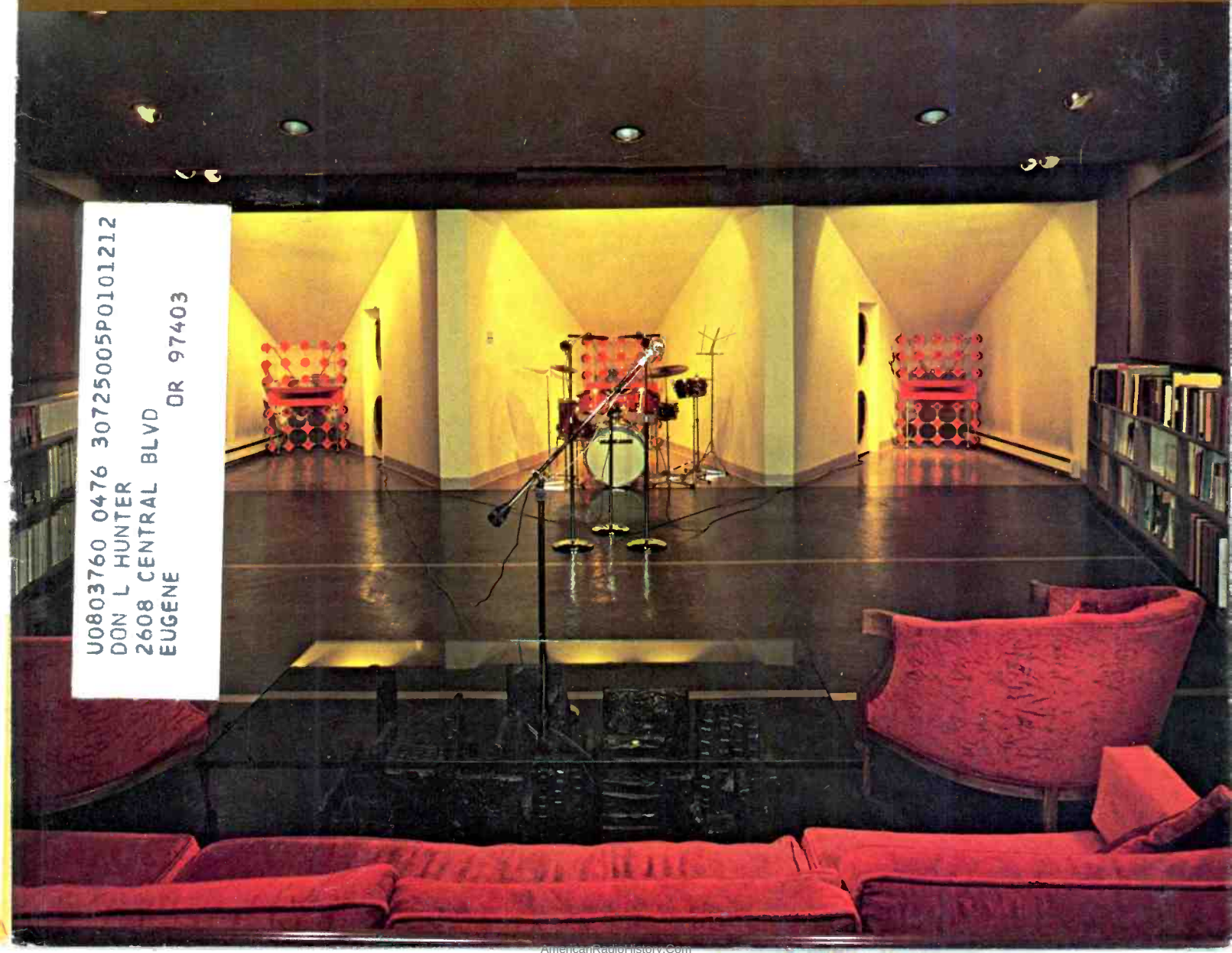
First Test: Sound Guard

Audio®

THE AUTHORITATIVE MAGAZINE ABOUT HIGH FIDELITY • APRIL 1976 75¢
47425

Understanding the NAB Equalization Standard

20,000-Watt Home Hi-Fi System



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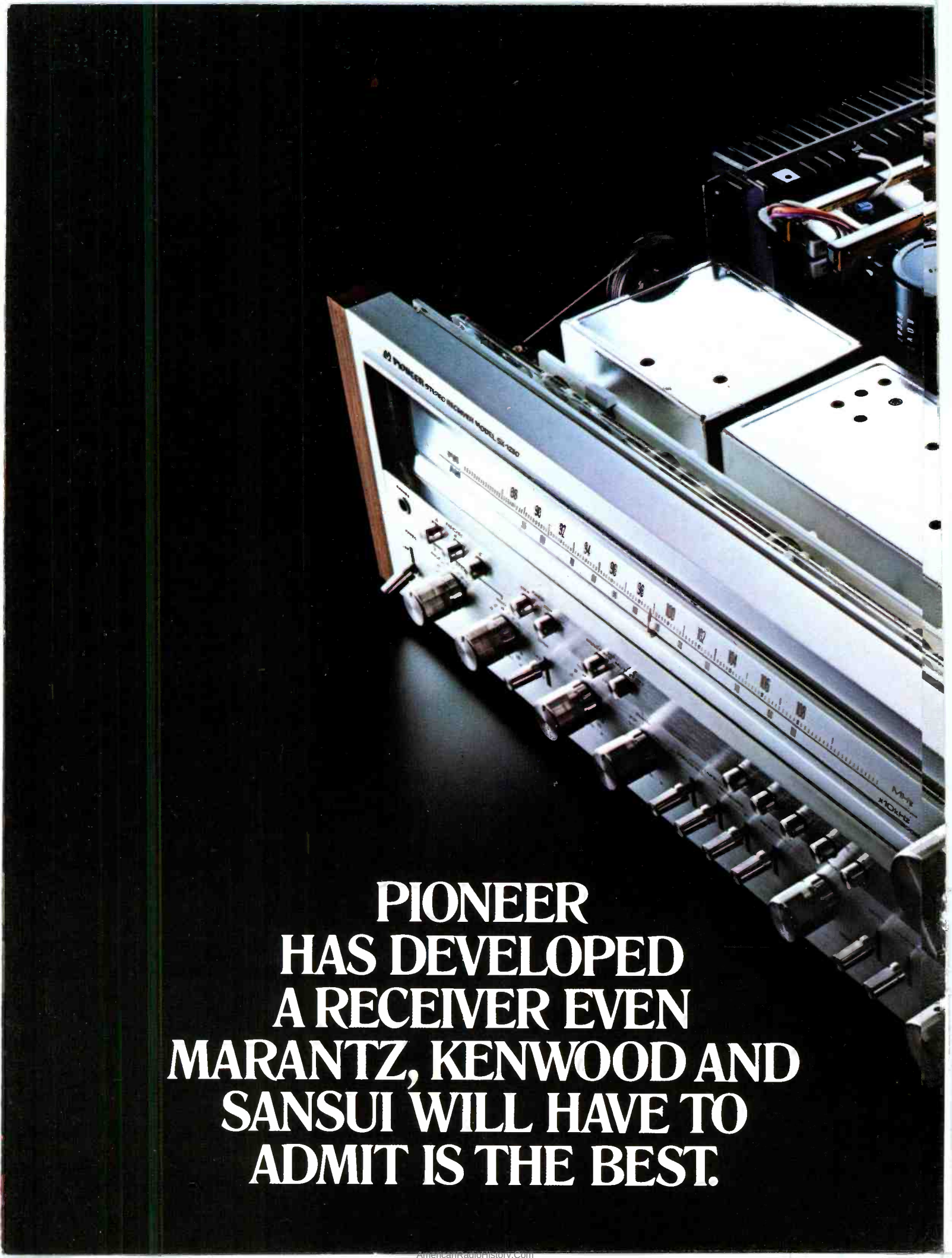

PIONEER HAS DEVELOPED A RECEIVER EVEN MARANTZ, KENWOOD AND SANSUI WILL HAVE TO ADMIT IS THE BEST.

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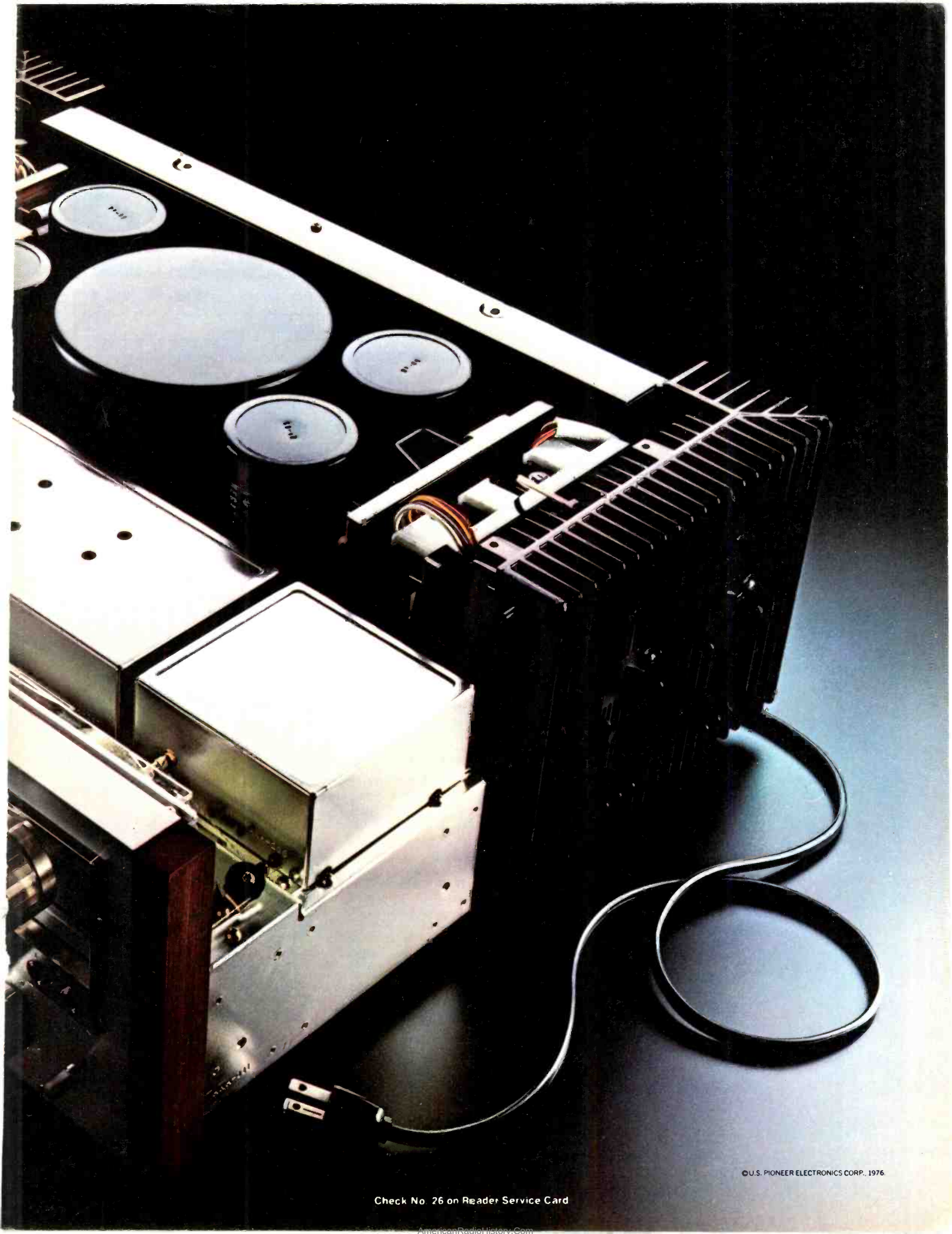

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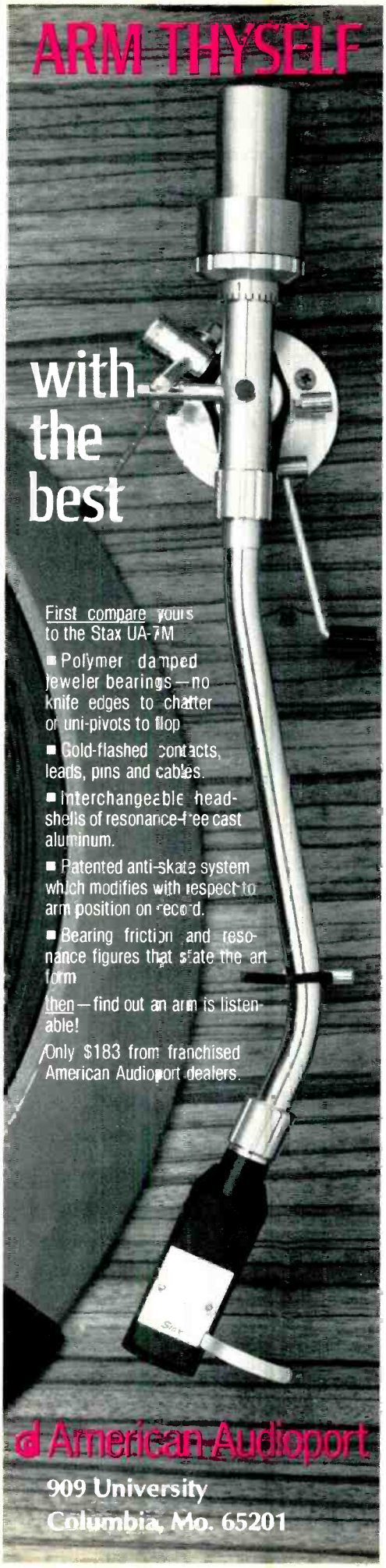

Audio

April, 1976 *"Successor to* RADIO *Est. 1917"* **Vol. 60, No. 4**

Feature Articles

Equipment Profiles

Record Reviews

Audio In General

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AUDIO (title registered U.S. Pat. Off.) is published monthly by North American Publishing Co., Irvin J. Borowsky, President; Frank Nemeyer, and Jay L. Butler, Vice Presidents; R. Kenneth Baxter, Vice President/Production; Vic Brody, Promotion Director; Mary Claffey, Circulation Director.

RATES—United States only: 1 year for $7.00, 2 years for $12.00, 3 years for $17.00; outside the U.S.: 1 year for $9.00, 2 years for $16.00, and 3 years for $23.00. Printed in U.S.A. at Columbus, Ohio. All rights reserved. Entire contents copyrighted 1976 by North American Publishing Co. Second class postage paid at Philadelphia, Pa. and additional mailing office. Back issues, $2.00 each. **World Library Congress** number: ISSN 0004-752X. **Dewey Decimal** number: 621.381 or 778.5.

REGIONAL SALES OFFICES: Jay L. Butler, Publisher and Sanford L. Cahn, Marketing Director, 41 East 42nd St., New York, N.Y. 10017, telephone (212) 687-8924.
Jay Martin, 2525 West 8th St., Los Angeles, California, 90057, telephone (213) 385-2917.

REPRESENTATIVES: Continental Europe: V. B. Sanders, International Publishers Advertising Service, Raadhuisstraat 24, Graft-De-Rip, Holland; telephone 02997-1303.
For Benelux and Germany, W.J.M. Saunders, Mgr., Herengracht 365. Amsterdam, Holland, telephone 24.09.08.
Japan: Japan Printing News Co., Ltd., No. 13.2 Chome Ginza Higasi, Chuo-ku, Tokyo, telephone 541-5795.

AUDIO Editorial and Publishing Offices, 401 No. Broad St., Philadelphia, Pa. 19108

Postmaster: Send Form 3579 to the above address

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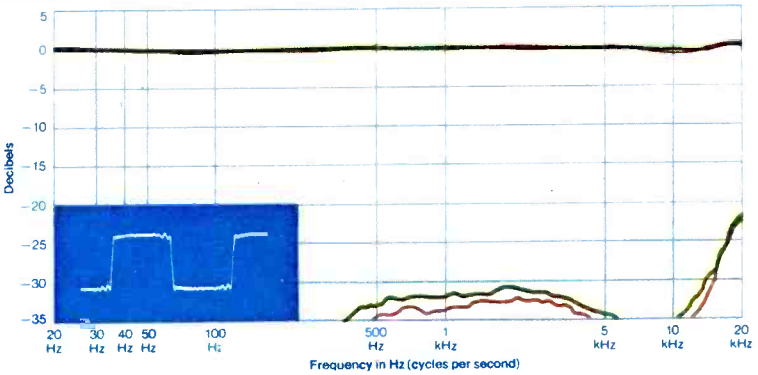
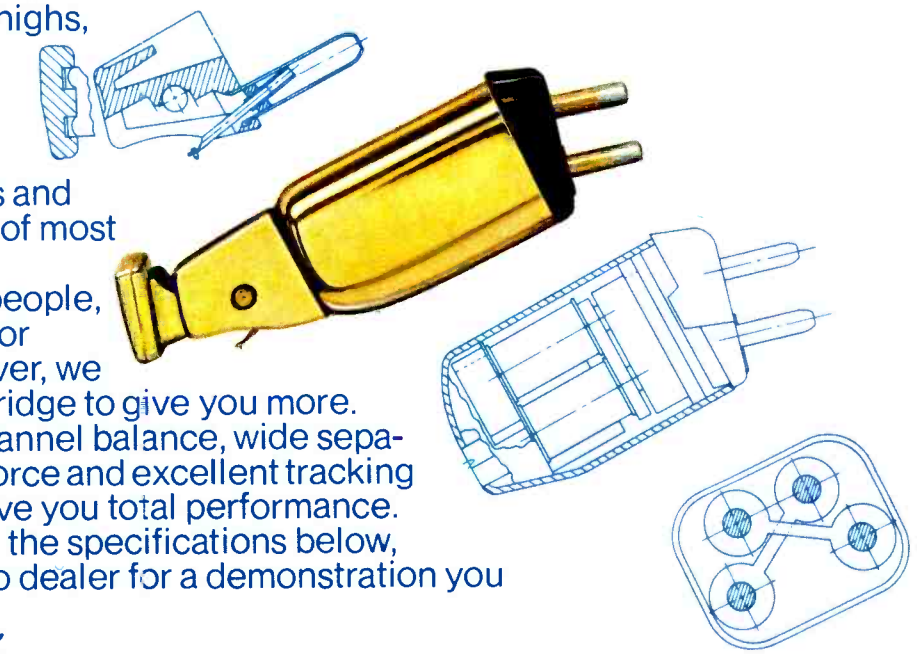
Blueprint for Flat Frequency Response

In the graph below, frequency response was measured using the CBS 100 Test Record, which sweeps from 20-20,000 Hz. The vertical tracking force was set at one gram. Nominal system capacitance was calibrated to be 300 picofarads and the standard 47K ohm resistance was maintained throughout testing. The upper curves represent the frequency response of the right (red) and left (green) channels. The distance between the upper and lower curves represents separation between the channels in decibels. The inset oscilloscope phata exhibits the cartridge's response to a recorded 1000 Hz square wave indicating its resonant and transient response.



Smooth, flat response from 20-20,000 Hz is the most distinct advantage of Empire's new stereo cartridge, the 2000Z.

The extreme accuracy of its reproduction allows you the luxury of fine-tuning your audio system exactly the way you want it. With the 2000Z, you can exaggerate highs, accentuate lows or leave it flat. You can make your own adjustments without being tied to the dips and peaks characteristic of most other cartridges.



For a great many people, this alone is reason for owning the Z. However, we engineered this cartridge to give you more. And it does. Tight channel balance, wide separation, low tracking force and excellent tracking ability combine to give you total performance.

See for yourself in the specifications below, then go to your audio dealer for a demonstration you won't soon forget.

The Empire 2000Z.

Already your system sounds better.

Frequency Response—20 to 20K Hz ± 1 db using CBS 100 test record
Recommended Tracking Force—¾ to 1¼ grams (specification given using 1 gram VTF)
Separation—20 db 20 Hz to 500 Hz
30 db 500 Hz to 15K Hz
25 db 15K Hz to 20K Hz
I.M. Distortion—(RCA 12-5-105) less than .08% .2K Hz to 20K Hz @ 3.54 cm/sec
Stylus—0.2 x 0.7 mil diamond
Effective Tip Mass—0.2 mg.
Compliance—lateral 30×10^{-6} cm/dyne
vertical 30×10^{-6} cm/dyne
Tracking Ability—0.9 grams for 38 cm per sec @ 1000 Hz
0.8 grams for 30 cm per sec @ 400 Hz
Channel Balance—within ¾ db @ 1 kHz
Tracking Angle—20°
Recommended Load—47 K Ohms
Nominal Total System Capacitance required 300 pF
Output—3mv @ 3.5 cm per sec using CBS 100 test record
D.C. Resistance—1100 Ohms
Inductance—675 mH
Number and Type of Poles—16 Laminations in a 4 pole configuration
Number of Coils—4 (1 pair/channel—hum cancelling)
Number of Magnets—3 positioned to eliminate microphonics
Type of Cartridge—Fully shielded, moving iron

INTRODUCING
EMPIRE
2000Z
SUPER STEREO CARTRIDGE

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Audioclinic

Joseph Giovanelli

Noisy Antenna Rotator

Q. I use an FM-band antenna, with shielded 300-ohm cable and drain wire, together with a rotator which is noisy only when rotating. The noise is present during rotation whether or not the drain wire is connected to the tuner. The shielded lead-in is new cable and never touches the boom, mast or other metal on its way down to the tuner. It never contacts the line feeding power to the rotator.

Somehow, leakage from the motor must be getting to the tuner's antenna input via the shielded lead-in. I thought at first it might possibly be coming from the rotator control box in the house, but I moved this unit into another room with no change in the noise level. I have also tried bringing the lead-in drain wire to a cold water pipe with no luck.

What do you think is the cause of my problem and do you have any ideas about how I can eliminate the noise?—Stanley L. Alekman, Newark, Del.

A. I think that the rotator produces the noise and more specifically that the noise is produced by the system which indicates the direction in which the antenna is aimed. I cannot tell whether this noise is an inherent property of your particular rotator, but this may be the case.

Perhaps, if the sensing element of the rotator is a pot, the pot may need cleaning. To do this, the rotator must be taken down and carefully opened. Service notes from the maker will be helpful here.

Another source of noise from such a motor or control unit is arcing, which can be radiated by the motor and therefore be picked up directly by the FM antenna. The cable feeding power to the rotator can also act as a radiating antenna, giving the noise a better chance to interfere. Hence, even if your lead-in cable is well shielded and is grounded both to the mast and the tuner chassis, noise will be picked up.

Try placing 0.1 μF ceramic disc capacitors between each of the rotator terminals and the common terminal. (Do NOT use electrolytic types.) If your rotator has only three connections, use two capacitors; if it has four connections, use three capacitors, etc.

If it happens that you listen to just one station, and if this station has recently begun SCA broadcasts, your tuner may not handle this situation well. Even if your tuner is equipped with the appropriate rejection circuits, they may be misaligned. While you are checking alignment, check detector and MX circuit alignment.

Stereo Interference with Cable Reception

Q. My year-old tuner is connected to cable TV. I get a high-pitched tone when my tuner is in the stereo mode. The filter helps a little, but the sound is still bad. Reception was fine before I got cable TV. What is wrong? What can I do?—Charles David, Ft. Wayne, Ind.

A. If your FM reception deteriorated immediately upon installing the cable, I would have to think that your stereo interference is caused by the reception of "direct" signals at the same time that you are receiving signals from the "cable." I suggest that your cable company should improve the shielding of any transformers, adaptors, etc., which may be involved with your particular installation. Unfortunately, there are some tuners which are, themselves, not well shielded. In the presence of only moderately strong signals, they might pick up some signal, even when there is no antenna connected to their input terminals. If your tuner is one of these, then there is probably little that can be done to eliminate the problem, assuming that "direct" pickup is the root of the problem.

If you made some modification to the original installation, such as running extension line from the cable installation point into another room, perhaps this is giving rise to the problem. Often such extensions are made with 300-Ohm twin-lead. It is best to have your cable company make the installation properly. (This assumes that the company does put the FM signals on the line.)

If you wish to check to see if this direct pickup is really what is taking place, disconnect the tuner from the cable and connect it to a regular antenna, which may be an indoor diple for this application. Determine whether the stereo is still plauged by the high-pitched whistle. If it is, chances are that there is something within the tuner.

Steps in Tone Controls

Q. I own an integrated amplifier having twin tone controls for both bass and treble which move in stepped increments of ±2 dB. Since the human ear can only detect a change of volume of 3 dB or greater, why are more and more manufacturers coming out with this type of system?—Gregory E. Gill, Fort Wayne, Ind.

A. Actually, the human ear can ordinarily hear volume changes of about 1 dB and under special conditions can detect changes of as little as 0.25 dB. However, the 2-dB increment is not all that large, so that it represents a good compromise between what is barely noticeable and large steps where the transition is jerky when the control is moved.

An additional factor here is the cost of the various systems. If the steps were made closer together, perhaps 1 dB, the extra cost of added components and wiring would be much greater, significantly adding to the final price of the unit without adding the same relative amount of performance. On the other hand, if the steps are made further apart, a less costly tone control system could be built, but the audible results would be more unpleasant when the controls were adjusted.

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.

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AU+TU=VALU

The great Sansui equation

For those who want and can appreciate superior high fidelity, here are three great values. These integrated amplifiers and tuners are both matched and designed to give you incrediby clean tonal quality, versatility, and performance.

The AU-5500 integrated amplifier with 32 watts per channel, min. RMS, both channels driven into 8 ohms from 20 Hz to 20kHz, has no more than 0.15% total harmonic distortion. Features triple tone controls with a middle frequency control to add pleasure to your music; high and low cut off filters; 7 position tape play/dubbing switch for creative recording versatility. The AU-5500 is matched with the TU-5500 tuner, with a 1.9μV sensitivity and a selectivity of better than 60 dB.

The AU-7700 integrated amplifier offers a power output of 55 watts per channel, min. RMS, both channels driven into 8 ohms, from 20Hz to 20kHz and no more than 0.1% total harmonic distortion. Features a 7-position tape play/dubbing switch for creative recording versatility; selectable phono input impedance. It is matched with the TU-7700 tuner, featuring a 1.8μV sensitivity for picking up even the weakest signals. Selectivity of better than 80 dB.

Sansui also offers an AU-4400 integrated amplifier and TU-4400 tuner which display the same Sansui high quality performance and many of the same features as the other pairs in this series of separates.

If you should not be as yet a devotee of separate components, any of these pairs is sure to make you one. Stop in soon at your nearest Sansui franchised dealer to select any of the three combinations for musical enjoyment you will value for many years to come.

TU4400
AU4400

TU5500
AU5500

TU7700
AU7700

Sansui

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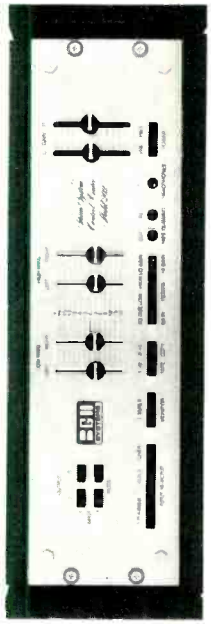
THE FIRST!
PREAMP BY BGW



THE BGW 202 HAS—

- Dual discrete OP amp phono stage for unprecedented accuracy
- Active tone controls using sliding step switches
- Active 18-dB/OCT. High and low pass filters
- Two phono inputs plus accessory socket for moving coil pre-preamp converter
- Separate power amp switching
- Remote AC switching unit accessory available

Guaranteed specifications:

Phono stage: Gain=42-dB, ±.25-dB of RIAA, S/N=82-dB, THD=.01%.
Tone controls: Active baxandall controls add virtually no distortion. ±18-dB at 50-Hz and 15-kHz in 3-dB steps.
High and low pass filters: Active 3-pole, 18-dB/OCT. Low frequency at 40-Hz, high frequency at 12-kHz.
Maximum output voltage: At line output, 8-volts RMS into 600-ohms (+20-dBm). Phono at tape output, 10-volts RMS into 5-kohms. Rated output, 4-volts RMS into 5-kohms.
Total harmonic distortion: Less than .01% at rated output, 20-Hz-20-kHz.

Write for the location of your nearest dealer.

BGW SYSTEMS

BGW Systems
P.O. Box 3742
Beverly Hills
CA 90212
(213) 973-8090

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Tape Guide

Herman Burstein

Reel Warp

Q. All of the plastic tape reels I've ever used on my TEAC 6010 tape deck tend to warp, and the result is that the tape rubs against the reel. This rubbing sound can be extremely annoying, especially when listening to classical or background music at low levels. I've tried using two different types of metal reels, both of which proved unsatisfactory when the deck was used in fast forward or rewind modes. It appears that the wider metal reels cause the tape to bunch up in a zig-zag fashion, which results in frayed tape edges. Do you have any recommendations?—Robert C. Armstrong, APO San Francisco, Calif.

A. Aside from trying more of the wide variety of plastic reels on the market, you can very likely solve your warp difficulties by storing your tapes differently. However, from your mention of what's happening with the metal reels, it appears that the tape guides may be out of alignment with the turntable on which the reel sits or that the turntable may not be parallel with the line of tape motion. The rubbing of the tape edge causes a squeal in the case of the plastic reels, while with the metal reels, this friction during high-speed tape transport simply results in frayed tape edges instead of the rubbing noise.

Use of Head Demagnetizer

Q. I notice in the manual for my TEAC 6010 tape deck that there is a cautionary note concerning possible damage to the VU meters from a head demagnetizer. Therefore, I am reluctant to use a bulk eraser, as has sometimes been recommended. The meters are approximately four inches from the head cover. How close can I get to the meters with a hand-held bulk eraser?—Floyd Rominsky, Glen Ridge, N.J.

A. I would strongly repeat the advice given in the TEAC manual about keeping bulk erasers a good distance from the meters because the strong field of the eraser might dislocate the windings in the meter. It might even do so in the case of a tape head, depending on construction of the head, though I believe there should be no problem in your case. My best guess is that six inches is about right, but I strongly suggest that you consult TEAC on this.

Causes of Print-Through

Q. I would like to find out about print-through. I have a large collection of tapes I recorded, some of which are as much as 10 years old. Only on one of these have I ever encountered a problem with print-through. Yet recently I made a recording on a 1-mil tape at 7½ ips in stereo, and when I played it back 24 hours later, I was dismayed to discover almost continuous background "music." I thought that print-through was a phenomenon of aging, particularly with thinner, cheaper tapes. The brand of tape I used is not particularly expensive, but has been reliable, and this individual tape had not bee previously recorded and erased. Would you please explain what causes print-through?—Barbara Foerster, Chicago, Ill.

A. Print-through increases with level of signal recorded on the tape, oxide formulation of the tape, thinner tapes, and time. In your case, the most likely cause appears to have been the thinness of the tape and quite possibly the signal level and formulation as well. Since the onset of print-through is shortly after the recording is made, if and when it is going to occur, your experiencing of print-through just a day later is usual.

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

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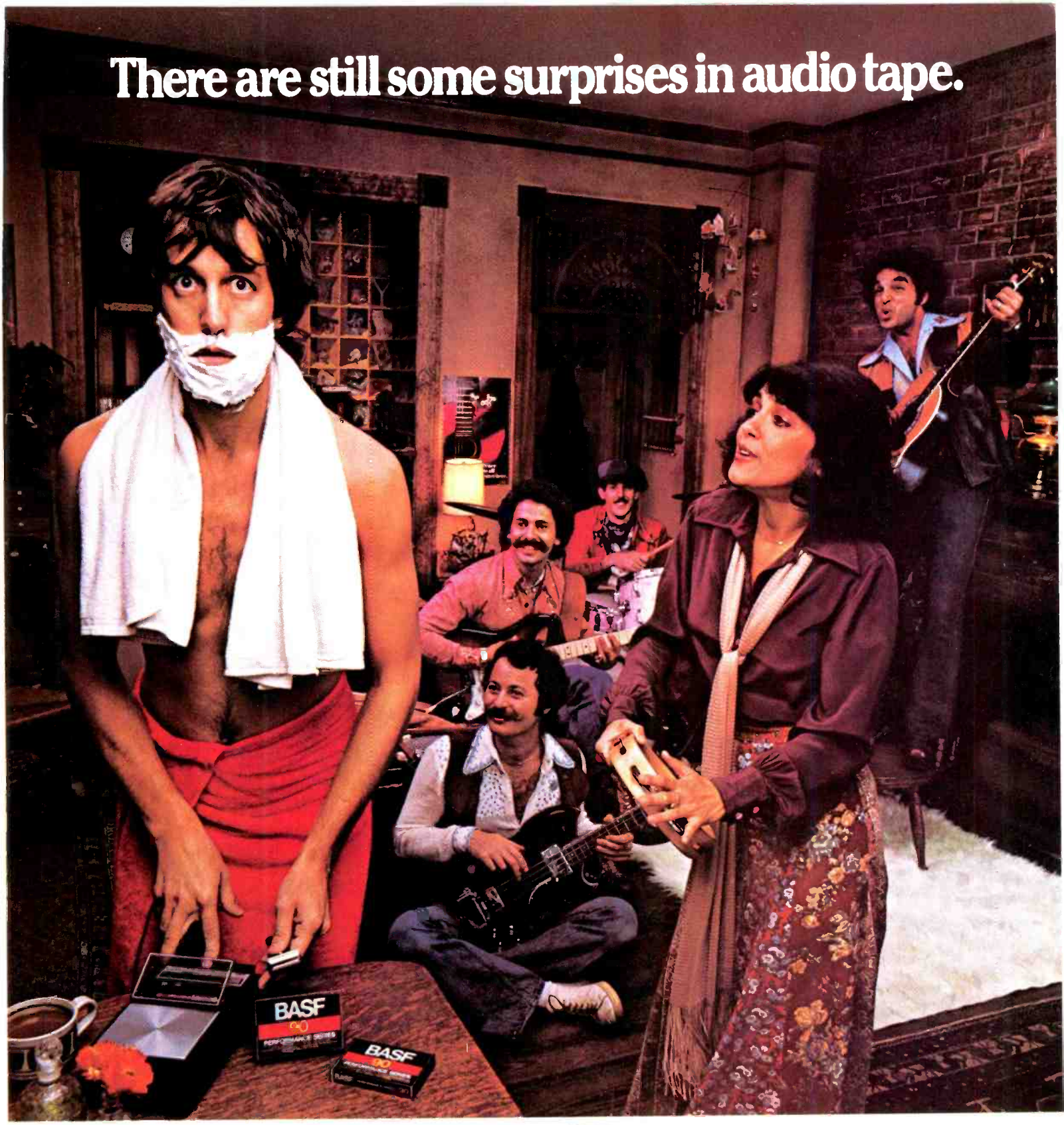
There are still some surprises in audio tape.



BASF sound is so clear, it's like the musicians are right there.

What you experience with BASF tape is simply this: the music. Pure and clear.

Why this extraordinary clarity? BASF polishes the tape. Literally. Getting rid of most of the thousands of tiny surface bumps that can cause background noise. (Get rid of most of them, you get rid of most of the noise.)

So what you're left with is sound so rich and clear, you don't just hear it. The music happens.

Which really isn't that surprising. After all, BASF invented audio tape in the first place.

BASF We sound like the original because we are the original.

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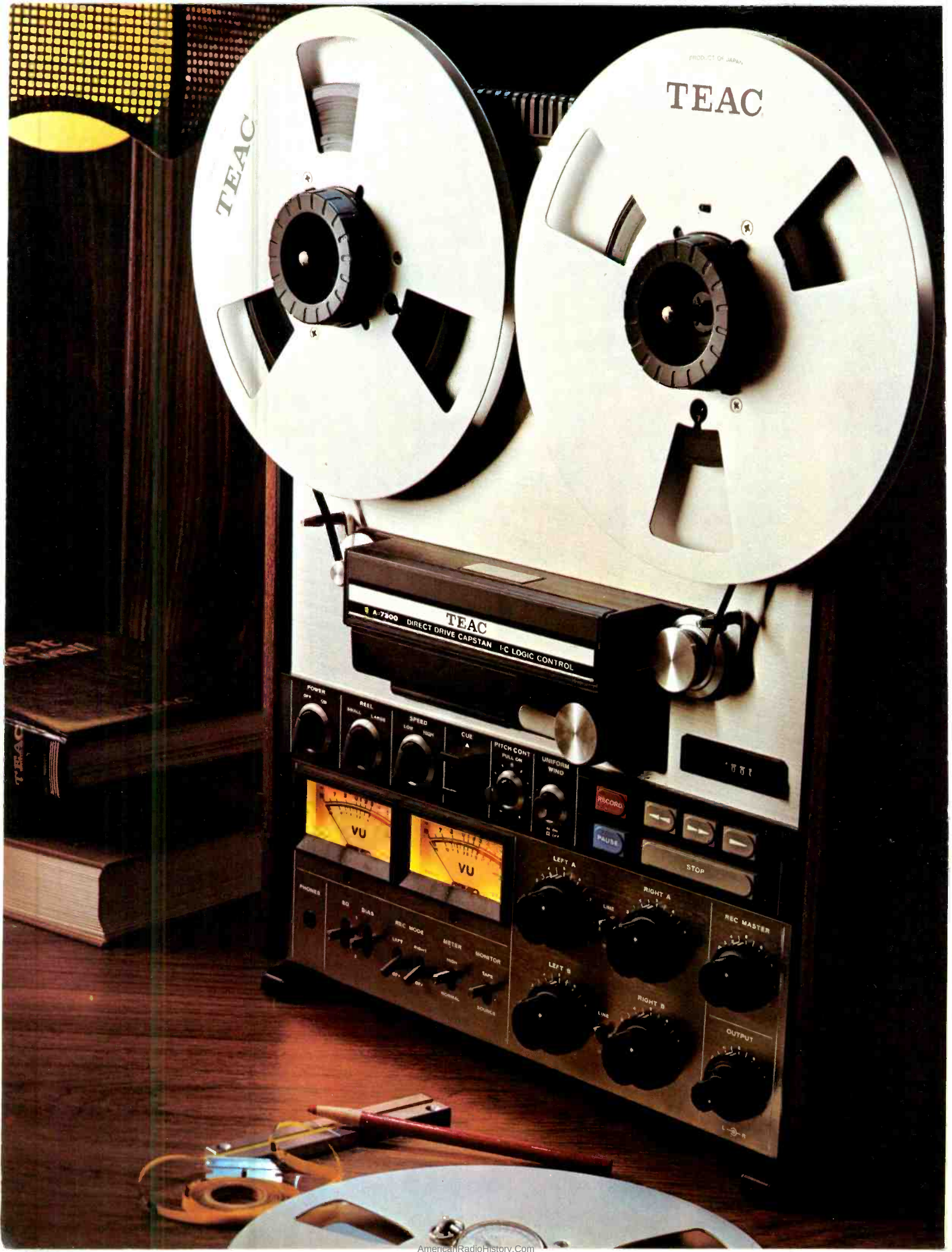

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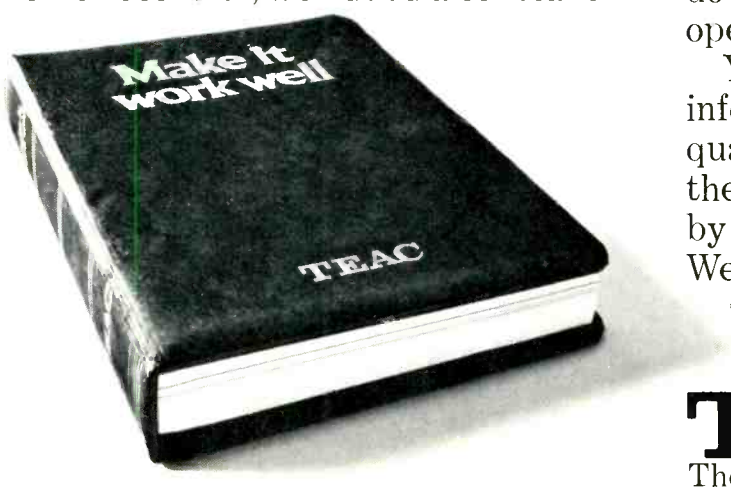
A-7300.

