

**AUDIO**  
**ETC**

# Audio

THE AUTHORITATIVE MAGAZINE ABOUT HIGH FIDELITY • FEBRUARY 1974 75¢ ® ©

47425 

## **Thermal Design of a High Power Amplifier ★ High Voltage Amplifier Design**



U0803760 0476 30725005P0101212  
DON L. HUNTER  
2608 CENTRAL BLVD  
EUGENE OR 97403

# Fidelity.



The Allman Brothers Band is available exclusively on Capricorn records and tapes.

# Pioneer High Fidelity



# The Allman Brothers Band has a great new sound...



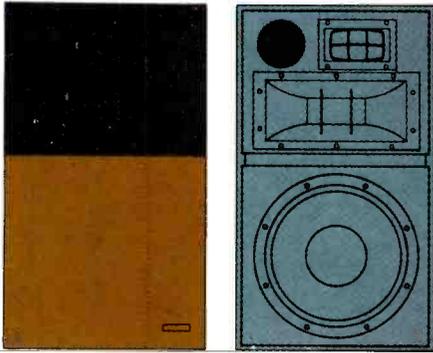
More than anything else, the Allman Brothers Band are musicians. Accomplished, sophisticated musicians whose blues-rooted improvisations have carried them to the top of their field.

Musicians, not rock stars. Their success doesn't depend on sequins or serpents, or make-up, or put-on showmanship. Instead, they innovate. And they stake their fame on their music.

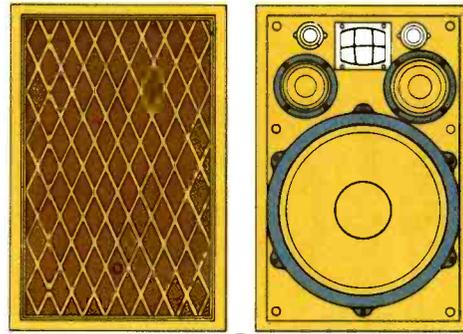
As musicians, the Allman Brothers Band prefer the sound of Pioneer speakers. They prefer Pioneer speakers because of their clarity and overall sound quality. They prefer Pioneer speakers because they reproduce the sound of an original performance without adding coloration, hyped-up bass or artificial brilliance. They prefer Pioneer speakers because exactly what goes in is exactly what comes out.

With Pioneer speakers, the Allman Brothers sound right to the Allman Brothers. It's that simple.

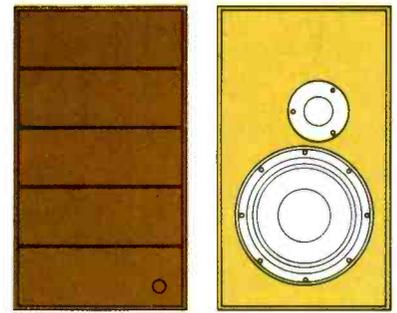
Pioneer makes a variety of speakers to match any hi-fi system. Speakers that are consistent in their clarity, sound quality and ability to exactly reproduce the sound of an original performance. Speakers that vary because people vary, hi-fi systems vary, room acoustics vary, budgets vary and tastes vary.



R-700



CS-99A



PROJECT 100

## Series R

Series R speakers are designed for the individual who demands the finest in styling, design and sound. Styling and design as contemporary as the state of the art. And sound as contemporary as a live performance.

Series R speakers bring new life to live performances. And truly live performances to your listening room. Their high efficiency, extreme accuracy and zero coloration have been equally praised by artists, engineers, critics and musicians.

All of the Series R speakers — R700, R500 and R300 — deliver the true vibrancy of a live performance. In an untouched, uncolored and unusually natural way.

## Project Series

Project Series speakers are designed to deliver maximum performance per dollar in a contemporary bookshelf design. Smallest of the three, the Project 60 is an extremely efficient speaker system that delivers a surprisingly high sound level from moderately powered receivers and amplifiers. It is perfect for smaller hi-fi systems. And equally well suited for 4-channel systems — since many of the new 4-channel receivers and amplifiers have less power per channel than their stereo counterparts.

Project 80 and 100 speaker systems use their air suspension design to deliver a beautiful natural

sound. Their superb bass response can effortlessly reproduce the lowest of lows with minimal distortion and uncanny accuracy. Their dome tweeters provide exceptionally wide dispersion and highs of unsurpassed clarity.

## CS Series

There is a myth about speakers that handsome cabinets hide inferior sound. Fortunately, it need not be the case.

If you seriously demand the acoustic quality of custom cabinetry along with powerfully smooth sound, the CS series speakers will be your first choice. Their sound is precise and natural. And their craftsmanship is a reflection of an almost bygone era.

The air suspension design of the CS series speakers help to provide the quality of sound that is the hallmark of Pioneer engineering excellence. From the compact 2-way 2-speaker CS-44 to the 4-way 6-speaker CS-63DX, Pioneer CS series speakers offer a combination of superb sound reproduction and custom-crafted cabinetry.

There are 12 different speakers in the Pioneer line. There are six different musicians in the Allman Brothers Band. Different people have different needs and different tastes. Even the Allman Brothers. But they agree that Pioneer speakers deliver the best sound available.

Pioneer speakers are part of a complete line of Pioneer audio components — components preferred by the Allman Brothers Band. A fact you might consider when you make your own selection.

U. S. Pioneer Electronics Corp.  
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New Jersey 07074.  
West: 13300 S. Estrella, Los Angeles,  
Cal. 90248 / Midwest: 1500  
Greenleaf, Elk Grove Village, Ill.  
60007 / Canada: S. H. Parker Co.

Model	Type	Maximum Input Power	Size (HxWxD)	Price
R-700	12" 3-way	75 watts	26"x15"x14"	\$229.95*
R-500	10" 3-way	60 watts	24"x14"x12"	159.95*
R-300	10" 2-way	40 watts	23"x13"x11"	119.95*
PROJ. 100	10" 2-way	35 watts	23"x13"x10½"	129.95
PROJ. 80	10" 2-way	30 watts	20¾"x11¾"x11"	99.95
PROJ. 60	8" 2-way	20 watts	18½"x10½"x8½"	79.95
CS-63DX	15" 4-way	80 watts	28"x19"x13"	269.95
CS-99A	15" 5-way	100 watts	25"x16"x11"	229.95
CS-A700	12" 3-way	60 watts	26"x15"x12"	189.95
CS-A500	10" 3-way	50 watts	22"x13"x12"	149.95
CS-66	10" 3-way	40 watts	22"x12"x12"	119.95
CS-44	8" 2-way	25 watts	19"x11"x9"	74.95

\*Fair Trade resale price where applicable.

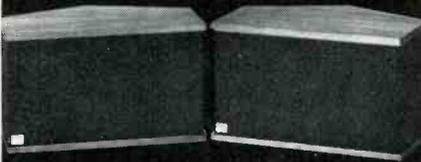
**PIONEER**

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speakers.



Better music, wherever you listen. Real fundamental, bass, including the attack of tympani and organ. An almost tactile feeling of presence. And transparent highs, providing unusual instrumental definition.

First and foremost, we built the LDL 749A to satisfy our own desire for musical enjoyment. Including the spatial sensations: from the intimacy of small groups to the awesomeness of full orchestra.

With their precise combination of forward-radiated sound and panoramic reflection, LDL 749A are a compact, elegant way to put the concert hall in your listening room. And the price is as realistic as the sound!

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Design  
Labs Inc.

20 Willett Avenue, Port Chester, N.Y. 10573

# Audio

FEBRUARY 1974

Successor to **RADIO** Est. 1917

Vol. 58, No. 2

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EDITOR *Eugene Pitts III*

ASSOCIATE EDITOR *Edward Tatnall Canby*

ASSOCIATE EDITOR *Bert Whyte*

ASSISTANT EDITOR *Peggy Bicknell*

PUBLISHER *Jay L. Butler*

MARKETING DIRECTOR *Sanford L. Cahn*

COVER DESIGN *John Kwasizur*

CIRCULATION MANAGER *Jean Davis*

CONTRIBUTING EDITORS: *Herman Burstein, Martin Clifford, Leonard Feldman, Martha Sanders Gilmore, Joseph Giovanelli, C. G. McProud, George W. Tillett, Sherwood L. Weingarten.*

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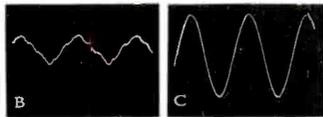
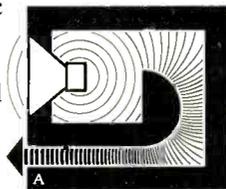
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# Now BIC VENTURI™ puts to rest some of the fables, fairytales, folklore, hearsay and humbug about speakers.

## Fable

*Extended bass with low distortion requires a big cabinet.*

Some conventional designs are relatively efficient, but are large. Others are small, capable of good bass response, but extremely inefficient. The principle of the BIC VENTURI systems (pat. pend.) transforms air motion velocity within the enclosure to realize amplified magnitudes of bass energy at the BIC VENTURI coupled duct as much as 140 times that normally derived from a woofer (Fig. A). And the filtering action achieves phenomenally pure signal (Scope photos B & C). Result: pure extended bass from a small enclosure.



B—Shows output of low frequency driver when driven at a freq. of 22 Hz. Sound pressure reading, 90 dB. Note poor waveform.  
C—Output of venturi coupled duct, (under the same conditions as Fig. B.) Sound pressure reading 131.5 dB, (140 times more output than Fig. B.) Note sinusoidal (nondistorted) appearance.

## Fairytale

*It's okay for midrange speakers to cross over to a tweeter at any frequency.*

Midrange speakers cover from about 800 Hz to 6000 Hz. However, the ear is most sensitive to midrange frequencies. Distortion created in this range from crossover network action reduces articulation and musical definition. BIC VENTURI BICONEX horn (pat. pend.) was designed to match the high efficiency of the bass section and operates smoothly all the way up to 15,000 Hz, without interruption. A newly designed super tweeter extends response to 23,000 Hz, preserving the original sonic balance and musical timbre of the instruments originating in the lower frequencies.



## Folklore

*Wide dispersion only in one plane is sufficient.*

Conventional horns suffer from musical coloration and are limited to wide-

angle dispersion in one plane. Since speakers can be positioned horizontally or vertically, you can miss those frequencies so necessary for musical accuracy. Metallic coloration is eliminated in the BICONEX horn by making it of a special inert substance. The combination of conical and exponential horn flares with a square diffraction mouth results in measurably wider dispersion, equally in all planes.

## Hearsay

*A speaker can't achieve high efficiency with high power handling in a small cabinet.*

It can't, if its design is governed by such limiting factors as a soft-suspension, limited cone excursion capability, trapped air masses, etc. Freed from these limitations by the unique venturi action, BIC VENTURI speakers use rugged drivers capable of great excursion and equipped with voice coil assemblies that handle high power without "bottoming" or danger of destruction. The combination of increased efficiency and high power handling expands the useful dynamic range of your music system. Loud musical passages are reproduced faithfully, without strain; quieter moments, effortlessly.

## Humbug

*You can't retain balanced tonal response at all listening levels.*

We hear far less of the bass and treble ranges at moderate to low listening levels than at very loud levels. Amplifier "loudness" or "contour" switches are fixed rate devices which in practice are defeated by the differences in speaker efficiency. The solution: Dynamic Tonal Compensation™ This circuit (patents pending) adjusts speaker response as its sound pressure output changes with amplifier volume control settings. You hear aurally "flat" musical reproduction at background, average, or ear-shattering discoteque levels — automatically.



## A system for every requirement

FORMULA 2. The most sensitive, highest power handling speaker system of its size (19¾ x 12 x 11½)". Heavy duty 8" woofer, BICONEX mid range, super tweeter. Use with amplifiers rated from 15 watts to as much as 75 watts RMS per channel. Response: 30 Hz to 23,000 Hz. Dispersion: 120° x 120°. \$98 each

FORMULA 4. Extends pure bass to 25 Hz. Has 10" woofer, BICONEX mid-range, super tweeter. Even greater efficiency and will handle amplifiers rated up to 100 watts. Dispersion: 120° x 120°. Size: 25 x 13¼ x 13". \$136 each.

FORMULA 6. Reaches very limits of bass and treble perception (20 to 23,000 Hz). Six elements: 12" woofer complemented by 5" cone for upper bass/lower midrange; pair of BICONEX horns and pair of super tweeter angularly positioned to increase high frequency dispersion (160° x 160°). Size: 26¼ x 15¾ x 14¾". \$239 each.

