr tape, Dolby\*\*\*out. \*\*\*FeCr tape. \*\*\*\*TM Dolby Labs, Inc. (Source: Sony Corp.)

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You'll find it in three manuals that start at under \$200\* with the SL-1500. Or for a little more money you can get a lot more convenience with our newest turntable, the semi-automatic SL-1400. The world's first turntable with a one-chip 321 element IC. That gets the platter to exact speed in only 1/3 of a revolution. There is also the fully automatic single disc SL-1300. And the world's first direct-drive changer, the SE-1350.

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Direct Drive System

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