Just because we don't call it professional doesn't mean it couldn't be.

We make professional recorders and we're in a position to know precisely what is meant by the word "professional." So we don't use it casually or carelessly in describing our tape recorders.

On the other hand, the A-7300 is far better than the typical high fidelity component. In fact there are certainly some professional features on the A-7300, like a servo controlled direct drive capstan system, full IC logic transport controls, four balanced mic inputs with XL-type connectors, and a flip-up hinged head cover for easy maintenance and editing.

Then, keeping in mind the serious home recordist, we added a constant speed wind control for even tape packs... a pitch control for fine-tune speed adjustments... a 3-position pinch roller setting for cueing and eliminating tape bounce... and a zero VU click stop on the output level control.



Yet we don't label the A-7300 professional.

Then what about those tape recorders that cost much less and are called "professional"?

They're only kidding.

In the final analysis, though, it isn't what it's called, but what it does that counts. You'll have to determine for yourself whether or not the A-7300 meets your specific needs, and you can do that only by examining and operating it for yourself.

You'll find that our retailers are well informed and helpful in general. Rare qualities, so there can't be many of them. You can find the one nearest you by calling (800) 447-4700.*
We'll pay for the call.

* In Illinois, call (800) 322-4400.

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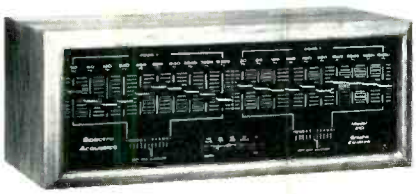
What's New in Audio

Spectro Acoustics Equalizer



Providing 10 bands per channel of equalization, Model 210 graphic equalizer allows 15 dB boost or cut in each of the 10 channels. Distortion is less than 0.1 per cent up to 1 V rms output at 20 Hz to 20 kHz with any combination of equalization adjustments. Distortion with equalizer bypassed or set flat is less than 0.05 per cent up to 1 V. S/N ratio is greater than 90 dB below 2 V rms. Output impedance is less than 600 Ohms, and the dynamic range for noise floor is over 100 dB below full output. Model 210 has a transferable five-year parts and labor warranty. Price, $275.00.

Check No. 81 on Reader Service Card

Stevenson Crossover

Interface Electronics' Stevenson Model X0312 is an electronic crossover capable of keeping all outputs in phase at all frequencies, in addition to providing continuous variable crossover frequencies from about 100 Hz to 1000 Hz and 1000 Hz to 14,000 Hz. Distortion is spec'd at less than 0.1 per cent, signal-to-noise ratio at better than 80 dB, with high- and low-pass filters in each crossover permanently crossed at 3 dB down. A state-variable filter provides a 12 dB per octave Butterworth response. The sum signal is flat ±1 dB from 20 to 20,000 Hz. Model X0312 has balanced 600 Ohm transformer outputs that are individually adjustable to a maximum of 8 V. Voltage gain is adjustable to a maximum of 2.

Check No. 82 on Reader Service Card

Revox Microphone

Model 3500 unidirectional moving coil microphone has a wide, flat frequency range, high output with cardioid characteristics. The 3500 is 6.3-in. L. x 0.945-in. D., has a frequency response of 40-18,000 Hz, and an impedance of 600 Ohms. Price, $165.00.

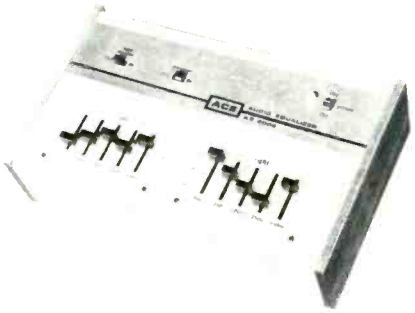
Check No. 83 on Reader Service Card

Quad Amplifier

Model 405 current dumping audio amplifier, from Acoustical Mfg., England, has a new circuit designed to drive modern low efficiency loudspeakers. The design uses an output stage in which the linearity of the main current carrying output transistors has no bearing on the overall amplifier performance. Thus the need for biasing and allied problems associated with crossover are eliminated. The 405 has an output of 100 watts per channel into 8 Ohms with total distortion of less than 0.01 per cent at mid frequencies. In addition, the company claims that there are no changes in performance due to junction temperature changes. Price, $410.00

Check No. 84 on Reader Service Card

Ace Audio Equalizer



Model AE2002 equalizer has 5 bands per channel, each covering a range of 2 octaves. The unit is rated at 2 V output into a 10k load; maximum output is 8V rms. Distortion is specified as less than 0.05 per cent IM or 0.05 per cent harmonic. Hum and noise is -80 dB. Model AE2002 is available in both kit or factory-wired versions. Most of the kit is on three printed circuit boards. Kit price, $84.25; wired, $133.75. Construction manual, $2.25; schematic diagram, $1.00.

Check No. 85 on Reader Service Card

Marantz Cassette Deck

Model 5420 is a top-loading cassette deck with master level control; 3-position tape bias/EQ with single knob selection for normal, chromium dioxide, and ferrichrome tape; LED peak-level indicator, and d.c. servo-control motor. Model 5420 also has a built-in mixing panel, pan-pot capability, 3 ½-in. VU meters with peak overload indicators, and Dolby noise reduction system.

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Pick-A-Pickering

It's the least expensive way to make the greatest improvement in the sound of your system

Here it is. The easy and inexpensive way to upgrade the sound of your entire hi fi system. Simply add a Pickering cartridge. Know why a good cartridge will make such a difference in sound? Because the cartridge and stylus have *first contact* with the music on your record. It's your *cartridge* that picks up the highest highs and the lowest lows in your record grooves. Not by plodding along, round and round, but by performing an incredibly quick dance between the two small groove walls. Too quickly for your eye to see, but not for your ear to hear. **No matter how much you sink into the rest of your equipment, a poor quality cartridge can murder the sound — bend the record grooves out of shape and blur the music.**

But not Pickering cartridges. They have a feathery touch we call *traceAbility* ™. A touch that lightly covers the whole range of musical tones on your record — giving you the type of sound you want to hear.

Upgrade your entire hi fi system the easy way, the inexpensive way. Just pick a Pickering cartridge, and you'll hear the difference.

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

PICKERING

"for those who can hear the difference"

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Dear Editor:

Ride-A-Rama!?!

Dear sir:

I have noticed lately in certain curious articles printed in your April issues, Professor I. Lirpa, whom these articles concern, usually discusses some radical ideas for sound reproduction. In 1973 he conceived the idea of producing records to play the inside of the disc first and finishing at the outside (clever yes, but hardly new; some of my friends had their turntables playing in reverse for years, for reasons you wouldn't understand if you're usually "straight" or sober!).

My present line of thought is on the subject of sound separation and isolation, which is part of the original "realism" formula for ultimate high fidelity in the home.

Commercially speaking, there is no pure separation or isolation of non-related sounds, even with discrete stereo or quadraphonic signals because they are both essentially mixes. Their gain over synthesized multi-channel systems is the fact that all their channels are individual and do not depend on each other. All these systems can be very satisfying as far as music is concerned, but many people (including myself) are frustrated with trying to locate the individual sounds.

Professor Lirpa's alternative to this, of course, was the basis to your "Converting To Mono" article. That article deserves a belated round of (monophonic) applause for preserving the sanity of those thousands who tried their utmost (budget permitting) to keep each sound separate.

Never-the-less, we "Isolationists" dream on....

One dreamer, a close friend of Dr. Lipra as it turns out, owns and operates a local hi-fi business and is known for his friendliness and fairness when making a sale. He is a modest man and had asked me not to mention his name. Therefore, I will refer to him by "Mr. Jones," a false name.

Mr. Jones, I have discovered, has been long displeased with the state of high fidelity and its lack of separation.

He was there like a trooper when audiomania first hit; with woofers, tweeters, and mid-ranges that would fill a store (which it did—his!). He had sounds like you would not believe. . .but only frequencies were discrete and he grew weary of whole orchestras getting up and running from one speaker to another, depending on their note and octave!

Stereo was next. He quickly doubled his system, speakers and all, to grasp its full effect. Suddenly, voices and instruments would walk from channel to channel. For once an actual separation of sounds took place. Still things seemed crowded. Sometimes two different sounds would occupy the same space at the same time. Often, I would hear Mr. Jones angrily yell, "WHAT'S THAT !!@%≠&¢ GUITAR DOING IN THE SINGER'S MOUTH?"

He finally realized you could only do so much with stereo, just as you could only tie so many knots in a piece of string before tying double knots.

Quadraphony was no better, except that he was no longer making double knots, but square knots.

The result of these phases provoked Mr. Jones into devising what Dr. Lirpa considers the future of, and perhaps the ultimate in high fidelity. For the past several months he has been designing a system which he has termed "RAR/64," or more explicitly, "Sixty-four channel RIDE-A-RAMA." As the first part of the title suggests the system consists of 64 separate, discrete channels. Each of these channels drives a full audio-range speaker set (containing as many drivers and crossovers as desired). The speaker units are placed in an empty room so that they completely cover all four walls. In the center of the room's floor would sit the system's nervous center. Basically, it is a super-quiet, hydraulically lifted chair which contains inside all electronics necessary to control each channel as well as movement of the chair. As Mr. Jones puts it, "Why make the sound come to you, why not go directly to the sound?" The chair not only serves the owner with a comfortable seat, it also increases listening pleasure by taking the operator to any specific speaker he desires. Incidently, this also eliminates those little knobs and joysticks known as "balance controls." Mr. Jones informs me that more than one chair could be attached to the lift. (Personally I think a love seat would be excellent for dating purposes!) Presently the RAR/64 has one holdback that is preventing it from becoming a reality: sixty-four channel program sources do not as yet exist. Jones says this can easily be worked out and expects to have an RAR/64 by 1984, possibly sooner.

So there you have it. Someday soon you may be riding on your very own personal Ride-A-Rama. If you are like me, 1984 can't come soon enough!

I hope you are as excited about this as Mr. Jones, Dr. Lirpa, and I. We'll be keeping our expectations high, and writing to you frequently to inform you of further developments.

I almost forgot! If you think 64 channels are not enough, remember that 128 are next.

George Atwell Beazy
Horse's Breath, Montana

Low TIM Amp Addendum

Dear Sir:

Those readers who are building the low TIM amplifier which I described in the February issue of *Audio* should be aware of a potential problem with the specified heat sinks. Unlike the heat sinks used on my two prototypes, those specified in the parts list for the amplifier are anodized. Thus, they have an insulated coating which may make ground contact through the four mounting screws on each circuit board impossible.

To remedy this, the anodized coating should be scraped away from the areas where all four nuts on the circuit board mounting screws make contact with the flanged edges of each heat sink. The same should be done under all nuts on the screws which attach the L-shaped mounting brackets to the heat sinks.

An alternate solution would be to run ground wires of No. 18 stranded wire from circuit board grounds to the chassis. However, the method described above is preferred for minimum hum.

W. Marshall Leach
Georgia Tech-EE
Atlanta, Ga. 30332

EDITOR'S NOTE: The last two paragraphs of "Build A Low TIM Amplifier" by W. Marshall Leach in the Feb-

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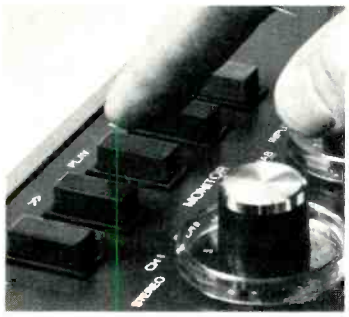
The 400 millisecond miracle.



Most people seem to take for granted the smooth, effortless way in which a Revox works.

And that is as it should be.

For a great deal of time, effort and sophisticated engineering have gone into translating extremely complex function into lightning quick, responsive operation.

For example, when you press the play button of a Revox, you set in motion a sequence of events that take place with the precision of a rocket launching.

It begins with a gold plated contact strip that moves to close two sections of the transport control circuit board.

Instantaneously, the logic is checked for permissibility. If acceptable, a relay is activated.

Within 15 milliseconds, power is supplied to the pinch roller solenoid, the brake solenoid, the back tension motor, a second relay and, at the same time, the photocell is checked for the presence of tape. If present, Relay One self-holds.

Elapsed time, 25 milliseconds.

At 30 milliseconds, Relay Two closes and puts accelerating tension on the take-up motor.

The logic checks are now complete and power is available to actuate all necessary functions.

From 30 milliseconds to 300 milliseconds, mechanical inertia is being overcome and the motors and solenoids are settling down.

By 300 milliseconds, the brakes have been released, the pinch roller is in contact with the capstan shaft, the tape lifter retracted, the playback muting removed and the motors have come up to operating speed.

At 350 milliseconds power is cut off from Relay Two, which changes over to another set of contacts, releasing the accelerating tension on the take-up motor and completing a circuit through Relay One that, in turn, restores normal tension to the take-up motor.

Total elapsed time, 400 milliseconds. The Revox is now in the play mode.

And it's all happened in a fraction of the time it takes to read this sentence.

The 400 millisecond miracle.

More proof that Revox delivers what all the rest only promise.

Please tell me where I can see and buy Revox ☐ A77 Revox ☐ Good used machines*

Name .....

Address .....

*As and when available from our dealers

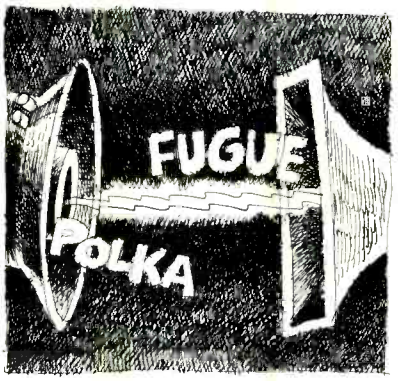
BMM

Revox Corporation in U.S.A.: 155 Michael Drive, Syosset, NY 11791

For other countries: Revox International, Regensdorf 8105ZH Althardstrasse 146, Switzerland.

AmericanRadioHistory.Com

Can a woofer from Duluth find happiness with a tweeter from Forest Hills?



If you gather different drivers from different sources, and coop them up in a little box, you could be dooming them to a lifetime of incompatibility.

And the only way to make sure they get along with each other is to make sure they have the same background.

That's why, at Mitsubishi, all our speakers are made from scratch. Conceived by the same designers, produced by the same craftsmen, tested by the same engineers.

With the result that none of our components end up fighting among themselves.

So when you're shopping for speaker systems, do a little checking into their background.

Because if they're constantly arguing among themselves, it could make for some terribly unpleasant sounds.

MITSUBISHI SPEAKER SYSTEMS

Melco Sales, Inc. A4
3030 E. Victoria St.
Compton, CA 90211

Gentlemen:

I, too, am very particular about speakers. Please send me a brochure and the name of my nearest dealer.

Name _____

Address _____

City _____

State _____ Zip _____

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ruary issue were inadvertently left out. They are:

Once R25 has been adjusted for both channels, the bias potentiometers should be marked with a fiber tip pen so they can be reset if they are accidentally misadjusted. Preferably, they should be sealed with wax so that this cannot occur. After this is done, the amplifier is ready for use.

Several precautions should be observed when using the amplifier. Never test it with a capacitor for a load, for the fused emitter resistors R29 and R30 will blow. Never attempt to connect or disconnect either the input or output leads with the amplifier on. Instead, turn it off and wait for the filter capacitors to discharge. They will discharge much more quickly if the amplifier is turned off without reducing the input signal level. When this is done, the amplifier will continue to operate several seconds until the filter capacitors are discharged. With the amplifier turned off, carefully check the speaker leads to insure that they cannot short together. Never drive a load of less than 4 ohms. And never place the amplifier where the air cannot circulate freely over the heat sinks. Happy listening!!

More on AM Sound

Dear Sir:

Around 16 years ago, I was chief engineer for a low-power, college AM broadcasting station. This was, as far as we could make it, a high-fidelity operation, from the choice of the same moving-coil pickups as enthusiasts used at home, through studio equipment carefully designed with judicious use of feedback, to use of modulators in class AB instead of the usual class B.

We did allow the telephone lines to introduce a gradual rolloff to −5 dB or so at 10 kHz, which was probably just as well considering what the mechanical impedance of the pickup styli was doing to the treble sound, but we discouraged gain-riding and never used compressors, peak limiters or other music homogenizers, which is more than some "quality" classical FM stations can honestly boast today.

At first I had the same skepticism as Paul Swartzendruber expressed in your January "letters" column, that these perfectionist efforts (largely my predecessor's) would be vitiated by the mediocrity of our listener's table radios. I was wrong. Aside from the mostly classinal content and often callow announcing, this station was identifiable by an easy clarity of sound not found anywhere else on the dial, if the radio was one getting adequate signal strength.

Unless broadcasting stations are very much better, or radios much worse, than in those days, the limitation on the sound quality of AM is not truly at the receiving end.

Jack Reed
Chicago, Ill.

TV Sound

Dear Sir:

After reading Paul Swartzendruber's letter about AM receivers (Jan. 76), I felt compelled to comment on the current state of audio in television broadcasting. While Mr. Swartzendruber complains of poor quality only at the receiving end, television audio suffers at the home receiver, as it passes through network leased transmission facilities, and at the point of origination.

Television utilizes frequency modulation (FM) to transmit the aural portion of its programming and is capable of essentially flat response between 30 Hz and 15 kHz. The only receivers I have ever seen which could reproduce this kind of bandwidth were old monochrome sets with big cabinets and multiple speakers or sets that were combined with a stereo system in one huge console. The trend today is toward smaller television receivers which necessitates smaller speakers, but even large consoles are being equipped with tiny speaker systems.

Most commercial television stations are affiliated with one of the three major networks (ABC, CBS, and NBC) and as a result receive a large portion of their programming from the network control center in New York City. The visual portion of the signal is routed to the station on AT&T microwave facilities leased by the network, while the aural portion arrives on a 5 kHz audio loop also leased from AT&T by the network. The visual signal travels through an essentially transparent medium, but the aural signal suffers considerable degradation as it passes through the reduced bandwidth audio loop. A typical specification for one of these loops is plus or minus 3 dB from 100 Hz to 5000 Hz with harmonic distortion less than 3% and noise at least 46 dB below normal program level.

This may all seem pretty gruesome until one realizes that the greater part of network audio is primarily vocal in nature. Most of the music we hear is in the background and not meant to be listened to solely for its entertain-

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Winner . . . and still champion!

The AR turntable was introduced in 1961. It created a revolution by virtue of its unprecedented combination of professional standards of performance, simplicity of operation, and low cost. Hirsch-Houck Laboratories reported on it as follows in *Stereo Review* for August,

1967

"The AR manual-play turntable has been, for some years, an outstanding example of professional-caliber performance at a modest price. . . .

The wow and flutter were extremely low — 0.035 and 0.03 per cent, respectively, at 33⅓ rpm. The unweighted rumble (NAB standard) was −38 db including vertical and lateral components, and −42 db with vertical components cancelled out. **Not only is the rumble figure at the level of the best we have ever measured, but since the basic rumble frequency is about 5 Hz, it is way down in the subsonic, sub-audible region.**

As a frame of reference, these performance figures are slightly better than those we measured on one of the original AR single-speed turntables several years ago. The differences are not significant, which is not surprising in view of the outstanding performance of the AR turntable. **It is obviously difficult to make very large improvements in products that are already outstanding performers.**

The tone arm had a tracking error of less than 0.5 degree per inch for record radii between 2½ and 6 inches. Its feel was excellent, with a comfortably shaped finger lift and no tendency to "get away" from the user, even when operating at a 1-gram stylus force. AR does not include any anti-skating features, holding that the benefits of such devices are not great enough to warrant their inclusion, since a minute increase in tracking force will accomplish the same reduction of distortion as anti-skating compensation.

The speed of the AR XA turntable was exact, and was not affected by line-voltage variation over a far wider range than would ever be encountered in practice (even in countries with poor line-voltage stability).

The AR XA turntable, complete with its oiled walnut base, plastic dust cover, stylus-force and overhang gauges, and attached power and signal cables . . . **whose performance is unsurpassed and is, at best, equaled by only two or three much higher-priced record players."**

How does the present version of the AR turntable (called the XB Model) stack up against the best of current competition? The magazine *Australian Hi-Fi* recently comparison-tested 28 different models for their *Stereo Buyers' Guide*. This is how they described the AR XB turntable in

1975

". . . now comes the AR-XB — the only visual difference is the inclusion of a damped cueing device but there are other subtle improvements in other areas which make an already superb performance even better. . . .

First — the rumble figure. We measured an incredible 46dB down reference to 1kHz at a groove velocity of 5 cm/sec RMS (7 cm/sec peak). **This is the best figure we have measured using present test conditions** and means that under just about any listening conditions rumble *from the turntable* will be completely inaudible. However, there's still recorded rumble, warps and the like. But with warps, the AR is likely to produce less subsonic disturbance than most turntables. . . .

Indeed, it is significant to note that for the first time while measuring rumble, we noticed *no* trace on the meter reading of warp component effects at all.

Wow and flutter came in at 0.06% which is getting very close indeed to that difficult to measure area — close to the residual level of the test record itself. It may be a bit lower than this — but who cares?

As we pointed out, there are no speed verniers — but the AR-XB hardly needs them. At 33⅓ the turntable was 0.08% fast — a negligible error and much better than the claimed specification.

We found, also, that the slight bias force created by the audio leads from the arm was exactly right for the Stanton cartridge.

This is an excellent turntable. Don't be put off by its spartan appearance or the low price. **In many areas, the AR-XB stacks up as the best turntable we have measured.**

The incredible thing is that AR has achieved this level of performance and sophistication with apparently the simplest of techniques — plus the soundest possible precision engineering. It has been said about the AR-XB that it leaves you wondering if perhaps some other manufacturers have been getting too complicated. We wonder too after testing this unit. **At the price, it's got to be a bargain, yet still a bargain that can be stacked up against the best of them."**

The most significant change has been the extension of the guarantee period from three years to five years.

Acoustic Research
10 American Drive
Norwood
Massachusetts 02062
Telephone 617 769 4200

Please send me a complete description of the AR turntable

Name _____

Address _____

_____ AU4

Check No. 1 on Reader Service Card

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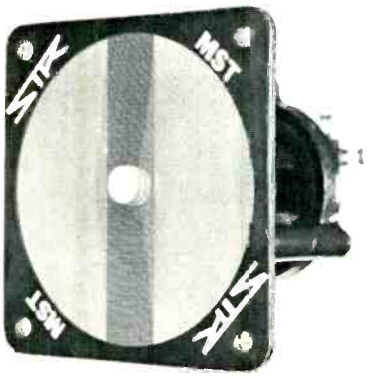
STR
STEPS FORWARD



THE NEW METASTATIC SLOT TWEETER

EARLY IN 1975, STR'S ENGINEERING STAFF BEGAN A PROJECT DEVOTED TO THE SONIC IMPROVEMENT OF THE SOLID STATE HIGH FREQUENCY DRIVER.

UPON COMPLETION OF THAT PROJECT, STR IS PROUD TO ANNOUNCE THE NEW METASTATIC SLOT TWEETER!

THE UNDENIABLE RESULTS ARE:

— WIDER DISPERSION —
— IMPROVE PHASE INTEGRITY — MINIMIZED "IMAGE WANDERING" —
— IMPROVED DEFINITION —
— HIGH RELIABILITY —

THE MS TWEETER IS NOW INCORPORATED IN ALL STR LOUDSPEAKERS: LISTEN FOR YOURSELF, WE ARE SURE YOU WILL AGREE WITH US THAT THE MS TWEETER IS BETTER THAN ANY OTHER TWEETER.

STR PRODUCTS ARE SOLD ONLY IN THE FINEST AUDIO STORES!

STR, INC.
3000 ORANGE GROVE AVE.
NORTH HIGHLANDS, CALIFORNIA

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ment value. Musical variety shows suffer the most from poor transmission facilities and small speakers in home receivers. The audio tracks of these shows are very good; usually having been recorded on multitrack machines, mixed down to mono, and then added to the videotape master after editing is completed. Feature films suffer somewhat less than the musical shows due to film's inherently poorer audio response. The optical sound tracks on 35 mm movie prints (the most common format for the networks) are only capable of response to about 8 kHz. Movies shown by local stations are primarily in 16 mm format. The optical sound tracks on 16 mm film are only capable of response up to about 5 kHz.

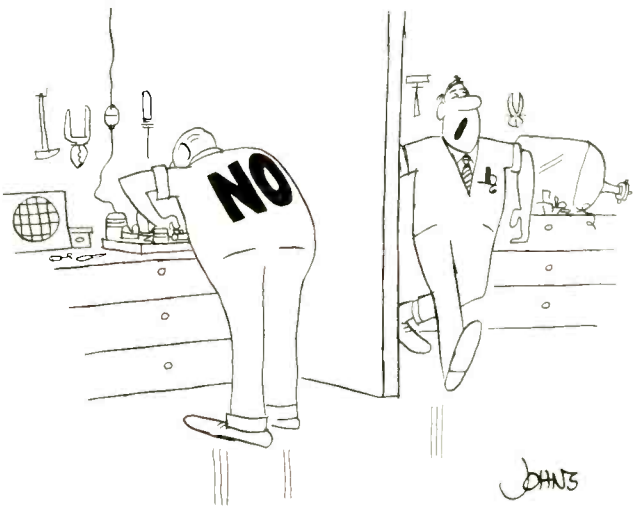
The end result of all this is a vicious circle in which the home viewer is the ultimate loser. The receiver manufacturers are not willing to add better and more expensive audio sections to their products because the quality of most of the audio being transmitted doesn't warrant it. The networks, on the other hand, are not too enthusiastic about upgrading their audio facilities because no one at home could hear the difference. An underlying factor here is whether or not AT&T could provide wideband audio facilities at a reasonable cost to hundreds of television stations.

All of what I have just said applies only to network programs broadcast by a particular local station. Anything a station broadcasts locally is limited in bandwidth only by the transmitter and whatever audio processing equipment the station has. If a station could obtain a videotape copy of a particular network show and play it back locally, the audio would not have to pass through miles of telephone cable and would suffer none of the resulting degradation. Unfortunately, this luxury is rarely if ever afforded to a local station.

There is one exception I know of to the network audio problem and that occurs in New York city. Each of the networks owns a commercial television station in New York city. The individual network control centers and their associated stations are, for all practical purposes, one in the same. Since no telephone lines are necessary to connect the station to the network, the audio information is passed on to the transmitter and finally the viewing public without first having its lows and highs chopped off. I've listened to the New York stations when visiting friends, and even on a television receiver with a small speaker the difference is amazing to say the least.

I personally do not feel that television audio is going to improve in the near future. Neither the networks nor the receiver manufacturers want to make the first move and the stalemate could continue for a long time. Major improvements in television audio will not come about until the consumer decides that he is ready for them and is also willing to pay for them. Until that time comes, we die-hards who would like better sound from our television sets can either move to New York City or jump on the bandwagon for better TV sound and convince the industry to get with it!

Richard P. Markey
Lebanon, Penna.



"Say, Steve, could I borrow..."

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THE END OF THE DOUBLE STANDARD.

OUR LEAST EXPENSIVE RECEIVER HAS THE SAME LOW DISTORTION AS OUR MOST EXPENSIVE RECEIVER.

IM Distortion Comparison

YAMAHA		Brand "A"	Brand "B"	Brand "C"
CR-1000	.1%	.1%	.15%	.3%
CR-800	.1%	.3%	.3%	.5%
CR-600	.1%	.5%	.5%	.8%
CR-400	.1%	1.0%	.9%	1.0%

With most manufacturers, price determines quality. However, in the above chart, you can see how Yamaha alone offers the same quality (low distortion) throughout our entire line, regardless of price.

At Yamaha, we make all our stereo receivers to a single standard of excellence.

A consistently low intermodulation distortion of just 0.1%!

A figure you might expect only from separate components. Maybe even from our $850 receiver, the CR-1000.

But a figure you'll surely be surprised to find in our $330 receiver, the CR-400.

So what's the catch?

There is no catch. Simply a different philosophy. Where high quality is spelled low distortion.

You'll find Yamaha's single-mindedness particularly gratifying when compared to the amount of distortion other manufacturers will tolerate throughout their product lines. (See chart.)

Particularly gratifying and easily explained.

Less of what irritates you most.

While other manufacturers are mostly concerned with more and more power, Yamaha's engineers have concentrated on less and less distortion.

Particularly intermodulation (IM) distortion, the most irritating to your ears. By virtually eliminating IM's brittle dissonance, we've given back to music what it's been missing.

A clear natural richness and brilliant tonality that numbers alone cannot describe. A new purity in sound reproduction.

A musical heritage.

Our seeming preoccupation with low distortion, in general, and the resulting low IM distortion, in particular, stems from Yamaha's own unique musical heritage.

Since 1887, Yamaha has been making some of the finest musical instruments in the world. Pianos, organs, guitars, woodwinds, and brass.

You might say we're music people first.

With our musical instruments, we've defined the standard in the *production* of fine sound. And now, with our entire line of receivers and other stereo components, we've defined the standard of its *reproduction.*

Four different receivers, built to one standard.

Between our $330 CR-400 and our $850 CR-1000, we have two other models.

The $460 CR-600 and the $580 CR-800.

Since all are built with the same high quality and the same low distortion, you're probably asking what's the difference.

The difference is, with Yamaha, you only pay for the power and features that you need.

Unless you have the largest, most inefficient speakers, plus a second pair of the same playing simultaneously in the next room, you probably won't need the abundant power of our top-of-the-line receivers.

Unless you're a true audiophile, some of the features on our top-of-the-line receivers might seem a bit like gilding the lily. Selectable turnover tone controls, variable FM muting, two-position filters, even a special five-position tape monitor selector.

However, you don't have to pick one of Yamaha's most expensive receivers to get a full complement of functional features as well as our own exclusive Auto Touch tuning and ten-position variable loudness control.

The End of the Double Standard.

Just keep in mind that all Yamaha stereo receivers, from the most expensive to the least expensive, have the same high quality, the same low distortion, the same superlative tonality.

It's a demonstration of product integrity that no other manufacturer can make. And, an audio experience your local Yamaha dealer will be delighted to introduce you to.

YAMAHA

International Corp., P.O. Box 6600, Buena Park, Calif. 90620

Circle No. 44 on Reader Service Card

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Audio ETC

Edward Tatnall Canby

THROUGH MOST of a recent two-hour drive out of Connecticut into New York I found myself being quizzed by a young passenger, a musician, anthropologist, record collector, and into hi fi, about various types of speakers—and why. (I.e., What speakers should he buy for his system?) This guy reads a lot of the poop, as we tend to call it, and he knew the names of as many brands as I do. He has brains and curiosity; he wanted to know. Yet I was astonished at his basic ignorance concerning such fundamentals, say, as a speaker system which suppresses the back wave and makes use only of the front, the acoustic suspension type (he knew that term, all right), versus the newly resurgent front and back wave types which are now so very much in the hi-fi news. Maybe all the poop isn't doing its job, for all the glamour?

Most readers of this mag (I am supposing) are moderately up on technical matters and so know a lot about this, including all the excitement about Messrs. Thiele and Small (see "Dear Editor", Feb. 1976). On the other hand, for those younger readers who may be a bit new to our game, I figure a brief non-technical outline of speaker history (such as I had to produce, perforce, while driving) might be a useful background for the thorough technical coverage we offer in so many articles and equipment profiles in *Audio*.

What has concerned us the most, over the years, is bass. Highs—yes, but there, the problem involves the whole speaker cabinet only marginally, whereas the enclosure design and especially its size and shape is crucial for bass and always has been. True even for electrostatics, where bass and size are directly related. In the beginning (the beginning of electrical reproduction, that is), there was no bass. Skinny horns in the shape of a question mark, minus the point, and skinny sounds therefrom, even though horn loaded to an extent. Then—from the public's viewpoint—came the cone speaker in an open-back cabinet, and suddenly, *for the first time*, we who bought radio-phonographs and played 78 records on them, or listened to broadcasts of music, and heard genuine bass of a loud, emphatic sort.

No, no, not flat bass! Obviously there were specialists who even then built vast horns and what-not to achieve hi-fi bass down to the subsonic, but we, the listening public, knew nothing of such matters. Instead, we positively gloried in what later came to be known as "boom bass." Technically, this was peaky, highly distorted mid-bass reproduction, ruinous of transients, mushy and thumpy; but if you had heard no other, it was marvelous. A new sonic experience and a musical bonanza, after so many long years of the old acoustic records and a million tinny machines that produced no bass whatsoever, leaving the ear to reconstruct the musical sense in the bottom range from the meagre sonic clues available. It could be done. Otherwise—no music. But real bass, audible bass unreconstructed, was something else again, and it kept us happy for a good many years through the 1930s and on into the postwar period's beginning.

Yes, most of us became aware that if you removed a loudspeaker from its (open back) cabinet, the bass disappeared. You needed the cabinet as a baffle, to keep the back-propagated bass from cancelling the front wave as the two curled around the edge and met head-on. The lower the tones, the worse the cancellation; hence a neat roll-off to zero. In a cabinet, and with the separation between back and front nicely compounded by the sides of the box, you could get that good old thump bass (not really very low—just heavy and positive) to everybody's idea of perfection.

Then, among those of us of an experimental turn of mind, came the "separate baffle," a big plywood or celotex board, as big as possible, with a hole in the middle for your speaker, removed from its cabinet. Terrific improvement—and just try putting said board up against a fireplace. Suddenly, a gargantuan bass! And much cleaner than before. I produced this miracle in my New York apartment in the late 40s and that fireplace served me for, I hate to tell you, how many years. The fireplace itself wouldn't

AmericanRadioHistory.Com

Introducing the Aristocrat of Loudspeakers—Celestion Ditton 66.

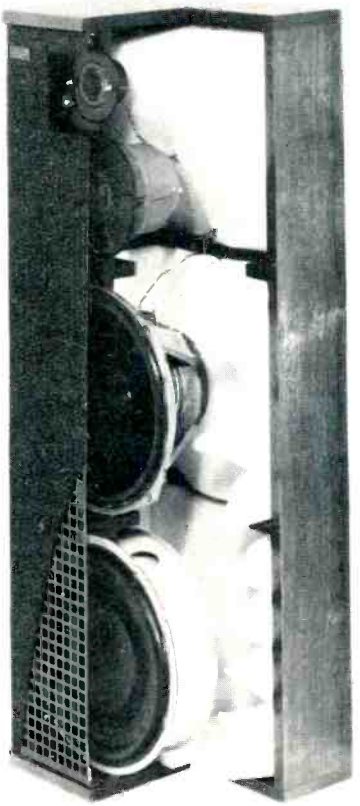
Are you the rare audiophile who seeks to step above the mundane and into the realm of of exceptional? Then Celestion Ditton 66 deserves your careful scrutiny. We are not examining an ordinary speaker—but Britain's most refined distillation of 50 years of loudspeaker expertise.

Starting with the exterior, Ditton 66 appears not as a precision musical reproducer but as an elegant piece of hand-crafted furniture. Its slim, classical proportions and angled front corners provide an unobtrusive appearance which belies the sophisticated array of drivers within.

We now examine the interior of the Ditton 66. Removing the front grille panel, we immediately notice that the four drive units are all flush mounted for complete absence of tunnel or diffraction effects.

High flute notes must be clean, smooth, and avoid ringing. Celestion's HF 2000 tweeter reproduces these flawlessly from 5000 to 40,000 Hz. There is nothing like it for exceptionally smooth, extended frequency response, tight transients and outstanding dispersion for matchless stereo definition. The HF 2000 is renowned for its complete absence of listener fatigue.

The MD 500 dome midrange unit covers 500 to 5000 Hz with very low distortion, exceptional dispersion and correctly maintained phase relationship. The MD 500 possesses an extremely powerful magnet, ensuring critical damping and high power handling.



Ditton 66 employs a 12" bass transducer capable of exceptional quality low frequency reproduction. The diaphragm is formed of heavy fibre, plasticized to prevent resonances and suspended by means of a neoprene roll surround and concentric rear suspension. The result is ample linear excursion for lowest possible distortion on bass notes. Finally, a 12" auxiliary bass radiator with double roll suspension ensures correct ultra-bass reproduction to 16 Hz.

These drivers were totally researched, designed and built by Celestion to work together in the Ditton 66. Exceptionally clean, wide-open sound, outstanding dispersion and transient response, and total harmonic distortion of well below 1% at almost all frequencies —these qualities combined make a truly aristocratic performer of the Ditton 66.

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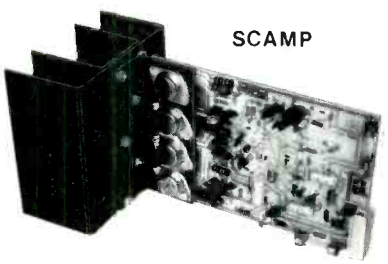

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work, anyhow (the room just filled with smoke), and so there was no reason not to use it. Maybe a tenth of one per cent of informed record listeners got so far as to try the Separate Baffle back in those days. The rest of them went along with the standard open-back cabinet, assuming they did anything as fancy as that; as now, there were countless table-top machines with speakers in their lids or in the front panel, for a slight but very limited improvement over the old acoustic phonograph.

Remember..., Remember

I should toss in a word about the Orthophonic Victrola, from around the time Victor became RCA Victor. The Orthophonic disc was electrically made, via microphones and electrical cutters, but the Orthophonic phonograph was still acoustic powered. What it had, though, was an ingenious and carefully designed horn loading, a folded-horn system, which took hold of a lot more bass than any earlier standard acoustic machines, particularly via the new electrical recordings. Today, the Orthophonic Victrola sounds pretty tinny and thin, but I can vouch for its amazing effect upon us at the time. There was not only an extension of the low end into what could really pass for bass sound, more or less, but the volume was—still acoustic—remarkably loud. This was one of the earlier examples of horn-loaded efficiency in sound reproduction, powered entirely from the energy of the moving "needle." There were other famous models, acoustic and electric—as I remember the Brunswick Panatrope was electrical; but the Orthophonic Vic. was the one that really impressed musical people who bought recordings.