Sturdily constructed enclosures. Removable grilles in choice of 6 colors. Optional bases for floor standing placement. Write for brochure A-2.

Audition today's most advanced speakers at your BIC VENTURI dealer.



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# BIC VENTURI™

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# Coming in March

## Special Phono Cartridge Issue

Test Reports on  
Four-Channel Cartridges

**All About "Q"**—Don Davis explains directivity in speaker systems

## Quadra-Direction Discrete Compatible Stereo System

—Fumitaka Nagamura concludes his series on a new multi-channel phono system

**Plus**—Rock, Pop, Classical, and Jazz record reviews

**And**—All the regular columns



**About The Cover:** Our editorial coverage focuses this month on amplifiers, and since few audiophiles actually look into their amps to see where the power comes from, we thought we'd show a few different types of power output transistors.

# Audioclinic

Joseph Giovanelli

## Measuring an Unknown Frequency

*Q. I should like to find out the frequency of an unknown audio signal. How can I hook up the unknown signal and a calibrated signal generator. sweep until I hear a beat or null, and then take my reading from the calibrated generator?—F. Alexander, Maspeth, New York.*

A. The simplest way by which one can determine a frequency generated by an uncalibrated source is to obtain a frequency counter. Certainly if you plan to do much along these lines the investment in a counter is justified. The uncalibrated source is fed directly into the input of the counter. If its output level is too low for the counter to handle, an appropriate preamplifier must be used. The frequency of the unknown signal is read directly on the counter's display.

Here is another method for determining the frequency of the unknown signal source. This system is more like the one mentioned in your question. In this arrangement the unknown signal is compared to a signal of known frequency. The two signals are adjusted to produce equal audio outputs. Each signal is fed to the input of a two position mixer, whose output is connected to an amplifier and loudspeaker system.

Perhaps the best procedure is to listen to the unknown and then attempt to match that sound fairly closely to that of the known generator, by alternating listening to one or the other of the signals, while you adjust the known to equal the frequency of the unknown source.

When you think they are reasonably close in frequency, listen to the two signals together. You probably will hear them, plus a third signal set up by interaction between the two signals. Adjust the known signal till this third sound disappears. What you will then hear is a variation of the amplitude of what appears to be one signal. Carefully adjust the frequency of the calibrated source until even this effect vanishes. You will then have the two signal sources running at the same frequency. Therefore, the frequency of the unknown source can be read as though it was the known source. The accuracy of your results will depend on the accuracy of the known signal generator's calibration.

If the frequency of the unknown signal is above the range of audibility, the same basic procedure can be used, although it would be subject to error. In this instance you would sweep the calibrated source until you hear a signal. This signal represents the beat tone created by the known and unknown signals which are close enough in frequency to produce an audible beat. Unfortunately, rather than obtaining a true beat between the known and uncalibrated signals, it is possible that the harmonics of the signal of known frequency can beat with the fundamental frequency of the unknown or vice versa. Thus, when you adjust for the absence of such a beat, your reading of the known signal frequency may reflect a reading created by harmonics rather than the fundamental frequencies involved. Therefore, be sure to sweep the known signal's frequency over a sufficient range to pick up more than one beat. The beat which is the strongest will represent the beating of the two fundamental frequencies.

Where supersonic frequencies are not involved, a third procedure is possible. Instead of combining the signals, feed each of them into a stereo amplifier channel. Make the same tests while listening to the output of that amplifier with headphones.

## Compatibility Between Dolby Devices

*Q. Are the various makes of Dolby decoders compatible? Can I play tapes recorded on a KLH 40 tape-deck and Dolbyized on the unit's built-in Dolby system, though a TEAC deck with the TEAC Dolby unit, and get no degradation of the sound?—Michael Deutsch, Travis AFB, California*

A. Assuming that the various pieces of Dolby equipment are properly calibrated and adjusted, there is no reason why you cannot play a tape made on one machine, on a completely different make of machine and Dolby decoder. The performance of the equipment should be perfect.

The parameters for proper operation of the Dolby System are spelled out carefully by Dolby Laboratories with this idea of compatibility in mind.

If you have a problem or question on audio, write to Mr. Joseph Giovanelli, at AUDIO, 134 North Thirteenth Street, Philadelphia, Pa. 19107. All letters are answered. Please enclose a stamped self-addressed envelope.

# Introducing a small miracle

Miracles, even small ones, are hard to believe. We know.

When we first introduced our small 404 speaker some years ago, believers were hard to find. Today, our credibility is really being challenged. The new XT-6 is so good that even the people who know ADC's "small box, big sound" achievements find it incredible.

But it's true. This book-sized bantam outperforms anything its size. And rivals enclosures many times its size and price.

How do we do it? With a unique combination of cone structure, magnet force and coil configuration, for one thing; they interact to let a small woofer pump out a staggering amount of bass. Handle as much power as any standard-sized room requires. And keep distortion at a minimum.

Granted, the XT-6 has its limitations. It won't shake timbers. And it won't project massive sound into huge rooms. But in typical apartments, the ADC XT-6, at under \$60, gives you more sound per dollar than any other bookshelf speaker on the market.

The specifications will confirm the technical capabilities of the XT-6. But we suggest you go to your dealer and listen... Even if you don't believe in miracles, the XT-6 will give you something to think about.

## XT-6 SPECIFICATIONS

<b>NOMINAL IMPEDANCE:</b>	6 ohms
<b>RESPONSE:</b>	45Hz to 20 KHz $\pm$ 3dB in average listening room.
<b>HIGH FREQUENCY DRIVER:</b>	2 1/2" viscous impregnated cone tweeter with 1 1/2" Dia. effective radiating surface.
<b>LOW FREQUENCY DRIVER:</b>	6" with high compliance, soft suspension and viscous coated cone.
<b>CROSSOVER FREQUENCY:</b>	2000Hz Nominal.
<b>HIGH FREQUENCY LEVEL CONTROL:</b>	When in "treble down" condition tweeter level is pivoted from the crossover point to approximately 3dB down at 10kHz.
<b>ENCLOSURE:</b>	Walnut finish air-tight cabinet 12 3/16"H x 7 7/8"W x 8 1/2"D. Filled with sound absorbent material.
<b>POWER REQUIREMENTS:</b>	10 watts RMS power output per channel.
<b>PRICE:</b>	\$ 58.00

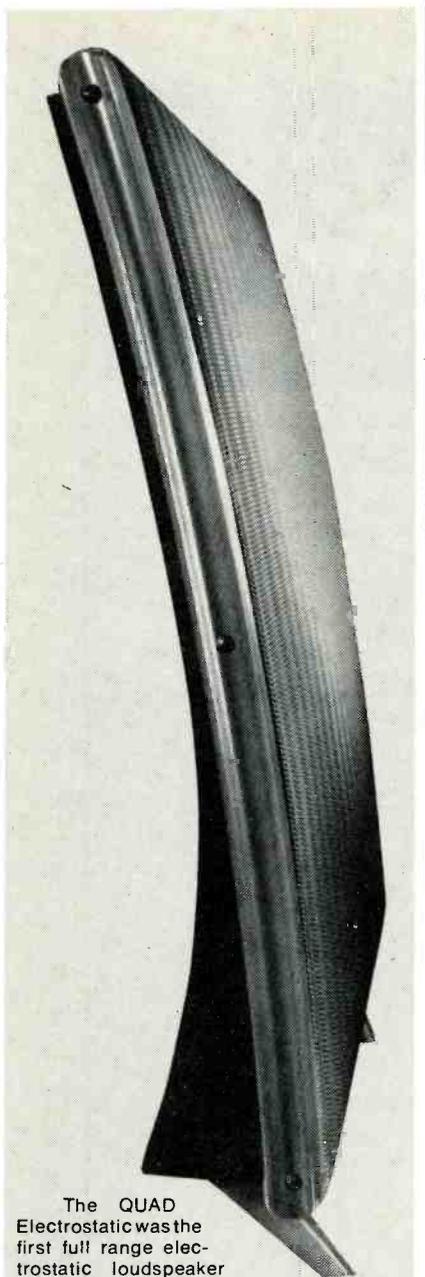


## ADC XT-6 SPEAKERS -the insider's choice.

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# Tape Guide

Herman Burstein



The QUAD Electrostatic was the first full range electrostatic loudspeaker produced commercially and is still the standard by which all others are judged. Using closely coupled moving elements some two hundred times lighter than the diaphragms of moving coil loudspeakers and being entirely free of cabinet resonances and colouration, this loudspeaker overcomes the usual major problems of loudspeaker design and provides remarkably natural reproduction of sound. This explains why the QUAD electrostatic loudspeaker is used by broadcasting and recording organisations all over the world, in applications where quality is of prime importance, and as a standard of reference by the majority of loudspeaker manufacturers.

QUAD for the closest approach to the original sound.

# QUAD

is a registered trade mark

For details of your nearest dealer write to Acoustical Manufacturing Co. Ltd., Huntingdon PE17 7DB, England.

## Tape Sticking & Heads

*Q. There are a few things I would like to ask you about tape recording. First, does it really make a difference to use a tape advertised as low noise? Is lubrication necessary in open reel recording tape? A disc jockey I've spoken to claims that the ads about low noise, extended frequency response, and lubrication are just sales gimmicks. It all leaves me wondering, and hence this letter.*

*Please tell me what to watch for to detect if my heads have begun to wear to the point which warrants replacement.*

*With a few of my tapes, one of which is an expensive name brand, I've had a problem. The tape coming off the supply reel tends to stick to itself, causing irregular speed. I've cleaned the tape several times with silicone cloth, and run it fast forward and backward to no avail. I've surmised that it was static electricity causing the problem, but if it is, I don't know how to overcome it.—Thomas M. Nicholson, Las Vegas, Nevada*

A. If a tape recorder is properly adjusted for low noise tape—bias increased, treble boost decreased, and audio drive current increased—the net result is a moderate but significant improvement in signal-to-noise ratio. Good tapes are optimally lubricated; that is, they have enough lubrication for smooth passage over the heads and guides, but not so much as to cause tape slippage when engaged by the capstan and pressure roller. Such tapes should require no additional lubrication on the part of the user. Adding lubricant entails the danger of slippage, with consequent wow and flutter.

When treble response starts to deteriorate in playback, this usually signifies that the playback head should be replaced. The other heads may have to be replaced when they show marked physical wear.

I don't know of a cure for the sticking problem you describe, except to suggest that you stay away from the particular brand which gives you this trouble. You state that you have run this tape at fast speed in order to relieve the static charge; possibly this made the situation worse. A remote possibility is that transferring the tape to another type of reel may help matters.

## Buying A Recorder In Europe

*Q. I plan to make a business trip to Europe, and it occurred to me that this might be an excellent opportunity to purchase a high quality tape deck. This idea has brought to mind several questions: Where is the best place to purchase a deck? What problems might be encountered in bringing it back? Might servicing be a potential problem?—Name Withheld*

A. When you arrive in Europe, you might inquire of your host, and use the telephone directory, to find places of purchase. In making your purchase, be sure that you get a unit designed for the American market, so that it operates at 60 Hz line frequency and 117 volts; has the type of input and output jacks customarily used in America; has the equalization (NAB) employed in America; uses parts readily available to technicians in America; meets the electrical standards of American underwriters; etc. Consult American customs about problems in bringing back the unit.

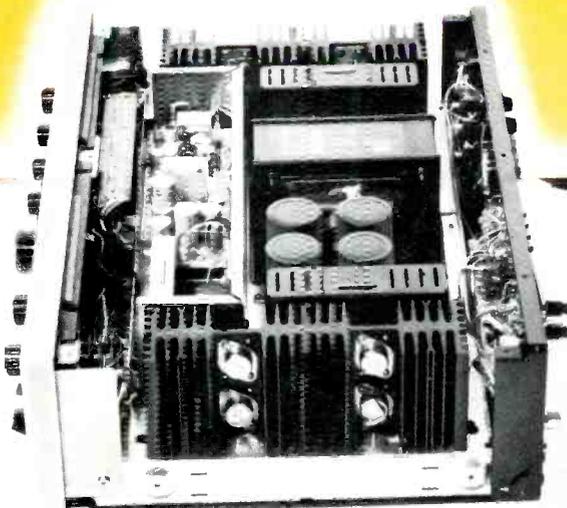
## Harm From Demagnetizers

*Q. Can a tape head demagnetizer introduce a magnetic field of sufficient strength to damage either the head or the electronics to which the head is connected? I don't suspect the commercial demagnetizers made for this purpose, but I'm considering building one from an old solenoid.—Don L. Davis, Seattle, Washington*

A. I doubt very much that a head demagnetizer roughly of the size of a commercial one will damage the heads; and certainly not the electronics. However, if you construct something of the strength of a bulk eraser, you should be careful about coming too close to the head; there is a slight possibility that a very powerful magnetic field might disturb the head windings. The same applies to the VU meter if there is one in the tape deck.