By comparison, the succeeding electric phonograph in its stand-up cabinet made a monstrously big bass noise, and I remember intensely disliking it. Instinctive dislike of the boom bass? Maybe. It was a violently resonant effect, going off with a rattle and a blast on certain pitches, the speaker simply breaking up into meaninglessness. But I think the real trouble was the concomitant lack of a high end. "Nothing over 4000 cycles," we used to say but actually the roll off (approaching a cut off) left very little useful sound above 3 kHz. Hard to believe today. Not a trace of an "S." The sibilants were identical with the fricatives (S and F). Nor any more than the barest hint of instrumental color in music, so that flutes and violins were the same; triangles simply did not exist. You could hear a piccolo faintly, if it didn't play too high.

No highs and a heavy, boomy bass; it was a bad combination. But in the end we got used to it and enjoyed it for the music it brought us, there being, as far as we knew, no other kind of reproduced sound. This boom/muffle effect was in fact wholly "normal" for reproduced music and voice, right up until the advent of popular hi fi in the late '40s.

Tuned Boxes and Horns

We had moved precipitately from the shrill acoustic sound, tinny and minus bass, straight to a sound which was just the opposite, muffled and bass-heavy. And here, opportunely, entered the juke box, on the most solid of practical grounds. In that astonishingly prolific public instrument, the boomy resonance was magnified unbelievably and, in the jukey sort of location, was absolutely ideal. First, a strong, thumpy rhythm, dominating all else. Second, a super-muffled high end where highs were quite useless—drowned out or swallowed up by assembled humanity and vast amounts of talking and other extraneous noises. The boom bass moved easily around every corner and into every nook, non-directional and largely immune to absorption. So the juke box was king for a generation and inevitably influenced the home receiver, the radio-phonograph in the living room. If people wanted anything more, it was more of this boom bass (though *this* purist continued to hate it!). So the stage was set—for the bass reflex. And there *it* was—a new all-around cabinet with a back which could produce lower, stronger bass than any open cabinet and, with careful tuning, might even produce a crisp, relatively flat bass too. And it wasn't any bigger than the usual box either—maybe smaller.

The tuned bass reflex box came in slowly. It gradually proliferated, making its way into what eventually became the early world of hi-fi componentry. My memory is hazy—was it first used in the 1930s? Was it a Jensen patent? (And is the term still protected? If so, all credit where credit is due.) But for many years, I personally remember this type of tuned cabinet with its solid, well-insulated insides and its tuned port to let out the back wave, as pretty much the elegant standard in good-quality, enterprising home systems amid the beginnings of do-it-yourself. That would take us right up to the late '40s, after the War,

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If you're surprised to learn that tubes solve some amplifier problems best, you have something to learn about amplifiers.

And about LUX.

It may seem courageously retrogressive for a company to introduce a *tube* amplifier—even a highly advanced type—to the semiconductor audio world of 1976. Especially for a company only recently established in the U.S. market with a comprehensive line of solid-state amplifiers and tuners. But for LUX, it is simply consistent with our philosophy: whatever path may lead to improvement in the accuracy of music reproduction will be explored by our audiophile/engineers. Whether it leads to transistors or tubes.

Certainly, transistors are not about to be obsoleted by tubes. However, there are some amplifier problems that tubes still handle better than transistors. Overloading is one such problem.

When a solid-state amplifier is driven beyond its rated power, it clips abruptly. Engineers call it "hard" clipping. The term is apt, as the sound from the spurious high-order odd harmonics is raspy and irritating. Further, if the overall circuitry is not stable, and the protective circuits not very well-designed, the distortion is extended in time beyond the moment of overload. Drive a tube amplifier beyond its rated power and it too clips the waveform, but gently and smoothly. This "soft" clipping introduces much smaller amounts of odd harmonics. The distortion is far less irritating, hence less noticeable.

Notch (or crossover) distortion, present in many transistor amplifiers, is another source of spurious high-order odd harmonics. It occurs when the transistor output circuits are not able to follow the musical waveform accurately at the points where it changes from positive to negative and back again. Since notch distortion, unlike clipping, is at a constant level regardless of the power the amplifier is delivering, the ratio of this distortion to signal is worse at lower power. The gritty quality heard from many transistor amplifiers, particularly when they are playing at low levels, is usually due to crossover distortion.

Of course, tubes also have *their* limitations. Especially conventional tubes. The only tube previously capable of high-power amplification—the pentode—has inherently higher levels of distortion than the triode. Existing lower-distortion triode tubes cannot deliver sufficiently high power as a simple push-pull pair. But LUX, together with NEC engineers, has developed the first of a new breed of triode tube, the 8045G, which with other related technological advances, makes possible a high-power, low-distortion triode amplifier—the Luxman MB-3045. Among the differences in this new triode: the plate-electrode uses a special bonded metal with high heat-radiation characteristics. Also, the fin structure further aids heat dissipation.

LUX also developed a low-distortion high-voltage driver tube, the 6240G, capable of delivering over 200 volts of audio signal to the output triodes. Also, a new output transformer (LUX's long-time special area of expertise) has been designed to take optimal advantage of the triode configuration feeding it. The quadrafilar winding and core technology of this transformer represents another breakthrough. Overall, from input to output, the use of advanced design direct-coupled and self-balancing differential amplifier stages ensures stability and minimum phase shift.

The MB-3045 produces a minimum of 50 watts continuous power into 4, 8, or 16 ohms, at any frequency from 20 to 20,000 Hz, with total harmonic distortion no more than 0.3%. As the MB-3045 is monophonic, a pair of them connected to a stereophonic preamplifier will not be subject to stereo power-supply interaction.

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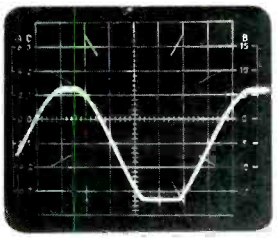
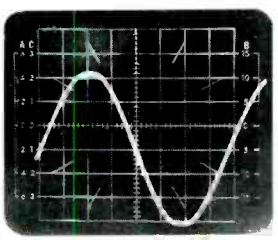
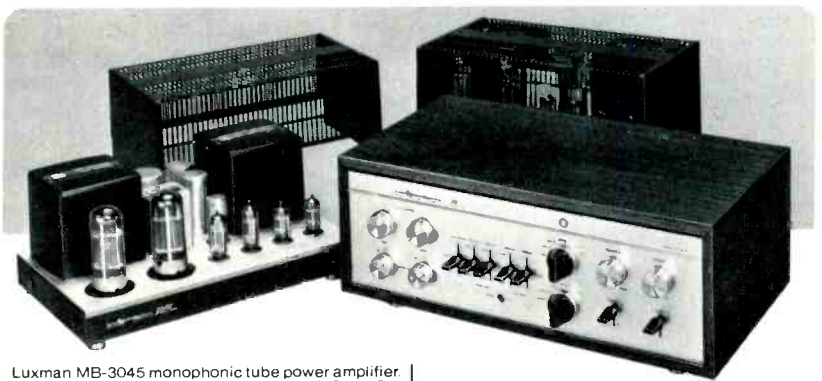


When a typical transistorized amplifier tries to deliver more power than it can, the top and bottom edges of the waveform "clip" sharply and abruptly, and not always symmetrically. Result: high-order harmonic distortion, raspy and irritating.



When a tube amplifier, such as the Luxman MB-3045, is driven into overload, the "clipping" is softer, with more rounded edges to the waveform. The resulting distortion is much less audibly bothersome.



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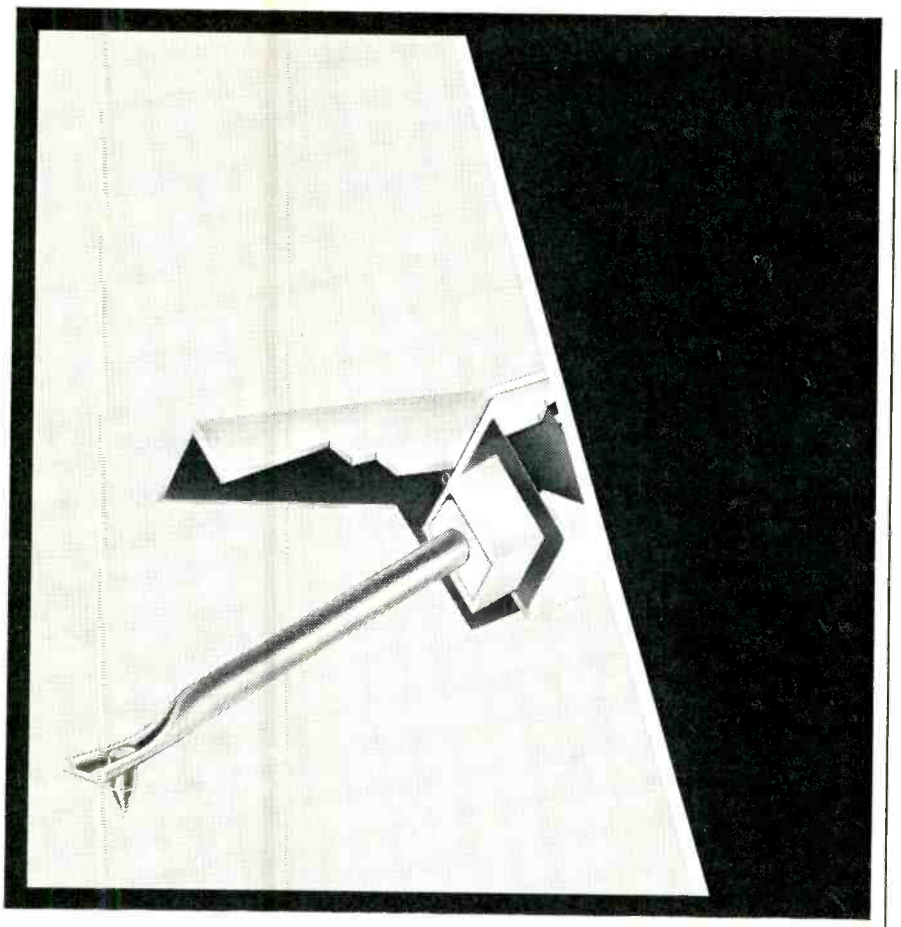

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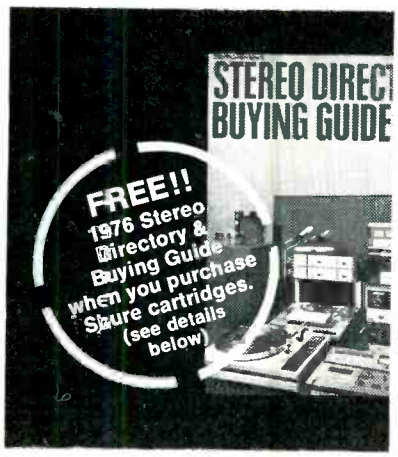

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when hi fi (and this magazine) first began—literally—to boom.

Horns? Paul Klipsich didn't produce the first horn-loaded loudspeaker, if you count the old acoustic Orthophonic and the fireplace baffle but his, no doubt, were (and are) among the very best and most ingeniously folded. Exponential expansion of the space behind the speaker (or in front), to load up, pull down, and smooth out the bass range—and to maximize efficiency. I don't remember who built the first concrete house-size horn monster, but this excellent principle for getting good, and flat, bass has always been bulky (not to say complex) even in its folded format, and that is probably why the bass reflex in its numerous variants was the type we listeners got to know as a standard.

It blossomed everywhere, and there was only one major hitch to its operation—assuming that you had tired of juke boom and wanted a lower, crisper bass out of your box. In those days you bought your loudspeaker as a component and installed it in a separately bought cabinet. Chaos! For the essence of this system is the careful tuning of the cabinet space and port to the characteristics of the speaker. This delicate matter was left to the home user or the non-knowledgeable dealer and 99 per cent of the time it was botched. Just put the speaker into the cabinet and turn on the juice! Either it boomed unmercifully, or it didn't, and very few of us knew enough to understand that we could do something about it. Most of us assumed that the sound we heard, so to speak, came straight from the loudspeaker—and if there was an unlovely thump and boom, then that driver couldn't be a very good one. Mushy kettledrums, growly string basses, were speaker unit faults. Not so! More likely, a mistuning of cabinet and speaker, to produce a big resonant peak due to the resonances of speaker and cabinet coinciding, instead of being smoothly offset to carry the speaker's range lower than its free air resonance. . . .

All this, of course, is primer stuff for anybody who knows his present hi fi. Nevertheless, I suspect that a good many sharp readers of Thiele and the others are unaware of the earlier background, so well known to us, who are older. In another installment, I'll continue the capsule history of speaker bass and speaker fashions through the hi-fi ages and will hope you oldsters will go nostalgically along with me.

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Behind The Scenes

Bert Whyte

IN 1974, THE long-playing, 33 1/3-rpm record celebrated its 25th anniversary. It is, of course, the prime medium for recorded music and an economic giant. Now, in 1976, open-reel recorded tape has reached its 25th anniversary and, sad to say, has fallen on parlous times.

Twenty-five years ago, I was, in essence, the mid-wife at the birth of open-reel music tape. I was with Magnecord at the time, and negotiated a pact with George Mendelssohn, President of Vox Records (who was as venturesome then as he is today), to produce open-reel recordings which we called "Magnecordings by Vox." The tapes were, of course, monophonic, at 7½ ips, full track, although I seem to recall we issued some half-track tapes as well. The signal-to-noise ratio was a snappy 48 dB, but they were duped one-to one, using a battery of Magnecords as slave units. The tape masters were of European origin, on huge 14-in. reels, and the tape oxide was a bilious yellow which shed all too easily. Even back then, we were ambitious enough to turn out such items as Otto Klemperer and the Vienna Symphony Orchestra performing the Mahler *2nd Symphony*.

A little later, a few small companies produced some mono tapes. Then RCA got into the act, producing mono tapes they called "orthophonic," and not long after that Livingston and Concert Hall Society produced the first stereo tapes. Finally, in 1954 RCA issued the first "major company" stereo tapes, and open-reel music tapes were well and truly launched. Columbia, Vanguard, Mercury and other companies issued stereo tapes. Ampex created United Stereo Tapes and became a major factor in the business. Quite a respectable catalog of pop and classical tapes was built up, and sales of half-track stereo tapes had reached about $7 million per year, when the stereo disc was introduced in 1958.

Although the technical quality of the early stereo discs left a great deal to be desired, they had one very significant advantage over the stereo tapes, and that was that they were far lower in price. Consider the fact that a stereo tape of the Tchaikovsky *6th Symphony* cost as much as $18.95 versus $5.95 for the same music on stereo disc, and you can understand why there was a rapid erosion of the sale of stereo tapes. As the quality of the stereo discs improved, the sales of stereo tapes decline even more drastically.

Why the big price differential between tape and disc? You must remember that the stereo tapes were made in what we call today "half-track" stereo, that is two channels played back in one direction from supply reel to take-up reel. Thus, if a piece of music was 46 minutes in duration, it was necessary to use a length of tape that would give you this running time at 7½ ips. The tape reel alone cost more than the basic disc pressing, to say nothing of the sheer mechanical and handling complexities of tape duplicating, with their subsequent higher labor costs. As the stereo disc gained momentum, there came a period when the stereo tape market was so depressed, that none of the companies issued new releases for many months.

Finally, when the stereo tape market was at its very nadir, Ampex came to the rescue by introducing the quarter-track stereo tape. In this configuration, there are four tracks interleaved with appropriate guard bands, with one set of stereo tracks (1 and 3) running from supply reel to take-up reel, and at the conclusion of the first pass or "side," the reels are reversed and the other set of stereo tracks (2 and 4) are played. Naturally, at the conclusion of the second pass, the tape has wound onto its original reel and is once again ready for playback. Of course, each set of stereo tracks is derived by approximately halving each track of the original two-channel format. Thus, for any given amount of playing time, the quarter-track stereo format requires but half the length of tape that would be necessary in the half-track stereo format. Evidently, the cost of the duplicating tape was a major factor in the overall costs of producing stereo tapes, so when the tape requirements were halved by adoption of the quarter-track format, Ampex was able to substantially reduce the price of its stereo tapes. To be sure, they were still more expensive than their counterparts on

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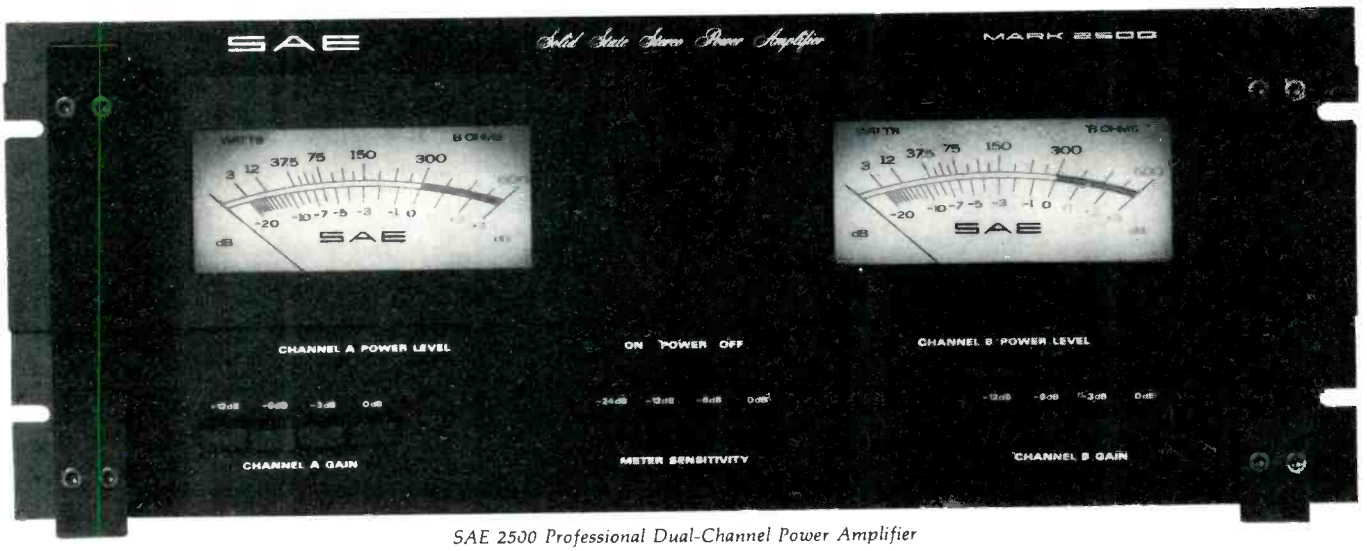

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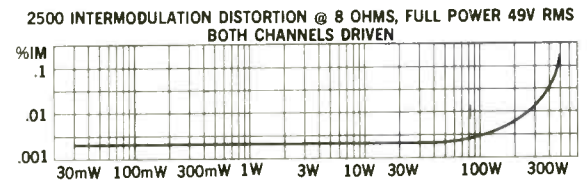
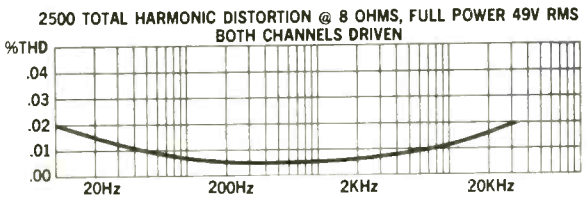
*These specifications comply with FTC requirements for power amplifiers.





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disc, but the differential was relatively modest.

The adoption of the quarter-track stereo format was a much needed stimulus to the open-reel tape market, but it was not without its problems. First and foremost was that tape decks needed a playback head of the proper configuration to reproduce the new tapes. The tape machine manufacturers were quick to jump into the breach, but it still was some time before large numbers of the units were in the hands of the consumers. Then there was the irksome problem of inter-channel crosstalk.

To give an example, when playing stereo pair of tracks 1 and 3, the stereo pair of tracks 2 and 4 are going by the head backwards. If there is insufficient isolation between the pairs at an unfortunate juxtaposition, such that a pianissimo section is being played while a fortissimo section on the other pair of tracks is passing at the same instant, there will be leakage and the sound of tracks 2 and 4 will be heard backwards, superimposed on tracks 1 and 3.

Many people have thought that this crosstalk is the fault of the tape duplication. In the earlier days of the quarter-track stereo format, the fault lay usually in the playback head, where the crosstalk was the result of a transformer coupling phenomenon between adjacent pairs of head stacks. Improvements in head design have eliminated most of this crosstalk problem, but it still crops up in certain tape decks. A typical stereo playback head these days should have isolation between channels of better than 50 dB, and providing the playback is not at very elevated levels beyond the usual domestic situation, crosstalk shouldn't be bothersome.

Within two years after the adoption of the quarter-track stereo format, open-reel tape was prospering. Ampex reorganized its operations and formed Ampex Stereo Tapes. Under this umbrella, Ampex turned out open-reel stereo tapes for a multitude of record companies. Many other companies independently produced open reel tapes. It is claimed that by 1966, open-reel tape sales were running at an annual rate of $36 million. In 1974, this figure had shrunk to about $2 million a year. What had happened once again to bring open-reel tape to this low estate? It is hard to say. Certainly there were continuous improvements in the stereo disc, which undoubtedly cut into tape sales. Probably, a lot of people were satisfied with the quality of the cassette format, especially when Dolbyized, and moved out of open reel. It must be admitted that, with all of the advantages of open reel tapes, the omnipresent and ongoing problem of tape hiss turned many people away from open-reel tape.

Ampex addressed itself to allaying the hiss problem by coming up with better duplicating tape and more sophisticated methods of tape processing, as witness their Ampex 2 tapes and then their EX-Plus tapes. As readers of this column know, I long and loudly championed the idea of Dolby B processing for open-reel tape, and finally Ampex capitulated. Eureka! I thought we had it made and the tape millenium had arrived. The first examples of the Ampex Dolby B tapes were very promising with that old bugaboo tape hiss finally laid to rest. Alas, the ongoing program has been inconsistent. Some tapes are fine, others, while free of hiss, have other defects, most commonly what sounds like tape sat-

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If all loudspeakers were tested with a square wave, only one we know of would pass.

Ours. Our new Phase-Link™ loudspeakers would pass this demanding test because they do not exhibit the phase distortion present in most conventional loudspeakers. Phase distortion is one of the reasons you do not see a square wave being used to test speakers, cartridges and amplifiers, yes, but not loudspeakers.

Phase Distortion Explained. Phase distortion is heard as a blurred sound picture and prevents accurate localization of instruments. It is most noticeable in the low frequency range at higher volumes. It occurs in most conventional, multi-way loudspeakers at the crossover point, when the same note is being reproduced by two drivers. Because today's high quality loudspeakers have virtually solved the problems of frequency response as well as harmonic and intermodulation distortion, the study and correction of phase distortion is all the more important if you are to literally recreate the original performance.

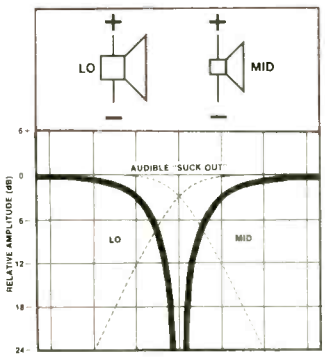


Diagram A. When drivers are placed in-phase, a problem of audible "suck out" is created.

Our Research. At the 1973 AES convention in Rotterdam, two Bang & Oulfsen engineers, Madsen and Hansen, presented a paper on audible phase distortion. This paper represented three years of concentrated research within which they developed an electronic crossover, tri-amplified loudspeaker that allowed them to demonstrate three important facts: 1. Phase distortion did indeed exist in loudspeakers. 2. That it was audible. (Hundreds of hours of critical listening tests confirmed this.) 3. That it could be effectively eliminated through sophisticated technology.

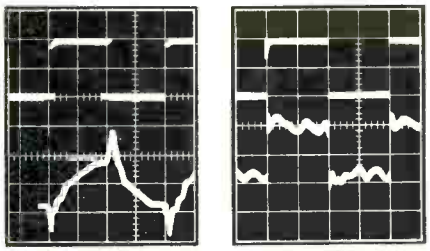


Diagram B. A high quality conventional loudspeaker (left) and our new Phase-Link loudspeaker (right) reproducing a square wave. What happens to the square wave is what happens to music.

Our Product. The experimental speaker developed by Madsen and Hansen was far too expensive to consider for distribution to the audio consumer. A practical solution had to be found.

At this point Bang & Olufsen engineer, E. Baekgaard began his work with mathematical computer simulation. He discovered that the fixed phase shift, present in most conventional speakers (drivers alternated 180° out-of-phase) could be "cured" by placing all drivers in-phase. However, when this was done, an audible amplitude "suck out" was created (See diagram A.). It was to solve this problem that an additional narrow band filler driver—the Phase-Link™ Driver— was developed. Its compensating signal cured the amplitude "suck out" and the variable phase shift. It made the audible output of the loudspeaker virtually identical to the input—the square wave, for example.

Another Refinement. Phase-Link™ loudspeakers have their drivers mounted on a common acoustic axis so that the sound from each driver will reach your ears simultaneously. That is the reason for our slightly canted grill.

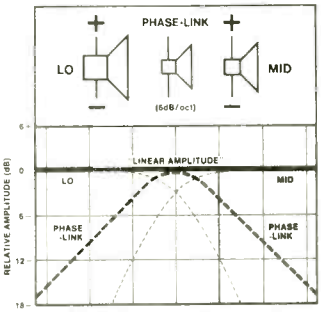
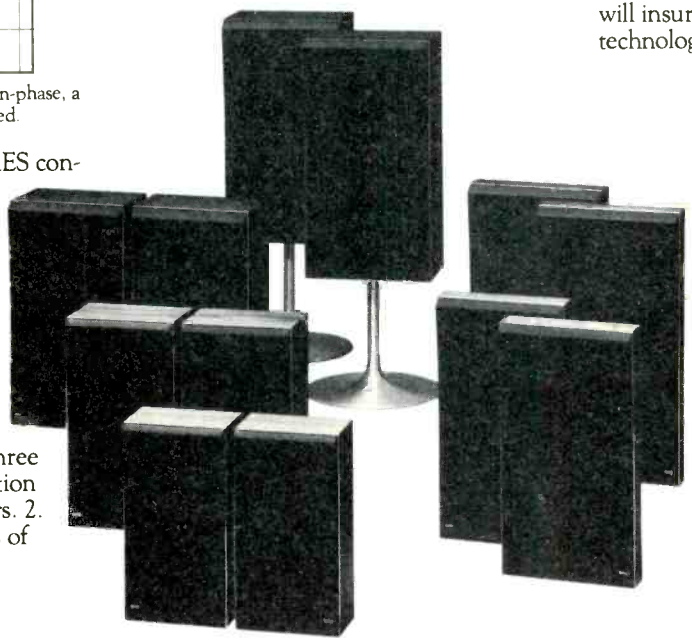


Diagram C. Our new Phase-Link filler driver provides a compensating signal to eliminate "suck out" and variable phase shift.

Your Listening Experience. The importance of our new Phase-Link™ technology and square wave tests is of course determined by the fidelity of the music recreated by our speakers. It is your sensitivity to the accurate reproduction of music that will give them their severest test. It is our technology which will insure they pass, for rarely has technology served music so well.



Because the ear is sensitive to phase distortion mainly in the lower frequencies, Phase-Link is used between the low-frequency driver and the mid-range unit in the high power, 3-way systems (M-70, S-60) but not between the mid-range and tweeter. In medium-power, 2-way systems, one Phase-Link driver is used in 12dB/oct. filter combinations (S-45, P-45). Low-power, 2-way systems (S-30, P-30) do not utilize a Phase-Link driver but instead eliminate phase distortion through a sophisticated 6dB/oct. filter technique.

Bang & Olufsen speakers include the M-70, shown on trumpet stand (supplied), three bookshelf models, the S-60, S-45, and S-30, and two wall panel speakers, the P-45 and P-30.

Bang & Olufsen

Bang & Olufsen of America, Inc., 515 Busse Road, Elk Grove Village, Illinois 60007

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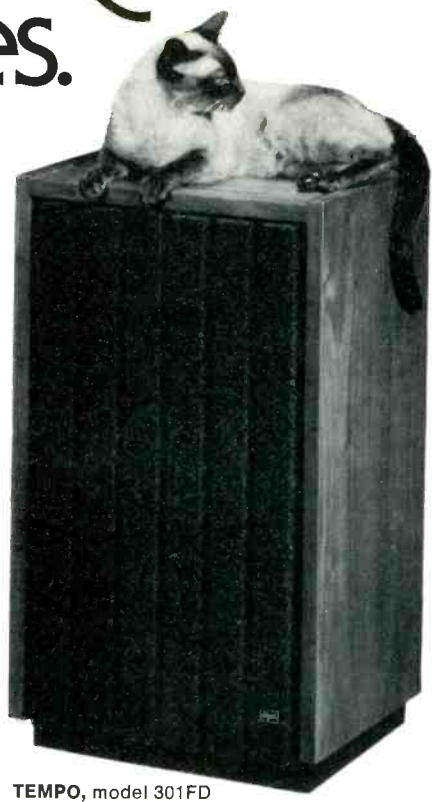
uration and a compressed sound. A visit to Ampex in Elk Grove revealed that in production an automated tape level sensor was in use, and it is possible the level threshold was set too high so that the red "no-go" light came on too late. Then there were Dolby B tapes, that in spite of this processing, still had tape hiss. This wasn't the fault of Ampex, since a number of Dolby A masters sent to them by their record company clients were not made from Dolby A originals, and therefore had the tape hiss of the "straight" originals. While Ampex was producing 8-track cartridges and cassettes by the skillion, open-reel sales continued to decline. Then there was a management reshuffling at Ampex Stereo Tapes, and, after a while, the announcement that Ampex was getting out of the pre-recorded tape business. At first it appeared as if Ampex would continue to duplicate tapes, but have the business of selling and distributing the tapes handled by their record company clients. Although it is hard to find out what is really happening, it now appears that they will get out of open-reel processing altogether. Period. I assure you that there are plenty of die-hard open-reel enthusiasts to whom this is very bad news indeed.

Enter at this bleak moment, the firm of Barclay-Crocker, of 11 Broadway, New York. Tony Barclay and John Crocker are two enterprising gentlemen, who several years ago decided to go into the business of selling open-reel tapes exclusively. They published a catalog of open-reel tapes, and six times a year, a supplement of new releases and chatty information about music and tape matters, which they call *Reel News*. As you can imagine, with Ampex Stereo Tapes their principal supplier of product, the news of the imminent demise of the Ampex operation was a real shocker! After mulling over the situation for awhile, and reasoning that there are an awful lot of people with open-reel tape machines, and that the sale of high-quality tape decks has been in an upward curve for some years now, they have courageously decided to go into the open-reel tape duplicating business themselves. Thus, they have purchased as a starter, an Ampex master playback unit and several slaves. They are lining up all their ancillary equipment such as Dolby A Units and Dolby 320 B generator, etc. They are retaining the services of Harold Kovner, a well-known engineer versed in tape duplication procedures, and Jerry Bruch, a recording engineer of considerable reknown, who has been associated with the fine Unicorn recordings. I have acted as a consultant to them in the initial set-up and will do the master evaluation for them. They are determined to run a ultra high-quality operation. For example, the duping tape will be the equivalent of Scotch 177 Dynarange or better. Then the running master will run at 60 ips and the slaves at 30 ips, so the resultant 7 ½-ips copies will be at a relatively low 2-to-1 duping ratio and should be virtually indistinguishable from the master. At present they are busy trying to line up the various record companies to convince them to enter agreements for the production of open-reel tapes. It is their intent to try for London, DGG, RCA, Columbia, Phillips, Vanguard, and Vox as their principal clients. Needless to say, more power to them! If they can maintain the stringent quality-control procedures they have imposed on their operation, open-reel tapes will have a new lease on life.

BOZAK QUALITY in room-sized packages.



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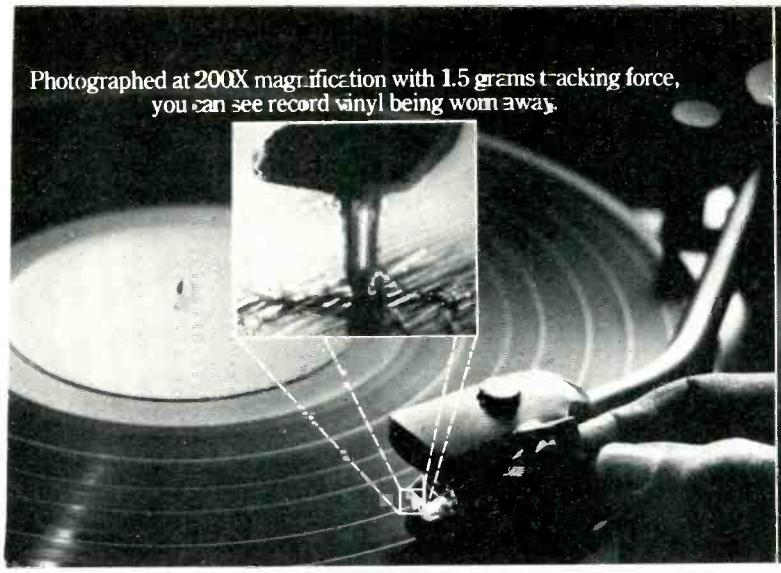
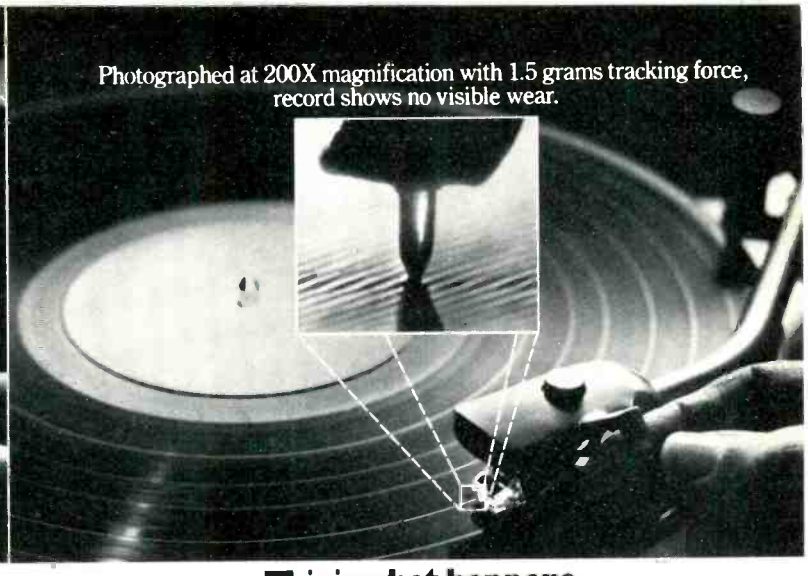


This is what happens every time you play a record.



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Understanding The NAB EQ Standard

Herman Burstein

THE CURRENT National Association of Broadcasters (NAB) Standard for Magnetic Tape Recording and Reproducing (Reel-to-Reel) appeared in April 1965. Although more than 10 years have passed, the nature of standard tape equalization tends to remain obscure and imperfectly understood. I gather this both from audiophiles' questions and statements that are made in some of the popular periodicals devoted to audio.

Such misunderstanding is partly due to the complexity of the subject, which entails the velocity characteristic of the playback head; gap loss, electrical losses, resonance effect, and contour effect of the playback head; electrical losses of the record head; magnetic losses of the tape; surface induction of the tape; magnetic flux entering the core of the playback head; maximization of signal-to-noise ratio; minimization of distortion, and achievement of flat record-playback response.

Misunderstanding is also due to the indirect and piecemeal manner in which the equalization standards are presented. The playback curve in the 1965 Standard is visually much different than the playback curve ordinarily shown in the popular audio periodicals, although one is translatable into the other. The 1965 Standard shows a playback curve with *apparent* treble boost and bass cut, whereas the curve popularly shown has treble cut and bass boost. To put the entire NAB equalization standard together, one has to hunt through various sections of the 1965 Standard, *including* footnotes. One finds only hints, rather than a straightforward statement, that record-playback response should be flat (within certain tolerances).

Presumably an understanding of standard tape equalization is desirable to the aduiophile, perhaps as knowledge in itself and perhaps to assist him in the use, modification, and even construction of tape equipment. To provide this understanding, we shall assume operation at a standard speed of 7½ ips. In principle, what is said about 7½ ips applies to other speeds, except for differences in amount of frequency losses and therefore in equalization required. We shall also assume operation at "normal bias" for a given recording tape—the tape recommended by the tape deck manufacturer and/or chosen by the user. Normal bias is approximately that which minimizes distortion in recording.

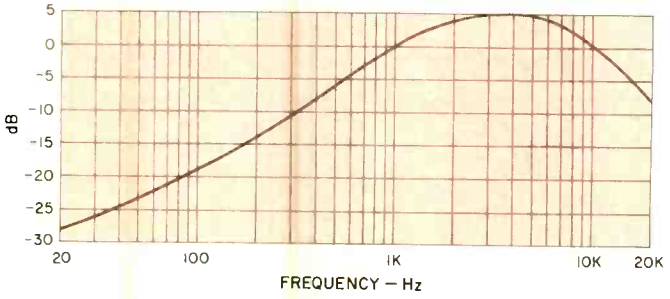

Fig. 1—Typical unequalized record-playback response of a tape deck at 7½ ips.

Unequalized Record-Playback Response

First we require a clear understanding why equalization is needed. Therefore, Fig. 1 shows the typical *unequalized* record-playback response of a high-quality tape deck at 7½ ips, using good tape, with normal bias for this tape. Although input to the deck is flat—constant amplitude for all frequencies in the audio range—output is anything but flat. Output rises steadily until about 4,000 Hz and soon after drops quite abruptly.

Ideally, record-playback response should be flat (or nearly so), represented by a horizontal line throughout the audio range. Clearly, bass boost and treble boost are needed to restore flat response.

Departure of an unequalized tape system from flat response is *largely* explained by two factors: (1) rise in output of the playback head as frequency increases; (2) serious treble losses on the tape owing to magnetic phenomena.

These and other factors are examined in the next two sections, which respectively deal with playback "losses" and record "losses." We put the term losses in quotes to draw attention to the fact that, like the NAB Standard, we will use it in both a positive and negative sense: Losses include gains as well as declines in frequency response. In other words, losses designate both upward and downward deviations in response.

Playback Losses

In playback, the chief deviation from flat response is due to the playback head being a velocity device. As such, it produces steadily rising output voltage in response to a flat input signal (constant magnetic flux in the core of the head). This rise, illustrated by the solid line in Fig. 2, amounts to 60 dB over the audio range of 20 to 20,000 Hz.

A velocity device is one whose output voltage is proportional to the number of changes per second in a magnetic field. For a playback head, the changing magnetic field is due to the signal recorded on the tape. In short, head output is proportional to signal frequency (assuming all frequencies are recorded so as to produce equal flux in the core of the head). Thus, if frequency doubles, voltage output of the head doubles. One octave represents a doubling of frequency, while 6 dB represents a doubling of voltage. Therefore, as in Fig. 2, playback head output tends to steadily rise 6 dB per octave. (More accurately, output rises 6.0206 dB per octave, or exactly 20 dB per decade, on 10-fold rise in frequency such as from 100 to 1,000 Hz.)

A steady 6-dB-per-octave rise characterizes an *ideal* playback head—one with no deviations from Fig. 2. However, a *practical* head displays some irregularities. For a high-quality

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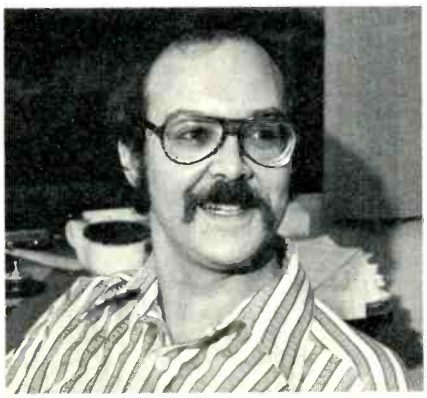
Charles Barker on the Bose Model 301 Direct Energy Control.



"When the Model 301 project came into the engineering department, our goal was to design a bookshelf speaker with minimal placement constraints, that sold for less than $100, yet had the unique spatial qualities characteristic of the Bose 901® and 501 Direct/Reflecting® speakers.

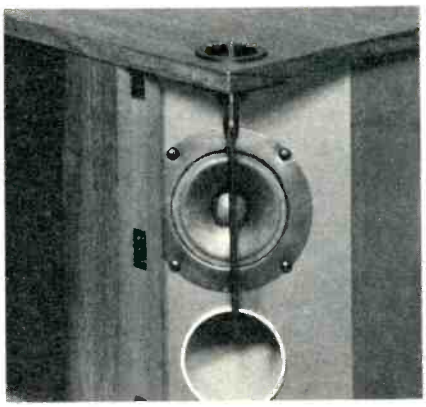
"Initially, two quite unconventional design concepts evolved. First, we deliberately operated the woofer and tweeter simultaneously over a significant portion of the midrange. This Dual Frequency Crossover™ network gave us very smooth midrange response and an open spatial quality.

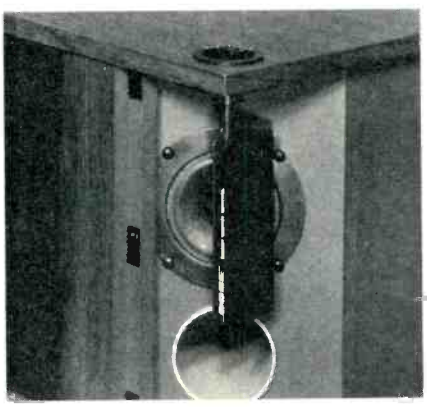
"Second, we perfected a very precise asymmetrical configuration, with the woofer radiating straight ahead, and the tweeter angled to the side, to reflect sound off the room's side wall and into the listening area. From our experience with the Bose 901 and 501 speakers, we knew that this combination of direct and reflected sound would give us the open, spacious sound we wanted.

"At this point, we felt we had an extraordinarily fine loudspeaker. But we were also aware of a problem. Since this design relied on side wall reflections to maintain its spacious sound, what happens in a room with no convenient side wall?

"We felt this was a crucial problem, since we wanted this speaker to sound very good in any listening room.

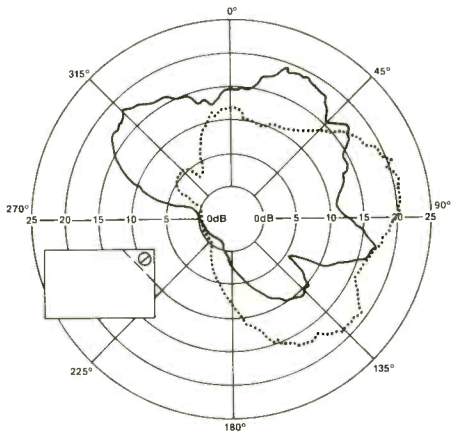
"The solution was the Direct Energy Control – an adjustable deflector in front of the tweeter and hidden behind the grille. The Control can be set to reflect sound off a side wall, or, if there is no side wall, it can deflect high frequency





sound back toward the center of the room, so energy balance is maintained in the listening area.

"Beyond that, the Control lets the listener adjust the spatial qualities of the speaker for different types of music: very spacious for an orchestra, or a much more intimate sound for a soloist.



The solid line is the polar characteristic for the Model 301 with the Direct Energy Control set for maximum direct energy and a more intimate sound. The broken line is the polar characteristic with the Control set for maximum reflected energy and a more spacious sound. Frequency is 8 kHz, bandwidth is ⅓ octave.

"The Direct Energy Control is deceptively simple: of all the things we did in the Model 301, it's the one I get most excited about, because I've seen how people react when they hear the unique dimension it produces in a speaker priced under $100."

BOSE®

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Framingham, Mass. 01701

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For a full color brochure on the Model 301, write: Bose, The Mountain, Framingham, Mass. 01701.

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head operating at 7½ ips, the irregularities are *quite minor* and are as follows.

1. *Treble Loss Due To Gap Width.* Modern playback heads have gaps as narrow as 4 microns (.000160 in.) or less, sometimes approaching 1 micron (.000040 in.). A useful formula for approximating playback head response before gap loss becomes appreciable is f = 0.85S ÷ 2G, where f is frequency in Hz, S is tape speed in ips, and G is gap width in inches. Substituting 7.5 for S and 0.000160 (4 microns) for G, we find that f is about 20,000 Hz. If the gap is appreciably narrower than .000160 in., significant treble loss owing to the gap does not occur until well above 20,000 Hz. Therefore, in the case of a high-quality playback head operating at 7½ ips, gap width accounts for negligible deviation from Fig. 2. (The horizontal dimension of the gap is usually called gap *width* in the popular literature and gap *length* in the technical literature, such as the NAB Standard.)

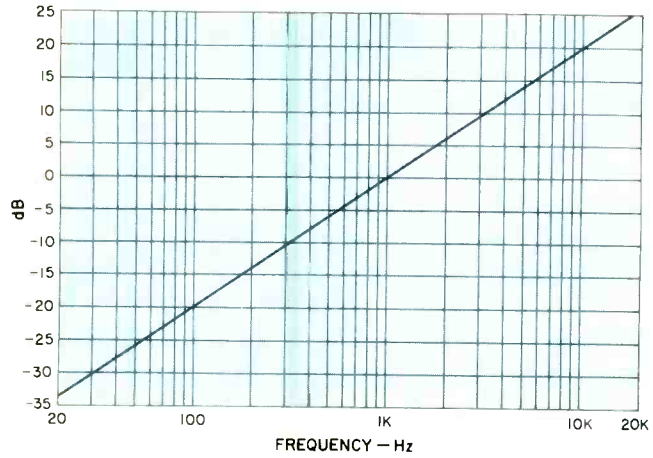

Fig. 2—Response of an ideal playback head with constant magnetic flux in its core.

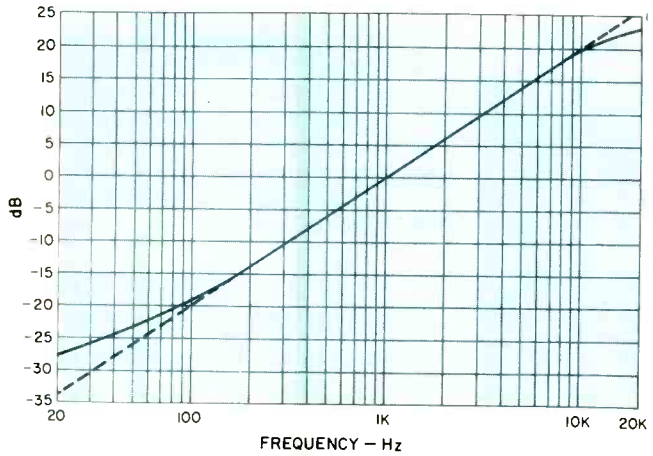

Fig. 3—Typical response of a practical playback head with constant magnetic flux in its core.

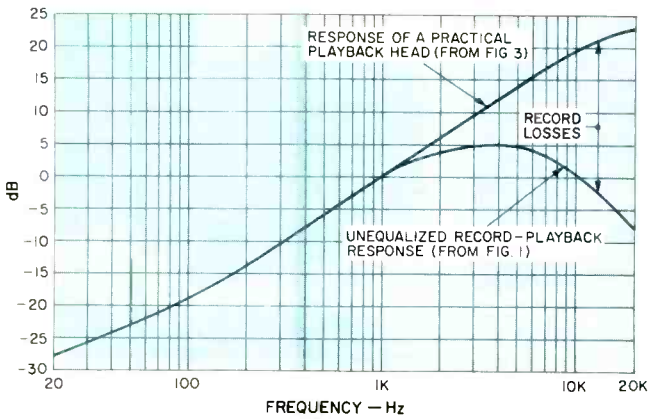

Fig. 4—Typical record losses at 7½ ips.

2. *Electrical Treble Losses.* These are largely due to hysteresis and eddy currents in the core of the playback head, and to winding capacitance of the head. Partially offsetting these is a resonance effect due to the head capacitance in series with load capacitance. For a well-made playback head in a well-designed circuit, the net electrical loss tends to be very little within the audio range, perhaps in the vicinity of 1 to 3 dB at 20,000 Hz.

3. *Bass Rise Due To Contour Effect.* As frequency declines, wavelength of the signal recorded on the tape grows longer. (Wave length is tape speed divided by signal frequency, or inches of tape per audio cycle.) As recorded wavelength increases, the entire playback head (not only the gap) reacts to the tape's magnetic field, augmenting response. Thus, the output of the playback head tends to rise in the bass region relative to the theoretical, or ideal, response slope of 6 dB per octave. The nature and extent of this relative rise in bass depends in part upon the angle at which the tape approaches and leaves the head. Sometimes the effect of this angle is separately identified as the "wrap effect." However, we can conveniently combine all these phenomena under the single term "contour effect." For a well-designed playback head in a well-designed transport, the contour effect tends to be moderate—resulting in something like 3 dB relative bass boost at 50 Hz.

Altogether, for a flat signal input, the irregularities in output of a high-quality playback head cause it to deviate very little from the ideal response of Fig. 2. In other words, for constant magnetic flux in the core of the head, output would typically be about that of Fig. 3. Here the response rises 6 dB per octave through most of the audio range, but at a slightly slower rate in the low bass and in the high treble owing to the contour effect, gap loss, and electrical losses.

Record Losses

Figure 4 compares the response of a practical playback head with unequalized record-playback response. The difference between the two curves is due to losses in recording. Playback head response assumes constant magnetic flux in the core of the head owing to a flat signal on the tape. Unequalized record-playback response reflects the actual signal on the tape—one that embodies vast treble losses.

Depending upon the kind of tape employed and the amount of bias, the treble losses in recording may vary somewhat from those shown in Fig. 4. Typically, however, they total around 30 dB at 20,000 Hz at 7½ ips. (They are appreciably smaller at 15 ips and appreciably larger at speeds below 7½ ips.) In order of importance, following are the factors that cause record losses.

1. *Self-Demagnetization.* Frequencies recorded on tape are in effect a series of bar magnets oriented lengthwise on the tape; each bar magnet corresponds to a half-cycle. The opposing north and south poles of a bar magnet tend to cancel as the bar becomes shorter. With increasing frequency, the recorded wavelength (tape speed divided by frequency) becomes shorter, thus the bar magnets become

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At Harman Kardon, we explore new technical directions not solely for their inherent challenge, but as methods of predicting and improving music quality.

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Our 730 receiver meets specifications equalling or surpassing those of the finest individual component units. Yet it achieves a quality of transcendent realism which these specifications alone cannot explain.

To predict musical accuracy, we have found it necessary to go beyond conventional specifications. We test, rigidly, for square wave response. We monitor, strictly, slew rate and rise time. These tests account for the sound quality of the 730—not in place of conventional specifications, but beyond them.

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All of this suggests further discussion. If you are interested in such an exploration, please write us (directly, since we imagine you are impatient with coupons and "reader service" cards, and so are we). We'll certainly write back, enclosing a brochure also unconventional in its detail. Just address: The 730 People, Harman Kardon, 55 Ames Court, Plainview, New York 11803.

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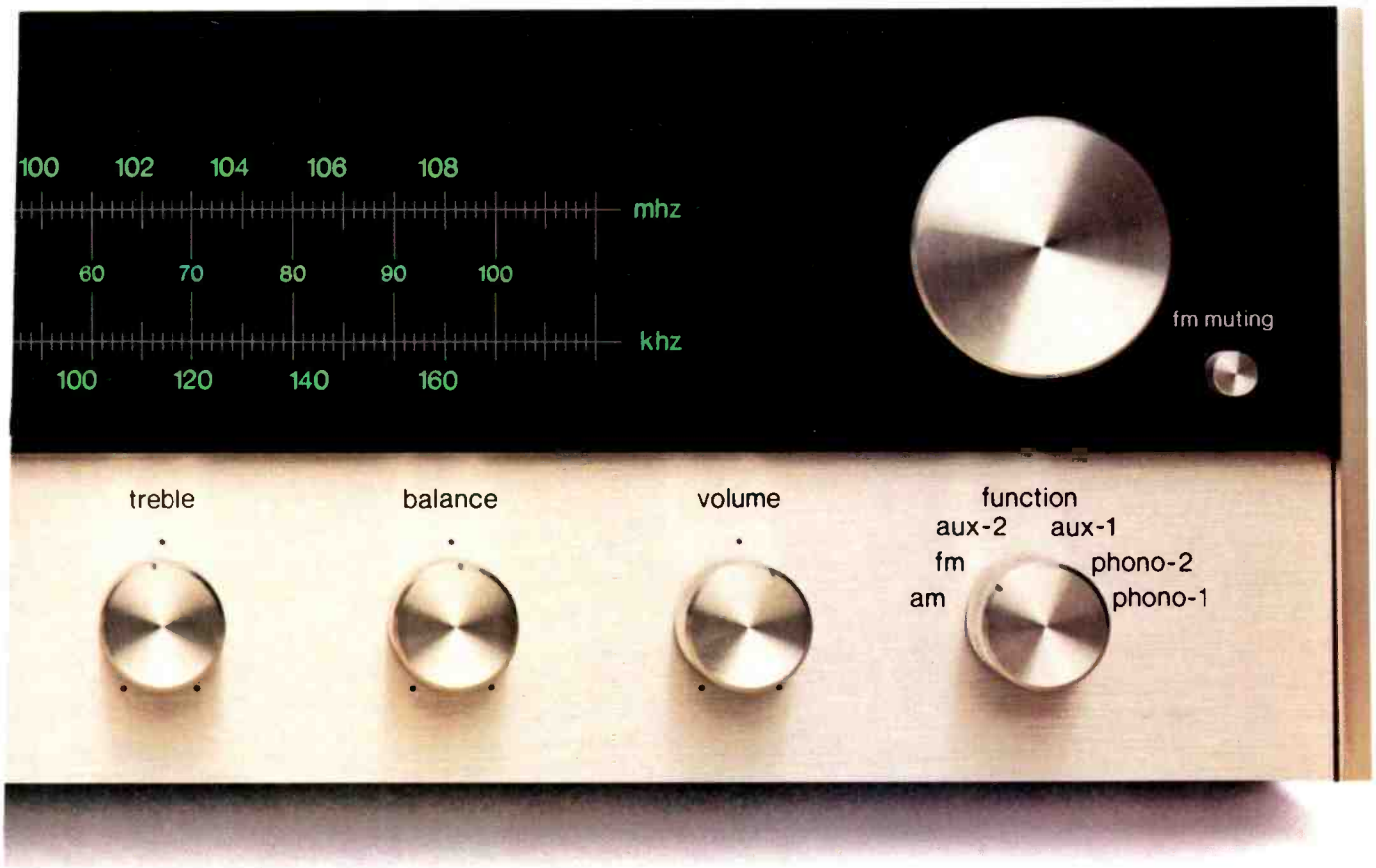
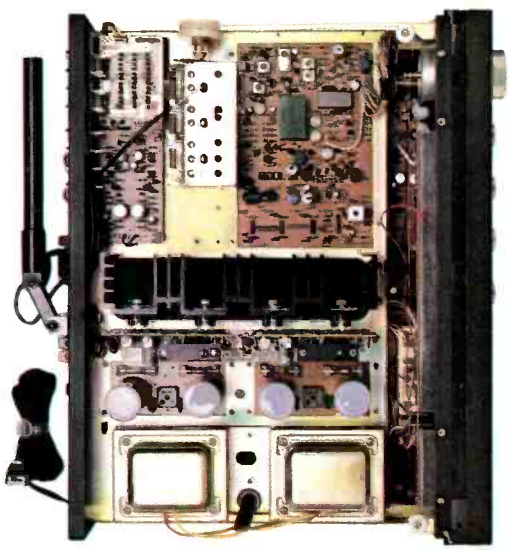


The expression is new.



SPECIFICATIONS

Power Output	40 Watts Min. RMS per channel both channels driven into 8 ohms from 20Hz to 20kHz, with < 0.1% THD.
Power Bandwidth	From 10Hz to 40kHz at < 0.1%THD into 8 ohms, both channels driven simultaneously at 20 watts per channel
Frequency Response	4Hz-130kHz±0.5 dB
System Rise Time	1.5μsec
System Square Wave Tilt	<5%
Total Harmonic Distortion	<0.1% from 250 milliwatts to 40 watts RMS, both channels driven simultaneously into 8 ohms, 20Hz to 20kHz
Intermodulation Distortion (40 watts—SMPTE)	<0.12%
Intermodulation Distortion (1 watt—SMPTE)	<0.15%
System Hum and Noise	Better than 60 dB below rated output (unweighted)
Damping Factor (1kHz @ 1 watt)	>30
Power Amplifier Input Sensitivity	<1.2V
Power Amplifier Input Impedance	33 kilohms
Power Amplifier S/N (40 watts)	>90 dB
Power Amplifier Square Wave Rise Time	<1.5μsec
Preamp Input Sensitivity	
a. Aux	<150 mV
b. Tape Mon.	<150 mV
c. Phono	<2.5 mV
Preamp Input Impedance	
a. Aux	30 kilohms
b. Tape Mon.	30 kilohms
c. Phono	47 kilohms
Preamp Input S/N	
a. Aux	> −75 dB
b. Tape Mon.	> −75 dB
c. Phono	> −67 dB
Preamp Harmonic Distortion	<0.15%
Crosstalk	
a. Aux	−47 dB
b. Tape Mon.	−47 dB
c. Phono	−37 dB
Preamp Output Impedance	600 ohms
Phono Overload	>95 mV
RIAA Equalization	±1.0 dB
Tone Control Action	
a. 50Hz	±12 dB
b. 10kHz	±12 dB
Contour Effect (50Hz)	+10 dB
High Cut Filter (10kHz)	−10 dB
Low Cut Filter (50Hz)	−6 dB
FM Sensitivity	
a. IHF	1.9μV
b. −50 dB (mono)	3.5μV
c. −50 dB (stereo)	35μV
Ultimate S/N	−70 dB
Capture Ratio	2 dB
Image Rejection	−80 dB
Spurious Response Rejection	−80 dB
IF Rejection	−90 dB
AM Rejection	−60 dB
Alternate Channel Selectivity	80 dB
Multiplex Separation (1kHz)	40 dB
FM Harmonic Distortion (1kHz)	
a. Mono	0.3%
b. Stereo	0.4%
Pilot Suppression	−55 dB
De-Emphasis	75μsec
Mute Level	Variable
Mute Suppression	−65 dB
Stereo Indicator Threshold	
a. "off"	<3%
b. "on"	>6%
Audio Output	0.5V
AM Sensitivity	>250μV/m
AM Signal for 1 watt Output	<150μV/m
AM Selectivity	35 dB
Alternate Channel Selectivity	55 dB
Image Rejection	−75 dB
IF Rejection	−60 dB
Hum	−40 dB

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20,000 Watt Home Hi-Fi

Richard S. Burwen
Burwen Laboratories
12 Holmes Road
Lexington, Mass. 02173

Every audiophile has sometimes fantasied about the components he'd get if he had unlimited funds, the most knowledgable design engineers to serve him, and a couple of highly qualified technicians for construction and installation. But that's where it ends for most of us—as an occasional fantasy.

Not, however, for space/electronics engineer Richard S. Burwen of Burwen Laboratories, Lexington, Mass. Although his primary professional activity until recent years has been circuit design in many fields outside of audio, Dick Burwen can (and has) indulged himself, audiowise, as probably no one else in the world has been able to. His incredibly elaborate home listening and recording system not only includes many of the best commercially-available components, but numerous facilities which can't be purchased anywhere, at any price. These are available only if you happen to be one of the most inventive audio engineers of the day, Richard S. Burwen. Recently we took a guided tour of his home system. His description of it follows—*Editor*.

THIS EQUIPMENT has taken about 12 man-years to design and build, starting as far back as 1962. My objective is to produce the maximum entertainment value from prerecorded program sources and from live recordings. The room and equipment are designed for reproduction over five speaker systems at the original live sound levels and with more than 100 dB dynamic range.

Above left: Richard S. Burwen relaxes at the controls of his incredibly elaborate home listening and recording system. **Below left:** Taken from just behind the main listening area, this photo shows the three horns which make up the front channels. **Below:** Burwen's laboratory is also very well equipped.

Playback System

Mounted in the racks are signal processors for recording and playback which are normally separate but can be interconnected; you can get an idea of the functions of the playback portion of the system from the block diagram. We start with the Program Selector switch panel which selects various program sources. Among the six tape machines I have a four-channel ½-in. 3M machine, a four-channel ¼-in. Sony TC-854-4, two quarter-track stereo decks, a cassette changer, and a half-track ¼-in. stereo machine. All of these decks have had their electronics somewhat redesigned and,

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although their performance is quite good, they still need more rebuilding. For broadcast reception I have a Fisher 1000T FM tuner here in the listening room and a 500T receiver in the master bedroom which sends signals to the selector switch. These receivers have been used together in past years when the Boston Symphony broadcasts were available in four channels via two stations combined. There is also a National HRO 500 for AM and shortwave reception connected to a 400-ft. long wire antenna via a special preamplifier and there is a Motorola TV receiver. All the receivers have been modified to provide higher quality audio. In addition, the FM tuners each feed through complex active notch and low-pass filters to completely remove the 19-kHz stereo subcarrier and ultrasonic frequency components without attenuating the higher audio frequencies.

The two Dual 1019 turntables have phono cartridge preamplifiers built into their bases. These preamplifiers are individually equalized to provide flat response on an NAB test record when using JVC CD-4 phono cartridges. The two phono preamplifiers then feed into a two-channel phono mixer which provides input and output buffering for a CD-4 demodulator.

The Program Selector switches provide five stereo outputs from the previously mentioned sources as well as the Recording Mixer and 15 spare input jacks distributed around the studio. In addition, the Program Selector switches can connect four Burwen Labs Model 2000 Audio Processors [1,2] to the various tape machines and the phono mixer for decoding tapes recorded through the Audio Processors and also experimental encoded records. [3]

Following the Program Selector switches is a pair of three channel Stereo Control Systems. These units, which provide signal mixing and equalization for *Lows, Bass, Middles, Trebles* and *Highs,* were described in the October 1974 issue of *Audio.* [4] When construction of the system began, three channels were planned and several of the playback processors are three-channel units. For four or five channels one Stereo Control System is normally used for the front and the other for the rear.

Connected into the front Stereo Control System is a series of signal processors, each of which can be bypassed. The first is a 250 Hz to 4 kHz Dynamic Noise Filter for processing telephone and shortwave signals. This unit can be switched to the incoming telephone lines via an active transformer and was the developmental predecessor of the Burwen Laboratories Model 1500D Dynamic Noise Filter. Next, the signal passes through my original three-channel Dynamic Noise Filter. [5] This unit incorporates notch filters to get rid of various hum components and provides 6-, 12-, or 18-dB/octave cutoffs which can be either fixed or varied by the signal. Currently, this unit is undergoing modification to incorporate some of the latest advances in the art of dynamic filtering.

Following the lab model DNF, the signal goes through a three-channel volume expander-compressor. This unit expands or compresses on a variable dB/dB basis over a 30-dB input range and has a continuously variable decay time adjustment. In contrast with the usual volume expanders which have flat response controllers, this unit incorporates bass boost in its controller to emphasize the beat in popular music and heavy crescendos in classical music. After the expander-compressor, the signal is processed by a three-channel half-octave equalizer having 22 control frequencies. Each frequency can be boosted or attenuated in 2-dB steps and the three channels are accurately ganged to within 0.2 dB. In combination with the tone controls on the Stereo Control unit and the 6-, 12-, and 18-dB/octave cutoffs in the three-channel Dynamic Noise Filter, just about any useful frequency response curve can be attained with all three channels matched.

Connected into the rear Stereo Control System is a Burwen Laboratories Model 1000 Dynamic Noise Filter [6] having modules for three independent channels. In addition, one of the new Burwen Labs Model EQ3200 Frequency Extend-

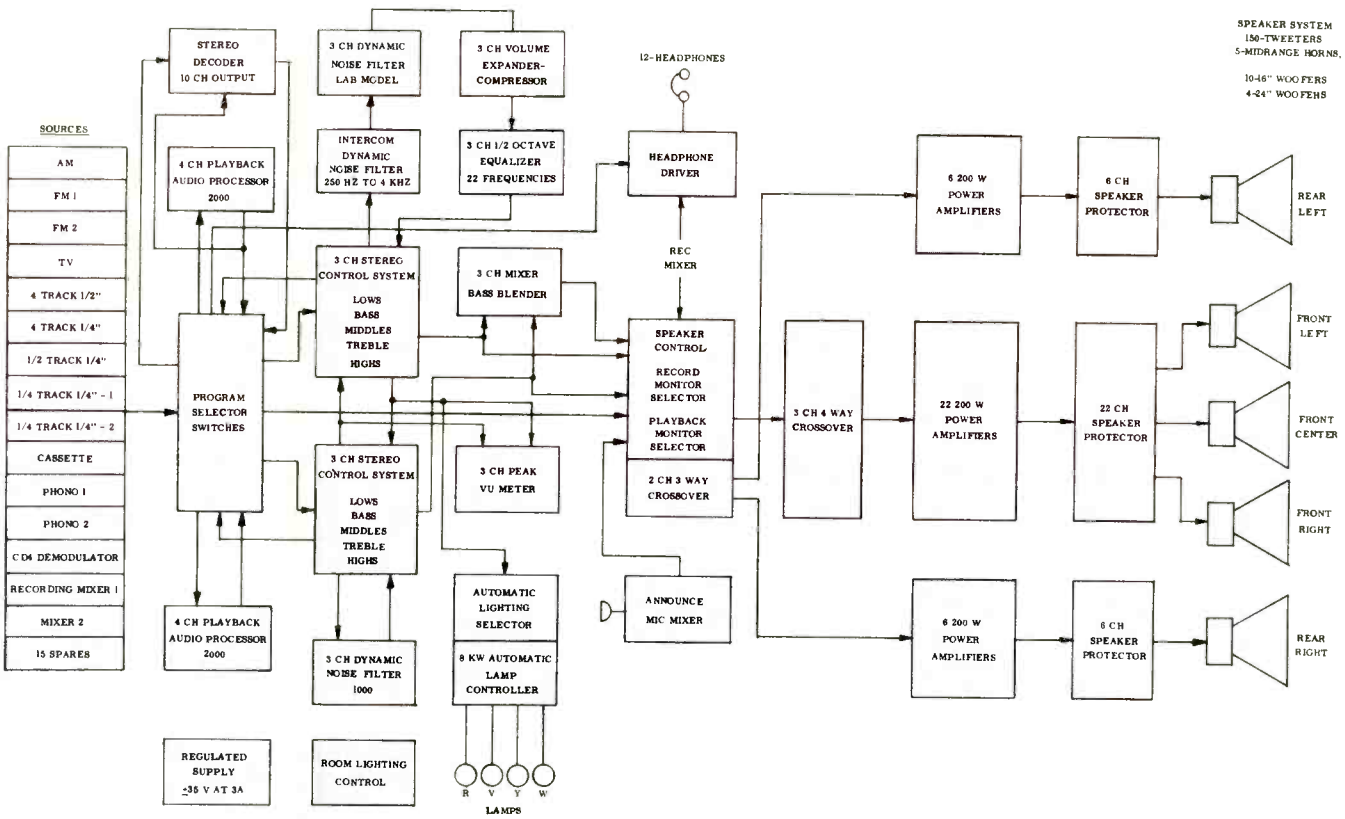

Fig. 1—Block diagram of playback system.

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Every Fuji cassette means beauty and purity in sound. No hiss, no dropouts. Widest frequency response and dynamic range. Total reliability. Fuji high-fidelity cassettes such as the FX will give you the best performance possible on your tape recorder. Already widely recognized by experts as the finest cassette in the world. Fuji. The cassette of the pro.

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er-Equalizers is ready to install for processing the rear channel signals. The signal levels of the Stereo Control System are monitored by a three-channel peak VU meter. This instrument will take a reading in as short a time as 20 μS and will hold the reading for an hour so you don't have to stand around watching it. You can simply come back later and see what the highest peak in the program was.

On the table to the right of the rack is a set of Burwen Dynamic Noise Filters which are used for demonstration purposes. There is a professional Model 1500D for telephone lines, a Model 1500A for network use, and a Model 1100 independent channel unit for general purpose high fidelity applications. On top is our early Model 1200 consumer unit and the current Model 1201. These are all connected in series and can be switched into the front Stereo Control System.

Another device whose output can be selected by the Program Selector switches is a Stereo Decoder. The Decoder has 145 potentiometers on the front panel including 20 10-turn digital pots. I can set up any matrix I want, such as QS or SQ, on the digital pots, test it out, and then set it up permanently on the screwdriver adjustment pots. The system allows me to switch in any of six combinations and is used not only for quadraphonic records but for producing various surround effects from one- and two-channel records. The system has phase shifters in it which provide left and right signals at 270° and 180°. These may be added in any combination to produce a five-channel output.

The main outputs of the three-channel Stereo Control System feed both the three-channel Mixer and Bass Blender and the Speaker Control System. The Mixer will accept three three-channel stereo signals, mix them together, and blend the bass below 60 Hz so that all the woofers are working in unison. This enables the system to produce more bass power with less distortion. In addition, it cancels vertical turntable rumble.

The Speaker Control unit permits monitoring of the playback signal from various parts of the sound system in one, two, three, four, or five channels. For example, you can se-

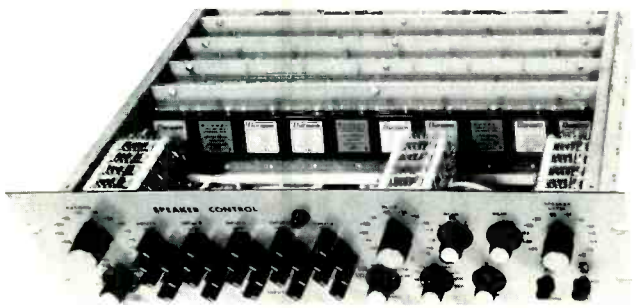

Fig. 2—Front view of speaker control.

lect the outputs of the Stereo Decoder, the Stereo Control System, the three-channel Mixer-Bass Blender, and the outputs of the Model 2000 Audio Processors. The record section of the Speaker Control System allows monitoring of the various parts of the record mixer, which we will get into later. The construction of this unit is typical of the more recently built equipment. The gain controls consist of high-quality, five-gang step switches, having 1-dB steps over a 30-dB range. All the resistors that determine the gain are 1% so that the channels are very accurately matched. The unit incorporates about 50 Burwen Laboratories UM201 Universal Mixing Amplifier modules to perform amplification and mixing functions. The continuously variable faders, which are ganged for five channels and for two channels, consist of precision conductive plastic types. On the rear there are 65 BNC jacks for the audio signals plus four- and five-pin audio connectors for power and crossover outputs. Units in the rack are generally interconnected by means of RG62U coaxial cable with BNC plugs and the racks are quite full of cables for this use.

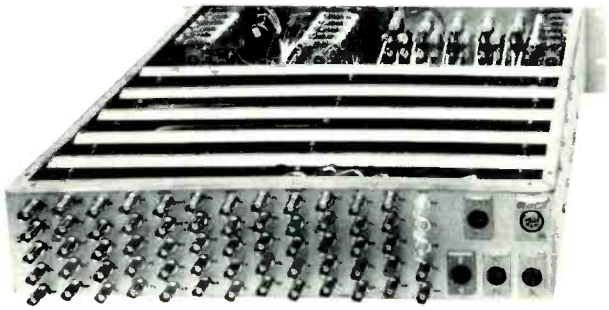

Fig. 3—Rear view of speaker control.

The performance specifications of the Speaker Control system are typical of most of the specially built equipment. Each chassis must have less than 0.1% total harmonic distortion at unity gain and 7-V output at any frequency from 15 Hz to 20 kHz and be flat within 0.1 dB. The dynamic range ahead of the record or playback level controls is over 115 dB. Since this particular unit feeds the active speaker crossover networks, extremely low noise is required when the speaker level controls are turned down. Under this condition the noise output is only 2 μV or 130 dB below maximum output. It might seem that this noise is lower than needed but bear in mind that at maximum output the system can clip 10 dB beyond producing 20,000 watts equivalent level.

Speakers and Crossovers

Each of the five speaker horns is 13 ft. deep and has about 64 sq. ft. of mouth area. The horns are conical, in preference to exponential, in order to produce a gradual low frequency rolloff, instead of a sharp cutoff. As it turned out, due to reinforcement from the room, the average low frequency response on one-third octave noise bands is flat down to 16 Hz without equalization. Each speaker horn contains 30 Cerwin-Vega tweeters, a midrange horn with two JBL 2440 drivers, and two Empire 16-in. woofers. In addition, the left-front and right-front horns have two 24-in. Cerwin-Vega woofers mounted on the doors. These woofers are equipped with feedback windings to linearize their acoustic output over their range.

The rear speakers, which are shown diagrammatically in the room plan, point towards the rear of the room so as to provide reflected sound. At the principal seating position on the sofa, the time delay from the rear speakers, including the reflection, is about the same as the time delay from the front speakers. Thus, an electronic time delay system is not required.

As you can see from the room plan, the storerooms between the front speakers constitute a 200-cu.-ft. back enclosure. The rear speakers vent into the room at the ceiling level in the manner of a bass reflex speaker. In the case of the right-rear speaker, the venting permits the use of a 30-in. exhaust fan located in the garage above. The entire room is solidly constructed of concrete, cinder block, and extra heavy plaster. Although the horn walls are made of 4-in., filled cinder block, I am amazed at how much these can vibrate. If I were to build a room like this again, I would use 8-in. thick walls. The ceiling is wavy so as to diffuse the

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10XD bridges the gap between consumer and professional tape recorders.

Meet the world's first and only 10½" reel tape recorder that operates at 15 ips and combines Tandberg's unique Cross-Field recording technique with the world-famous Dolby* B system. Result: A *guaranteed minimum* signal-to-noise ratio of 72 dB, measured on a 4-track machine using IEC A-weighting. Simply put, the 10XD completely eliminates audible tape hiss!

Here are some of the many sophisticated features that make the 10XD the finest tape recorder Tandberg has ever built:

- 3 speeds: 15, 7½, 3¾ ips. Electronically selected
- 3 motors; Hall-effect capstan motor
- 3 heads; plus separate bias head
- Electronic servo speed control
- Electronic logic mode controls, including photo optics
- Electronic balanced microphone inputs
- Echo, sound-on-sound, editing, A and B tests
- Peak reading meters
- Direct transfer from playback to record (flying start)
- Ferrite playback head with symmetrical balanced output for hum cancelling purposes and differential playback amplifier.

Remote control and rack mount optional. Pitch control by special order.

For a complete demonstration of this remarkable new advance in stereo tape recording, see your Tandberg dealer.

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sound, and the low points of the ceiling conceal heavy steel beams which support the house above. Optimum sound absorption occurs due to the upholstered furniture, books, records, and two 4 ft. by 20 ft. panels on each side wall. These panels consist of a sandwich of plastic on acoustic tile on cinder block. They absorb middle frequencies while reflecting high and low frequencies.

To drive the speakers there are a total of 17 Phase Linear 400 amplifiers, 11 of which are located in the storerooms at the front and three are located in each of the rear horns. Each woofer, midrange horn, and set of 9 or 12 tweeters is driven from one 200-watt amplifier channel. With the electronic crossover at 50, 400, and 5,000 Hz ahead of the amplifiers, the speakers can produce the same sound level that would be produced by a single 20,000 watt amplifier. The

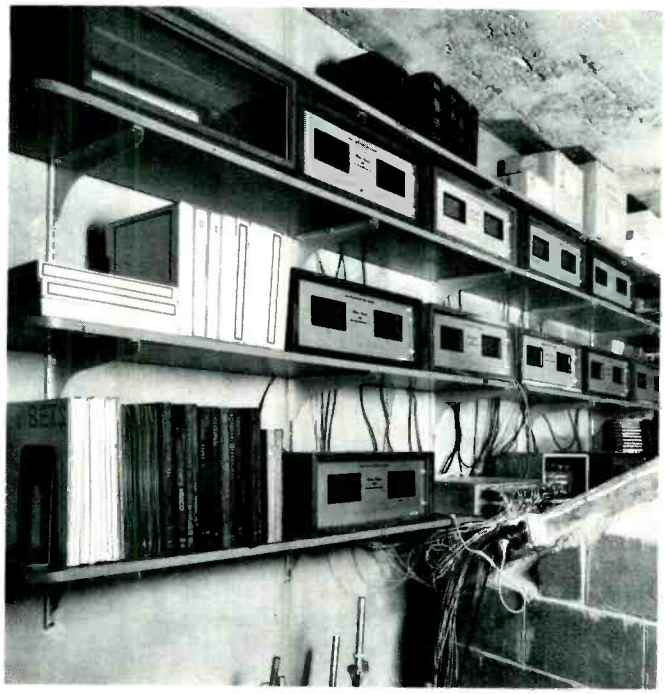

Fig. 4—Room in back of front speakers holds the Phase Linear 400 amplifiers.

crossover network for the front speakers is located in the storerooms between speakers, and the crossover for the rear speakers is part of the Speaker Control panel. The crossover filters utilize UM201 modules to produce 6-, 12-, 18-, and 30-dB/octave cutoffs for the various drivers. In addition, the crossover provides equalization to flat acoustic response. In designing and adjusting the crossover networks, I used one-third octave noise measurements based on a six microphone average of omni-directional microphones for low frequencies and an average of two cardiods located in front of the left-front and right-front horns for the high frequencies. The microphones used for adjusting the crossover frequency response are the same ones used for making recordings here; so the entire system is flat. On one-third octave noise bands, it measured flat within 1 ½ dB from 15 Hz to 20 kHz. Nevertheless, I find that when reproducing much of the prerecorded program material available I use from 3 to 30 dB of low frequency boost.

When you have a high-powered sound system like this, one of the difficult problems to solve is to keep from blowing out 169 speakers at once. That is the reason for having so many speakers in the first place. The tweeters are wired three in series so that each can receive only 1/3 of the amplifier output voltage. All the speakers can handle the clipping levels of their respective amplifiers without mechanical damage. Nevertheless, during sustained clipping the voice coils can get too hot. To prevent overheating, there is an elaborate speaker protection system in each of the rear horns and one for the three front horns. The protection system has a total of 34 channels, each of which measures the amplifier power output, computes the voice coil temperature, and disconnects its speaker with a relay before the voice coil gets too hot. The same system eliminates turn-on and turn-off thumps. In over a year of operation there has been no damage to any of the speakers.