If you have a problem or question on tape recording, write to Mr. Herman Burstein at AUDIO, 134 North Thirteenth Street, Philadelphia, Pa. 19107. All letters are answered. Please enclose a stamped, self-addressed envelope.

# You can't tell an amplifier by its cover.



**Control Amplifier** — Combination Amplifier and Preamplifier. It takes a source signal, such as a tuner or phonograph output, and electronically boosts the signal to a level usable by the speakers. It also has a section to manipulate tonal color with treble and bass controls and filters of various types. A control amplifier serves as the brain and function selectors for a stereophonic system. It is exemplified by the extraordinarily good design of the Sansui AU-9500.

The Sansui AU-9500 is the ultimate control amplifier for the serious audiophile. It combines a powerful 75 watt RMS per channel (both channels driven) amplifier with controls and input/output flexibility to make it the world's premier unit. Each channel is separately driven by the Sansui AU-9500's twin dual power supply system built around four large capacitors and separate windings. Parallel push-pull output circuits reduce distortion. The AU-9500 affords speaker and transistor protection three ways: 1) electronic protector circuit, 2) four quick-acting fuses, 3) current limiter circuit.

Two tape decks can be

monitored or, with a flick of a front panel switch, you can dub from one tape deck to another. The AU-9500 can also handle two phonographs, a microphone, a tuner and an auxiliary input. It can give you normal stereophonic or reverse the channels, monophonic or each channel separately. The unit is ready for 4-channel and the addition of a noise reduction unit.

Sansui also makes the AU-7500 control amplifier with 32 watts RMS per channel into 8 ohms and the AU-6500 with 28 watts RMS per channel into 8 ohms.

The AU-9500 by Sansui is the definition of a state-of-the-art Control Amplifier.

**Tuner** — A high fidelity tuner is an instrument used for the capture of radio signals. It requires an amplifier to yield signals usable by speakers. It can be either AM, FM, or FM Stereophonic (called Multiplex) or any combination of them. In an FM stereo tuner there are a number of important parameters: separation, selectivity, sensitivity, etc.

Sansui's new TU-9500 (a perfect match for the Sansui AU-9500, see control amplifier) is an AM/FM and FM stereo tuner with very good

specifications and unusual features. Its FM IHF sensitivity is a very low 1.7  $\mu$ V, channel separation is better than 40 dB at 400 Hz and better than 30 dB at 10,000 Hz. Selectivity is an unusually high 30 dB. In addition, the Sansui TU-9500 features a remarkably low 0.3% Total Harmonic Distortion in Stereophonic. A newly designed Differential Demodulator Circuit (DDC) eliminates the SCA (Subsidiary Communications Authorization) sub-carrier beating and increases stereo separation.

The Sansui TU-9500 has set of output jacks that can go directly to a tape deck and a set that can go to an oscilloscope to check multi-path. This is in addition to the conventional output to amplifier jacks and the less conventional dis-

criminator output which makes this set 4-channel ready.

To the left of the wide linear dial scale are the signal strength (operating on AM and FM) and center channel meters. The TU-9500 has its own output level control, noise suppressor and FM muting switches and a rotary switch to yield AM, FM stereo or FM monophonic.

The AM section, frequently the step child of high fidelity, is not neglected here. It is newly designed for more selectivity and an advanced AGC (automatic gain control) circuit ensures minimal distortion.

Sansui also makes the TU-7500 with an IHF FM sensitivity at 1.9  $\mu$ V.

The TU-9500 by Sansui is the definition of a state-of-the-art quality tuner.

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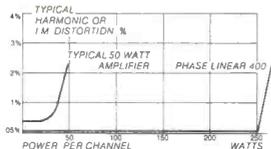
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# Can you live without a 400 watt amplifier?

Maybe. If you don't mind the loss of quality caused by clipping during the more dramatic passages in your favorite records. Julian Hirsch put it this way: "Anyone using a low-efficiency speaker . . . with an amplifier in the 30 to 50 watt class cannot approach realistic listening levels without severe clipping." If you want to listen at a real-life level without distortion, you need *at least* 400 watts of amplifier power. At \$499, why live with anything less than the Phase Linear 400?



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# What's New in Audio



### Levinson Cartridge Preamp

The JC-1 allows moving coil cartridges to be used to their full advantage. According to the manufacturer, the revolutionary design of the JC-1 provides extremely accurate and low noise disc reproduction. The unit measures 8¾ in. L. x 3¾ in. W. x 1¾ in. H., uses two size "D" battery cells and is said to provide precise evaluation of test pressings, clear reproduction of highest quality disc recordings, and simplified and improved analysis of records. Equivalent input noise is -147 dBm; frequency response, 20. Hz to 50 kHz  $\pm$  0.2 dB; distortion (THD @ 100 mV output), less than 0.09%; max. output, 250 mV/0.25% THD; max. input (for rated output), 8 mV; gain (with 2-4 ohm source), 35 dB. The unit includes phono connectors and an LED battery tester. Price: \$170.00.

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### Superscope Dolby Adaptors

Designed for use with cassette or open-reel recorders, the NR-335 Dolby Noise Reduction adaptor enables you to create your own Dolbyized tapes or play back prerecorded Dolby tapes. This unit is to be used with 3-head recorders and features separate Dolby circuits for record and playback, built-in 400 Hz oscillator, 19 kHz filter, and calibration tone. Also included are two record level controls, two playback volume controls, two VU meters, source monitoring, mic/line switching, and a 2-position mic-attenuator switch. Price: \$259.95. Model NR-115, an economy unit for 2-head recorders, is priced at \$99.95.

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### Infinity Speaker

The 2000AXT is a 3-way, floor-standing unit using Infinity's recently developed omnidirectional-wave transmission-line tweeter covering the frequency spectrum from 5 kHz to 21 kHz. The 4½-in. midrange and 12-in. transmission-line woofer are treated with special stiffening and damping materials to provide five times the stiffness-to-mass ratio of other drivers. This factor is said to eliminate virtually all distortion emitted from different parts of the cones at different instances of time. Frequency response is 35 Hz to 21 kHz  $\pm$  3.5 dB; minimum amplifier power, 25 W. rms per channel; dimensions, 28 in. H. x 20 in. W. x 14 in. D. Price: \$299.00 each.

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### Literature

A revised and updated edition of *FM Atlas and Station Directory* is available now. Included in the 80-page book is a listing of FM stations by frequency (with effective radiated power and antenna heights) and geographical location. New features in this edition: a discussion of FM programming trends, station allocations, FM station coverage and how to improve FM reception; an FCC chart showing how to calculate FM coverages; a list of TV channel 6 stations in North America with instructions for tuning in channel 6 audio on car radios; call letter station directory; music formats and more. Priced at \$2.50 from FM Atlas, Box 24, Adolph, MN 55701.

# There are some things you'll appreciate about a Dual right away. Others will take years.

You can appreciate some things about a Dual turntable right in your dealer's showroom: its clean functional appearance, the precision of its tonearm adjustments and its smooth, quiet operation.

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## It takes more than features.

If you know someone who has owned a Dual for several years, you've probably heard all this from him. But you may also wish to know what makes a Dual so different from other automatic turntables which seem to offer many of the same features. For example, such Dual innovations as: gimbal tonearm suspensions, separate anti-skating scales for conical and elliptical styli, and rotating single play spindles.

It's one thing to copy a Dual feature; it's quite another thing to match the precision with which Duals are built.

## The gimbal, for example.

A case in point is the tonearm suspension. Dual was the first manufacturer of automatics to offer a true twin-ring gimbal suspension. More importantly, every Dual gimbal is hand assembled and individually tested with precision instruments especially developed by Dual. The vertical bearing friction of this gimbal is specified at 0.007 gram, and quality control procedures assure that every unit will meet this

specification. Only by maintaining this kind of tolerance can tonearm calibrations for stylus pressure and anti-skating be set with perfect accuracy.

Other Dual features are built with similar precision. The rotor of every Dual motor is dynamically balanced in all planes of motion. Additionally, each motor pulley and drive wheel is individually examined with special instruments to assure perfect concentricity.

## The Dual guarantee.

Despite all this precision and refinement, Dual turntables are ruggedly built, and need not be babied. Which accounts for Dual's unparalleled record of reliability, an achievement no other manufacturer can copy. Your Dual includes a full year parts and labor guarantee; up to four times the guarantee that other automatic turntables offer.

If you'd like to read what several independent testing laboratories have said about Dual turntables, we'll be pleased to send you reprints of their impartial reports. To appreciate Dual performance first hand, we suggest you visit your franchised United Audio dealer.

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# Behind The Scenes

Bert Whyte

AT THIS point in time, anyone remotely connected with audio and recording knows that Dolby noise reduction does an efficient and reliable job of reducing tape hiss during the recording process. This fact is attested by the virtual standardization on Dolby A-type noise reduction in recording studios all over the world.

On the other hand, if I had a nickel for every time an audio engineer wished he had a device that would reduce or remove noise from recorded material without degrading the signal, I'd be rich! The quest for such a device has got to be one of the Holy Grails of audio. Through the years various ideas have been tried. For example, in certain specific cases of single-frequency noise, steep notch filtering can be effective. But in general, if a tape has hiss, hum, room rumble, or any extraneous noises, that is that . . . the noise is there to stay. Or is it? Hold that wistful sigh, Mr. Engineer! There is a ray of sunshine in this otherwise gloomy prospect. It is called the Burwen Dynamic Noise Filter.

Mr. Burwen gave a detailed technical description of his device in the June 1972 issue of *AUDIO*. With the Burwen Dynamic Noise Filter, there is no compression/expansion, encode/decode function as in the Dolby System, but it does utilize the noise masking characteristics of human hearing, a basic of the Dolby System. For our purposes, the operation of the Dynamic Noise Filter is neatly capsulized by Mr. Burwen. . . . "The operation of the Dynamic Noise Filter is based on two principles: (a) the noise output of an electronic system is dependent upon the system bandwidth and (b) the human auditory system 'masks out' noise in the presence of the desired signal at frequencies in the vicinity of the signal frequency when the signal-to-noise ratio is sufficiently high. The Dynamic Noise Filter can be described as an automatically variable bandpass filter whose bandwidth changes rapidly with each musical note and whose high and low frequency cutoffs are independently controlled by the spectral content of the input signal. Noise reduction is achieved by restricting the bandwidth at high and low frequencies when the signal level is very low (the minimum bandwidth is 800 Hz). At medium and high signal levels, it passes the full

20 Hz to 20 kHz bandwidth. As in the other noise reduction systems, the filter reduces noise only for low level signals; the noise is passed along with the high level signals. However, due to the characteristics of the ear, the noise that is present during each note is masked by the music."

Burwen's own catalog sheet describes the Dynamic Noise Filter as reducing noise by attenuating the high and low frequencies when there is no music present. This is rather an oversimplification as we have seen that it also operates at very low signal levels. However, it is true that in a great deal of music, there are many little pauses and rests . . . cessation of sound between notes . . . much more than we are consciously aware of hearing. In this circumstance, the filter works with maximum efficiency. Since these music discontinuities are of extremely short duration, one might expect to hear the dynamic "working" of the filter. Burwen brings some psychoacoustics into play here by choosing attack and decay time constants for the high and low frequency sections of the bandwidth controller such that the action of the filter is inaudible. An attack time of 1 millisecond was found to be short enough to have no effect on musical transients. Decay time was optimum at 50 milliseconds. A shorter attack time would have the undesirable effect of the filter being actuated by the "ticks" and "pops" of a disc recording. A shorter decay time would reduce the effective reverberation in the program material. The low frequency part of the bandwidth controller is about 14 dB less sensitive than the high frequency section because music tends to have more low frequency energy than high frequency energy.

The Dynamic Noise Filter sounded like an intriguing device, and if it worked as advertised, I had envisioned several applications where it would be invaluable. Dick Burwen was kind enough to furnish me with one of his Model 1000 units, and I found it a most useful and fascinating tool.