You may wonder why it takes so much power to feed such efficient speakers. I have found that when reproducing a live drum set out of any one of my five horns at the original sound level, the peaks can reach within 3 to 6 dB of the clipping level when the drummer is playing as loud as he can. For prerecorded music, however, much less power is needed because the high peaks are clipped off during the recording process.

Automatic Color Lighting System

The electronics for the color lighting for the front horns consists of a four-channel silicon-controlled rectifier a.c. phase controller capable of delivering 20 A at 115 V on each channel. Three channels are automatic, and the lamps are now switched so that the bass is red, middles are purple, and the highs are yellow. The control system receives its signals from the front speaker Stereo Control unit. Lamps can be switched to change the colors versus frequency and to change colors with location of the sound. It works much more slowly than conventional color organs so the lights do not flicker and cause annoyance after a few minutes of watching. The attack time is about 50 mS but it takes about 20 S for the light to decay, light intensity is proportional to loudness.

Recording System

When making live recordings I generally record simultaneously on two four-track machines and one two-track machine. All my tapes are recorded in encoded form using the Burwen Labs Model 2000 Audio Processor and then played back through the same type of processor. The machines and processor together are capable of a 110-dB dynamic range. Combined with the microphones and mixer, all of which add noise, the final reproduced dynamic range, even on a second generation tape, is over 100 dB. Basically what the recording mixer does for most of the inputs is to provide a master gain control followed by five separate gain controls which can send that input channel to any of my five speaker systems in any desired amount. There is an encoder which permits me to matrix five channels into four, with leakage between channels down 12 dB. On playback the four-channel signal can be matrixed back to five channels down 12 dB. On playback the four-channel signal can be matrixed back to five channels using a portion of the Stereo Decoder mentioned earlier.

Eight of the inputs to the recording mixer come from the Program Selector switches which can, therefore, provide any of the sources available to the playback system. Other inputs come from the Stereo Control Systems and the Mixer and Bass Blender after these sources have been fully processed. A set of five inputs is allocated to my Lowrey electronic theatre organ, a rhythm unit, and a synthesizer which will be added later.

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How (and how not) to buy a loudspeaker.

Every year thousands of high fidelity customers are put through a variety of "demonstration" rituals on their way to choosing loudspeakers. It's enough to make a tire-kicker blush.

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We're going to tell you how to buy a loudspeaker.

We're not going to tell you which one, because loudspeakers are very personal. One man's nice is another man's noise. Still, there are some common sense (and not-so-common-sense) things you should know. For instance:

Enjoy yourself.

You're not getting tetanus shots. You're searching for love. Enjoy.

Bring your own music.

Bring a favorite record or tape; something you know by heart. There's no quicker, simpler way to tell the difference between speakers. If you've been listening in black and white you'll know it when you hear Technicolor.

Also, don't evaluate any speaker by listening to radio—AM or FM. By the time a radio signal comes out of a speaker, it's been strained through generations of electronics and the signal has been clipped on both ends. It's just not a test of high fidelity sound.

Listen to the speakers through the kind of electronic system you plan to have at home.

No point listening through $5,000 worth of pre-amp, amp and turntable at the store unless that's what your speakers are going to live with, right? Right.

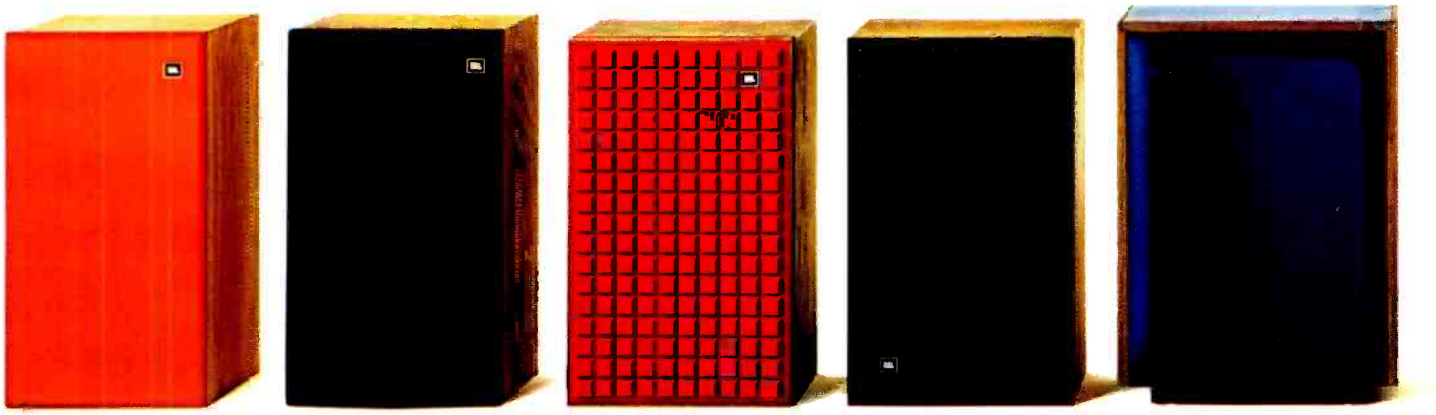
Turn it up!

Way up. Loud loud. Kid-next-door loud.

You don't have to live with loud music, but you ought to visit there. Loudness magnifies the imperfections that will scar your subconscious at regular listening levels.

Do you like the sound? Is it clean? Is it clear? Does it hum? Does it splatter?

Loudness tells you what time will do to your ears, your head, your disposition. So, turn it up!



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JBL's least expensive three-way system. Natural oak cabinet.
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$375 each.

Jubal L65.
The smallest floor system we make. Oiled walnut finish with smoked glass top. **$426 each.**

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Turn it down!

Right to the edge of silence.

Are all the textures and details and harmonics of the music still there or does only the melody linger on?

No one wants to live with a loudspeaker that can't make its point unless it yells. So, turn it down.

Don't stand right in front of it. You're not taking batting practice.

One way to spot a not-so-good loudspeaker is to listen to the way it handles high frequency sound. If the sound narrows as the tones go higher, if there's a peashooter effect that requires you stand right in front of the speaker to hear the highs, that's not so good.

A good loudspeaker will disperse the sound throughout the room.

So, stand to one side, then the other. If you don't get all the music, move on.

One demonstration isn't a demonstration.

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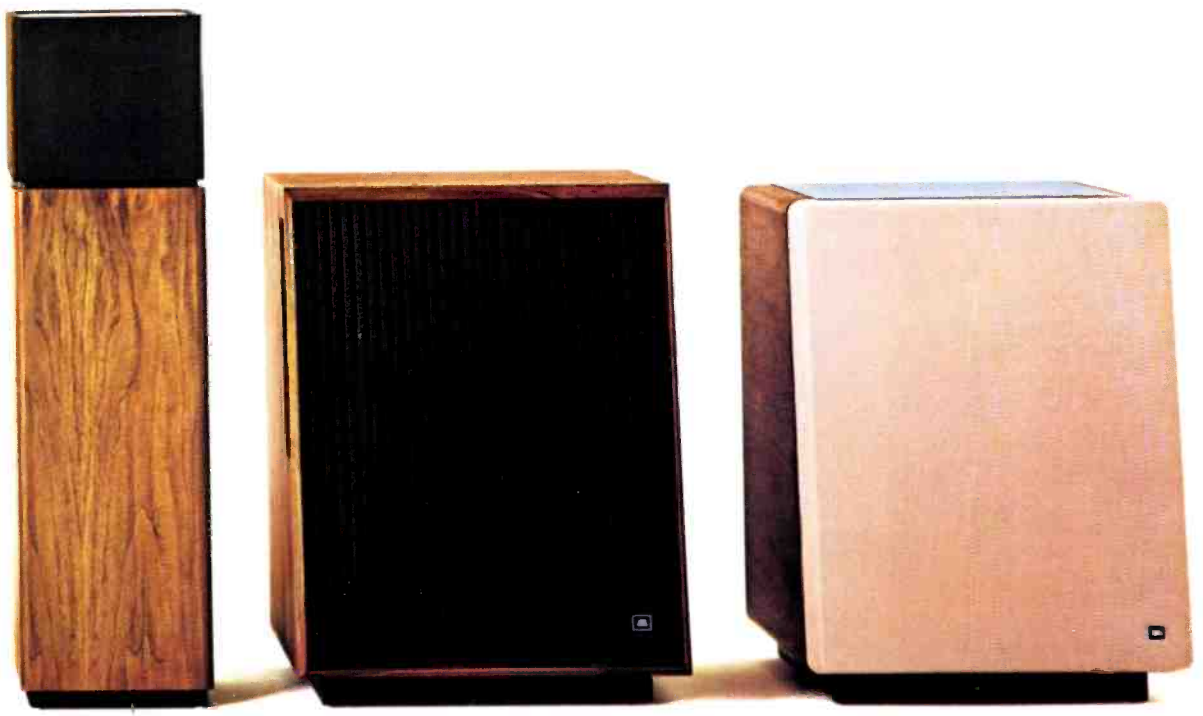

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The organ plays through a device I call the Spatial Modulator which is an electronic replacement for the rotating Lesley speaker system built into the organ. This allows the organ to play through my main speakers instead of its own and recordings made by direct connection sound exactly like the real organ. The Spatial Modulator has been working for three years but still consists of an open breadboard circuit sitting on the table next to the organ console at the mouth of the left rear horn. This circuit produces modulation sideband frequencies which are distributed among the five horns along with the main organ signal in such a way as to provide frequency and amplitude modulation. On pure tones the effect very closely simulates the Lesley; on more complex signals the Spatial Modulator sounds quite different from the Lesley providing a much purer bell-like sound which I happen to prefer.

There are 27 microphones in my recording system. Seven use Altec 28A capsules and their vacuum tubes have been replaced by low-noise FET amplifiers of my own design. Of these, three are permanently mounted on the 10-ft. Steinway piano located in the right rear horn. These three microphones have their own amplifiers and tone controls mounted right in the piano. Incidentally, this piano which I think is a beautiful sounding instrument, is about 100 years old.

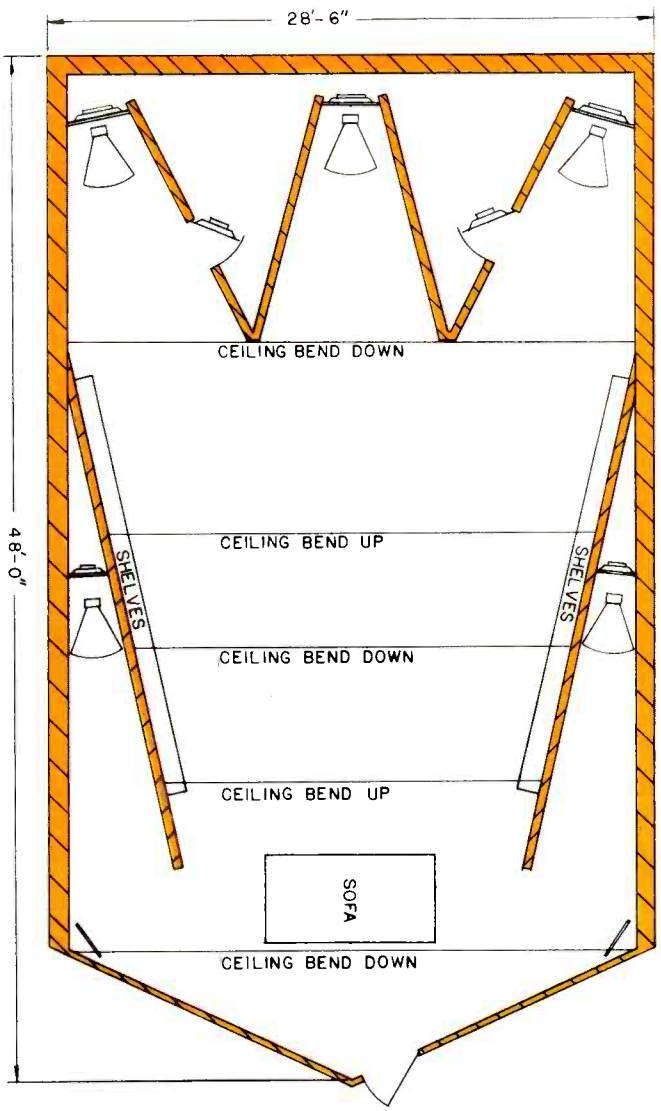
Twenty of the microphones have specially designed amplifiers built into them which are capable of delivering a high output signal level of +20 dBm. These microphones, which utilize Schoeps capsules, have a noise level of 15-dB SPL and are capable of handling 140-dB input. Each microphone is equipped with a gain switch for close, medium, or distant miking and is built into concentric pipes for double shielding. They operate on ±15 V d.c. and have 5-pin connectors with double shielded cable.

Associated with 28 of the mixer inputs, and almost ready to install, is a set of equalizers[7] which provide two gain switches and six tone switches per channel. The tone switches provide peaking at 16 Hz and 24 kHz and are able to tilt the response in other portions of the audio range. The total range of equalization is more than ±25 dB and the dynamic range when flat is 120 dB.

Two of the mixer panels, each 19 in. wide x 5¼ in. high, handle 14 inputs and deliver two five-channel outputs each. Inputs can be switched to the five-channel output buses in groups. Generally one five-channel output bus is utilized for monitoring while the other is used for recording. Another mixer panel handles 24 inputs and a fourth panel mixes together six three-channel stereo signals. One set of three channels comes from a three-channel microphone mixer designed to power three of the special FET amplifiers associated with the Altec 28A microphones. Sixty-two of the input channels have monitor switches which connect into mono and stereo monitor preamplifiers and 19 channels are equipped with phase inverting switches. The outputs of the four input mixing panels are combined at a master mixing panel which can send signals to a reverberation unit and receive them back. The master unit permits recording from either of the two five-channel mixed signals, contains the 5-to-4 matrix encoder, and provides a simultaneous mix to two channels. The various input and five-channel mixed signals, as well as two, four, and five-channel playback signals, can be monitored on a set of 13 peak VU meters. These meters utilize Burwen Laboratories Model VU306 Peak VU Detector modules which convert an ordinary VU meter to peak reading. The meters will register peaks as short as 10 μS and hold the output steady on the meter for 2 S. Each meter has two ranges, one with 0 on the meter at 0 dBm, the normal system calibration level, and a high scale with 0 at +10 dBm (2.5 V) which is the normal peak program level for the system. Extra headroom in the system allows peaks to reach +20 dBm before clipping. The construction of the mixing panel is similar to that of the Speaker Control unit. Although extremely compact, each chassis performs functions comparable with those of a 5-ft.-long studio control console.

Since the recording controls are located in the same room with the music, monitoring must be via headphones and the peak VU meters. A separate binaural headphone driver unit associated with the playback system permits monitoring of various sections of both the record and the playback system. This unit is capable of driving up to 20 sets of AKG 50 headphones and contains equalization to flatten the response of these particular phones. The headphone driver also allows variable blending of the sides to reduce the exaggerated stereo effect.

Both the recording and the playback system are powered from a pair of hefty ±25 V and ±35 V highly regulated power supplies. These supplies deliver 5 and 2.5 A respectively and have hum-bucking transformers with triple mumetal shielding. Each panel in the rack contains its own ±15 V or ±18 V



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shunt regulator system which operates from these common supplies. The use of shunt regulators prevents a.c. power supply ground currents which could cause crosstalk between units.

Besides the equipment in the racks, I own a portable recording mixer. This unit has 10 inputs and two outputs and was built by Mark Levinson Audio Systems to my specifications. Along with this mixer there is a 10-channel version of the wide dynamic range equalizer system and a Model 2000 Audio Processor.

All the developmental work for the past 10 years has been performed in my laboratory occupying two adjacent rooms. The abundance of equipment, parts, and test leads makes an environment conducive to high efficiency.

Recordings

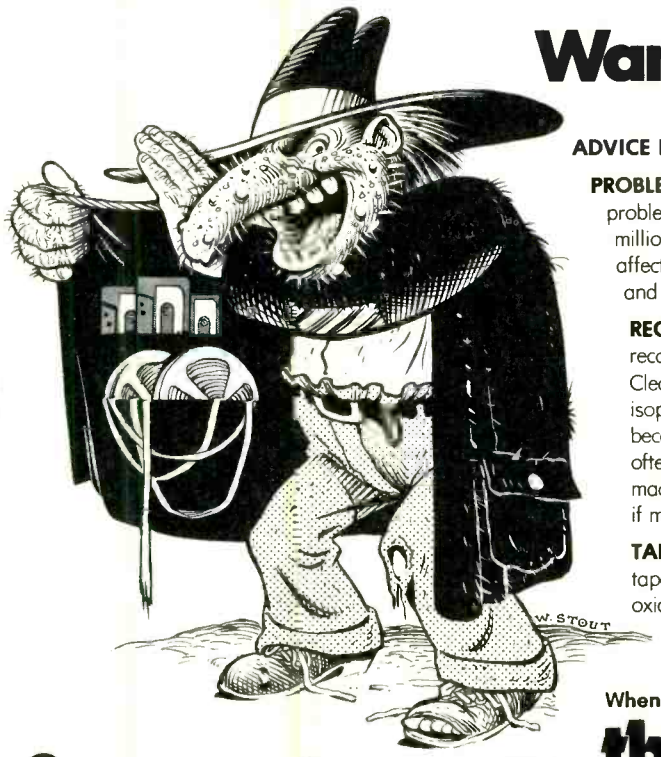
Because of the liveness of the studio, which has a reverberation time of about 0.75 S, I thought at first it was nearly impossible to achieve a decent recording. My technique has developed in the past two years, however, so that now I consider the liveness a great benefit. The East Bay City Jazz Band recording on Burwen Labs Perfectly Clear label was made with 14 microphones placed at about 10 in. from each instrument with two microphones used for ambience pickup. Because of the extreme leakage between microphone channels due to the room, all the mikes had to be operated at nearly the same gain and placed in such a manner that the leakage contributed to a desirable stereo effect. Lately I have been recording with only four cardiod microphones, three for the front speakers and one for the rear speakers. The front microphone heads are generally 16 in. apart and 6 ft. from the performers. If the performers are placed along an arc around the microphones during the recording, they appear to be lined up linearly across the front of the room on playback. The rear channel microphone is typically about 6 ft. behind the front microphones, is aimed at the performers, and feeds the rear speakers at a level of about −25 dB. This arrangement seems to produce a good two-channel mix and was used in making the Babson College Dixieland Band record. Most of my in-studio tapes have been jazz and dance music by such artists as Norm Bistany, Dick Wellstood, and Bobby Hackett plus some operatic arias by Richard T. Gill. Next I would like to get into chamber music. Well, that is my system.

References

For more detailed information on equipment in the author's sound system refer to the following articles by R. S. Burwen:

1. "110 dB Dynamic Range For Tape," *Audio*, p. 49, June, 1971.
2. "Design of a Noise Eliminator System," *Journal of the Audio Engineering Society*, Vol. 19, No. 11, p. 906, December, 1971.
3. "100 dB Dynamic Range Disc Recording," Audio Engineering Society preprint no. 995 P-4, September, 1974.
4. "A Stereo Control System," *Audio*, p. 20, October, 1974.
5. "A Dynamic Noise Filter," *Journal of the Audio Engineering Society*, Vol. 19, No. 2, p. 115, February, 1971.
6. "A Dynamic Noise Filter for Mastering," *Audio*, p. 29, June, 1972.
7. "A Wide Dynamic Range Program Equalizer," *Journal of the Audio Engineering Society*, Vol. 23, No. 9, p. 722, November, 1975.

SECRETS FROM THE AUDIO FILE



Wanna dirty recording?

ADVICE FROM: Hugh B. Davies, recording engineer, Capitol Records, Inc.

PROBLEM: No one wants dirty recordings. They sound flat, dull, lifeless. The problem could be all in your heads. Dirty. Dirty. Dirty. Oxide shedding of 20 millionths of an inch—an invisible film no thicker than a fingerprint—can affect cassette performance by as much as 6 db at 10 Khz. If you record dirty and play back dirty, you could lose as much as 12 db.

RECORDING TIP: Keep a clean machine. Inspect and gently clean recording heads, capstan and pinch roller before recording. Every time. Clean them every 4 to 10 hours of playback time. The safest cleaner is isopropyl alcohol on a cotton swab. It's cheap. Sold at drugstores. And, because it dissolves away deposits instead of scraping, you can't clean too often. To move the cassette heads forward for easy cleaning, fool the machine into thinking it's playing. Press the "play" button (and interlock, if machine has one).

TAPE TIP: Those problem deposits are oxide debris from your recording tape. Switch to The Music Tape by Capitol. Its heavy duty binder prevents oxide shedding. So there's less gunk. (No bunk.)

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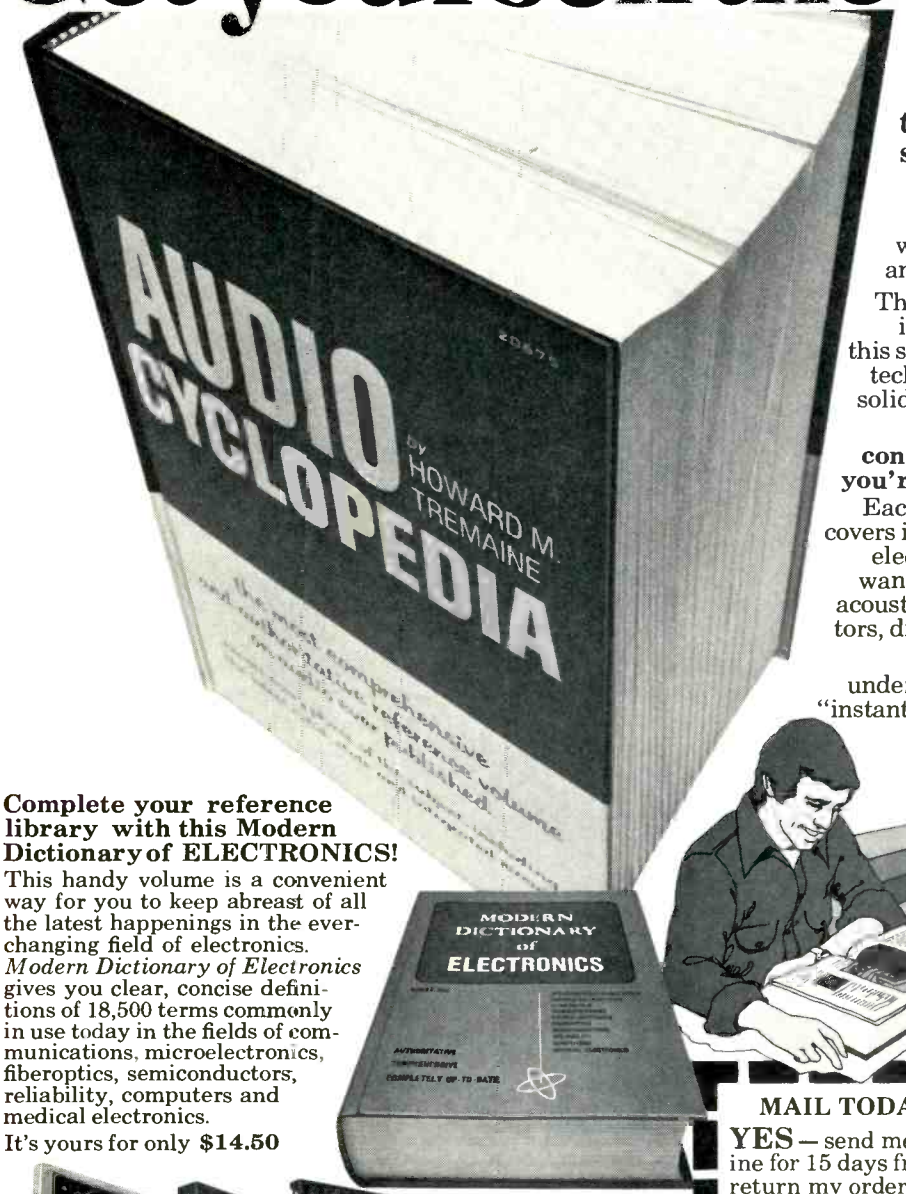

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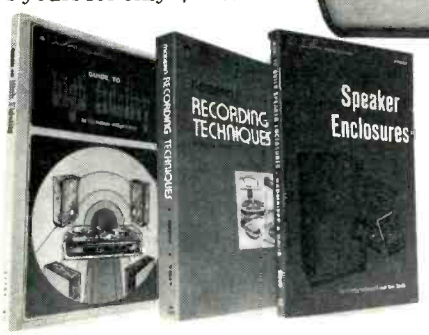

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Tape Guide II

Herman Burstein

FROM TIME to time, as a companion piece to The Tape Guide, we would like to supply ideas to readers who think of tape recording not merely as a passive activity but as one that offers the opportunity to be imaginative and creative. To do so, we will have to rely greatly on your suggestions. Therefore we shall be happy to hear from you. To get things going, following are four ideas, for better or worse.—*Herman Burstein*

Spaciousness

Record the left and right tracks slightly out of synchronization, by a fraction of a second, and play them back simultaneously. The source can be stereo or mono. If there is a great difference between the left and right channel sounds in stereo, try mixing the channels slightly in recording or in playback. The time lag between the two tracks has to be experimentally determined. If the lag is too small, there will be little if any change in the sound. If the lag is too great, one will hear two distinct sounds. If the lag is about right, the sense of spaciousness will be greatly enhanced.

The equipment used is a recording tape deck and a signal source, which may be either a playback tape deck or a turntable. It is important that the equipment be able to maintain constant speed. Following is the procedure.

1. Record the left channel onto the left track.

2. Rewind the tape and play the left channel. Identify the point on the tape where the sound begins. If the deck has separate record and playback heads, back up (rewind) the tape a distance corresponding to that between the centers of the record and playback heads. Thus, the point where the sound begins is at the record head.

3. Play the right channel. Just as the right channel sound begins, start the record deck, and record on the right track.

4. Play both the left and right channels. If the results are pleasing—a definite increase in spaciousness without double sound—stop there. If the results are unsatisfactory, repeat Steps 2 and 3, this time starting the right channel sound somewhat earlier or later with respect to the left channel. There is no need to repeat Step 1.

Warped Record

A prized 33-1/3 rpm record, unplayed for a long time, turned out to have acquired an ugly warp. For about the first inch of the outer radius, the warp was so bad as to throw the stylus out of the groove, even when tracking force was greatly increased. It so happened that the turntable in question included the 16-2/3 rpm speed. *And* the stylus remained in the groove when the record was played at 16-2/3. With the help of a tape deck, the problem was easily solved.

The first inch or so of the record, up to a convenient break in the sound (conclusion of a symphonic movement), was played at 16-2/3 and recorded at 3-3/4 ips on tape. The rest of the record was played at 33-1/3 and

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recorded at 7-1/2 ips. The result was a tape recording which sounded good throughout when played at 7-1/2 ips; for the first movement, half-speed when playing the record was compensated by double-speed when playing the tape.

Playback of Dolby Encoded FM

Many of us involved in taping off FM, or just plain listening, have FM tuners that provide only the old standard 75 μS de-emphasis. But Dolby encoded broadcasts call for 25 μS de-emphasis plus Dolby decoding. What can one do without adding new equipment, such as an adapter that gives one the choice of either 25 or 75 μS de-emphasis, as well as a Dolby decoder?

Perhaps the following will not satisfy the ultra-finicky, but it may provide an audibly satisfactory answer for many others. Simply feed the FM signal (with 75 μS de-emphasis) into the tape deck *without* Dolby decoding. The treble loss due to 75 μS de-emphasis tends to be offset by the treble boost due to lack of Dolby decoding. The net effect, at least to this writer's ears, is quite satisfactory.

New Tapes with Excessive Treble

New tape formulations sometimes have "hotter" treble response than their predecessors. This may be a boon, helping achieve flatter treble response than formerly. Or it may result in unwanted exaggeration of highs. The proper answer is to adjust bias, but this often presents problems: The adjustment may be an internal one, entailing difficulty of access and of proper setting for the average owner. Even if the bias is adjusted by a competent person, then bias may be right for the new tape but wrong for older tapes that one wishes to record.

An alternative answer is to use the tone controls in playback. A better answer—because it results in less distortion—is to use the tone controls in recording *if the receiver or preamp permits the tone controls to be effective for tape recording*. Some receivers and preamps (probably a minority) permit this, while other don't.

Another answer is possible for those having a tape deck that supplies Dolby decoding for the incoming signal. An example is the Tandberg 9200XD. Using tape with a new oxide, sound was overbright. But setting the Tandberg's Dolby switch to the Dolby FM position enabled the frequency response to appear "just about right."

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Equipment Profiles

Otari MX-5050-2SH Open-Reel Tape Recorder

MANUFACTURER'S SPECIFICATIONS

Speeds: 7½ and 15 ips. **Reel sizes:** 5, 7 or 10½ inches. **Heads:** ½ track erase, ¼ playback, ½ record, ½ playback. **Motors:** Three. **Wow and Flutter:** Less than 0.05% (NAB). **Frequency Response:** 15 ips, 35 Hz to 22 kHz ±2 dB; 7½ ips, 30 Hz to 18 kHz ±2 dB. **Distortion:** Less than 1% at 1 kHz at 200 nW/m. **Output:** +4 or −10 dBm. **Input:** −15 dBm line, −70 dBm microphone. **Crosstalk:** Greater than 55 dB. **Signal/Noise:** 62 dB (unweighted). **Dimensions:** 21½ in. W by 21 in. H by 17 in. W (with 10½ inch reels), portable case. **Price:** $1450.00

The Otari MX-5050 is described by the maker as a professional recorder—which needs a few words of explanation. During the past three or four years, O-R recorders have steadily improved, not only in terms of basic performance but in regard to such features as user variable bias, sound-on-sound, fast acting VU meters, syncing, and so on. Indeed, you can bet your last reel of tape that any open-reel recorder priced at over $500 will lay claim to the word "professional" somewhere along the line! But there are differences—mainly in the number and range of adjustments and editing facilities, so let's take a look at the Otari controls.

On the left, just below the reel, is a black lever switch marked *cue*. If this is depressed, the automatic tape lifters are inoperative so the tape remains in contact with the heads during the *rewind* and *fast-forward* modes and an audio signal can be heard. The function of the tape lifters is primarily to reduce headwear but judicious use of the cue control can be a great help when editing. The lever also works a level control, thus preventing possible overload of the monitor amplifiers or headphones. Under the *cue* switch is a digital counter and four push-buttons labelled *on/off, speed, reel* and *edit*. The speed control selects 7½ or 15 ips modes, and the reel control is pushed in to adjust the tape tension to suit the large 10½-in. reels. The last button in the group, marked *edit*, deactivates the tape tension lever and take-up motor so the tape is released for editing. It also enables the tape reels to be rocked back and forth to find a particular spot or section.

On the right-hand side is a row of five push-buttons for *record, play, stop, rewind* and *fast-forward*, and under those is a dual concentric control for output level. A small slide switch is located nearby; its function is to adjust the output

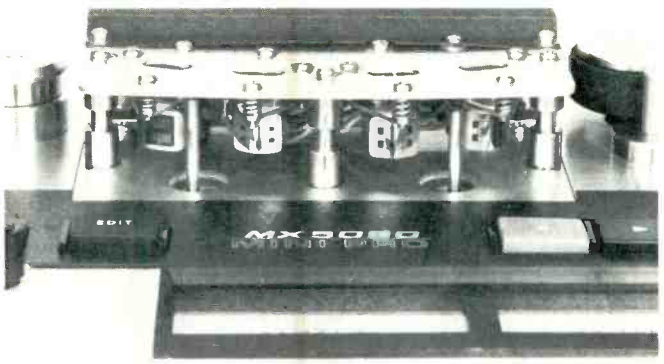

Fig. 1—View of heads from bottom of deck.

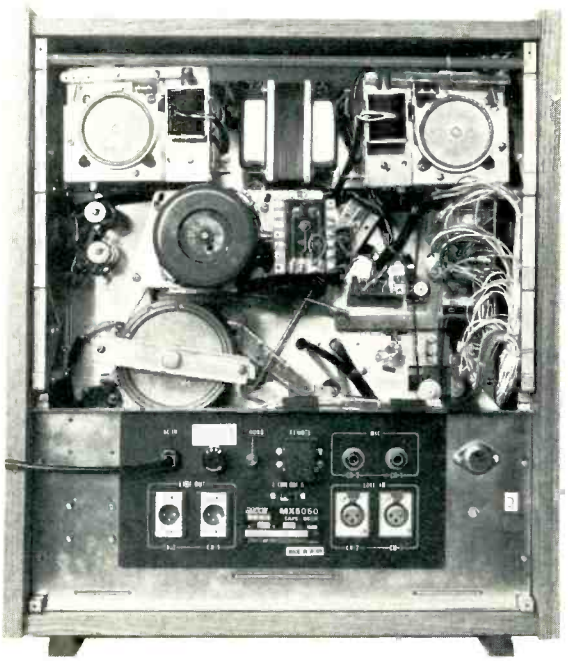

Fig. 2—Interior view.

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level to a Standard Reference Level (SRL) which in this case is +4 dBm (4 dB above 1 milliwatt at 600 Ohms). Back on the left-hand side, there are two dual concentric input controls for line and microphone, and then at the bottom on a black panel are a number of controls. First comes a pair of red push buttons for *record*, and then there are two labelled *Sel/Rep*. This refers to Selective Reproduction, and it is a multi-sync arrangement that permits a new track to be added in synchronization to previously recorded tracks. This is accomplished by switching the recording heads to a playback mode so a performer can listen to the previously recorded material on earphones while he or she records a new track. Next to the *Sel/Rep* button is a series of eight preset adjustments for bias, equalization (both 7½ and 15 ips), and reference level calibration. A headphone socket is next, and finally there are three push buttons, one to activate the built-in 1-kHz generator and two for monitoring the signal source or direct from the tape.

Straight-line tape threading is used, and a switch is mounted on the top of the head cover to select quarter- or half-track playback heads. A built-in splicing block is an unusual but very handy feature, and the perpendicular cut is accurately aligned with the gap on the playback head, another smart piece of design work. As in most professional recorders, the pinch roller is on the oxide side of the tape so the hard metal of the capstan cannot cause wear.

Three motors are employed, a hysteresis type for the capstan drive and two motors for the reels. The tape transport mechanism is fully electronically controlled, using 15 transistors in a motion sensing circuit so there is no danger of tape breaking or stretching. In fact, you can go directly into the *play* mode from either *fast-forward* or *rewind* without waiting for a logic circuit to function! All input and output connections (apart from the headphone jack) are at the rear, with heavy-duty XLR sockets for line and standard quarter-inch jacks for the microphone. Also at the rear is a remote control socket, a fuse, and a switch to select either a +4 dBm, 600-Ohm output or a lower one at −10 dBm.

Measurements

The first measurement was the playback response using a NAB type Ampex Standard 7½-ips Test Tape, and the results are shown in Fig. 3. Then, record-playback measurements were taken at 0 VU and −20 VU using Maxell UD-35 tape at 7½ ips, adjusting the bias/eq for optimum results. It will be seen in Fig. 4 that the upper −3-dB point is about 18.5 kHz, with a slight attenuation from 10 kHz at 0 VU. The response at 15 ips is shown in Fig. 5, and here the −3-dB point has moved up to an impressive 28 kHz with very little significant loss at 0 VU. Next, the measurements were repeated with the new TDK "Audua" tape, again adjusting the bias/eq for best results. As was expected, the differences were negligible and so the curves are not shown.

The frequency versus distortion characteristics can be seen in Fig. 6, and the THD at 1 kHz is shown in Fig. 7. The 3% distortion level was not reached until the input level was

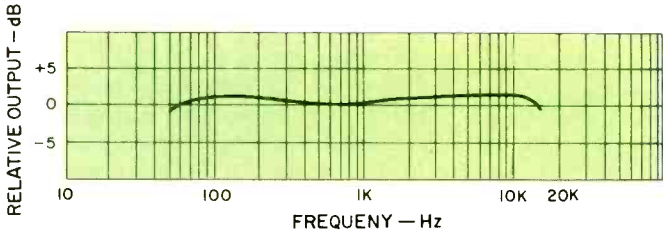

Fig. 3—Frequency response from Ampex Standard Test Tape.

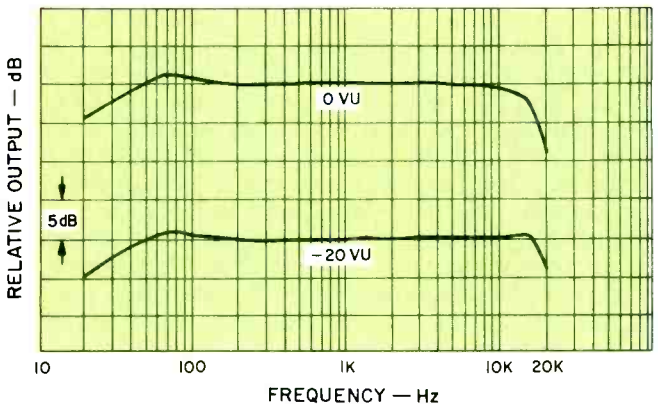

Fig. 4—Record-replay response at 7½ ips.

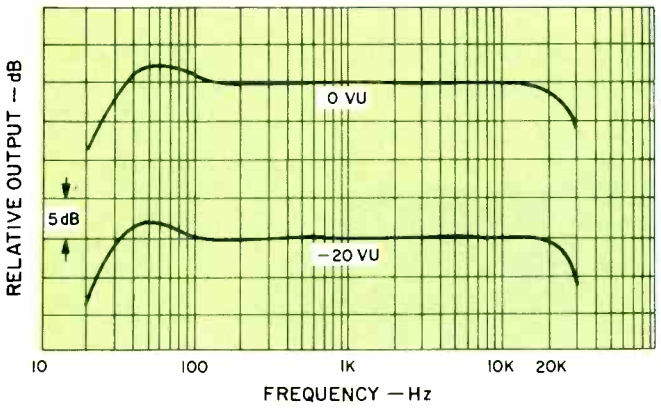

Fig. 5—Record-replay response at 15 ips.

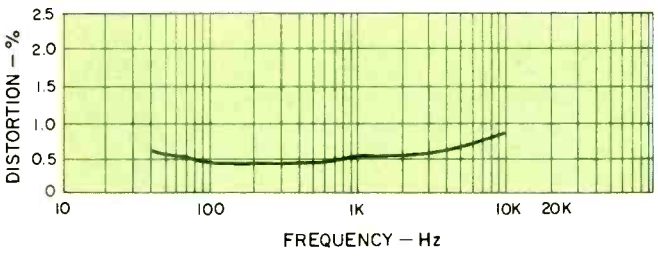

Fig. 6—Frequency versus distortion at 0 VU.

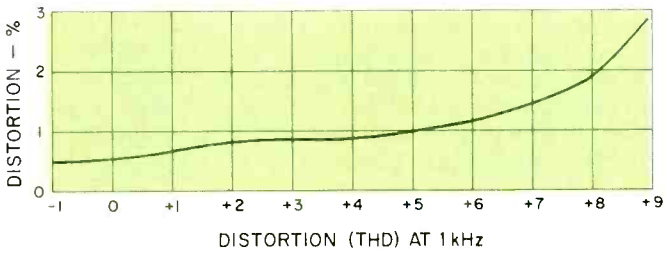

Fig. 7—THD versus meter level at 1 kHz.

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increased to nearly +9 VU! Taking the tape saturation characteristics into account, it is apparent that the headroom of the 5050 is very satisfactory indeed. Signal-to-noise ratio (ANSI "A" weighted) referred to 0 VU was −66 dB or −75 dB at the 3% distortion figure still used by some manufacturers. Wow and flutter (DIN weighting) came out at 0.07% for 7½ ips and 0.06% at 15 ips—also very creditable. The maximum output level was 2.95 volts with an 0 VU input signal which measured 150 millivolts for the line and 300 microvolts at the microphone jack. Maximum noise increase at the microphone input would be 8 dB, although in practice, with the input control turned down slightly, it would be of the order of 4 to 5 dB. Crosstalk was −58 dB, and erase efficiency better than −60 dB.

Use and Listening Tests

The 5050 is no lightweight, as it turns the scales at over 50 lbs., so make sure your mounting shelf is strong enough! The machine can be used in the horizontal or vertical position, the latter being more convenient for editing. I personally like to mount such recorders at an angled position—which does use up a lot of space!

As indicated by the impressive array of features, plus the above test figures, the 5050 is obviously a well-designed and quite versatile recorder. The controls, particularly the motion-sensing tape transport, worked smoothly and with precision. The Selective Reproduce or track syncing feature proved to be remarkably easy to use, though the number of tracks is limited. The recorder was primarily designed for studio or location use by professionals, but I am sure many dedicated enthusiasts will invest in one but they should be warned: the instruction manual is written for engineers. For example, as noted previously, signals are described in terms of dBm instead of voltages. Bias adjustments are simple enough to make but equalizing changes are not—those controls should be left to the advanced recordist. I must add that a variety of options are available to to suit individual needs; these include d.c. servo capstan with variable speed, balanced inputs, EIA, IEC, or CCIR equalization, and a choice of head configurations, portable road case, and remote control box. *George W. Tillett*

Check No. 90 on Reader Service Card

Ball Corp. Sound Guard Record Preservative

Record cleaning and static removal is a part of record preservation. Recently, the Ball Corporation introduced a unique record preservative, Sound Guard, a commercial application of their VacKote® a lubricant designed for moving parts on space craft. Sound Guard is a dry lubricant in a liquid (Freon 113) spray form. The solution, which is sprayed on the record surface, evaporates very quickly, leaving an invisible lubricant film on the record. The record is then buffed with the velvet pad supplied, resulting in a film coating five-millionths of an inch thick on the modulated record grooves. The solution also contains cleaning and anti-static materials.

A well-known independent electronic testing laboratory studied the effects of Sound Guard on such important record parameters as frequency response over repeated playing of both stereo and CD-4 records, harmonic distortion, and surface noise. Their tests indicate that there is no noticeable deterioration in frequency response for either the stereo or CD-4 records, it decreases the normally occurring harmonic distortion after repeated plays, it retards the appearance of surface noise that also occurs after repeat plays, and reduces the amount of dust that is normally attracted to the record surface. Sound Guard apparently preserves the full amplitude of frequency modulations and groove modulations up through 45 kHz. In general, Sound Guard protects the modulated record groove against wear or further wear.

The maker says that a Sound Guard coating might show wear after about 25 plays, though the lab mentioned above found this to be an extremely conservative figure. Repeated use will fill in the bare spots without additional build-up. Although Sound Guard adheres to the record, it does not adhere to itself, thus assuring the user that the film coating will not exceed five-millionths of an inch at any time.

Sound Guard is packaged in a plastic container that holds a two-ounce bottle of fluid, a pump sprayer, and a velvet pad buffer, which is also the cover for the container. The package sells for $5.99.

Tests

Although Sound Guard is also a record cleaner, we found it to be effective in removing surface dust only. It does not remove fingerprints. Its anti-static property becomes effective about fifteen minutes after the record is buffed. However, buffing does build-up a static charge which may be eliminated with the Zerostat for immediate play.

Our experience indicates that records should be cleaned with either the Monks Record Cleaning Machine, the Discwasher, our two reference cleaners, or with the Fidelicare Spin and Clean Record Washer, using the DII solution, before applying Sound Guard.

In our tests, we applied the spray to the outer half of a record just starting to show wear. The inner half of the record was used as a control. Sound Guard definitely reduced the amount of surface noise present on the record when compared to the untreated portion. We were unable to detect any reduction of frequency response between the treated and untreated portions. CD-4 records treated as above also showed no audible change except that there appeared to be less noise in the rear channels. Sound Guard is normally applied to new records, but we found it to be quite effective when applied to used records.

Because Sound Guard reduces friction between the stylus and the groove, it is advisable to slightly reduce the anti-skating force.

Collectors of old acoustic 78s will find Sound Guard to be an effective way to reduce the normally present background hiss, particularly when transferring them to tape. We tested it on some well-played shellac 78s, circa 1904, as well as some from the early 1920s. Its effectiveness was beyond our greatest expectations. The playback cartridge used was the Shure V15, Type III, fitted with the Shure VN-78E elliptical stylus for playing 78s.

Based upon our tests, we have always advised against the use of treated record cleaning cloths or sprays. With the introduction of Sound Guard, we are making an exception, particularly since there is no silicone present. To prevent record wear and to preserve the high frequencies present on a record, we found Sound Guard to be without a peer, the best thing for records since vinyl. *B.V. Pisha*

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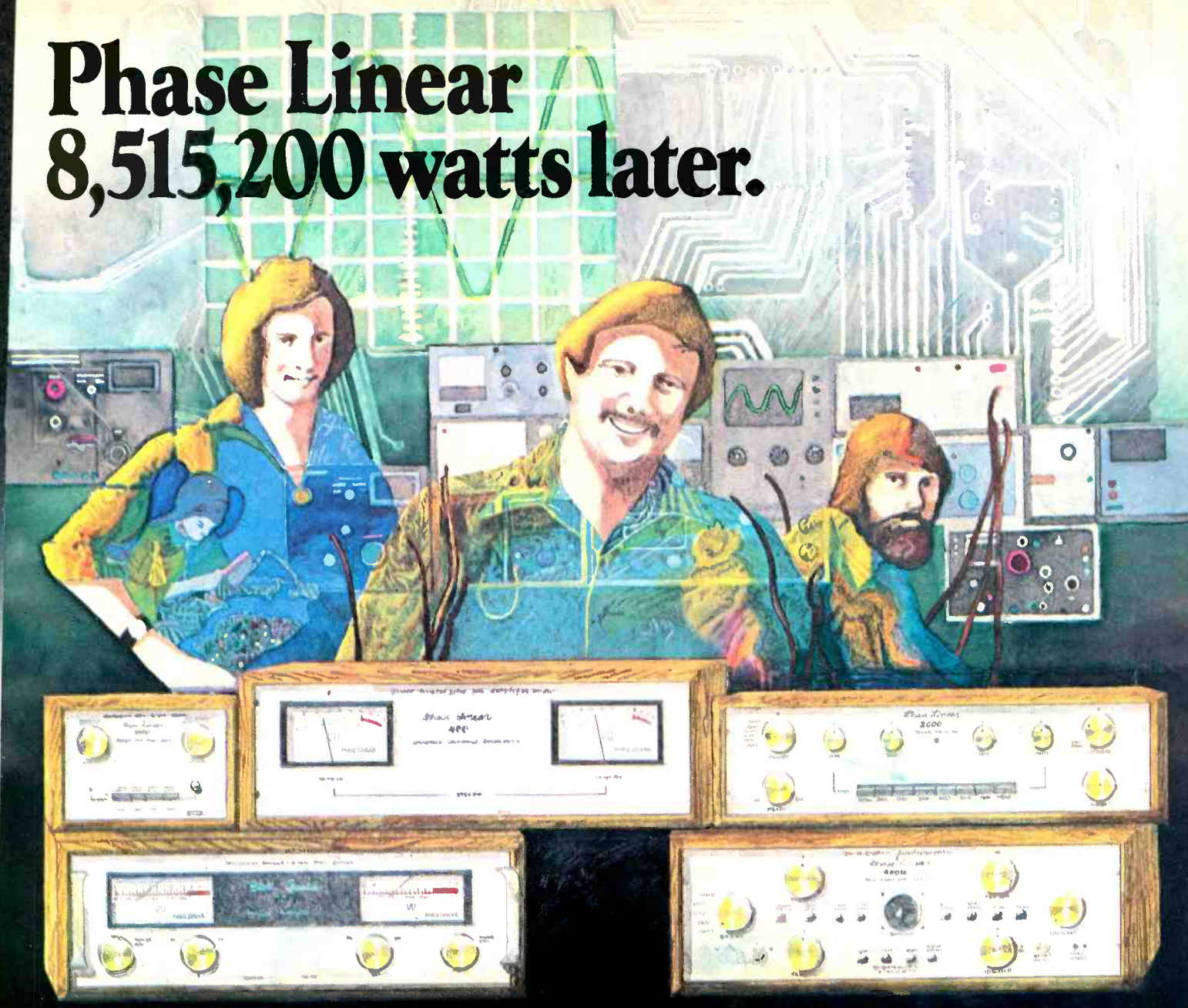
Phase Linear 8,515,200 watts later.



Back in '71 Phase Linear was Bob Carver, an audiophile with 200 square feet in the basement of an A & P store in the Pacific Northwest and one all-consuming obsession: to design and build the world's most powerful stereo amplifier.

Today Phase Linear Corporation is an acknowledged leader in high power technology, selling a complete line of amps and pre-amps throughout the world, operating out of one of the most advanced stereo component plants in the industry.

Phase Linear is now a household word among serious listeners, a word synonymous with power, quality, reliability and way-out-front technology.

And Bob Carver, Steve Johnson and A. P. VanMeter have come to be recognized as the gurus of state-of-the-art amplifier design and development.

Phase Linear has dispensed over 8½ million watts of power to music lovers everywhere, starting with the famous super reliable, virtually distortion free Phase Linear 700, the first successful 700 watt amplifier. The popular Phase Linear 400 watt amplifier quickly followed. The incredible Phase Linear 4000 pre-amplifier was then perfected followed by a smaller version, the Phase Linear 2000. Recently the Phase Linear 1000 Noise Reduction System was added to the line . . . and there are many more advanced products in the wings.

Technological milestones along the way have included a unique Amplifier Protection Circuit (Patent # 3,727,148), the first practical Expansion System, the innovative Auto Corralator Noise Reduction System and a unique Ambience Injection System for pre-amps.

Phase Linear has come a long way from that basement lab of Bob Carver's. But products are still made one at a time, and one out of every three people in production is involved in quality control or testing.

And that's the way it'll be for the next 8 000 000 watts.

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Mark Levinson JC-2
Straight-Line Preamplifier

MANUFACTURER'S SPECIFICATIONS

Phono Section

Five systems available; system A, standard, has specifications as follows. **Noise below 10 mV ref. at 1 kHz:** -88 dB, 20 Hz to 20 kHz equivalent bandwidth. **Slew Rate:** 20 V per μS. **Maximum Output:** 6 V min. **Channel Tracking:** 0.2 dB typical. **Input Impedance:** 49.9 kOhms. **Overload:** 1 kHz, 100 mV min.; 20 kHz, 900 mV min. Other systems detailed in text.

Line Section

Frequency Response: Flat ±0.2 dB, 20 Hz to 50 kHz; -1 dB at 12 Hz and 100 kHz. **Maximum Output:** 10 V. **Gain:** High, 21 dB; Low, 11 dB. **Noise:** Below 2.5 V, 100 dB min. **Input Impedance:** High, 10 kOhms min.; Low, 30 kOhms. **Open-Loop Bandwidth:** 40 kHz. **Slew Rate:** 100 V per μS, min.

Prices:

JC-2 system A, $1050.00; JC-2 system B, $1050.00; JC-2 system D, $1175.00; extra plug-in cards, $50.00 for system A, $175.00 for system D; case, $50.00.

The Mark Levinson JC-2 is a quite interesting attempt at producing an audiophile perfectionist's preamp. The circuitry was designed by John Curl, a competent, well-travelled audio consulting engineer.

Physically, the preamp is in two parts, the preamp itself and a separate power supply. The metal sheet preamp chassis is bent into a closed shape that forms the rear panel, sides, and front. A rack-width, two-inch-high front panel is bolted on the front of the chassis piece with the rotary control bushing nuts. Separate top and bottom pieces are bolted to the chassis to enclose the unit. All of the metalwork is black anodized aluminum. A single master PC board occupies most of the internal space inside the chassis and is mounted to the bottom cover with 10 threaded metal spacers. On this PC board are five active potted modules, miscellaneous Rs and Cs for bypassing, gain determination, and coupling functions, two plug-in equalizer boards for the phono function, and space for a JC-1SM pre-preamplifier. The five potted modules are the active circuitry for the two phono preamps, two output amplifiers, and an active power supply decoupling filter for the supply to the phono circuits. All of these modules and equalizer boards have a number of protruding gold-plated pins on each and plug into mating gold-plated socket receptacles on the master PC board.

This preamp has provision for a number of different front-end options which are installed by plugging in different equalizer boards and, in one case, the JC-1SM pre-preamp which consists of a PC board with external components and a sixth potted amplifier module. This PC plug-in fits between the two phono amplifier modules. The options are:

A. Normal Phono: 32.5 dB gain at 1 kHz. Uses system A plug-in equalizers and is for regular magnetic cartridges.

B. Normal Phono: 30 dB gain at 1 kHz. Uses system B plug-in equalizers and is for high-output magnetic cartridges.

C. Special Phono Equalization: For B&K test records.

D. Moving-Coil Phono: 60 dB gain at 1 kHz. Uses JC-1SM pre-preamp with phono amplifiers. Uses D or D1 equalizers.

E. Strain Gauge: Provides equalization and d.c. exitation for certain strain gauge pickups.

F. Flat Response: Provides for flat gain of front end for microphone and other flat-gain applications.

Note that only one option can be operational at a time. The unit tested was supplied with two A equalizers, a JC-1SM, two D and two D1 equalizers. The D equalizer provides nominally flat moving-coil RIAA equalization and the D1 rolls off the high-end response above about 7 kHz to offset the rise in this region which some moving-coil pickups exhibit.

On the front panel are four rotary controls, four miniature toggle switches, and a LED *power-on* indicator. From left to right, the controls are rotary selector switch, *tape monitor* toggle, *tape 1/tape 2* toggle, *left* balance rotary switch, pilot, *right* balance rotary switch, *mono-stereo* toggle, *high-low gain* toggle, and the rotary level control. The gain control is a high-quality dual Waters unit that features close tracking between sections and very low or nonexistant nonlinear distortion. There are no tone controls or filters on this preamp.

The rear panel has all of the signal input and output RCA jacks and male and female four-pin XLR connectors, the male being used to receive power from the external power supply and the female presumably being available to power some other piece of gear that uses ±15 V d.c.

The power supply is in a black anodized aluminum case and is fully potted. A three-foot a.c. cord and a five-foot power cable serve to connect to line and preamp and allow enough separation so that no hum is induced in the preamp from the power supply. Component parts appear in general to be high quality with resistors being 1% metal film types and capacitors being either dipped mica, mylar or better,

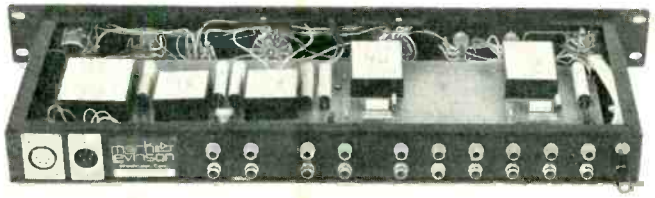

Fig. 1—Back panel view.

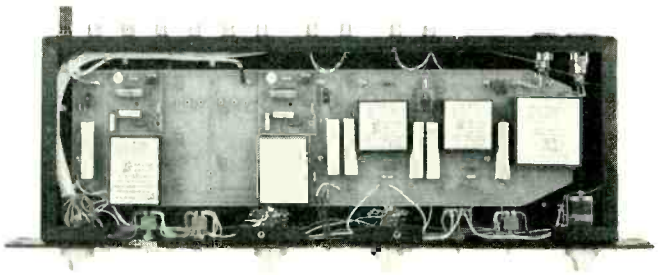

Fig. 2—Internal view.

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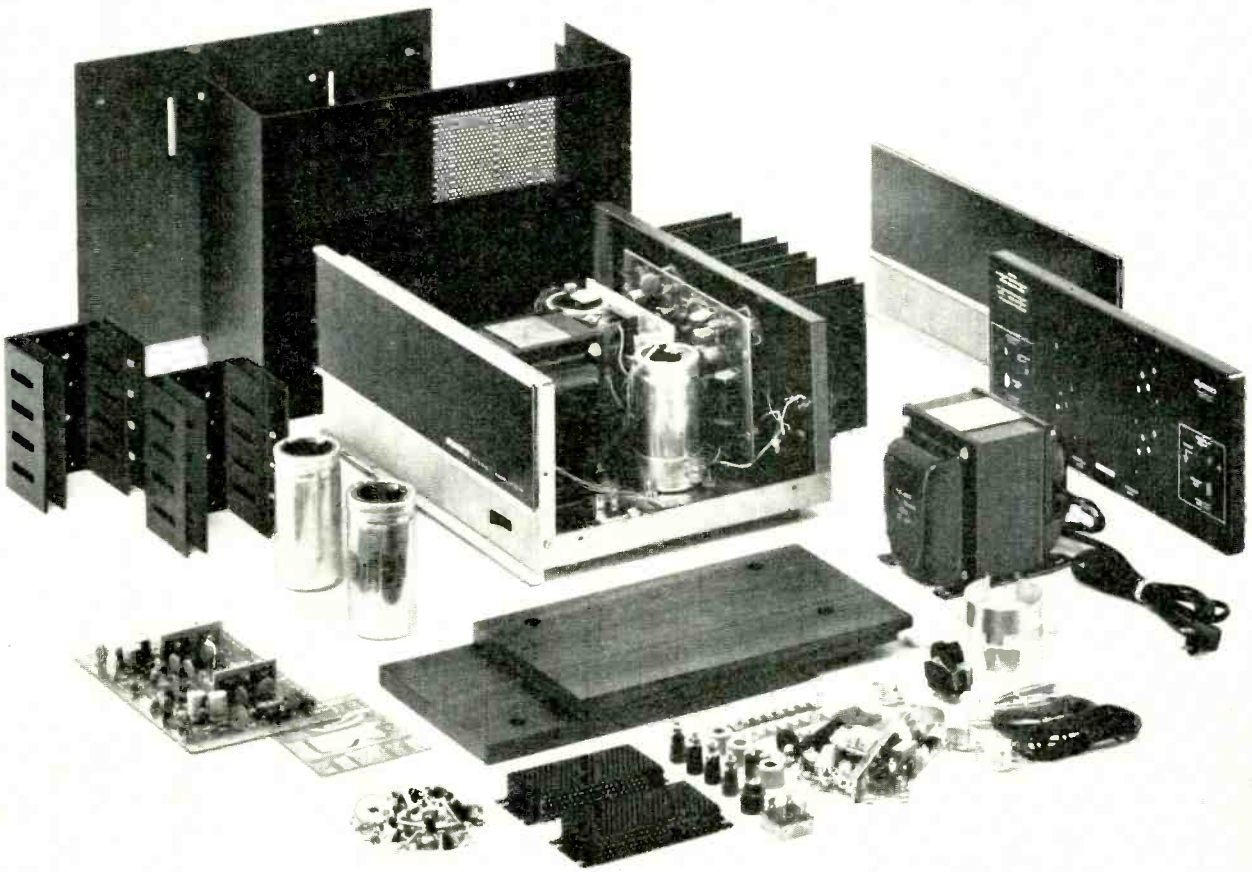

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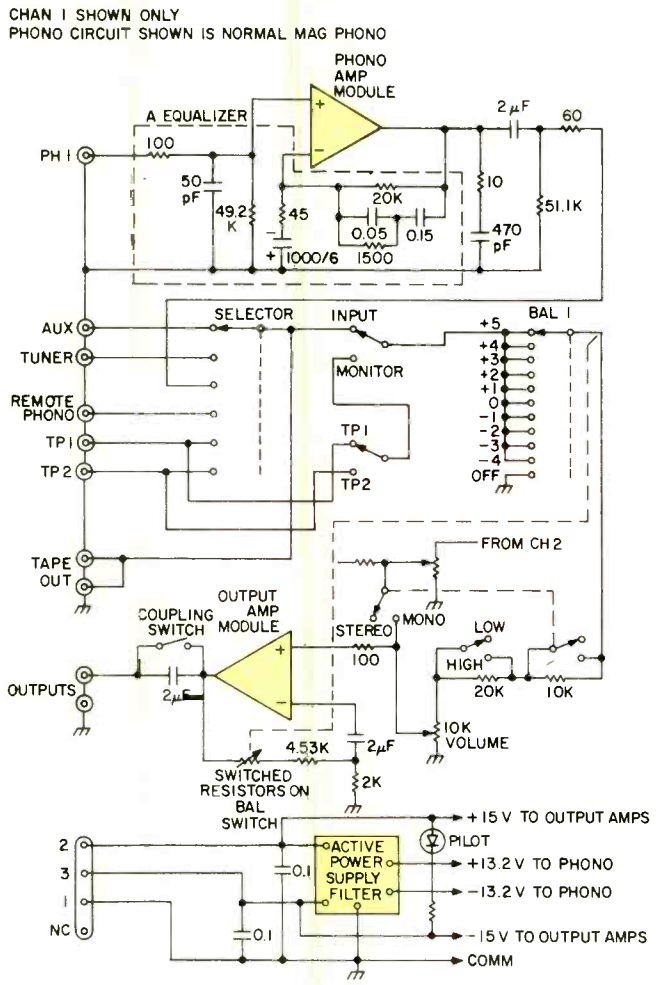

Fig. 3—Simplified schematic.

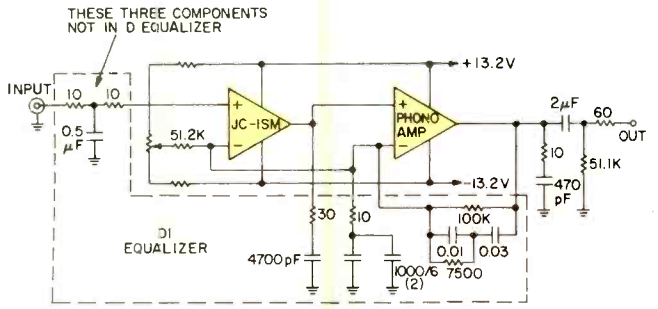

Fig. 4—Moving-coil circuit.

and tantalum, with the exception of four aluminum electrolytics on the JC-1SM plug in, which are used for power supply filtering. Teflon wiring is used throughout.

Circuit Description

Starting with the phono section, the components enclosed within the dotted lines on Fig. 3 are on the A equalizer plug-in boards. The phono amplifier module itself is a low-noise class-A complementary push-pull amplifier—the actual schematic is proprietary and therefore is not available for discussion. The overall circuit functions as a non-inverting equalizer-amplifier with a closed loop gain of about 33 dB at 1 kHz and RIAA equalization accomplished by the RC network in the feedback loop. Quiescent current drawn by these modules is rather high, being about 65 mA at ±15 V d.c. A good part of the quiescent current must be in the output stage in order to gracefully drive the feedback loop at high frequencies since the impedance level of the network is rather low—about 160 Ohms at 20 kHz.

When the JC-2 is set up for moving-coil pickups, two D series equalizers are installed along with the JC-1SM pre-preamp board. The equivalent interconnection of the JC-1SM, equalizer, and phono amplifier is shown in Fig. 4 with a D1 equalizer installed. The D equalizer is identical except that the input low-pass filter is absent. In this configuration, the impedance level of the RIAA series-feedback network is scaled up five times and the shunt feedback resistor is down to ten Ohms. These network values indicate a closed-loop gain of about 60 dB at 1kHz. The special input stage in this configuration is included in the feedback loop which is a good idea and is one of the first circuits to do so; it could have been designed as a separate flat-gain block ahead of the phono preamp, as has been done by several Japanese manufacturers. Both the normal phono and moving-coil gains are low compared to normal practice by some eight dB. The Mark Levinson people apparently do this in order to increase input signal acceptance, which is a legitimate design choice.

The output amplifiers in the JC-1 have a nominal closed-loop gain of 21 dB when the balance controls are set to the 0 dB mark. This preamp has a separate balance control for each channel. The controls vary the series-feedback resist-

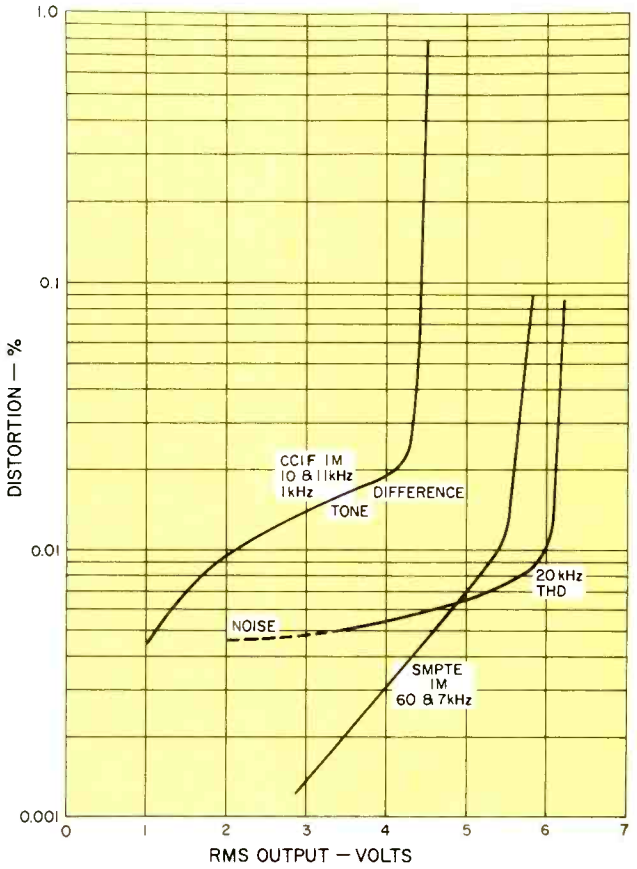

Fig. 5—CCIF and SMPTE IM and 20-kHz total harmonic distortion levels.

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ance around the output amplifiers such that the gain changes in 1 dB steps. The most counterclockwise position mutes the output by grounding the wiper of one section of the balance switch. Low gain in the output section is accomplished by adding 20 kOhm in series with the 10 kOhm volume control. This inserts 10 dB attenuation ahead of the output amp, resulting in a net 11-dB gain for high-level inputs. High-level input impedance is obviously affected, being 30 kOhms at low gain and 10 kOhms for high gain. When the *mono* mode is selected, the wipers of the volume control sections are tied together and 10 kOhms is placed in series with the feed to each volume control section. The 10 kOhms addition causes the volume to drop noticeably when in mono. The 10 kOhms resistors were probably considered necessary, however, to prevent direct shorting together of the left and right source signals when the volume control is at maximum.

A switch mounted on the master PC board allows direct or capacitor coupling of the output of the line amplifiers to the main preamp output jacks. One is supposed to capacitor couple to d.c. responding power amps and direct couple for a.c. coupled power amp inputs.

The power supply delivers regulated ±15 V d.c. up to 300 mA. The JC-2 draws about 250 mA, leaving some 50 mA available to power something else.

Listening Tests

The JC-2 was first listened to as a phono preamp only, connected for normal phono gain. A Fidelity Research FR-1 Mk II cartridge was used with the reviewer's own pre-preamp. The output signal from *Tape Out* was fed into a 50-kOhm dual volume control and then into a power amplifier. Listening was done with Dahlquist DQ-10 speakers, kindly on loan from the manufacturer for these tests, and Stax SR-X MkII headphones. Under these conditions, the sound of the phono preamp was quite good. Overall definition and openness were excellent, with just a very small bit of the irritation and edginess in the highs that has been present, almost always to a greater degree, in every solid-state circuit listened to so far. The transparency of the sound was judged superior. Curiously, when including the output section, the sound became noticeably softer with less irritation and high-frequency edginess. All in all, a very creditable performance.

The unit was then set up for moving-coil operation. The sound of the unit was about the same as above, and again, it sounded smoother when the output amplifiers were used. The unit in this form was also listened to by several other critical listeners and the general consensus was that it sounded quite good though the trace of high-frequency edginess was also noticed by these people.

All of the functions worked well with the exception of the level drop when in mono which was mildly annoying. The separate balance controls were judged to be a very handy feature, and noise with moving-coil operation was outstandingly low. This is a definite contender for the state-of-the-art crown among a very few other preamps.

(Editor's Note: This listener used the JC-2 with a Shure V-15 III, a freshly peaked Sony TC-277-4 open-reel recorder with second-generation masters, a Heath AA-1640 amp, and Duntech DL-15 speakers. Sound from records was judged outstanding, with a superior definition not found with any preamplifier listened to so far. Sound from tape was similarly superior, characterized by an openness and freedom. Particularly appreciated was the absolute dead quiet of the unit, along with a subtle sense of "accuracy" which gave choral selections a new sense of separation and location not found with preamps previously tried. Instruments such as banjos, guitars, and mandolins seemed substantially more life-like with this unit, while piano music appeared to have greater clarity and strength.

Though there is a certain lack of flexibility in the controls of the JC-2, in that the unit has no filters or tone controls, an unusual and worthwhile feature is its ability to take the output of a moving-coil cartridge directly with the suitable boards.

Overall, then, this unit must be judged as the best preamp thus far reviewed, and certainly as one which any newcomer would have to push aside to come away with state-of-the-art honors.—E.P.)

Measurements, Phono Section

Measurements were first made in the normal phono mode using the A equalizer boards. The 1 kHz gain was found to be 43X in both channels or 32.7 dB, a bit above the specified 32.5 dB. The 20-kHz THD, CCIF two-tone difference distortion, and standard SMPTE IM are plotted versus

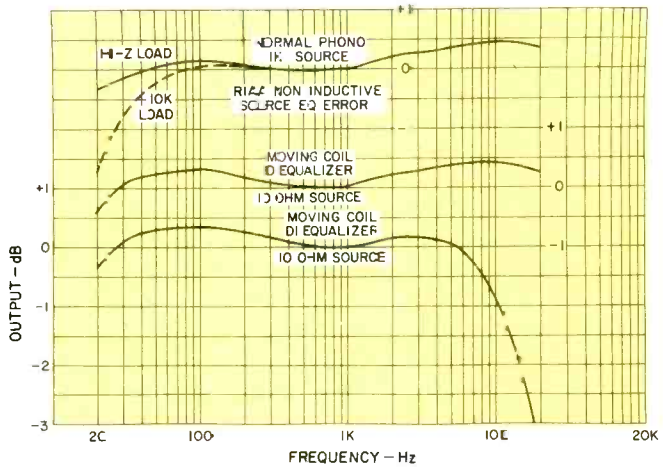

Fig. 6—RIAA noninductive-source equalization error.

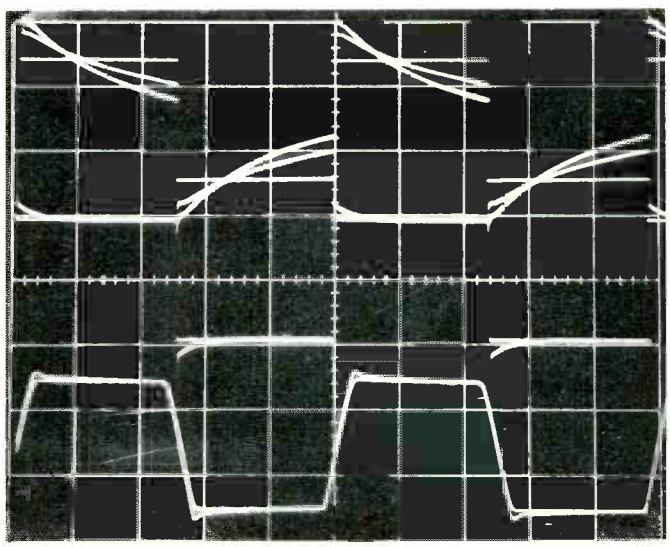

Fig. 7—Normal-phono square-wave responses, with inputs adjusted to overlay outputs. Top, 40 Hz with Hi-Z and 10-kOhm loads; middle, 1 kHz, and bottom, 10 kHz. (Scales: all 0.5 V/cm; top, 5 mS/cm; middle, 200 μS/cm; bottom, 20 μS/cm.)

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phono output voltage in Fig. 5. All of these distortion levels are very low and, in view of the low phono gain, are likely to be low in practice with high-output magnetic cartridges. Of interest here is the fact that the distortion products are essentially second and third order harmonics. The RIAA equalization error with a non-inductive source is plotted in Fig. 6. The low-frequency rolloff with a 10 kOhm load is due mainly to the 2 μF output coupling capacitor used. The effect of non-ideal 47-kOhm input resistance and possible interaction of reactive sources on the feedback equalization was checked using representative low- and high-inductance magnetic cartridges. With the high-inductance source, the response was up about 0.9 dB at 5 kHz, up 1.4 dB at 10 kHz, up 0.7 dB at 15 kHz, and down 0.25 dB at 20 kHz. With the low-inductance source, response was up about 0.5 to 0.6 dB from 3 to 20 kHz. This behaviour is generally in line with other circuits though most other circuits roll off the last octave a little more than this one with a high-inductance source.

Slew rate of the phono section was measured at 2 V peak to peak, and it was found to be 20 V per μS, which appears to be substantially faster than most other phono sections.

Equivalent input noise as a function of measurement bandwidth was found to be 0.38 μV and 0.35 μV for left and right channels in a 20 Hz to 20 kHz bandwidth. This noise was composed of a low amount of identifiable line harmonics and lower frequency 1/f noise. These input noise voltages are equivalent to a signal ratio of 88.4 and 89.1 dB below 10 mV at 1 kHz. In a 400 Hz to 20 kHz band, the input noise for both channels was 0.23 μV. These noise measurements qualify this preamp as the quietest unit so far measured.

Scope pictures of pre-equalized square wave response are illustrated in Fig. 7. Equivalent input bandwidth is limited to 50 kHz for these tests in order to represent some realistic bandwidth from a real cartridge. The upper trace shows the

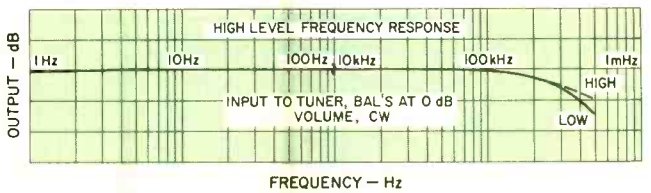

Fig. 8—High-level frequency response; note break in curve at 100 Hz/10 kHz.

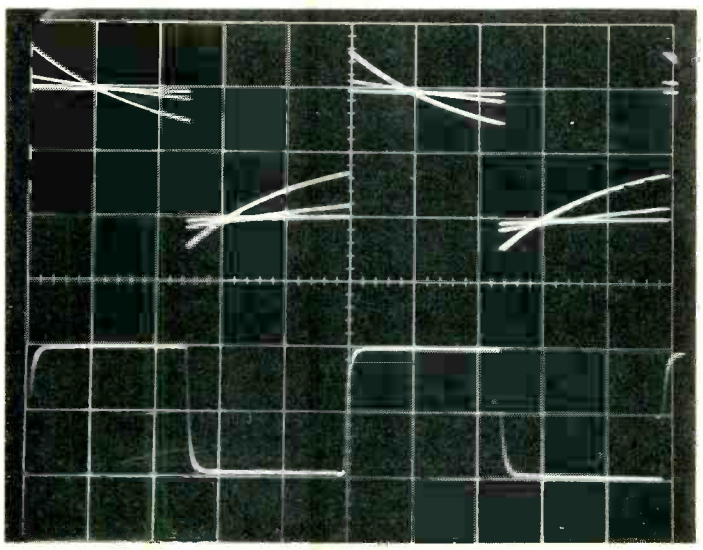

Fig. 9—Output section square-wave responses. Top, 20 Hz, d.c. coupled and a.c. coupled with 47- and 10-kOhm loads; bottom, 20 kHz. (Scales: top, 10 mS/cm and 1 V/cm; bottom, 10 μS/cm and 1 V/cm.)

Table I—Normal-phono overload versus frequency.

Frequency, Hz	Output Voltage Volts rms	Input Voltage mV rms
20	7.2	18.0
100	7.2	37.0
1k	7.2	167.4
5k	7.2	432.0
10k	7.1	804.3
20k	6.5	1427.4

Table II—Moving-coil gain at 1 kHz.

Equalizer	Left	Right
D	940X, 59.5 dB	950X, 59.6 dB
D1	890X, 59.0 dB	890X, 59.0 dB

Table III—Moving-coil input noise and signal-to-noise ratio re 1 mV versus equalizer and measurement bandwidth.

Equalizer	Bandwidth, Hz	Left, μV	S/N, dB	Right, μV	S/N, dB
D	400-20k	0.028	91.1	0.028	91.1
D	20-20k	0.1	80.0	0.085	81.4
D1	400-20k	0.046	86.8	0.049	96.2
D1	20-20k	0.17	75.4	0.175	75.2

Table IV—Moving-coil overload versus frequency.

Frequency, Hz	Output Voltage, volts rms	Input Voltage, millivolts rms
20	6.7	0.76
100	7.0	1.63
1k	7.0	7.37
5k	7.0	19.0
10k	7.0	35.9
20k	7.0	69.9

Table V—Output-section noise versus bandwidth, gain, and volume control position.

Bandwidth, Hz	Gain setting	Left, μV CCW	Left, μV WC	Left, μV CW	Right, μV CCW	Right, μV WC	Right, μV CW
20-20k	high	13.5	16.7	12.8	16.0	18.2	14.5
400-20k	high	11.2	15.3	11.2	12.8	16.5	12.8
20-20k	low	13.8	21.2	21.2	15.5	22.0	22.0
400-20k	low	11.2	20.0	20.0	12.8	20.9	20.9

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effect of a 10 kOhm load on low frequency tilt—the greatest tilt being for the 10 kOhm load.

Phono overload versus frequency is tabulated in Table I. Overload was visually judged on a 'scope and was the onset of clipping on the negative half cycle at all frequencies. Crosstalk between channels was measured on a pre-equalized basis and found to be greater than 80 dB down from 20 Hz to 11 kHz, decreasing to 74.6 dB at 20 kHz. These are excellent measurements on this test. S/N at 1 kHz re 10mV was 92.8 dB.