In a 1 $\frac{3}{4}$ -in. high rack panel, up to four channels of the filter are available, with stereo channels ganged in pairs or independently. On the panel are controls for high and low frequency sensitivity, a high frequency cutoff, and a switch that permits listening to program material with the filters operating, or in the wide band mode

in which the unit acts as a unity gain amplifier. The quality of the components in the Dynamic Noise Filter and the general construction is of the highest order, really of the calibre of aerospace equipment. In normal use, the low frequency sensitivity is set so that for example . . . rumble . . . just begins to operate the low frequency filter. The high frequency sensitivity control is set so that hiss just begins to operate the high frequency filter. For poorer material, a limit can be placed on the upper cutoff frequency on the high frequency cutoff control.

You may recall that last month I described that when I recorded Pablo Casals in Puerto Rico, the mics picked up the rumble of the air-conditioning ducts and also 60 cycle hum. Even though I was using 3-channel, half-inch Ampex recorders (this was before Dolby of course), there was still a small residue of tape hiss, enough to be obtrusive and annoying. Running the tape through the Burwen filter, after some experimentation with various settings of the controls, I A/B flipped between filtered output and flat, and the transformation was truly impressive. I would say that I was getting no more than 2.5 to 3 dB reduction of tape hiss, but that was enough to remove the overlay of hiss. The rumble was considerably attenuated without much apparent effect on low frequency music content. However, the 60 cycle hum was a problem, but one that was manageable by resorting to a very steep notch filter. This notch filter would be used before running the tape through the Dynamic Noise Filter.

I tried the Burwen unit on a variety of tapes. Some were 15 ips masters or copies of masters, sans Dolby, and here too, they had that miserable little overlay of tape hiss which is so distracting. On this material, there was no low frequency noise problems, so the low frequency control was not employed. Judicious twiddling with the high frequency control again removed sufficient tape hiss to make the tapes significantly quieter, while having no or very minor attenuation of high frequencies. It is a fact that the Dynamic Noise Filter discriminates best between noise and music when the tape initially has a high signal-to-noise ratio. This was borne out by these experiments on my own tapes in



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Quality always comes first at

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this category, and also when I ran some of the better quality, least noisy commercially recorded music tapes through the filter. Of course, there is the natural tendency with this sort of device to go a bit overboard in the area of hiss attenuation. This was especially so when playing poorer material. A flip back and forth on the FILTER/FLAT switch would soon tell you that you had indeed removed the hiss . . . but that you also had succeeded in removing some high frequencies. Even so, in some cases,

with manipulation of the high frequency cutoff control, and a bit less heavy hand on the high frequency sensitivity control, you could get an eminently listenable program, more enjoyable than suffering through the unfiltered tape. Another use of the Burwen filter is when you are making an improved tape copy with equalization. Burwen also claims that in recording at 7½ or 15 ips, the unweighted tape noise reduction is typically 10 to 11 dB. Needless to say, the filter made considerable improve-

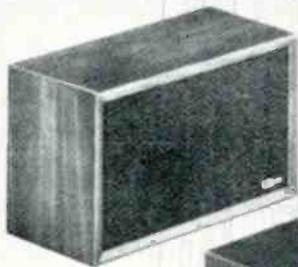
ment in the playback of some of the earlier non-Dolby cassettes and 8-track cartridges. I should point out at this juncture that almost everything in life that is good, costs money, and the Burwen is no exception. It is, in fact, an admirable tool for the audio professional, who is probably better prepared to pay the \$3500 for the filter than even the most earnest of audiophiles!

As you might expect, such a useful item as the Burwen Dynamic Noise Filter is finding much application in professional ranks, especially in FM broadcasting. The reason for this is that many stations are totally programmed for the special broadcast 8-track cartridges, and they suffer from S/N ratio problems, just the same as those used by consumers. One well-known New York FM station which uses cartridges say they get a 48 dB S/N ratio from these cartridges, a lot of which turns out to be 60 cycle hum and high frequency hiss. The chief engineer of the station says that with as many as six cartridge machines potted up at one time, the additive effects of the noise really can raise havoc with their "on-air" sound. He has been using the Burwen Filter and says that hum and hiss are minimized and they are broadcasting a much cleaner signal. He inserts the Dynamic Noise Filter in his broadcasting chain just before the stereo generator and, as a consequence, can get such added benefits as elimination of low frequency motor noise, transmitted as vibration to the microphone while a DJ is on the air, significant reduction of surface noise on older LP's and 45's, and automatic "cleaning up" of news feeds from such as bad phone lines and shortwave off-air pickup.

It was a pleasure to use the Burwen Dynamic Noise Filter. It performed well and would be an item that many an audiophile would love to have in his system, were it not for that cost. You know we are always looking for fancy professional devices to ultimately be revised and reworked and brought down in cost to consumer level. As precedent we have Dolby professional A-type noise reduction, and its offspring, Dolby B-type noise reduction. Who knows? Maybe Dick Burwen has something up his sleeve!

NOTE: In my column in the December issue of AUDIO, I described the new Revox A-700 tape recorder as the "successor" to the current A-77 deck. The A-700 is in fact a new generation, higher-priced addition to the A-77 line which will continue to be marketed. Æ

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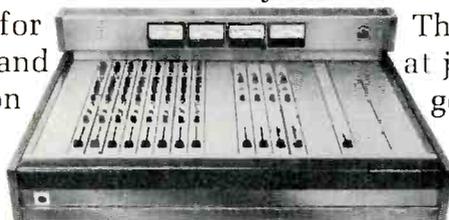
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# Audio—ETC

Edward Tatnall Canby

## Standing the Strain

THE BUSINESS of audio is music, I've been saying all along. Today, it's the music of speech and the music of computers and synthesizers and the music of pure chance, translated into sound—but still, though one man's music is another man's unmentionable, music in this widened area *is* audio's main concern. I'm a musician, so let's look at music. I leave the 'scope traces and the signal measurements to the rest of you. They make music possible.

I'm a musician, if the often-passionate attachment to the sound of music, a feeling of oneness with its audible expression, makes me a musician. I think it does. It's an ear occupation from start to finish for me. Along with a listening mind, an in-tune emotion, plus a bit of accumulated knowledge. That helps. My specialty, though, isn't any one kind of music; rather, it's a kind of musical sound becoming relatively universal: reproduced sound. I judge my music, relish it, hate it, am bored or shocked or elated by it, primarily in this area. I haven't occupied the best seat in the concert hall for years. (Only the fringe seats, now and then, to keep my ear in.) I spent years of my life going to hundreds of concerts. I loved 'em and still do. But I have other musical business, these days. Not a better business; just different.

Because I insist that recorded/reproduced music has its own special aesthetic laws, not necessarily those of the concert, I am perhaps distrusted by some people who think that music is an unalterable, inalienable and absolute art, however you may hear it. Mr. Petrillo's "canned music" of a generation ago came indirectly from that idea, though he had more immediate tactical matters in mind. Like music, the only good asparagus, I suppose, is fresh asparagus? A loaf in the oven beats ten in the marketplace? Or, to update, no food at all is better than—ugh—frozen food. Plenty think so. Indeed, the whole back-to-nature kick is an understandable reaction to our synthetic age. Right! Yes, when it comes to a plain loss of quality. But wrong if one

ignores *differences*—and new advantages. Music isn't canned merely to preserve it. Better no message at all than a telephone message? Well, hardly. Better no news than TV news? Perhaps. Better no travel than auto travel? Ah yes. Get out and walk, boys.

So we won't get far if we stick our obstinate heads into the sands of past time. Got to live today! Got to take advantage of today. Music, today, is reproduced more often than it is original. I'm not sorry, though a musician's life now is necessarily different, if perhaps neither worse nor better than 'way back. As a listener, rather than a producer (and listeners are still reasonably essential to music's existence). I find so many new advantages to the canned sort that I will never stop marveling until I die. They are real! Even in quadraphonic. (Boos from the wings.) New aesthetic dimensions, new experiences unimaginable in the past. That's what we have in our present musical world, with audio as its technology, its communications complex. If there's a shortage of vinyl, or of anything else, we may have to try to "go back to nature"—*but can we?* Better no symphonies than a symphony in the living room??

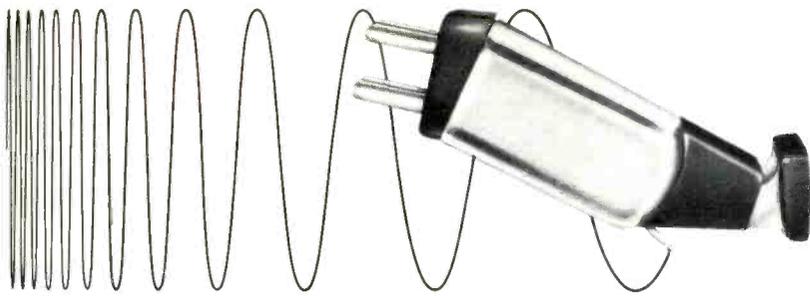
Canned music, for me, is a way of life and a way of infinite new listening. I am all ears. Certainly at a concert, though plenty aren't, I always was. Now, at home, I find I can listen so much more exhaustively, I can "emote" so much more safely, so to speak. I can choose and pick and eliminate, make my own programs. But more than anything else, I can hear music in a vastly more varied way than would *ever* be possible in the flesh, for me, or for most people like me. Yeah, I know. Five minutes of real live music is better than five years of the canned product. Yes, definitely. But not absolutely. The canned experience has new values, in new situations. Those values have become far more important than musicians know, they being generally conservative souls! Those values virtually *are music today*, if music means receiving as well as producing.

As a listener to canned music, I am a positive glutton. Not so much in quantity as in thoroughness. We

receive hundreds of new releases for review each year, which is a lot more than I can hope to hear all the way through, as they should be heard. Yet I try. We have a responsibility to the record companies, as well as to you; they depend on reviews not only for publicity but for feedback, negative or positive. As a some-time producer of a handful of discs, myself, I am acutely aware of the time and energy that can go into just one LP record. I could never skim through a pile of them without this thought. If it were *my* labor—! I persist in trying to work out rational means to act like a dozen reviewers with two dozen ears, and I could make it—I really could. Budget my time, do so much for each worthy recording, plan a campaign, to ensure the right emphasis on this, and on that, on big and little enterprises, on one type of music and another. But what happens?

In the middle of such rationality, I put on some record or other and in two minutes I'm snagged. Hung up, fascinated, bewitched. Hooked. Stop? How can I? Every system I've ever devised, deadlines, post office times, all go flying out the figurative window and I am stuck *with music itself*. Glued, pinioned, utterly *immersed* in the stuff! (Well, it's worth a mixed-up metaphor.) So I play the disc once and then I play it again. Reckless expenditure. I have no other recourse. The music demands it. I am no longer the rational me, I am one large pair of ears and connecting mind. I am wholly emotion, reception, sensing every twist and turn of musical thought, of recording technique, feeling the very presence of the musicians before me, of the recording engineers, of the composer's living personality, unfolding itself, right there in front of me. (And behind.) I am never more wholly alive. Talk about Higher States of Consciousness—who needs 'em! I have 'em. While our Editor fumes and waits. Sorry about that, Gene. (Yeah, me too, Ed. Ed.) That's what listening can be.

And it is why I so profoundly distrust the idea of background music. Not the principle of it—Mozart wrote gorgeous background music for dining. It's just the wallpaper approach that I can't take. Nothing-music, for non-



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Professional 4000 D/III	\$149.95	5-50,000 Hz	3.0	more than 35 dB	more than 25 dB	1/4 to 1-1/4	miniature nude diamond with 1 mil tracing radius <b>"4 DIMENSIONAL"</b>	S 4000 D/III White
Deluxe 4000 D/II	\$124.95	5-45,000 Hz	3.0	more than 35 dB	more than 25 dB	3/4 to 1-1/2	miniature nude diamond with 1 mil tracing radius <b>"4 DIMENSIONAL"</b>	S 4000 D/II Yellow
Standard 4000 D/I	\$ 84.95	10-40,000 Hz	3.0	more than 35 dB	more than 25 dB	3/4 to 2	miniature diamond with 1 mil tracing radius <b>"4 DIMENSIONAL"</b>	S 4000 D/I Black

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listeners. Tailored and sliced to fit, regardless of musical sense. Turn it on and off. Walk into an elevator and pick up the middle of a tune, slice it off as you get out. *Does it ever occur to you to wait until the tune comes to a musical end?* Even the ads that chop off their sleazy music in the middle of a note hurt me. An insult to the art. Even bad music should be allowed to have its say in its own terms.

To my horror, lately, there are certain ads for eelymasonry (urf—how do you spell that?) or charitable concerts of “great music” which use *that very music* as their sonic wallpaper, brutally sliced up to fit. Outrageous. Have we no longer any musical standards? I don’t mean quality standards. I mean simply standards of respect for the musical expression itself. Yes, we do make music collages, I’ll admit, sliced up in the contemporary fashion, and I have often done this myself in taped productions. But this is conscious, with an aesthetic, dramatic intent. It is NOT the wallpaper approach. Not always, anyhow.

The trouble with large numbers of us is that we take our music the way we take, maybe, pleasant weather. Nice to have around. Even worth seeking out. Just as soon have it, when convenient. Or leave it. The interest is skin deep. Since music is almost everywhere these days and background music is useful because on the air it means “this is a commercial,” we develop the non-listen syndrome only too easily. Can’t really blame us. But it’s BAD, nevertheless. Because it destroys one of life’s real experiences—listening in depth, in total concentration, out of knowledge, to sounds that are *worthy of that concentration*. That is what music has been, and still is, thanks to audio. But the going is tough. It’s an uphill fight.

Let me tell you, the finest, most

persuasive reason for quadraphonic sound in MY book is that inherently it demands and gets attention. It forces you to listen. You can’t avoid the message, loud and clear. Wow—is that dynamite.

It seems to me that the classical musicians should be the very first to acclaim it. Where else is their salvation? People listen less and less to more and more, which surely spells the doom of “serious”—that is, contentful—music. Unless people are persuaded to listen, really *listen*.

Of course quadraphonic is merely a physical medium with no inherent artistic quality in itself, other than technical. (Don’t think that audio isn’t an art, too—I am aware of this. The art of fine engineering.) But it does provide new facilities, new sonic values that point, even urge, towards real listening. You can’t avoid it. Quadraphonic wallpaper, frankly, is a contradiction of sense. Why give music more impact, more push, why provide it with more detail, with greater message-carrying ability, with more “handles” for the ears, if you aren’t going to listen? You’ll have to fight *not* to listen. Splendid thought.

Wow—just imagine quadraphonic in that elevator. Don’t forget that the four-way medium is at its best in a small room space, where the built-in space clues of the recording are immediately at hand and unconfused. I’ve heard superb quadraphonic in a room not much larger than an elevator. Huge hall, all around me. Is that what we want in our elevators, when the doors close? I begin to wonder.

\*\*\*\*

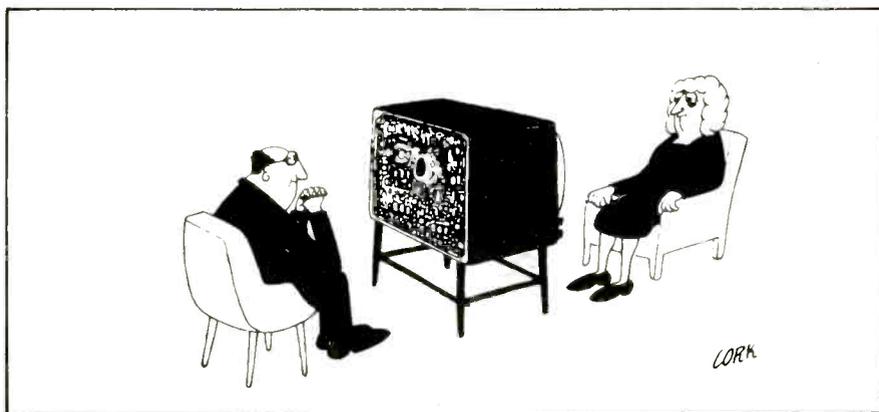
And so, in the very middle of a vast spate of catch-up work on record reviews, I go and get hooked on *one* recording, and can’t stop. I’m proud of it, though the Editor may groan and probably will. Yesterday, to my intense surprise, it was Paul Simon (*There Goes Rhymin’ Simon*). I can

be fascinated by gentle sounds like his, surround sounds, in SQ. Simon is such a stylist, so ingeniously twisting his music in unexpected directions. Have you discovered that his *American Tune* (side 2) is built straight out of the *Passion Chorale*, the famed ancient Lutheran hymn tune that appears in Bach’s *St. Matthew* and *St. John Passions* and a thousand other places, before and since? Not a word on the record. It doesn’t say so. I *heard* so. Why? Ask Paul! I played the whole record through twice—and I can’t even review it. Naughty, naughty, Canby. Play the right records. Ration your ears. (But I can’t and won’t.)

Then there was Haydn. I had assembled a good batch of Haydn and Mozart recordings with the thought of an interesting group of related reviews. Fine idea. Until I got to London’s STS 15249/54, six discs stereo. No review! It was the **Complete Symphonies of Haydn, Volume Six, Nos. 36 to 48**, and the instant that music began, I was lost. (And I had been so anxious, too, to get London’s music represented in our pages—maybe this will help.) Stuck again, in total bliss. Haydn is one of my top consciousness-raising composers when he is rightly performed. This is one of the finest sets of Haydn symphonies I *ever* hope to hear, way ahead of all others. Right in the middle of the album is my all-time favorite, **No. 45**. Plus its immediate neighbors, mostly brand new to me. I’ve been waiting quite literally a lifetime for this. So do I just skim the 12 sides? (Would you really imagine I could do that?)

Nope. I spent all afternoon, and most of an evening, absolutely immersed (as I say), striding around my quadraphonic enclosure, reading Robbins Landon’s immense booklet of notes—anything so long as that music didn’t stop. (Landon is a kindred soul! *He* knows what I know about one of the great musical minds.) I was, and am, unhinged. My schedule is shot. Haydn drips from my ears; that’s why I quit, to write this. But do you think I’m not going back to that album, when the drip ceases? You bet I am. Lucky they didn’t send the other five volumes. Yep. I’m a real musician.

Should I give up, then, and like some monk turn over my life to London and to Haydn, assuming they complete the approximately 55 LPs contemplated? I could! I’d need the time. But no. For tomorrow I’ll accidentally get stuck on something else. It’s a great idea, listening to music. If you can stand the strain. **AE**



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Kit AR-2020, includes cabinet, 31 lbs. . . . 249.95\*

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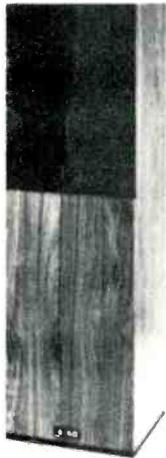
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# Dear Editor:

## Hurray for Heyser

Dear sir,

Congratulations on your new speaker tests. The precision of Mr. Heyser's tests and the candor of his evaluations of the data are very helpful. I am especially appreciative that he has the courage to follow his measurements with "Listening Tests," putting the speaker's strengths and weaknesses as he hears them into proper perspective. May he give us many more equipment profiles.

H. Kevil  
Kirkwood, MO

Dear sir,

Congratulations on the selection of Mr. Heyser as your loudspeaker reviewer. It is high time that we in the U.S.A. have a magazine publishing facts based on scientific measurement techniques.

While I recognize that some loudspeaker manufacturers may look with disdain and despair that the days of "black magic" are coming to an end, I for one am delighted.

R. Stoklos  
SARAS of America  
Venice, Calif.

## Speaker Comparisons

Dear sir:

I am writing in order to start a subscription to AUDIO. The reason for this, and this extended letter, is to encourage you in your magazine's recent speaker testing methods. The inclusion of Mr. Heyser's expertise places AUDIO and its management on a plane of commitment to the audio consumer which is unapproached by any other publication.

I might add that I subscribe to three "audio cultist" publications. These are not technically oriented publications, rather they specialize in detailed subjective evaluation. Their methods operate on the ultimate criterion of audio performance, but this very subjectivity is at once a source of candor and confusion. Clearly, objective testing methods are important when time and expense are involved in personal surveys of the audio world. Thus, they may provide a method of market screening. The failure of test results to correlate with subjective quality is well known. The impact of this disparity is most marked in speaker testing. It is for this reason that Mr. Heyser's efforts and AUDIO's

editorial judgment are especially noteworthy.

I am sure that the editor will receive strong opinions in both extremes of the reader response spectrum. Nevertheless, I would add one suggestion, as Mr. Heyser's methods require a backlog of comparison. Would it be possible to establish a comparison of widely known speaker types such as full-range electrostatics, horn-loaded drivers, direct radiators, etc. Also I should think that these methods would be limited to speakers above the bargain basement and console level of quality. Finally, I was pleased to see Mr. Heyser's subjective opinions show an interest in music and a realization that the perfect speaker does not exist. I would have been disappointed to conclude the review with the sort of strained neutrality one finds in AUDIO's competitors.

L. E. Larsen, M.D.  
Houston, Texas

*Thank you for your kind words concerning Mr. Heyser's addition to our testing staff. Objective test methods are a good way to screen systems, as you point out. but subjective assessment by the buyer and the reviewer should be the final touchstone, as Mr. Heyser mentioned in his article. After a number of speakers have been tested, it may be possible to rank them by design type, and we would be interested in additional reader and manufacturer comment both on this point and Mr. Heyser's reviews in general.*

## Custom Home Installations

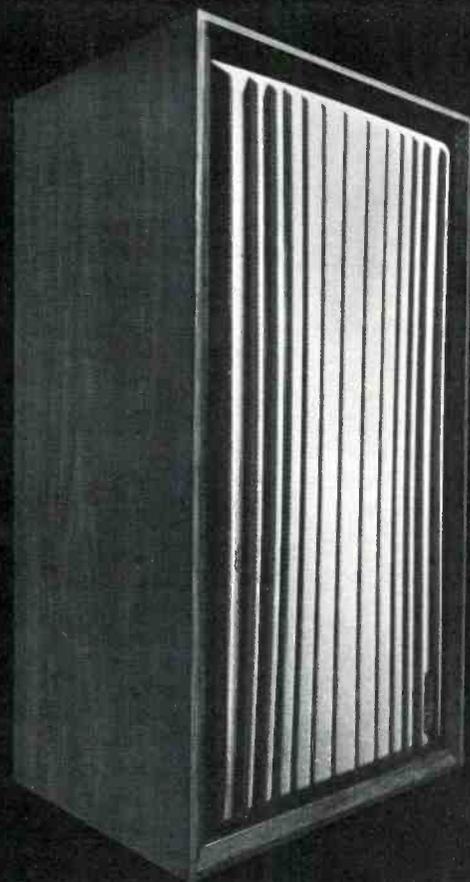
Dear sir,

Excellent publication you have, keep up the good work. I have one suggestion, which from time to time you already have done. Articles about custom home installation almost always contain information useful to all. There is always at least some small aspect about somebody else's installation that I haven't thought of, and maybe there are others such as myself. Your April 1973 article on Arne Berg's home setup was most interesting and thought-provoking.

Robert A. Crapo  
Gainesville, Fla.

*We'd like to hear from other readers who feel that more articles on custom home installations would be a welcome addition.—Ed.*

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# Editor's Review

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**T**HE 100th ANNIVERSARY of the birth of Guglielmo Marconi, the father of the radio, will be honored at a half-day symposium entitled "The Marconi Centenary" on February 25th. The intent of the symposium, arranged by Wilmot N. Hess, director of NOAA's Environmental and Research Laboratory, Walter Orr Roberts of the University Corporation for Atmospheric Research, and H. W. Leverenz of RCA Laboratories at Princeton, will be to discuss Marconi's contributions to the field of radio. The symposium will also cover the evolution of radio into a multi-billion-dollar-a-year enterprise and the many new fields of science which have been opened up by Marconi's work.

The program will begin with Marconi's daughter, Mrs. Braga, who will reminisce about her father. Following will be discussions of the developments which emerged from early radio, including transistors, computers, radio astronomy, etc.—achievements stemming largely from the work of Marconi.

## Golden Lyre Awards

The Institute of High Fidelity has honored AUDIO Magazine by presenting its Golden Lyre Award to our Marketing Director of long standing, Sanford Cahn. Mr. Cahn, who has been involved with the magazine since the late 40's when it was known as *Audio Engineering*, accepted the award at the recent Philadelphia Hi-Fi Show. Golden Lyre Awards were also presented to the Philadelphia Orchestra and to Philadelphia radio station WMMR-FM.

## Armstrong Awards

Some \$4,000 in prize money will be given out at the tenth annual Armstrong Awards Program for the best FM radio programs broadcast during 1973. More than 3,000 FM radio stations in the U.S. and Canada have been invited to participate in the competition, which is being sponsored by the Armstrong Memorial Research Foundation. It is administered by the Columbia University Engineering School, where the late Major Edwin H. Armstrong was a professor and researcher.

The major awards, divided into eight \$500.00 prizes, are awarded for excellence and originality in four categories: news, community service, education, and music. Half the awards go to commercial stations, and the other four to non-commercial outlets.