The preamp was next set up for moving-coil operation. The 1-kHz gain was measured with a one-ohm source for the D and D1 equalizer plug-ins. Results are shown in Table II. Equivalent input noise versus bandwidth for the two equalizers are tabulated in Table III. The noise level for the D equalizer in a 400 Hz to 20 kHz band is an absolute record of achievement in this reviewer's experience! Noise with the D1 equalizer is higher because of the extra 10-ohm resistors in the input circuit used to achieve the high-frequency rolloff. The 20 Hz to 20 kHz noise was dominated by 1/f low frequency components with line harmonics being conspicuously absent. This is the real reason for the external power supply—to get rid of hum field radiation problems of a power transformer in the preamp enclosure when using a moving-coil phono stage. RIAA equalization error is plotted in Fig. 6 for a 10-ohm source with the D and D1 equalizers. Considerations of source inductance effects aren't relevant with moving-coil pickups, as all of these pickups (at least the ones seen by the reviewer so far) are virtually purely resistive in impedance to well beyond 20 kHz.

Standard IM was measured for this configuration and was found to be less than 0.01% for output voltages of 5 V rms or below. It was noticed that with D equalizers installed the system became unstable when driven into clipping. Everything was fine just below clipping but just at the onset of clipping, the output started a low frequency oscillation. With the D1 equalizers in, the low frequency oscillation disappeared. Apparently, the added input network in the D1s help this minor problem. When the output clips and the minus half cycle clips first, a high-frequency nonsinusoidal oscillation of about 62 kHz appears on the clipped portion of the waveform. It is not known at this time whether this is characteristic of the design. THD versus frequency at 5 V rms or below was less than 0.01% from 20 Hz to 20 kHz. Overload versus frequency is indicated in Table IV. Overload was the visual onset of clipping which precipitated the above mentioned instability. Both IM and THD were relatively unaffected by output loading for loads of 10 kOhms or higher.

Waveforms for pre-equalized square waves for the D equalizer are substantially the same as in Fig. 7 with the exception that there is more low-frequency tilt. The 40-Hz tilt with a high impedance load is more like the 10 k loading on the normal phone. The 10 kHz response with the D1 equalizer is slow and what one would expect of a 20-kHz low-pass filter.

High Level Section

Gain of the output section for input to *Tuner*, balances at 0 dB, and volume control fully clockwise, was 3.8X or 11.6 dB for both channels with gain set for low. With gain set for high, it was 11.5X and 11.3X for left and right channels which works out to 21.2 and 21.1 dB.

Frequency response of the high-level section is plotted in Fig. 8. As can be seen, the response above 300 kHz is slightly better with the gain set at low.

Output noise with shorted inputs versus gain, volume control position, and bandwidth is in Table V. These output noise levels are satisfactorily low for the JC-2.

IM distortion was measured as a function of output voltage and found to be less than 0.01% for output voltages of 3 V rms or below, rising to 0.027% at 5 V, and 0.073% at 7 V rms output. Measurements of THD versus frequency and output voltage resulted in a distortion level of less than 0.01% between 20 Hz to 20 kHz for outputs of 6 V rms or less, about 0.01% at 7 V, and 0.043% at 10 V output. Both IM and THD were essentially unaffected by loads of 10 kOhms or greater.

An attempt to measure the slew rate of the output amplifier by usual methods was made. A slew rate of 300 V per μS is the same as 30 V per 0.1 μS, which means that the output amplifier should go from, say, -15V to $+15$V in 0.1 μS. A fast rise time square wave was used to drive the output amplifier to about 30 V peak to peak and was just below clipping. The edge transitions of the output waveform were exponential in shape, indicating that slewing wasn't occurring, and the rise and fall times were 1.5 μS. If the output amp was severely overdriven, the transitions became much faster—approaching 30V in about 0.2 μS. This appears to be invalid, as slewing generally refers to internal nonlinearity of the device under test during fast level transitions and not to steady state.

Mark Levinson Audio measures the slew rate of the output amplifier by the following manner. A sine wave test frequency, 4 megaHertz, is applied to the output amplifier and the output level driven up to 20 V peak to peak, the limit of our oscillator. With this amplitude and frequency, it then becomes possible to demonstrate an equivalent slew rate of 250 V per μS.

'Scope pictures of square-wave response of the output section are shown in Fig. 9. The upper trace shows the response for d.c. output coupling and a.c. coupling with a 47 kOhm load and a 10 kOhm load. The 20-kHz response indicates a rise time in the region of 1 μS. Crosstalk between channels was measured and found to be greater than 80 dB down from 20 to 175 Hz, decreasing to -70 dB at 600 Hz, -60 dB at 2 kHz, -50 dB at 13.6 kHz, and -40 dB at 20 kHz.

In conclusion, the JC-2 is a beautifully made piece of gear that may well find its way into professional application. Long term reliability of this unit is likely to be very good. It should be of more than passing interest to well-heeled audiophiles who would like to add a piece of top-quality gear to their systems. *Bascom H. King*

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Manufacturer's Comment: One of the big problems with "state-of-the-art" audio today is that most of the program source material available is loaded with distortion of various types, either by accident or by design. (We certainly agree with this point.—Ed.) One of the consequences of this is that sometimes a less accurate component can mask or veil some of the problems in the source material, and for this reason a superior or more accurate component will not always make the music sound better.

We designed the JC-2 to be as accurate as possible, not to provide any subtle colorations which might make program material sound "better," and we feel the result is a practical and beautiful instrument for people who want excellent sound quality and can do without certain conveniences and flexibilities offered by other commercially available designs.—Mark Levinson Audio Systems.

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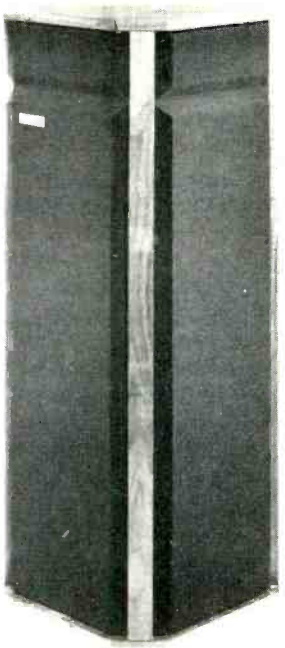
Allison Acoustics Allison: One Speaker System



MANUFACTURER'S SPECIFICATIONS
Speaker Complement: Two 10-in. woofers, two 3½-in. mid-range units, and two 1-in. tweeters. **Crossover Frequencies:** 350 and 3,750 Hz. **Impedance:** 8 Ohms nominal, 7 Ohms minimum at any setting of the balance switch. **Minimum Power Required:** 30 watts per channel to produce 100 dB sound pressure level in most domestic room environments. **Effective System Q:** 1.0; low-frequency response −3 dB at 35.5 Hz, −6 dB at 29.5 Hz. **Size:** 40 in. H by 19 in. W by 10¾ in. front to back. **Weight:** 67 lbs. **Price:** $360.00 each.

For a long time it has been the contention of audio engineer Roy Allison that people listen to loudspeakers in rooms, and that recognition should be taken of the influence of the room and its boundaries in loudspeaker design and placement. He has published technical papers on this subject in the prestigious *Journal of the Audio Engineering Society*. But rather than be content with theoretical work, he has now made some of these ideas available in commercial products, the Allison:One and Allison:Two loudspeakers. Similar in principle of operation, the Allison:One is the big brother of the Allison:Two. The intent of these loudspeakers is to provide a uniform power response throughout a room and to use the floor and wall boundaries in an optimum fashion to help achieve that goal.

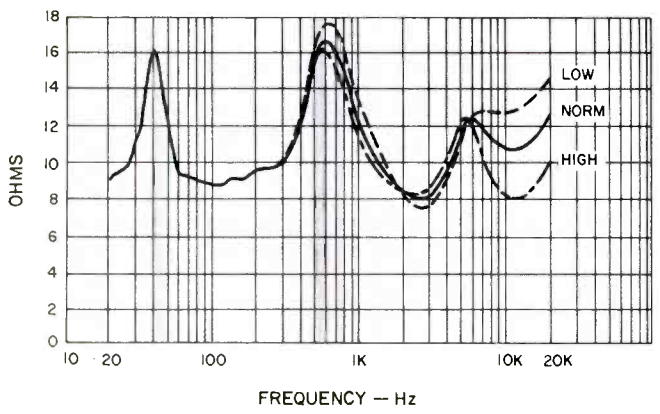


Fig. 1—Impedance versus frequency for three positions of the level control.

The Allison:One is a floor-standing unit that uses six speakers in a three-way configuration. Dual 250-mm (10-in.) woofers are housed in a common, sealed-enclosure, acoustic-suspension design which covers the range from below 30 Hz to 350 Hz. Dual 90-mm (3½-in.) mid-range units carry the acoustic load from 350 to 3750 Hz, and dual 25-mm (1-in.) tweeters cover the top end.

These speakers are housed in a vertical standing column, just over a meter tall, and are symmetrically placed on each front face of the triangular cross-sectioned enclosure. The back side of the three-sided enclosure is intended to be placed flat against a wall, which angles one of the front faces toward the normal listening area and the other away from it.

The front and top of the enclosure is oiled finish walnut veneer, with a perforated semi-rigid grille protecting the loudspeaker drivers. Well-marked terminals are housed in a protective cavity in the rear of the enclosure, which allows for flush wall placement. A three-position lever switch is provided in this cavity for adjusting the balance of the overall response between a nominally flat power curve and a slightly rolled-off slope referred to by Allison as "concert-hall balance."

The grilles are formed from a plastic compound that, while possessing good acoustic properties, is not terribly strong. The grilles are snapped into place in grooves in the enclosure and must be slightly deformed for removal. There is no reason for a user to remove a grille, but care should be exercised if they are, because they will crack if deformed excessively. In addition, a sharp blow, such as due to a chair shoved against the grille, could result in a damaged grille.

(*Editor's Note:* The makers tell us that they began using a stronger ABS type plastic for the grille about the first of the year, and that owners who have experienced difficulty with grilles of the earlier material should contact the company.—Ed.)

The Allison:One is heavy, 30 kg (67 lb.), and moderately tall, but the center of gravity is low enough that it can be tipped quite far before it could fall. However, if there are toddlers about, I would recommend that no heavy objects be placed on top of any speaker of this height for safety reasons. The Allison loudspeakers carry a full warranty for five years and this warranty is transferable.

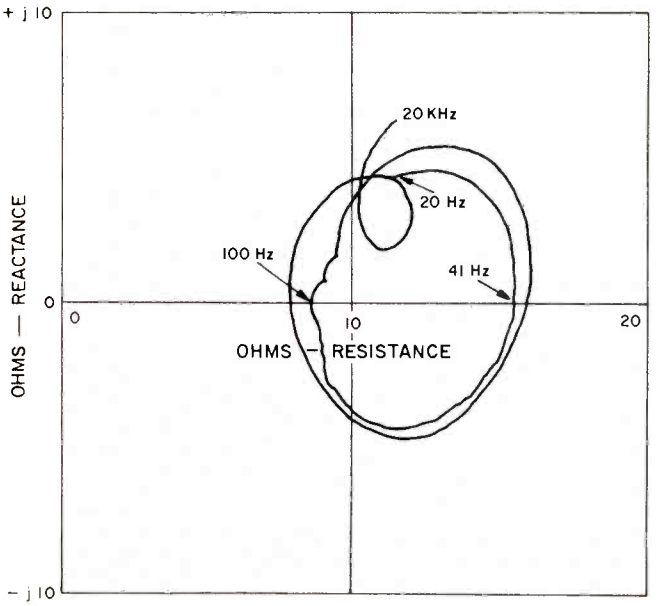


Fig. 2—Complex impedance.

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Technical Measurements

The magnitude of loudspeaker impedance for each of the three equalizer positions is plotted in Fig. 1. This shows that the Allison:One can safely be rated at 8 Ohms for the purpose of determining the load placed on the power amplifiers and the gauge of speaker wire required for an extensive run between power amplifier and speaker. The bass resonance peak has an unusual characteristic in the range from 60 Hz to 200 Hz that may be due to some interaction of the woofer with the enclosure in a standing-wave fashion.

The complex terminal impedance plot in Fig. 2 verifies this characteristic, but since the variations are small, the effect on the acoustic performance should be of little consequence. The reactive components of the impedance are quite small, which means that almost every power amplifier will be able to drive the Allison:One to the limit of that amplifier's capability without problems due to overload protection circuits coming into play.

The one-meter anechoic frequency response is plotted in Fig. 3 for two microphone positions. The curve marked "on-axis" was made with the microphone directly in front of the speaker, while the other curve was made with the microphone shifted 30° in the horizontal plane. This second position is approximately along the direction for normal stereo listening. In view of the deviation of this measured performance from the sound pressure uniformity stated in brochures for this speaker, some explanation is in order.

Audio normally measures the anechoic response at a microphone position one meter from the front of the enclosure and directly in line with the geometric center of the enclosure. In the Allison:One, the dual tweeters, midrange drivers, and woofers are horizontally displaced approximately 280 mm (11 in.). The spacing between tweeters and midrange units is 130 mm (5 in.) in the vertical direction and their mean average position is 400 mm (16 in.) above the geometric axis where our measurements are performed. Thus, there is a reasonable physical spacing between drivers sharing common frequencies. Because of this, the axial response at distances of one, two, and three meters is different and possesses the absorptive dips that can be expected from measurement of widely spaced drivers. We use a microphone position one meter from the enclosure in order to remain consistent with our measurement data so that it can be compared against data from other loudspeakers.

(*Editor's Note:* It should be emphasized that the above-mentioned anechoic frequency response measurement technique, which has been used to make this magazine's standard one-meter measurement, is *not* the same technique used by Allison Acoustics to make their performance warranty. Allison Acoustics considers flat power input into the room of greatest design importance, and time effects as secondary provided they are not horrible. While anechoic measurements have long been used as standard tests because of their repeatable accuracy, more recently other sorts of measurement techniques have been tried, such as *Audio's* three-meter room test, because, as Mr. Heyser points out, we do not listen in anechoic chambers. Two other sorts of techniques, being used by Allison Acoustics in an attempt to measure what is actually heard in a listening room, are detailed in the firm's brochure as follows:

"A separate set of response curves is made for each [midrange and high-frequency] driver so as to eliminate interference patterns which are dependent on microphone position and have little to do with true power output. Measurement conditions: Sine-wave input signal applied through system crossover network. Driver flush-mounted off center on baffle 1 meter square. B&K Model 4133 microphone 10 in. from center of driver."

The brochure further notes about low-frequency response:

"Low-frequency power output [is] obtained by integrating dual-woofer response at all angles around system with enclosure at floor-wall intersection six feet from another wall. Moving system closer to other wall will increase output at low frequencies."

Therefore, since all these techniques are gathering different sorts of data under rather different conditions, they should not be looked upon as tests or verification of each other or as *absolutely* accurate representations of what a listener will hear.)

The anechoic response was checked as a function of horizontal angle and found to have the following overall characteristic. At any single position, the response is nonuniform and possesses a number of absorptive dips. The frequency of these dips changes with azimuth and elevation angle such that, averaged over greater than 15° increments, the response is good up to beyond 22 kHz. The top end is best when the measurement is made on a direct line with the tweeters, which corresponds approximately to the position a listener would have in a normal stereo situation. Following a drop-off above 22 kHz, the response comes back up at around 38 kHz with a level only 6 dB or so below the 10 kHz to 20 kHz average response. It then falls off above 42 kHz.

Returning to the anechoic measurement, the single-microphone response is not only irregular, but strongly dependent upon the precise position of the microphone. Because of this we were unable to make a definitive phase measurement. The overall response is primarily nonminimum-phase due to the interaction between drivers. The technical interpretation of this measurement is that stereo localization is more likely to be diffuse than precise.

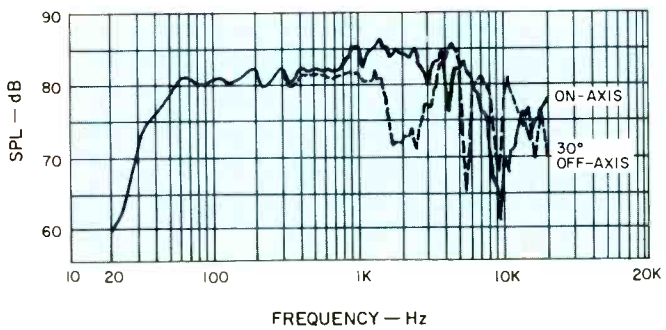

Fig. 3—One-meter anechoic sound pressure level for one-watt drive.

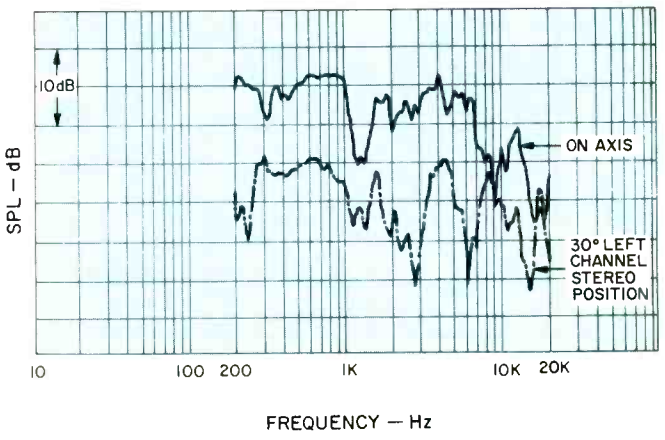

Fig. 4—Three-meter room response.

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Because the overall energy is uniform for the total sound in a room, the balance for instrumental timbre should be reasonably good, though the nonminimum-phase characteristic of the direct sound may remove the sharp edge from percussion instruments. The low-frequency response, particularly if the enclosure is placed against the wall-floor boundary as Allison suggests, should be firm and robust.

(Editor's Note: Some caution should be exercised in interpreting phase measurements for this type of system and design philosophy, as the results are highly dependent on the precise microphone location relative to the speaker system.)

Of course, we don't listen in anechoic chambers, we listen in rooms, and Fig. 4 shows the results of the measured three-meter room test for the Allison:One. The frontal axis response and normal stereo listening position response are shown and are displaced 10 dB on this plot for clarity. The room response comes through a little better than the anechoic response, however, the overall characteristic still indicates the presence of diffraction effects. The spectrum from 200 Hz to 1 kHz, which is principally handled by the woofer, is moderately smooth, but diffraction effects are seen above that range, as with the anechoic measurement.

The polar energy response for the three positions of equalization is shown in Fig. 5. Horizontal dispersion is moderately uniform out to about 60° off-axis, and there is good left/right symmetry. The dispersion beyond 90 degrees is rather strong for a loudspeaker intended for flat wall emplacement, and some precaution is indicated for placing the Allison:One next to book cases or other furnishings that could allow side-launched sound to reflect into the listening position. The maker indeed recommends placement with at least 2½ ft. between the cabinet center and the side wall.

Harmonic distortion is shown in Fig. 6 for the musical tones E1 or 41 Hz, A2 or 110 Hz, and A4 or 440 Hz. The distortion is particularly low for the tone A2. The distortion is quite low even at average drive levels of 100 watts. This indicates that this speaker can handle quite high sound levels without breakup and can really come alive when super power amplifiers are used.

The low distortion of the Allison:One is verified in the IM measurement of Fig. 7. The nature of this IM below 20 watts is principally due to amplitude modulation, which means that the 440-Hz tone is modulated in its level, but not its phase, by the 41 Hz tone. Above 20 watts the modulation begins to pick up phase characteristics and has a 5 degree peak-to-peak phase modulation at 100 watts.

Crescendo handling, the ability to handle momentary bursts of incoherent signals without modifying other signals at a lower average level, is also good in the Allison:One. Bursts up to 300-watts peak level can be handled without changing other tones by more than ½ dB.

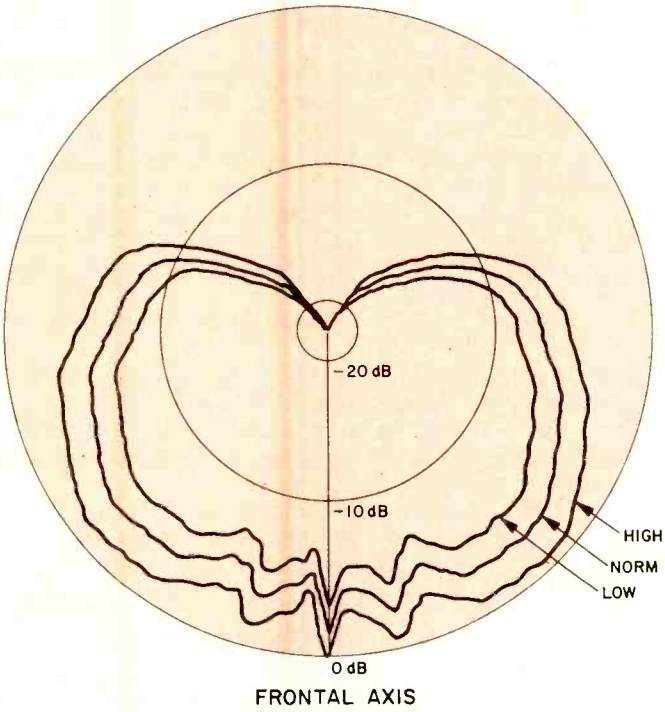

Fig. 5—Horizontal polar energy response for three equalizer positions.

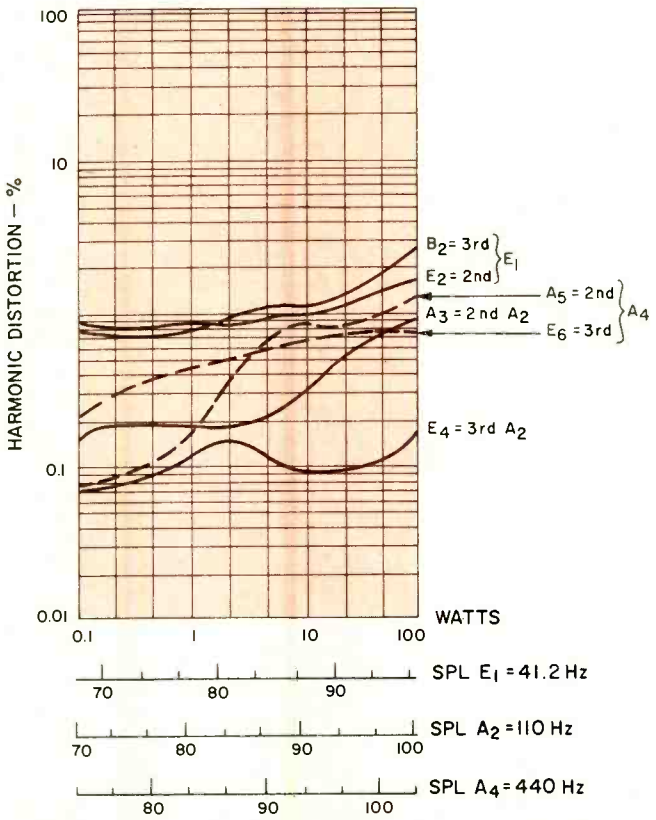

Fig. 6—Harmonic distortion for the tones E1 or 41 Hz, A2 or 110 Hz, and A4 or 440 Hz.

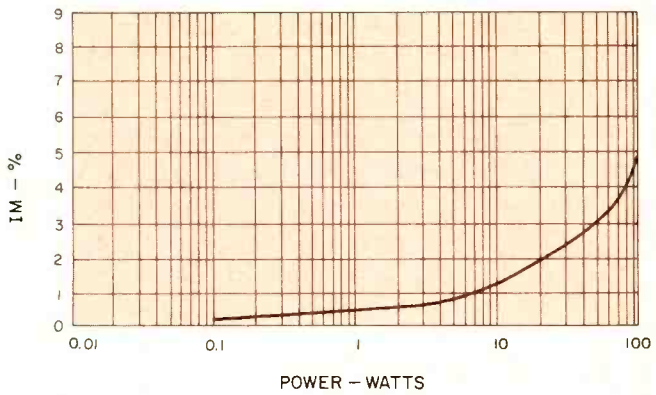

Fig. 7—Intermodulation of A4 or 440 Hz by E1 or 41.2 Hz mixed one to one.

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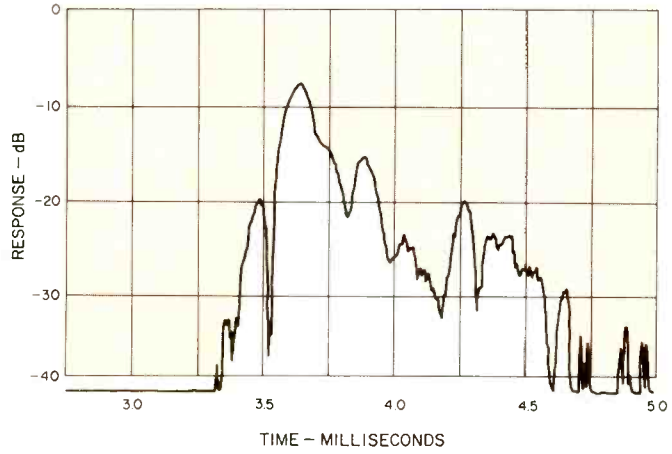

Fig. 8—Energy-time response for axial one-meter microphone position.

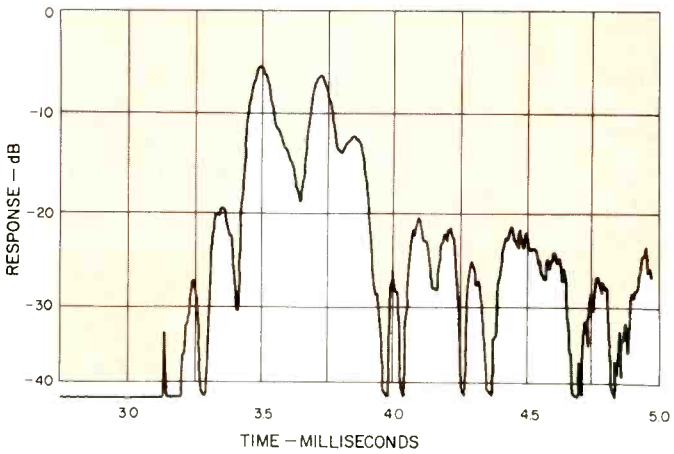

Fig. 9—Energy-time response for 30° off-axis one-meter microphone position.

Transient response is indicated by the nature of the reproduction of the loudspeaker of a perfect impulse. Figures 8 and 9 show the energy-time curve, which is one such measurement that indicates how the sound due to an impulse is spread in time. The positions chosen for Figs. 8 and 9, on-axis and 30 degrees off-axis, are identical to those used in the anechoic measurement of Fig. 3. The energy-time measurements verify that most, if not all, of the frequency response irregularities are due to time delay of the sound caused by the spatial spread of multiple drivers. Impulse response measurements (not shown) indicate that the first arrival is due to a 5-kHz component, followed within 0.15 milliseconds by two combined bursts of energy around 10 kHz and 20 kHz. The majority of the sound energy arrives within one millisecond of the sound peak and within 1.5 milliseconds of the first arrival.

Listening Test

The Allison:One's were placed, as recommended, standing on the floor with their back as close as possible to a wall. In view of the specific instructions on placement, no experimentation with other speaker positions were attemped.

The first impression is that the low bass is quite good. In fact, I felt that the very low bass was, if anything, a bit heavy. However, the sound was quite clean and the mild bass emphasis was not accompanied by any impression of muddiness or loss of clarity on percussive instruments in the bass register.

The general stereo imagery is good in lateral positioning accuracy, and there is very little subjective dependence of the position of the image with location of listening position. In that sense, the image has the broad-stage characteristic of some systems which use wall reflections to disperse sound. It was my opinion that the depth of the stereo image was just a bit two-dimensional and shallow.

The Allison:One can take a lot of amplifier power and deliver a clean sound at quite high levels. On the very cleanest wide-range material, the Allison:One system was able to take nearly the entire power output of a Marantz Model 500 power amplifier before showing distress, but that was at a lease-breaking power level. Those who purchase this speaker should consider a super power amplifier, if they do not have one, to make full use of the potential for handling instantaneous peak levels without audible breakup.

The reproduction of human voice was fairly accurate, in my opinion, and I felt that piano was moderately good. I preferred the reduced treble equalization position for classical music and piano. In addition, I preferred to reduce the bass slightly by preamplifier tone control for the most accurate piano reproduction.

On clean recordings of jazz and some contemporary music, I preferred the stronger high-frequency equalization position on the Allison. Brass has a good bite and some instruments came forward with the treble control up. I did not get the impression of absolute pin-point stereo imagery with the Allison:One, but neither did I sense that the reproduction was laterally smeared into Jolly Green Giant voices either.

From the standpoint of overall performance in the accurate reproduction of sound, the Allison:One is best for highly complicated, stage-filling material that can fill a room with sound. *Richard C. Heyser*

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Manufacturer's Comment: There are many opinions on what a product review should be, but everybody will agree that facts should be presented clearly and accurately. I should like to point out some possible areas of ambiguity.

1. Uniform power response *throughout* a small room is not possible. Uniform power *input* to a room is possible, however, and that is the design goal of the Allison:One.

2. It is desirable to place the cabinet so that its back is close to a wall. Actual contact is not usually practical and is unnecessary; the design allows for a spacing of three inches from the rear wall without performance degradation.

3. The spectrum from 200 Hz to 1 kHz is not principally handled by the woofer section. A crossover frequency of 350 Hz is established reliably and emphatically by an LC network. By 600 Hz, the woofer output is down 14 dB and is still going down at better than 12 dB per octave.

4. It is gratifying to note that diffuse stereo localization and removal of sharp edges from percussive sounds, indicated as possible problems based on the anechoic phase measurements, were not evident in the listening tests.—Allison Acoustics.

Editors' Note: Readers should remain assured that the technical information in these reviews is based entirely on actual laboratory measurement. Manufacturers are not allowed to participate in these measurements nor to alter the data we present. While legitimate differences of opinion may exist concerning subjective evaluation, the technical measurements are well defined and may be duplicated by any well-equipped acoustic testing facility. But these must be actual measurements, not technical inferences, to be acceptable to us.—*Richard C. Heyser & Eugene Pitts.*

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The Bookshelf

Celebrating the Duke (& Louis, Bessie, Billie, Bird, Carmen, Miles, Dizzy & other Heroes). By Ralph J. Gleason. Little, Brown and Co., 280 pages; $8.95.

Ralph Gleason was the most widely read writer on jazz in the Sixties and Seventies, until his death at 58 last June. This was because he had the ear of young readers, chiefly as a founding editor and regular columnist for *Rolling Stone*. Prior to his association with that publication, he had built for himself a considerable audience from his base (from 1952 on) as jazz critic for the San Francisco *Chronicle*, which led to a syndicated column. (The only other jazz writer with national syndication has been Leonard Feather.)

By background, outlook, and temperament, Gleason was uniquely suited for this position. Almost alone among his colleagues, he was in sympathy with the music and aspirations of youth in revolt, and almost alone among veteran jazz writers, he was a consistent yea-sayer to the jazz avant-garde.

Gleason was a proselytizer at heart. He loved jazz and wanted other people to share his discoveries and enthusiasms. He thought that much of jazz's lack of popular success and acceptance was due to social injustices deeply rooted in the American system and national psyche, and he called these shots as he saw them.

Formal criticism and musical analysis were not his strong suits, and when he delved into jazz history, he tended to rely on memory rather than research—after all, he'd begun to write about the stuff for the Columbia University *Spectator*, and been on the staff of America's first serious jazz publication, *Jazz Information*, as far back as 1939. He approvingly quotes Albert Ayler's statement that music is about "feelin's" rather than notes, and it sums up his own approach quite neatly.

These articles, columns, and liner notes, collected by the author himself though published here posthumously, add up to a compendium of Gleason's best writing from the last 25 years. Had some of his early things been included they might have surprised. There was a time when Gleason was a loyal spokesman for the Bunk Johnson or "moldy fig" camp. But while this might appear inconsistent with his later glorification of the founding fathers of bebop, ideologically it was not. Bunk and New Orleans jazz represented pure Black folk culture to young Gleason; later, he came to see bop as a continuation of the Black struggle against commercialization and assimilation.

Small wonder, then, that the only really hostile musical note in the book should be sounded against Benny Goodman and Tommy Dorsey, i.e., the commercially successful band leaders of Gleason's youth. These comments are the only instance where Gleason's cavalier way with facts results in unfairness; elsewhere, inaccuracies are relatively unimportant, though it made me unhappy that Ralph thought Louis Armstrong had always been deferential to Joe Glaser and Jack Teagarden. There's a form of address starting with the letter "m" I've heard Louis employ with both that was decidedly not "mister."

The most rewarding portion of the book is the 100 pages of columns about Duke Ellington, dating from 1952 to 1974, which constitute an informal chronology of Ducal activities and achievements and bear witness to Gleason's profound love and admiration for the man he considered the true master of the music.

Gleason's admiring words for another of his avowed heroes, Miles Davis, do not wear quite as well, perhaps because the writer was himself one of the creators of the Davis mystique. This makes some of his statements border on the disingenuous. Yet I'm certain of their sincerity; Gleason always believed what he wrote.

Sincerity and conviction are the most attractive features of Gleason's writing. At times, one might argue with his facts or findings, but his fundamental belief that jazz is great music and important music is unarguable, and he fought the good fight for what te believed in hard and well. He never used jazz to further his own ends and remained devoted to the cause after he had achieved personal success. It was a case of true love.

Gleason's pulpit stands empty now. His congregation was unique. Ralph Gleason's most important achievement was that he made young people listen to—and perhaps even hear—the jazz message. This book is small solace for our loss.

Dan Morgenstern

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The Column

Desire: Bob Dylan
Columbia PC 33893, stereo, $6.98.

All last Fall, reports were filtering around of Dylan recording new songs with nearly everyone under the sun backing him, people like Eric Clapton, Emmylou Harris, and the British blue-eyed soul band Kokomo. Interestingly, after all that experimentation, *Desire* appeared with the songs in relatively simple, uncluttered settings with a sparse, basic band that traveled with Dylan through the Northeast for the infamous Rolling Thunder tour of late '75.

With **Desire** Bob Dylan returns to the storytelling-with-a-vengeance of his early days. *Hurricane,* the single that preceeded the album, tells the story of the alleged frame-up of middleweight contender Ruben "Hurricane" Carter and John Artis on a triple murder charge, which resulted in a life sentence for each. The courtroom scenes are even more charged than in the nearly forgotten *Lonesome Death of Hattie Carroll* for which the white William Zantzinger drew a six-month sentence. Contrast *Hurricane* with *Joey,* an 11-minute saga of the life and execution-murder death in a clam bar of the mobster "Crazy Joey" Gallo, "caught between the mob and the man in blue."

Dylan's narrative skill has never been fiercer. Not ever. Nor has he ever seriously collaborated on lyrics before as he has with Jacques Levy for nearly all of **Desire.** Levy is best known for his work with Roger McGuinn, the father Byrd, on McGuinn's best stuff from *Chestnut Mare* and *Lover of the Bayou* to the present, and he also was instrumental in staging *Oh, Calcutta* and the Rolling Thunder tour. His role with Dylan, according to Allen Ginsburg's notes, was "working on song facts & rhymes, sharing information seriousness—lots of high rhythmic art."

Not all of **Desire** is from the headlines. *Isis* harkens back to the kaleidoscopic *Visions of Johanna* style of the **Blonde on Blonde** days. The *Romance in Durango/Black Diamond Bay* pair of songs seem to stem from the "Pat Garrett and Billy the Kid" movie experience.

The other songs of **Desire** are the catchy future hit *Mozambique,* a

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plaintive song for his wife Sara, *Oh Sister* written over the chords to *Girl from the North Country*, and *One More Cup of Coffee*, a haunting violin-led love song.

Dylan's albums have never been highly produced. They have been almost exclusively first- and second-take performances virtually devoid of overdubs. For Dylan, the advantage of this "heat of creation" style of recording is obvious; it gives a certain raw, natural sound to all of his records, uniting them despite the "new Bob Dylans" critics talk about so much. If there is a disadvantage to the sound, it is the incomplete feel which sometimes occurs. Dylan's vocal duets with Emmylou Harris throughout the album are stirring and profoundly moving. Yet, I wonder, if he had taken a little time to smooth out the blend where it just doesn't make it, in some of the choruses of *Joey* for instance, when Dylan and Emmylou are not so much singing together as singing simultaneously, would any of that song's passion have been lost? Might it have been stronger? With Dylan, the question admits no answer. More importantly it doesn't really matter.

What does matter are the new songs. And they matter much. As a collection, they are at least the equal of the **Blood on the Tracks** collection, completing the vindication of Bob Dylan. Back around the time when Dylan was putting out **Nashville Skyline** and **Self Portrait,** people were wondering if possibly Bob Dylan was washed up. They were dead wrong, not believing in the power of circles. He is stronger than ever, firing his work with a fresh maturity and hitting a furious stride. It's only beginning now. *Michael Tearson*

Performance: A+ Sound: B+

Midnight Lightning: Jimi Hendrix **Reprise MS 2229,** stereo, $6.98.

There is an overpowering hype surrounding both this album and the **Crash Landing** album, two posthumous records by Jimi Hendrix which Alan Douglas "cleaned up." He claimed that the original tapes featured excellent playing and singing by Jimi Hendrix but that the backing musicians were not particularly able, so he overdubbed two guitarists (Jeff Mironov & Lance Quinn) and a new rhythm section (Bob Babbit & Alan Schwartzberg) and removed the original players. So here come these two albums, "just like Jimi would have

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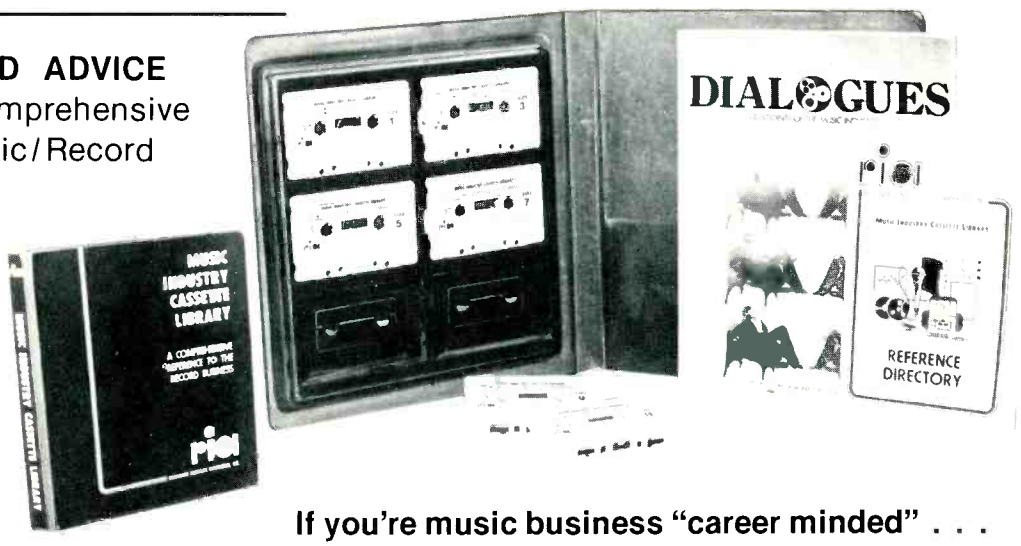

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Contd from p. 77
wanted us to have them," and they sound all right. But is everything kosher here?