Deadline for entries is February 18th, 1974. Entry forms may be obtained by writing to Executive Director Armstrong Awards, 510 Mudd Building, Columbia Univ., New York, N.Y. 10027.

## "Aw, Gee Whiz" Dept.

The following is a verbatim transcription of the first six paragraphs of a press release recently received in the Audio Editorial Offices:

"The energy crisis is beginning to knock low priorities off their rock-bottom perches. Christmas lights are hoisted but never lit, Las Vegas casinos darken their miles of neon tubing, we all begin to work and play in surroundings that are a mite dimmer and cooler. . . .

". . . and Ringo Starr's flashing billboard gets a power cut in the glitter burg of Hollywood.

"The billboard, located so that it is unignorably noticeable to drivers on both the Sunset Strip and La Cienga Blvd., spells out the letters of the Apple artist's famous first name one by one via the brilliance of sundry lightbulbs, in a glaringly entertaining manner that has all of Hollywood, and certain areas of Lompoc, talking about it.

"Including Charlie Van Dyke, who remarked on his morning KHJ radio program that, however amusing the blazing billboard might be, there were the following questions to be considered: the energy crisis (though it eats a miniscule amount of power compared to, say, the World Trade Center, the billboard nevertheless eats) and personal discomfort (Charlie lives near the sign and was being kept awake at night by its indefatigable resplendence).

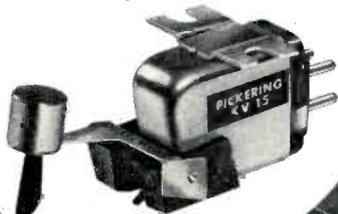
"So: taking all interests to heart, the people at Apple and Capitol decided to limit the Ringo billboard's hours of luminosity. At 1:00 AM Tuesday morning, November 20, the sign was shut off, not to be relit until 4:30 PM the next afternoon, and the same schedule shall follow each day as long as the sign stands . . . flashing R-I-N-G-O from 4:30 PM to 1:00 AM, nonoperative the rest of the time.

"Mr. Van Dyke has expressed his approval regarding the Apple/Capitol move. He counts far fewer sheep before shuffling off to dreamland now, thus being able to disperse his A.M. wit and music over Southern California more chirpily. More power to him, even if it means less going to Ringo's sign."

E.P.

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**SPECIFICATIONS:**

Frequency Response:	10 Hz to 30 kHz
Channel Separation, Nominal:	35 dB
Tracking Force:	3/4 gram, + 1/2 gram, -1/4 gram.
Nominal Output:	4.4 mv
Stylus Tip:	0.0002" x 0.0007"

**For the world of DISCRETE 4-CHANNEL—  
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Designed and engineered specifically for playback of discrete recordings.

The discrete 4-channel system requires a completely new cartridge that could not only faithfully reproduce the 20 Hz to 20 kHz AM signals, but also the 30 kHz FM modulated signals. The result is the Pickering UV-15/2400-Q. It consists of a completely redesigned cartridge and a new high performance stylus assembly, the Quadrahedral™, specially developed for this application. The UV-15/2400-Q performs in a superior manner by every test, and is capable of satisfying all technical and aesthetic requirements for playback of both discrete and stereo disks. Moreover, its stylus is designed to reduce record wear.



QUADRAHEDRAL™

**SPECIFICATIONS:**

Frequency Response <sup>1</sup> :	10-50,000 Hz
Channel Separation:	35 dB
Tracking Force <sup>2</sup> :	1-3 grams
Output <sup>3</sup> :	3.6 mv ± 2 dB
Stylus:	Quadrahedral

**Notes:** 1. Recommended by manufacturer for optimum performance. 2. When the cartridge is terminated in the recommended load of 100K ohms and 100 PF. 3. Output with reference to 5.5 cm/sec record velocity.



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# Thermal Design of A High-Power Amplifier

J. L. Veranth\*

**T**HE DETERMINATION of how to remove heat from the power transistors is an important aspect of the design of power amplifiers. This task, which separates the design of power amplifiers from that of most other audio components, is called thermal design. The thermal design of the Bose 1801 amplifier, which delivers 250 watts (rms) per channel into 8 ohm loads, illustrates several little-understood concepts.

Thermal design requires the answers to three questions: (1) How high should the temperature be allowed to get? (2) How much power must be dissipated? (3) How is this to be done?

The answers to these questions are not always simple. This is illustrated by some common misconceptions. Do you believe that a 500 W amplifier

needs twice as much heat sink as a 250 W amplifier, or that an amplifier generates much more heat when operated at full power than at half power? Do you believe that an amplifier is ever used at half power, or that a high-power amplifier will be more reliable than a low-power amplifier, since it just loafs most of the time? If so, you may be surprised as we study thermal design.

The temperature of amplifiers is normally limited by three considerations. First, no exposed parts should get so hot that they pose a hazard to the user in terms of burned fingers. Second, the temperature must be limited to provide adequate operating margins for power transistors. Transistors are reduced in capability by higher temperatures and must be derated accordingly. A typical manufacturer's derating curve for power

transistors is shown in Fig. 1. Higher temperature means that more transistors are required to do a given job. Third, the reliability of most components is reduced by higher temperatures. The power transistor and heat sink temperature determine the environment in which these components must operate. The lifetime of electrolytic capacitors, for example, is strongly dependent upon temperature, as shown by the manufacturer's data in Fig. 2. On the other hand, heat removal costs money, so that making it too cool can be expensive. This trade-off is usually weighed by the engineer and results in the selection of a maximum operating temperature. A temperature of 65° C. (150° F.) is frequently chosen, since it is cool enough to avoid hazards and to provide adequate device margins.

\*Bose Corporation

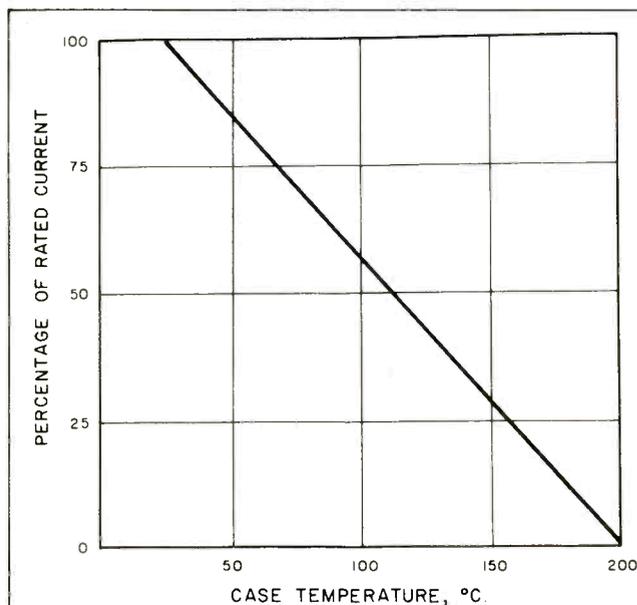


Fig. 1—Power transistor derating (dissipation-limited region.)

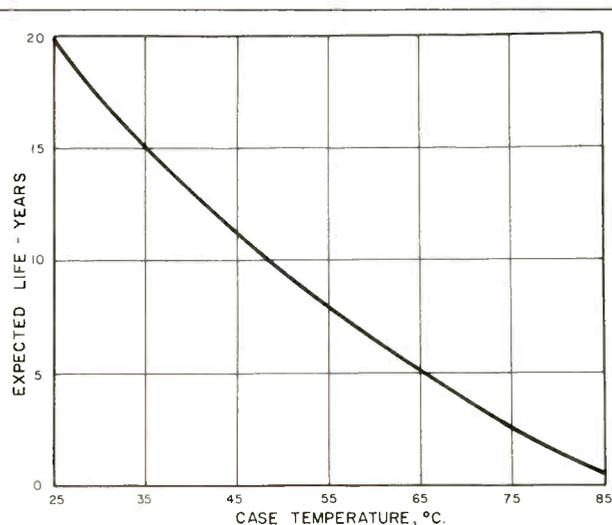


Fig. 2—Electrolytic capacitor lifetime.

Selection of the temperature allows calculation of device parameters, worst-case variations, and expected reliability. A thermostat is then chosen and located so that the hottest spot in the amplifier will never exceed the desired limit.

The determination of how much power must be removed sounds simple. The power comes primarily from dissipation in power transistors. The operation of an amplifier power stage is illustrated in Fig. 3. Power is supplied to the power stage from the power supply by means of two voltages  $+V_c$  and  $-V_c$ . This power is transferred to the load through power transistors. In a class B amplifier only one set of transistors is "on" at any instant (except perhaps for insignificant bias currents). Therefore, the current flow in the power transistors is always equal to the load current. Whenever the voltage across the load is less than the supply voltage, the difference between the supply voltage and the output voltage is developed across the power transistors.

In order to illustrate more clearly how the power stage operates, let us consider a resistive 8 ohm load and a power supply voltage of  $\pm 100$  volts. Let us look at some instanta-

neous voltages and currents which may occur across the load and power transistors for several cases of operation. Since an 8 ohm resistive load is being considered, the load current will always equal one eighth of the load voltage at any instant.

Four cases of load and transistor operating conditions are presented in Table I. Since these are instantaneous voltages, currents, and watts, the numbers will not be exactly the same when considering the average value of a.c. voltages, currents, and watts, but the trend will be similar. This data, therefore, illustrates two significant points. (1) Full-power operation is not the worst-case amplifier condition, since the transistors then dissipate very little power relative to the load. (2) A high-power amplifier works harder to put out a given power than a low-power amplifier. This can be checked by trying the 8 W load case while assuming only a 25 V power supply.

Of course, this description has been oversimplified by looking at instantaneous values of voltage, current, and power. For a thermal analysis, we must consider average dissipation. The calculations are commonly done for continuous sine-wave signals, as in rms power testing. We must also

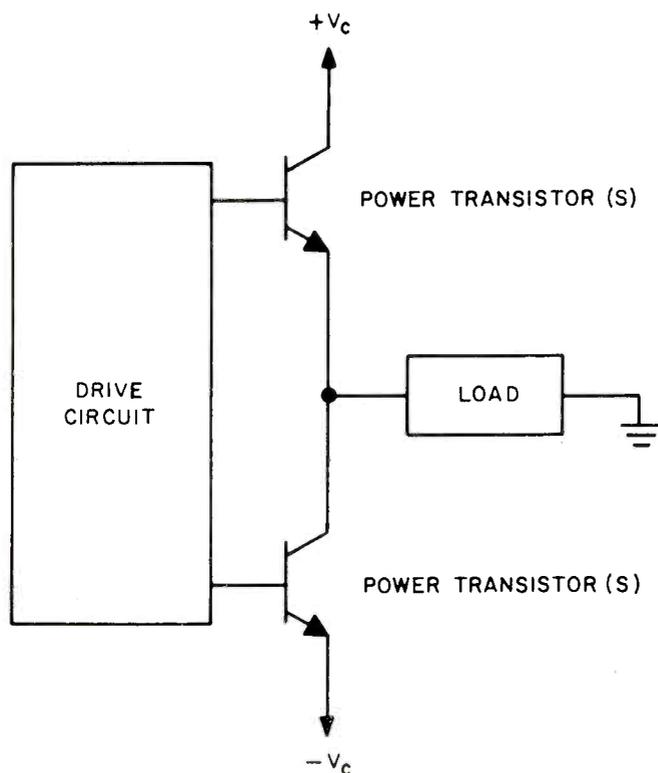


Fig. 3—Amplifier power stage.

## The Real Operating Environment

There has been a great deal of discussion on how much amplifier power is required in the home listening environment. This depends upon the efficiency of the loudspeakers, the size and acoustic properties of the room, and individual listening taste. Instead of providing another opinion on the subject, we determined the actual operating conditions of home stereo systems. The questions answered are:

1. What is the background noise level in the typical home listening room?
2. What are the typical listening levels?
3. How much power is used to produce these levels?

These were not laboratory tests but actual measurements made in several dozen homes using the stereo equipment and room configuration found there without alteration. Our equipment consisted of a voltmeter, portable sound pressure level meter, and test recording. A 1 kHz warble tone was used to measure speaker sensitivity with minimum disturbance by room modes. The subject selected his own recordings for determining listening levels.