Methinks not. I have heard some of the original recordings of these songs without the new musicians, and they're far more powerful than these versions. True, there are a few spaces in the music, but there are no obvious mistakes, no "bad playing," and no cluttered arrangements on the original tapes. However, the original tapes *must* be in the spirit Jimi would have wanted us to hear—Jimi rarely played with an additional guitarist (and more often than not the added guitar, as on **Midnight Lightning** only lessens the impact of Jimi's playing). None of the musicians on the album had actually ever played with Jimi.

The explanation which was offered to me by Mitch Mitchell, one-time drummer with Jimi (and the original drummer on most of these tracks), was that if the recordings were released with him on them, by the stipulations of his contract he would have to be paid a royalty for his performance. He refused to elaborate, as many of the questions were currently being settled in courts, but let it suffice to say that the motives involved in the reprocessing of the Hendrix tapes may involve less musical motives than strictly financial ones. As John Lennon puts it, "Gimmie some truth!"

Jon Tiven

Sound: C- Performance: Altered

Reach for the Sky: Sutherland Brothers & Quiver
Columbia CS 69191, stereo, $6.98.

At one point in time these boys were amongst the more exciting Sixties-ish British bands, playing a brand of music in the same general category as Stealer's Wheel, Big Star, and the Raspberries. They were refreshingly clean, melodically pleasant, and even had a fair-sized hit with *You Got Me Anyway*, then quickly faded into obscurity as their record label went through big business changes just as their second album was issued. There were a few hasty exits by band members, a third album was issued in England but not in America, and they were released from their recording contracts.

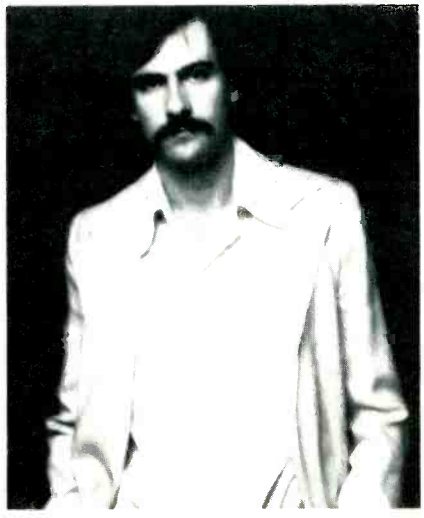
A long period of silence followed and then came this album, produced by two Americans who had been brought in to further commercialize the Suths & Q, as if the music they were making before couldn't have been left alone and still saleable. **Reach for the Sky** is an overslick production and anything but subtle—the dance beats hit one over the head, the songs (besides being the least interesting tunes the Suths have ever written) seem to have been written for one purpose only (To Sell), and Tim Renwick's much heralded guitar playing has never sounded less distinctive. The cover artwork is the nicest thing about this album—everything else is a total disappointment, but if they can get a hit out of it, maybe it's worth it. To them, maybe, but not to me.

Jon Tiven

Sound: C Performance: B –

Gorilla: James Taylor
Warner Bros. BS-2866, stereo, $6.98.

The temptation to discount the value of James Taylor as a music maker is unavoidable in the light of his output of the last few years. Now, here comes **Gorilla** offering all the sensitivity any sophomore could want on a lonely night in the dorm, all the style that makes him a rock star, and all that art-



istry that has been hiding for quite a while. His ultra-personal talents as a composer have come around to a "New Maturity" which alone makes this album.

The songs are all individually good—*I Was a Fool to Care, How Sweet It Is, You Make It Easy,* and the title song *Gorilla* are standouts—but **Gorilla** is an album that brings out all my hostility toward the world of the 45 single and the vagaries of radio programming. The album, the opus, the music are best kept intact. The soft majesty and easy flow of the music truly reveal themselves when the songs are listened to as a set. The splendor of **Gorilla** is its completeness.

Lenny Waronker and Russ Titelman have produced a real beauty. The sound is gorgeous, and the recording is perfect. Who expected a perfect James Taylor album? Not I! Don't overlook this one as I almost did. It's a very fine album. *Fred DeVan*

Sound: A Performance: A

Live: The Sensational Alex Harvey Band
Atlantic SD 18148, stereo, $6.98.

I won't say that **Live** is the only way to experience the Alex Harvey Band, but only one other of their recorded efforts (**Next**) managed to capture the essence of Alex. Brutal but gentle, a 40 year old who's 16 at heart, Mr. Alexander Harvey is truly one of the greatest living rock performers, and all of his energies seem to be shown in their best light when he's placed in front of an audience. **Alex Harvey Live** delivers all of the guts and guffaws that I anticipated, with David Batcherlor's production at last able to put down on vinyl what flies through the air at a performance. The music of The Sensational Alex Harvey Band is almost as personable as a fifth performer—Zal Cleminson's guitar lines every bit as comical as his clownface makeup, Hugh McKenna's synthesizer mocking the electric guitar, and the brimming rhythm section of Chris Glen and Ted McKenna thrusting its pelvic drive straight through the front row and back into the bleachers.

Alex Harvey's music reminds one of a high school football game when you're not sure whether you're rooting for the team or the cheerleaders. This is one of the first musical groups to echo the confusion of the Seventies and place that confusion in its proper context; all is sacrificed for the sake of fun. His lords are a sham (*Vambo*), his doctors are quacks (*The Faith Healer*), his laws are an illusion (*Framed*), and even his pop music is all in jest (*Delilah*). To say that Alex Harvey and his Sensational Band are brilliant would understate the true facts of the situation; The Sensational Alex Harvey Band are here, and that is all that matters. *Jon Tiven*

Sound: A Performance: A

Mistrel in the Gallery: Jethro Tull
Chrysalis CHR-1082, stereo, $6.98.

First off, I think it is of great importance to note the fact that this group has not changed personnel in some time and has produced two records in a row which are not con-

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cept albums. This is no small accomplishment for Jethro Tull, who in the past were known to fire band members at the drop of a hat, and who at one time seemed incapable of writing a song less than 40 minutes long.

This one is your typical Jethro Tull album—the same chord sequences, classical dirge music disguised by heavy metal guitar, intellectual musings cloaked under a bathrobe, and basically just another album by what purports to be a group but in actuality is just an extension of lead singer/flautist Ian Anderson's personality (in fact, many a fan of this group is convinced that the lead singer's name *is* Jethro Tull). Many are probably unaware that Anderson not only writes

the songs, produces the records, and leads the group onstage, but keeps the rest of the band on salary and collects all the percentage points for himself. Rock 'n' roll fascism at its finest.

How does this album compare to its predecessors? It's about the same as the last one, better than the two before that, and not as exciting as the first four. The group peaked very early in their career—their second album, **Stand Up**, was undoubtedly their finest hour—and ever since they've been more or less just cranking out the music. I for one certainly wish that two years or so ago when they announced their retirement, they had been sincere. But then, everybody likes to wear out his welcome.

Jon Tiven

Sound: B *Performance: C+*

Harpin' the Blues: Charlie McCoy **Monument KZ 33802,** stereo, $5.98.

Charlie McCoy is one of those Nashville sessionmen who play on more records than you want to know about, occasionally putting out his own albums of lukewarm rehashes of the hits of 3 months ago.

This one, however, is not the usual McCoy; it's more thought out, more personal. Charlie's devoted this outing to tributes to some of his musical heroes. There's a bit of Hank Williams, some Jimmie Rodgers, some Little Walter, a Delmore Brothers tune, some Dixieland, even one of Willie Nelson's songs. Fortunately, with such a stylistic variety of tunes, he's varied the backing to suit each one, with some dandy playing along the way to keep it interesting. Uncle Josh Graves' dobro combined with the fiddling of long-time Bill Monroe stalwart Kenny Baker makes Jimmie Rodgers' *Blue Yodel #1* a special treat. But the real surprise is the cameo appearance of Al Hirt and Pete Fountain together for some *Basin Street Blues.*

Unifying the album's concept is the occasional narration Charlie adds, at

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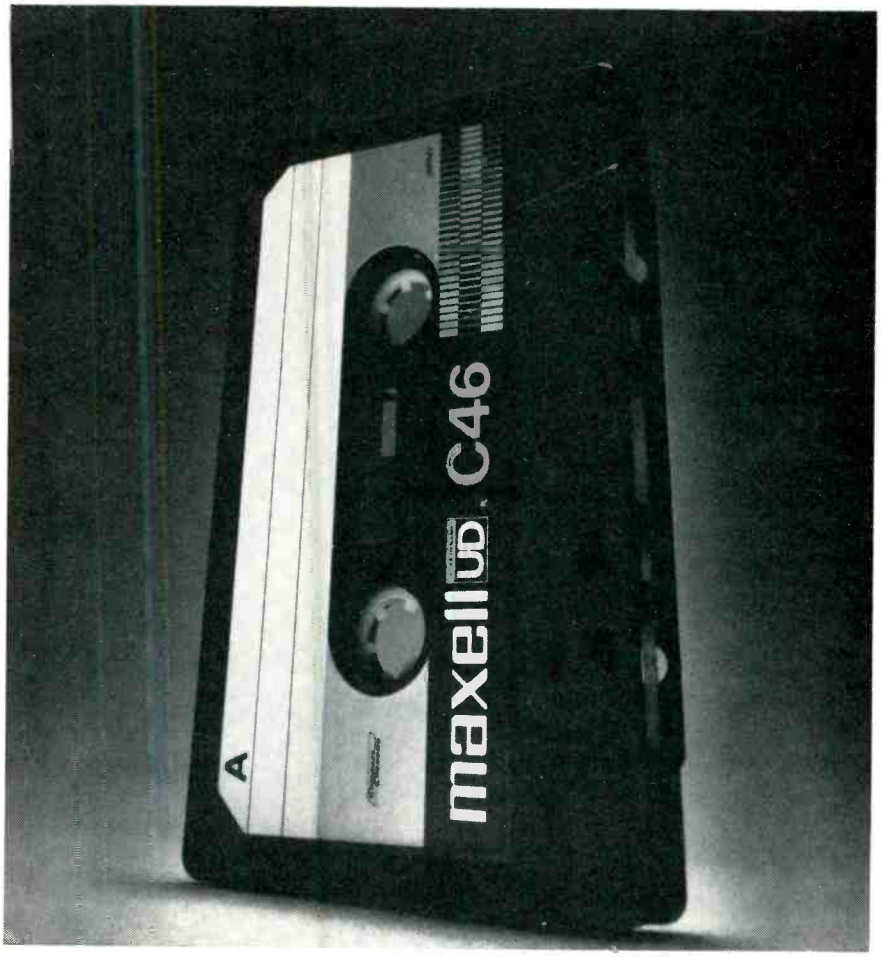

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once illuminating the music and giving a rare personal feel for a Nashville Cat's album which is really refreshing.

Occasional lapses do mar the record. The *Nashville Sounds* voices should have been left out. *Basin Street Blues,* for example, sizzles until the voices dissipate it utterly. *Columbus Stockade Blues* is an inspired choice, a tried-and-true country classic, unfortunately given a listless performance.

Harpin' the Blues sounds fine—nobody in Nashville ever seems to record a sour note—and there are even flashes of fire and passion, but not consistently. *Michael Tearson*

Sound: B+ Performance: B

Royal Bed Bouncer: Kayak
Janus JXS-7023, stereo, $6.24.

If records were judged solely on the basis of their packaging, Kayak's album would never get through the preliminaries. Adorned with a lifeless photograph and featuring one of the ugliest hues as the main color for the album jacket, this disc would be better off sold in a plain white wrapper.

But records are not sold entirely on a visible aesthetics basis, and some people actually buy records because what they hear on the radio sounds nice. When this listener first heard **Royal Bed Bouncer** on the FM waves it sounded pleasant—very similar to a lot of the appealing English progressive rock of the past few years, with most noticeable influences being early Argent and late Zombies. The group actually hails from Holland, and may mature into a first-rate group any day now; compared with their earlier albums (only available as imports), this is a masterpiece. As of yet Kayak is still in the formative stage of chucking away the influences, and until they produce a wholly original music I find it difficult to give them my wholehearted recommendation, although I do wish them the best of luck. And Janus Records, former employers of yours truly—please recognize that the record business is not an "ears only" business and shape up your artwork.
Jon Tiven

Sound: C+ Performance: B

Fool for the City: Foghat
Bearsville BR 6959, stereo, $6.98.

My great hope for Foghat was that somehow, after years of hard playing and hard work, they would be able to transcend the rock 'n' boogie idiom to become the first rate rock 'n' roll band that their initial album (and even the two which followed) seemed to

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promise. There was always a faint hint that there was something there that was more than the archetypal chooga-chooga, both in their records and in their personalities. There seemed to be a lot of people pulling for Foghat to grow into the position of being the British Creedence Clearwater Revival, or something like them.

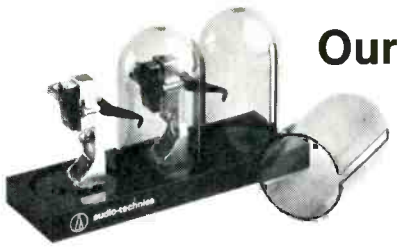
Well, here is what must be their fifth album, and they are still stuck in "De Blooze." They're proficient at it—they make *Terraplane Blues* and *My Babe* rock some, and they write decent enough Seventies blues—but you can just about give up any hope of this outfit becoming anything beyond what they already are. Foghat is probably the most lovable contemporary blues group around, but they're never going to be a Beatles/Zeppelin/Stones vehicle that travels from point A to point B. **Fool for the City** is one-dimensional rock, and if that's your cup of Teaneck, fine for you—but I thought it might turn into something better. *Jon Tiven*

Sound: *B* – Performance: B

Flying Again: The Flying Burrito Brothers
Columbia PC 33817, stereo, $6.98.
Live in Amsterdam: The Flying Burrito Brothers
Ariola 86 439 XCT (Import), stereo, $12.00.

Here are two albums by the Burritos and neither begins to approach what the Burritos were once all about. The first is a new album by a group purporting to be the Burritos reunion although featuring the minimal number of original members (I suppose all you need is one ex-Byrd and you've got it made), and a music which is closer to straight country than any sort of rock/C&W conglomerate, but slicker than any Burritos album has ever been. The only songs which are even half-interesting were written by Dan Penn, the man who created the Box Tops and at one time was a major force in C&W and rock music.

The import album captures the Burritos in their dying days, dominated by Rick Roberts and performing songs by the likes of Merle Haggard, Parsons/Hillman, and even Jagger/Richard (yes, there's a live version of *Wild Horses*, a song which Keith and Mick gave to Gram Parsons before the Stones chose to record it). It isn't a great album, even compared with the latest Burritos LP, but yes it does exist, and it's difficult to come by and not worth the bother. *Jon Tiven*
Rating: a solid C in all categories for both LPs.



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Canby's Capsules

Edward Tatnall Canby

Mozart: String Quintets, B flat K. 174, C minor K. 515. Grumiaux Trio, A. Gérecz, M. Lesueur. **Philips 6500 619,** stereo, $7.98.

The richest of Mozart is in the Quintets, here an early one and a late (see also 6500 620, two more). The playing is warm and rich, too, in the Viennese manner, but lacks the architectural intensity of the leaner "Budapest Quartet" school of playing, is more soloistic. Lovely, just the same, and one legitimate approach to the music among several.

Copland Conducts Copland—El Salon Mexico; Danzon Cubano; Three Latin American Sketches; Dance Panels. New Philharmonia Orch. **Columbia M 33269,** stereo, $6.98.

Continuing the long Copland/Copland series, this disc is a good idea—the familiar *El Salon* together with a whole group of other Latin-style pieces never before recorded. Plus one of his stately ballet works, end of the 50s, in seven segments on side 2. An attractive record.

Canadian Brass. Canadian Brass in Pairs. Boot Master Concert Series (Canada) 3001, 3003, stereo.

These two were sent down from Canada and there are more of the same. A standard conservatory-type brass quintet, complete with tuba on the bottom and two trumpets; they play a lively mix of arrangements, largely Baroque but also earlier, and even unto Joplin (who else?), not at all "authentically," yet very musically done if you enjoy this kind of brass.

Tanzmusik des Rokoko. Tanzmusik der Wiener Klassik. Ensemble Eduard Melkus. **D-G Archive 2533 303, 2533 182,** stereo $7.95 ea.

Two interesting collections of lilting dance music, played, as is increasingly standard in Germany, on wholly authentic instruments of the time—either old or in modern copies. It makes for a sound you will not forget. The "rococo" disc is late-late Baroque, on the florid side, Rameau, C.P.E. Bach, someone called Stärker. The "Viennese Classics" are much simpler for the casual ear—Gluck, Haydn, Mozart, early Beethoven, et al. Maybe this one is best to try first; it's gracious and lovely.

Rameau: Les Paladins. (Original version). Rodde, Farge, Benoit; La Grande Ecurie & La Chambre du Roy, Malgoire. **Vanguard Everyman SRV 318 SD,** stereo, $3.98.

This disc from Columbia International via license is a super French production of the Rameau opera-ballet, the solo voices typically nasal, the music full of complex turns and twists and ornament—not an easy style first-off. A dedicated performance, surely, but tense, hard-pushing and awfully whiney. The "Grand Stable" (ecurie) is the name of the orch., traditional out of Versailles.

Teldec Informationsplatten Quadraphonie. SQ, CD-4. Teldec, (Telefunken), two discs, Hamburg, 1973.

If you have these two quadraphonic systems in *your* system, by all means badger and cajole your dealer into finding a copy of this for you somehow, even though the material is several years old; the direct comparison, same music in both types of disc, is invaluable and just about unique. Two discs, pop on one side, excellent classical, in considerable variety, on the other; one disc is all SQ, the other, same music, is CD-4. You can learn plenty; a big difference in some musical items, scarcely any in others. Allow for much CD-4 improvement since 1973 (SQ sound was then ahead in development); even so, the comparisons are instructive and valid. Try with back speakers only! Very revealing.

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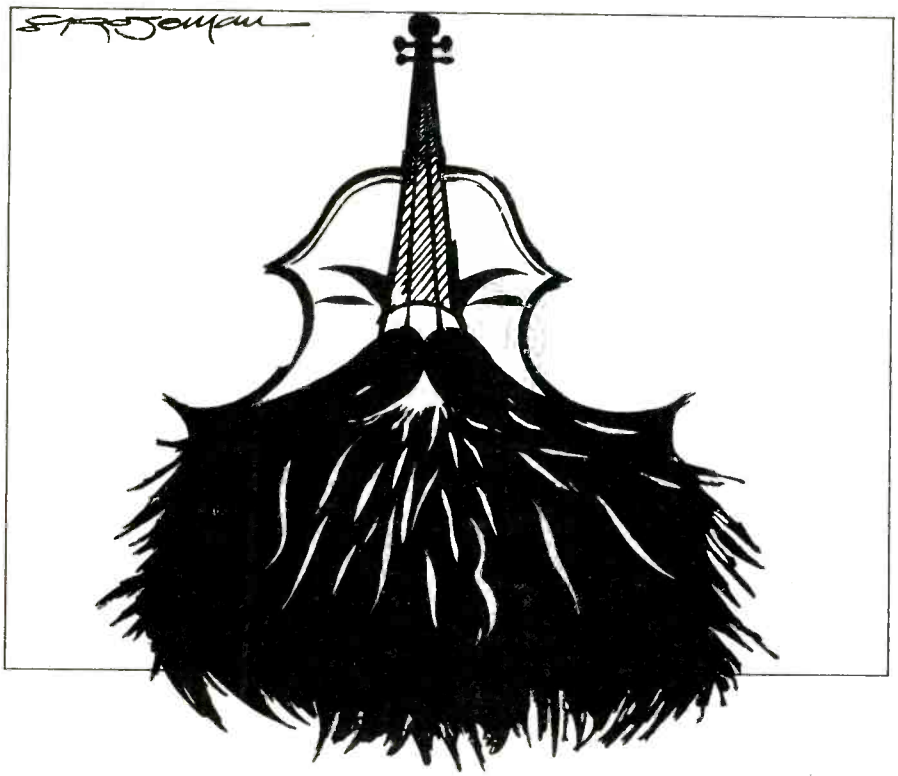
Classical Reviews

Edward Tatnall Canby



Dvořák: Concerto for Cello. Lynn Harrell; London Symphony, James Levine. **RCA ARD1-1155,** quadradisc, $7.98.

The Romantic Cello. Jeffrey Solow; Doris Stevenson, piano, ABC **Command COMS 9006,** stereo, $6.98.

This is curious. The first item, the big *Romantic Concerto* by Dvořák, features a prize youngish team of performers, Levine being RCA's conducting specialty in recent months, Harrell having played cello just about everywhere that matters in America. The sound of the record in CD-4 quadraphonic is exemplary, with a fine spread of ambience for the orchestra, the cello rightly placed at some distance and at a relatively low volume level—as is the intention in any live performance in a large hall. (How much the engineers have learned!) But the performance just does not bloom; it doesn't take off. The orchestra plays well but without any overwhelming conviction, the drama seems to sag for minutes at a time. Dvořák's fault? In part—it is a longwinded piece, if full of goodness. But also, Levine does not seem to have a dramatic grasp for such a big, sprawling hunk of Romanticism and there, I think, is the real problem. It takes, maybe, a Stokowsky, an Ormandy, to put over such an item with conviction.

The cellist? He plays the whole with faultless technique and pitch, yet with astonishing monotony. No color, no drama! Chaste.

I toss in the second cello record to prove the point. Jeffrey Solow plays the usual recital kind of arrangements of this and that, remade for the cello, a nice but not unusual collection—but in two seconds of Side 1 you know that this youngster *Understands*—he has every bit of the dramatic sense that is lacking in the big piece by Dvořák. Ha!—this is a real

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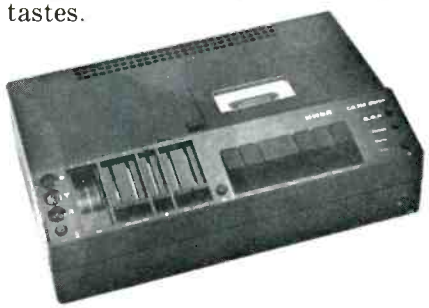

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swinging cello. And guess what. He studied with the man he would *have* to study with to be such a player—Piatigorsky, no less. The old Roosian master of cellistic unction, the one-and-only, now carrying on a respectable career as a teacher of his instrument in California. I'd like to hear Jeffrey Solow play Dvořák.

Georg Muffat: Apparatus Musico-Organisticus 1690. Leena Jacobson, organ. **Musical Heritage Soc.** *(Mail order only. 1991 B'way, NYC 10023).*

What a curious name! No, nothing orgiastic about it, or worse, and the only "apparatus" involved is an excellent Baroque organ of the early 18th century, on which the music is played. Just one of those fancy Baroque titles they like to invent back around 1690 for large-scale collections of assembled works, published and (usually) dedicated in flowery style to the nearest high-and-mighty potentate. In this case, it was the Emperor Leopold I on his coronation.

What we hear is a suite of no less than 12 showy organ toccatas, three to an LP side, plus a monumental passacaglia, all of side 5, and still another pair of Baroque works, a *ciacona* (chaconne) and something called *Nova Cyclopeias Harmonica*—more flowery entitlement. The music is really able, the first word that comes to my mind, rich in harmonies, with plenty of variety in form, tempo, rhythm, though this was when J.S. Bach, the ultimate composer of this sort of music, was no more than 5 years old. If you have enjoyed such early contemporaries as Buxtehude and Pachelbel, you'll find this music in the same general idiom. Muffat, for all his name, was somebody.

One complaint. The organist plays her Muffat with enormous musicological authority (her "program notes" are enough to scare you away), especially in the complex French-type ornament which Muffat requires; but her playing personality is didactic and mannered with a plethora of exaggerated phrasing and general unevenness. Maybe this is authentic and all that, but I found it quickly wearing on the patience. A smoother delivery is a great deal more listenable, at least in this day of ours.

Roger Sessions: Rhapsody for Orch.; Symphony No. 8. Thea Musgrave: Night Music. Wallingford Riegger: Dichotomy. New Philharmonia, London Sinfonietta, Prausnitz. **Argo ZRG 702,** stereo, $6.98.

So many foundation-sponsored albums of contemporary music come through (this one via that mysterious

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Calouste Gulbenkian Foundation)—do hi-fi fans really want to hear such music? The answer, of course, is usually "yes/no, depending," but in this case the answer is surely yes. For three excellent reasons.

First, excellent recording throughout, and music by three composers each of which is a real pro in the use of the old-fashioned, full-blown classical orchestra. Sonics galore! That in itself is enough to make hi-fi ears prick up, even though the idiom is generally, and healthfully modern-astringent. Don't you get tired of bland chords of the old-fashioned sort, once in a while? A dose of screaming dissonance, expertly handled, can clear the air like a gargle of Listerine in a froggy throat.

Second, and concomitantly, this is a well-planned and cohesive disc with an over-all shape and sense, which all too many contemporaries are not. Two of the most rugged and rock-like of top-level older-generation American pro composers, and between them a dynamic and astonishingly interesting (male or female) younger composer who is in a sense the resultant in time of the older generation who preceded her. For any ear, trained or no, this sort of cohesiveness can be *heard*. It makes aural sense.

The third reason, straight out of the other two, is a set of really dedicated, hard-working, top-flight performances, making audible persuasion out of the super-difficult material. How seldom do we get this sort of playing today! These musicians are challenged to the limits of their know-how; their conductor, too, is challenged and he is an old pro who can meet the challenge like one of those baseball or football coaches you hear about. He's savvy.

So, I challenge *you*—try these sounds on your own hi fi and for your own ear drums. Start, maybe, with Thea Musgrave, a long "chamberish" work which features two horn players who actually walk about in stereo and produce the d----ndst horn music I've ever heard. Then move up to old Wallingford Riegger (d. 1961), a Vermontish sort of character who wrote the present piece in the pioneer days, around 1930. You'll get a bit of the nostalgia sound, here and there among the dissonant crags. Then, finally, to the uncompromisingly intense Roger Sessions (yes, the Sessions clock family) who is now getting into his 80s and, like Stravinsky, Copeland and others, has converted his classic modernism to the serial system in his late years, out of Schoenberg but wholly American. . . .Enjoy yourself.

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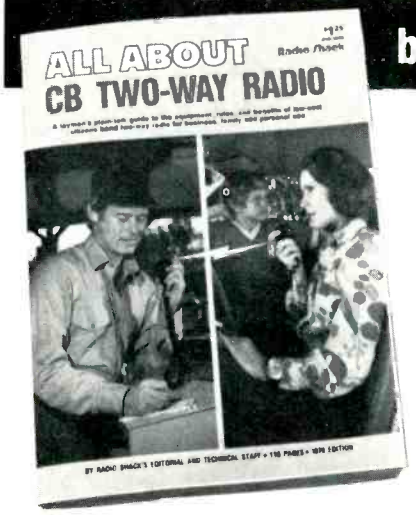

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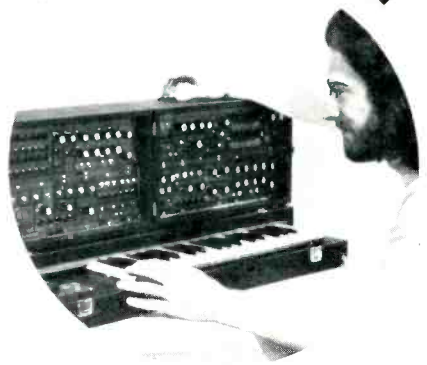

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Jazz & Blues

Basie Jam: Count Basie
Pablo 2310 718, stereo, $5.98.
Count Basie Encounters Oscar Peterson
Pablo 2310 722, stereo, $5.98.
Jam Session at the Montreux Jazz Festival: Count Basie
Pablo 2310 750, stereo, $5.98.

Jam is simply marvelous, the fluid drive of the master is felt from the beginning as Basie establishes his authority from the first note of this Norman Granz studio session recorded in December of 1973. Basie's timing and placing of notes, his graceful interaction with drummer Louis Bellson, bassist Ray Brown, and guitarist Irving Ashby; the way he pushes and drives soloists Zoot Sims and Eddie "Lockjaw" Davis (tenors), Harry "Sweets" Edison (trumpet), and J.J. Johnson (trombone), is an object lesson in the art of jazz. Harry Edison is particularly outstanding on numbers like *Red Bank Blues, Hanging Out* and *One-Nighter;* his controlled exuberance and crisp, bouyant phrasing make him sound like an edited-down Roy Eldridge. The silky swing of Zoot Sims' tenor makes for a perfect contrast with tenor Eddie Davis, a powerful, extroverted soloist and regular member of Basie's big band. One final comment, although I am no lover of the jazz organ, the roaring swing of Bill Basie's Hammond on *One Nighter* is something to hear.

Sound: A Performance: A

The Basie-Oscar Peterson encounter has many splendid moments even though it does not hit the consistent heights of **Jam**. The fault lies with Peterson, who, though he may be the most facile pianist in jazz, with a supersonic technique, simply cannot swing the blues as Basie does. It's Basie, with his spare, condensed striding style, working with comping guitarist Freddy Green and drummer Louis Bellson, who injects vibrant, rhythmic life into every cut on side one; on each of these tracks (*Buns' Blues, These Foolish Things, RB, Burning, Exactly Like You*), Peterson seems content to go along for the ride, embellishing and decorating on top of the cat-like tread of the Basie rhythm. On side two, Peterson makes a flashier show of his technique, and, on numbers like *Lester Leaps In, S&J Blues* and *Big Stockings,* the bravura excesses occasionally get in the way of old-fashioned swing. Despite this, **Count Basie Encounters Oscar Peterson** is very engaging mainstream jazz.

Sound: A Performance: A –

Jam Session at the Montreux Festival, 1975, is the most disappointing of the three Basie Pablos. Most of the numbers are typical jazz festival solo round-robins, long, often uneventful blowing sessions that lack cohesion and integration. The group Basie heads at Montreux consists of Milt

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Jackson, vibes; Johnny Griffin, tenor sax; Roy Eldridge, trumpet; Neils Pedersen, bass, and Louis Bellson, drums. Jackson plays superbly throughout, for he can dig into the blues as deeply as Basie, but Griffin is a tedious, shrill, cliche-ridden soloist who spoils every track on which he appears. (Obviously, the Montreux audience doesn't agree with this reviewer, for they clap hysterically at every one of Griffin's solos, choruses that contain more wrong than right notes—I sometimes think that jazz festival audiences are as donkey-eared as the supposedly less-discerning rock crowds.) Eldridge tosses off several of his tigerish solos, but I, for one, wish he would come down to earth once in a while. Pedersen is an excellent bassist, one of the finest Europe has to offer. Basie, of course, swings mightily all the time, his joyous four beats to the bar are what keeps things going even when Griffin threatens to ruin the whole show.

John Lissner

Sound: B Performance: B+

Balboa/Summer 1941: Stan Kenton
Mark IV 581, mono, $5.95.
Fire, Fury and Fun: Stan Kenton
Creative World ST 1073, stereo, $5.95.
By Request Vol. VI: Stan Kenton
Creative World ST 1069, stereo, $5.95.
Hits in Concert: Stan Kenton
Creative World ST 1074, stereo, $5.95.

Stan Kenton's music can be tremendously exciting or a crashing bore. For those who want to know what the shouting was all about in the initial stages of Kenton's career, **Balboa/Summer 1941** is highly recommended. Mark IV has issued a broadcast from the Balboa ballroom that is truly invigorating; this first Kenton band really curls your toes; it is loose-jointed and punching as it swings through numbers like *Artistry in Rhythm, Two Guitars, Blues in Asia Minor,* and *Harlem Folk Dance*; the forceful solos, by such early Kenton sidemen as tenorman Red Dorris and trumpeter Chico Alvarez, enhance this exciting collection. Considering the year it was recorded, the technical quality of the aircheck is excellent.

Sound: B+ Performance: A

In 1967 Kenton left Capitol Records with whom he had been associated for 25 years, and established his own label, Creative World, taking all his Capitol masters with him. He has issued a steady stream of releases, some of them very good, others, dreadful. **Fire, Fury and Fun** is beautifully recorded, and contains pieces that are alternately brooding and brassily vehement. Two of the best cuts are by Kenton's long time arranger, Hank Levy; *Pete is a Four Letter Word* is a crisp, driving showcase for drummer Peter Erskine that the band plays with gusto; *Quiet Friday* spotlights Kenton's lyric piano, then moves into a series of exuberant ensembles that display the richness and power of Kenton's brass and reeds. *Ramon Lopez* is in the Kenton Latin jazz tradition, focusing on the band's pulsing conga drummer against bristling brass backgrounds; *Montage* has more of Kenton's tranquil pianistics effectively balanced against massive sonorities. This is undoubtedly one of the better albums from the rapidly growing Creative World catalog.

Sound: A Performance: A

Stan Kenton-By Request Vol. VI was compiled from Capitol outakes from the late Fifties and early Sixties; discographical information has been supplied by Kenton connoisseurs Jack Hartley of Waldwick, N.J., Michael Sparke of Hounslow, England and Pete Verudor of Amsterdam, Holland. Despite the diligent research of these three gentlemen, this is some of the dullest Kenton ever assembled—no wonder Capitol left this

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Earl Hines and Roy Eldridge at the Village Vanguard

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Songs: *Medley: Love Is Just Around the Corner/Canadian Sunset/Lullabye of Birdland/Misty/Satin Doll; Blue Moon; I Can't Get Started; Blues for Old "Ns"; Medley: Black Coffe/I Wish You Love.*

Xanadu 106, stereo, $6.98.

Recorded more than 10 years ago at a live session that has already yielded two other LPs (these, with Coleman Hawkins also aboard, were on the long-defunct Limelight label; one has recently been reissued on Trip), this music was well worth waiting for.

Far from being leftovers, this collection offers some of the best Hines and certainly the very best Eldridge of the lot. The 10-minute-plus *Blues* is a masterpiece of spontaneous music-making and takes its place with such Eldridge landmarks as *Rockin' Chair* and *Dale's Wail* in the discography of one of jazz's greatest trumpeters. It has the warmth, exuberance and energy—just hear some of those incredible high-note outbursts—that characterize the Eldridge style. It is vibrant music.

Also delightful is *Started,* despite a truncated opening (the tape ran out). Both these pieces are performed by Eldridge with bass and drums only, and the late George Tucker and the always solid Jackson give him excellent support. On *Moon,* Hines joins the accompanists.

Eldridge is not present on the two medleys. The first is a tour de force, full of Hinesian surprises, rhythmic jugglings, and stentorian piano sounds. He manages to make even *Canadian Sunset* palatable, perhaps because he likes it (I've heard him almost transform *Slaughter on Tenth Avenue,* so anything seems possible). His transitions between tunes are brilliant. The second medley is more ruminative, and on *Coffe,* Hines, who's not really a blues player, gets as blue as he ever has. It suffices to almost excuse the pointless fade, which, unlike the *Started* gaffe, is unexplained in the notes.

Xanadu is a new independent label, operated by producer Don Schlitten, whose track record is excellent. It offers both newly recorded and vintage jazz of high quality in its two initial releases, and this one's a true gem.

Dan Morgenstern

Sound: B Performance: A+

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JBL SG-520 (gold and silver panel); SE-400S, SE-460; Marantz 7C and 9S (pair); SME 3012. Kazuo Takishima, 33-7-1421, Takashima-Daira, 2-chome, Itabashi-ku, Tokyo 175, Japan.

MARANTZ 7c PREAMP—Perfect running condition. Katsuya Dogen, Post No. 664, Koya Tutumigauchi 24-1, Itami City, Hyogo, Japan.

WANTED: Info on BOSE, San Sui QRX-7001, ESS evaluator speakers, Wollensack 8080, SONY, Tapa Equip, Preamp Dual 701, any audio equipment. Send lists, spells, prices, to Louis Sonier, 139 Dawes Road, Toronto, Ont. M4L 501.

WANTED: SONY-355 DECK. MINT (OR NEAR) CONDITION. STATE COND/PRICE. BOURGOIS, P.O.B. 146, ISHPEMING, MI 49849.

SEEBURG, Used "Audiomation" record changer or console. Robinson, 4432 Ellsworth, Minneapolis, MN 55435.

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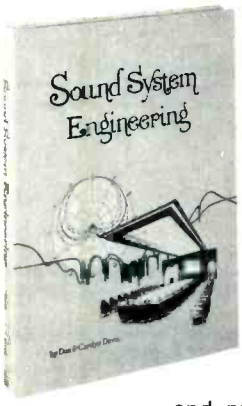

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In December, 1974, sound engineers and audiophiles were invited to examine and discuss the new Marantz Stereo Console Amplifiers featuring models 1040 and 1070 and the new Marantz 112 AM/FM Stereo Tuner. The following comments were taken from that taped discussion.

The 1070 Stereo Amp

"As far as good basic features are concerned, it's comparable to units costing twice as much."

"It maintains all the features of the Marantz 1060, plus it adds a number of features of its own. For instance, it now has graphic slide-type tone controls, two tape monitors and a versatile mode selector switch."

"With the 1070 you have a full range of tone controls like bass, mid range and treble slide controls plus preamp out and main in jacks."

"I feel strongly about the preamp out jacks. You can re-equalize tape recordings, insert equalizers or even add electronic cross-overs into the chain."

"One major feature that I like in the 1070 is its ambience circuitry. Essentially it's a speaker matrix or pseudo 4-channel. This means you can get into simulated 4-channel sound by just adding a second pair of speakers."

"In addition to the step up in power to 35 watts minimum continuous power per channel with no more than 0.3% total harmonic distortion, 20 Hz to 20 kHz both channels driven into an 8 ohm load, the circuitry is direct coupled."

"The circuitry is now full-complementary direct coupled to the speaker terminals. As a result, the damping factor is much improved at low frequencies where it counts."

"The output circuitry now includes a speaker protection relay circuit and turn on delay."

"There's improved thermal stability. This buys long term reliability as well as improved performance."

The 1040 Stereo Amp

"The new 1040 integrated amp is rated at 20 watts minimum continuous power per channel with no more than 0.3% total harmonic distortion, 20 Hz to 20 kHz, both channels driven into an 8 ohm load."

"It also has the ambience circuitry for simulated 4-channel. Most all of the features of the 1070 are on the 1040."

"It's an excellent performance component for a modest price."

The 112 Tuner

"It's got phase lock loop, a Dolby®* de-emphasis switch and a number of other high-performance features. There're no gimmicks in it. Every feature is practical."

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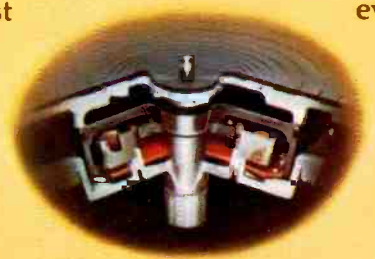

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