Wide variations in environment, equipment, and taste preclude the determination of a "norm." Instead, we attempted to establish the extremes by selecting subjects which maximized these variations. All types of equipment were represented within the constraint that the user felt it was of adequate quality not to restrict his or her listening habits. The results, which should not be considered definitive bounds, are listed below:

Background Noise	
Level, dBA	35-68
Listening Level,	
Background Music, dBA	48-82
Listening Level, Critical	
Listening, dBA	59-95
Level Produced by	
1 Vrms/speaker, dBA	74-85

The 60 dB difference between the loudest listening level and the lowest noise level indicates that these listeners were unable to utilize an equipment signal-to-noise ratio greater than 60 dB referenced to average output. It is also significant that a 95 dB level could be produced by 3 Vrms (1.1 W into 8 ohms) in some systems and would require 11 V (15W) in others. The startling conclusion for those users surveyed is that an *average* listening level of 95 dB meets the need even for critical listening. To produce this level, a continuous amplifier power of only 15 watts is required! Where does the rest go? Read the accompanying article.

recognize that an unregulated power supply will droop at full load from  $V_c$  to an average of  $\alpha V_c$ , and that the amplifier at low frequencies will deliver an output voltage less than the instantaneous power supply voltage by a factor of  $\beta$ . Knowing these factors, we can express power dissipation ( $P_{diss}$ ) in terms of power output ( $P_o$ ) and rms power rating ( $P_{spec}$ ):

$$\frac{P_{diss}}{P_{spec}} = \left[ \frac{4 \left( \sqrt{\frac{P_{spec}}{P_o}} - 1 + \alpha \right)}{\pi \beta (1 - \pi + \alpha \pi)} - 1 \right] \frac{P_o}{P_{spec}}$$

For  $\alpha$  equals 0.9 and  $\beta$  equals 0.95 the results are shown in Fig. 4. Note that the dissipation is nearly constant for output greater than about half power. You may have heard the story

that a high-power amplifier will be more reliable because it just loafs at lower power levels. But note that to play at 10 watts, a 25 W amplifier must dissipate 20 W, whereas a 250 W amplifier must dissipate 88 W! If you buy the high power amplifier, it should not be because it loafs.

Actually, all this theoretical analysis does not completely answer the question of how much power must be dissipated in a 250 watt amplifier. The reason I might buy a 250 W amplifier instead of a 25 W amplifier is because of the extra 10 dB of head room. The ratio of the peak power in a music waveform to the peak power in a continuous sine wave of the same average power is called the crest factor of the music. A 25 W amplifier would be driven into clipping when played at an average level of 5 W with any music which had a crest factor greater than 7 dB. A 250 W amplifier would be clipped if the

music had a crest factor greater than 17 dB. Most music has a crest factor between 10 dB and 20 dB (my taste runs toward the high end), which indicates that I really could not use my 250 W amplifier at average levels much above 5 W without frequent clipping anyway. (The fact that the amplifier has a higher IHF or peak power capability than its rms capability gives me, roughly, an extra 2 dB which is neglected for simplification because the extra margin vanishes, as a practical matter, on a long organ pedal or synthesizer note anyway).

The question of how much power is really "needed" is a subjective question beyond the scope of this discussion, but the results of some surveys may be found in the box.

As a real test of thermal requirements, a continuous tape loop of music with the lowest crest factor I could find (and therefore the highest power demand) was played at a level where frequent clipping occurred on the Bose 1801. Monitoring of temperatures with thermistor gauges indicated that this was thermally equivalent to an average dissipation of 110 W/channel, corresponding to a sine wave output of only 18 W! This continuous-loop operation undoubtedly exceeds most typical home requirements. In fact, we have concluded that for normal home music reproduction, where operation is intermittent and the amplifier is seldom clipped, a 250 W amplifier need dissipate only 100 W/channel.

This is all the information needed for thermal design. The 100 watts per channel must be removed from the power transistors without allowing the transistor temperature to exceed 65° C. at room temperatures up to 30° C. (86° F.). The heat sink parameter of significance is called thermal resistance: The temperature rise (35° C.) divided by the power-flow (100 W), or in this case 0.35 °C/W.

To choose a heat sink, a simple modeling technique shown in Fig. 5 is used. The structure is drawn and divided into simple sections for which the thermal resistance can be calculated. These thermal resistances are replaced by electrical analogs. For example, a section of aluminum becomes a resistor of value equal to its thermal resistance, a source of power becomes a current source, and temperature rise between two points becomes the voltage drop as illustrated in Fig. 5a. The mechanical structure of Fig. 5b, which consists of power transistors dissipating powers  $P_1$ , and  $P_2$ , a heat

CASE	LOAD			TRANSISTORS		
	Volts	Amperes	Watts	Volts	Amperes	Watts
1	1	1/8	1/8	99	1/8	12
2	8	1	8	92	1	92
3	48	6	288	52	6	312
4	88	11	968	12	11	132

Table I.

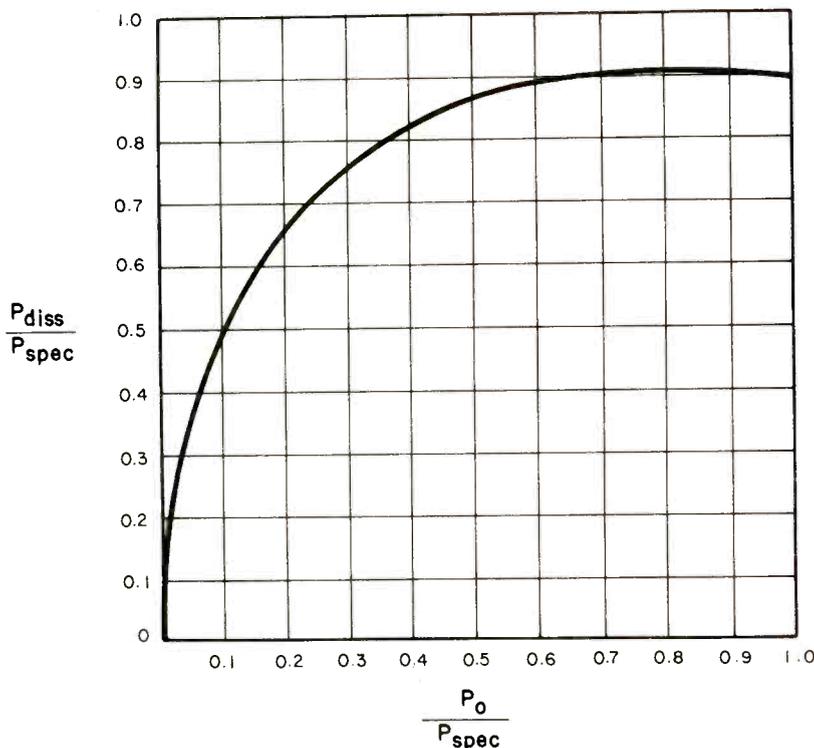


Fig. 4—Amplifier power dissipation per channel.



# THE PROBLEM SOLVER

Say farewell to the grand old DC300, and welcome to THE PROBLEM SOLVER, the amp that is going to make your job easier and your customers happier. The original model DC300 was a great amp — the first super-power low distortion amp in the world, when Crown introduced it five years ago. Meanwhile, top sound systems designers have used it successfully in hundreds of demanding situations, and made some excellent recommendations for improvements. The response of the Crown design team was *not* an updated DC300, but a totally *new* and different amplifier, the DC300A. It is the *only* high power low distortion amp specifically *designed* for commercial sound applications. (CAUTION: *There are some large consumer-type amps attempting to sell in the commercial sound field without providing adequate continuous power for all load impedances.*)

#### Power You Can Count On

The New DC300A has *double* the number of output transistors, effectively twice the muscle of the old DC300 at the same price. Each channel has eight 150-watt devices for 1200 watts of transistor dissipation per channel. The DC300A is rated at 150 watts per channel continuous into 8 ohms or 300 w/ch continuous into 4 ohms (both channels driven) and 500 watts continuous into 2.5 ohms (single channel driven).

#### Two Amplifiers in One

As a dual-channel amplifier with separate level controls and circuitry for each channel, the DC300A is almost *two* amplifiers in one. This gives you additional flexibility in controlling your speaker load, as when driving separate front and back speaker systems in a large auditorium, or when bi-amping a system. For 600 watts continuous output at 8 ohms, the DC300A converts to a mono amp with two plug-in parts. This makes it possible to drive a 70-volt line directly without a matching transformer.

#### Superior Output Protection

The DC300A output protection circuitry is a radically new design which completely eliminates DC fuses and mode switches and further reduces service problems to the negligible level. It is superior in every way to the old VI-limiting circuit pioneered by Crown and now used by most other high power amplifiers, since it introduces *no* flyback pulses, spikes or thumps into the output signal, whether operating as a single- or dual-channel amp.

Gone too is the need to baby the amp by carefully juggling load configurations. The Problem Solver can drive *any* speaker load — resistive or even totally reactive — with *no* protection spikes! Parallel speakers with no deterioration of sound quality, since changing the load impedance only affects the maximum power available, not the ability of the amp to keep on producing clean sound.

#### Lowest Distortion and Noise

Also new is the DC300A's IC front end, which sets new world's records for low distortion and noise. At the 8-ohm rated output, IM and harmonic distortion is less than 0.05% full spectrum; hum and noise is 110db below. Servicing — if ever necessary — is a snap, since removing the front panel accesses the entire circuitry.

Although it is a completely redesigned model, the DC300A has inherited some characteristics from its predecessor:

**PRICE** - still under \$700. As two amps in one, it will probably give you or your customers a welcome cost/break when you design your next multiple-amp system.

**WARRANTY** - three years, covering all costs of parts, labor and round-trip shipping.

**COOLING** - excellent heat dissipation provided by massive cooling fins and the entire chassis itself.

**DEPENDABILITY** - stringent pre- and post-inspection and testing proves every electronic component, every circuit module and every finished unit, to bring you one step closer to install-and-forget field dependability.

**PEOPLE** - the same innovative design team and careful craftsmen who made the DC300 such a sound success. And the same knowledgeable customer-service men ready to discuss your special application and send you detailed technical data. Phone 219 + 294-5571 or write Crown International, Box 1000, Elkhart, Indiana 46514.



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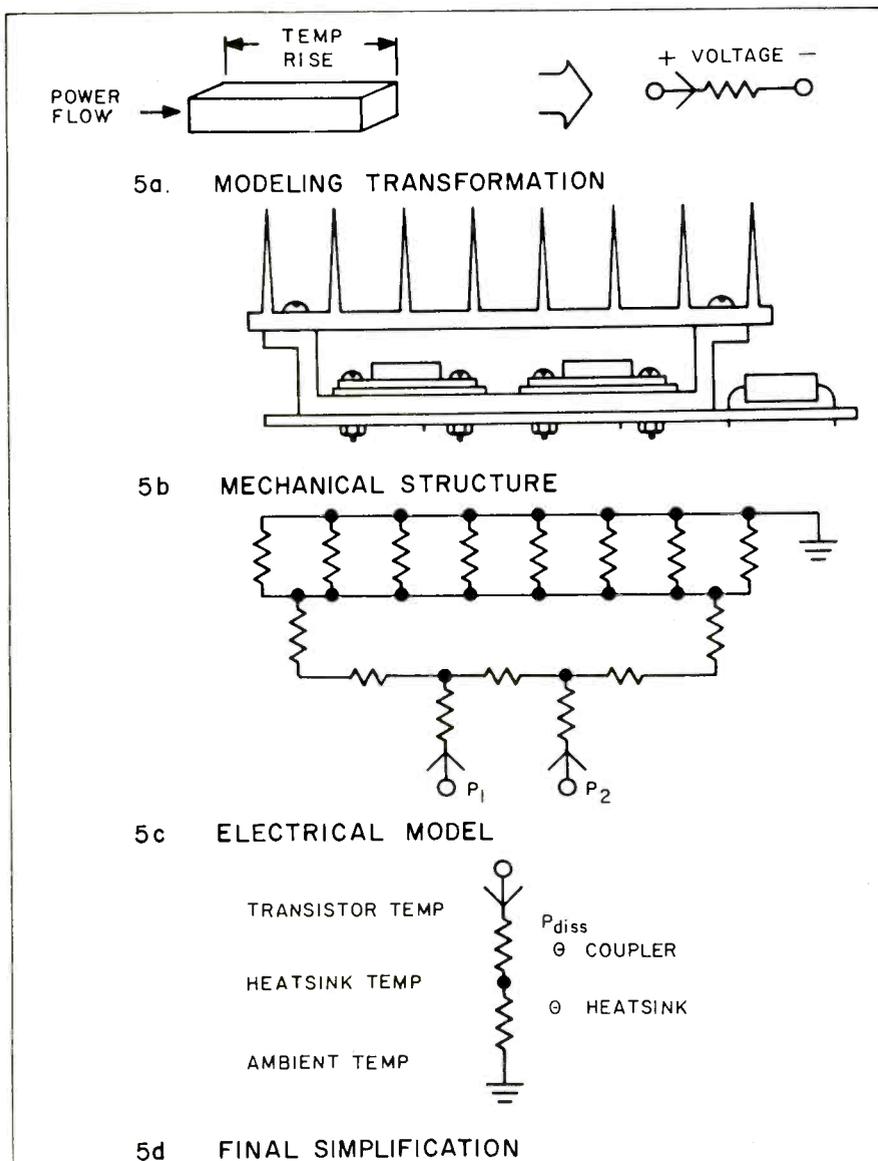


Fig. 5—Thermal modeling.

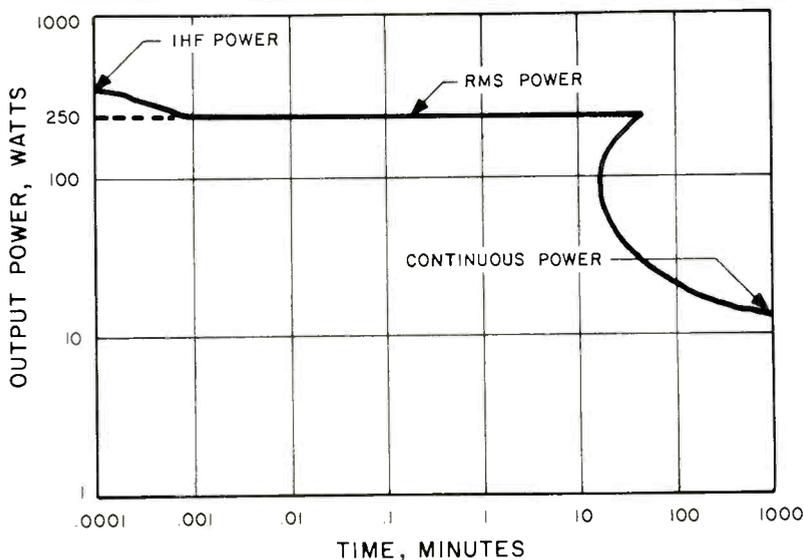


Fig. 6—Amplifier output power.

coupler which carries the heat to the heat sink, and the heat sink itself, is transformed to the electrical model of Fig. 5c, and finally simplified to that of Fig. 5d. The aluminum heat coupler structures and thermal grease used to fill surface irregularities where the surfaces are mated have a calculated thermal resistance of  $0.06\text{ }^{\circ}\text{C/W}$  so the heat sink must have a thermal resistance of  $0.29\text{ }^{\circ}\text{C/W}$ .

In fact, the coupling structure of the 1801 has a thermal resistance of  $0.065\text{ }^{\circ}\text{C/W}$ , and the heat sink has a thermal resistance of  $0.3\text{ }^{\circ}\text{C/W}$ . It should be noted that the heat sink is, by far, the dominant thermal limiting factor for natural convection cooling, so that reducing the thermal resistance of the heat coupler has negligible effect.

The 1801 heat sink was designed for free-air convection. What about forced air cooling? In worse environments, or non-audio applications, forced-air may be necessary. This changes the whole picture. For example, blowing on the heat sink will reduce its thermal resistance to  $0.1\text{ }^{\circ}\text{C/W}$  or less. Then the coupling bracket may have a significant effect. For this reason the professional version of the 1801 (the 1800) has a heavier coupling bracket.

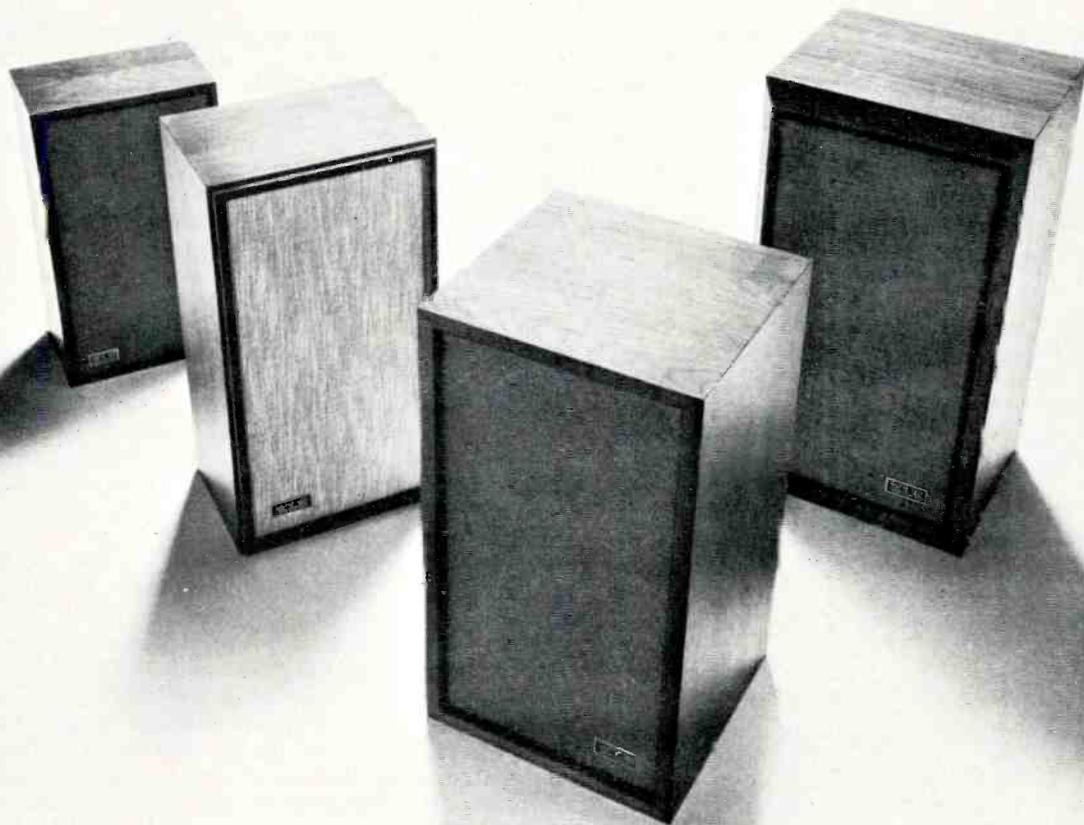
What's the net effect of all this effort? It should be clear that all relevant information is not conveyed by the rms power specification. Instead, let's look at a curve of power versus time. The time for which the amplifier can supply a specified power is given in Fig. 6. This capability has proved more than adequate for home music reproduction. It can be seen that for short periods of time the amplifier is limited by its no-load power supply voltage (IHF power). For longer periods, the amplifier is limited by the full-load power supply voltage (rms power). The curve at this point folds back upon itself, since the dissipation is actually lower at higher power levels. Finally, we reach the region of continuous operation.

All of these regions of amplifier operation are important and have to be considered in their relationships to the demands of music and the capacity of loudspeakers. This discussion has dealt only with the thermally limited region, which is always neglected by a single-number power specification such as IHF or rms power. Perhaps the insights provided concerning the thermal design of an amplifier will somewhat offset this lack of data. **AE**

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# High-Voltage Amp Design

James Bongiorno\*

IT HAS BEEN several years since I have written for this journal, and at that time I was working on an amplifier of very radical design both electronically and mechanically. Unfortunately, at that time the transistors involved were exasperatingly expensive and it would have been impossible to market an amplifier based on that design at anywhere near a reasonable cost. This situation has changed, of course, and today there are quite a few high-powered amplifiers on the market. It is my feeling that these amps are definitely needed to drive today's low efficiency loudspeaker systems.

Again, unlike the past, designers seem to be a little reluctant to write about their designs or philosophies, and as a result, only a few articles have been published concerning high power amplifier design. I also believe that this reluctance is due in part to reliability problems encountered in the common approach to these designs. There are presently on the market six high power amplifiers from major firms with at least 200 watts per channel, and no less than four of them are using this common type of circuit design. There

is one other manufacturer who is using another similar design approach, but with different transistors of an older vintage.

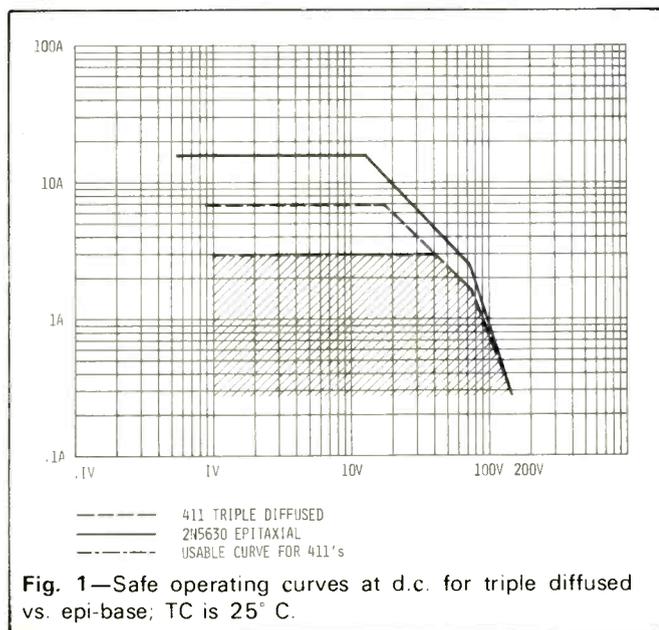
Most high power amplifiers today use what is known as the high voltage triple-diffused output transistor in the output stages with supply voltages reaching  $\pm 100$  volts. This approach is, of course, a far cry from the days when we were nervous about using even  $\pm 35$  volts, but it is necessary to use the  $\pm 100$  volts to achieve the needed power levels. Most engineers seem to feel that the triple-diffused power device is the answer for these designs. I feel this is unfortunate, as they are not really the best choice for output devices.

There are basically three different types of power transistors available: single-diffused homotaxial, double-diffused epitaxial, and triple-diffused. The single-diffused devices are considered to be very rugged. This is true; however, their extremely slow speed, combined with excessive leakage versus temperature, makes them a relatively poor choice for truly high quality designs, even though one manufacturer is touting them.

Even though triple-diffused devices are nice to work with, thanks to their high voltage capabilities, they have several problems associated with their use. They have several volts saturation loss even at reasonable currents, extremely poor beta holdup at higher currents, and virtually no safe area capability beyond 70 volts. Most difficult of all, they are not available in PNP configuration which means that these devices must be used in a quasi-complementary design. This is unfortunate as the classic cross-over notch cannot be eliminated with this type of output stage design, and one engineer has openly stated in a recent article that this amp does indeed have this problem. Another difficult problem associated with quasi-complementary output stages is their high frequency instability, which is more commonly described as common mode conduction or latch-up in the output stage itself. This problem is due to phase shifts within the output stage itself and is almost impossible to cure.

Full complementary stages do not have this type of problem when properly designed, but they can only be made using double-diffused epi-base transistors. These complementary devices are also available in power Darlington's, which we use exclusively at S.A.E. These epi-base transistors do not suffer from the problems associated with either single- or triple-diffused devices, as they have excellent beta hold-up out to several tens of amperes, virtually no saturation losses even at 20 amperes of collector current, and excellent safe-area properties. But, best of all, they don't leak at elevated temperatures. When they are used in an emitter-follower configuration, they have ten times more

\*Director of Engineering,  
Electronics Division,  
S.A.E., Inc.



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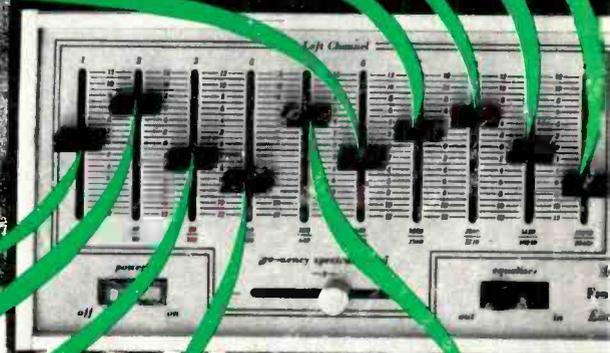
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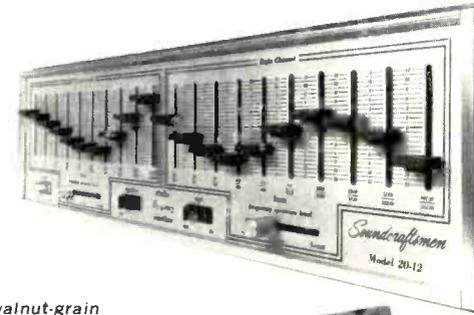
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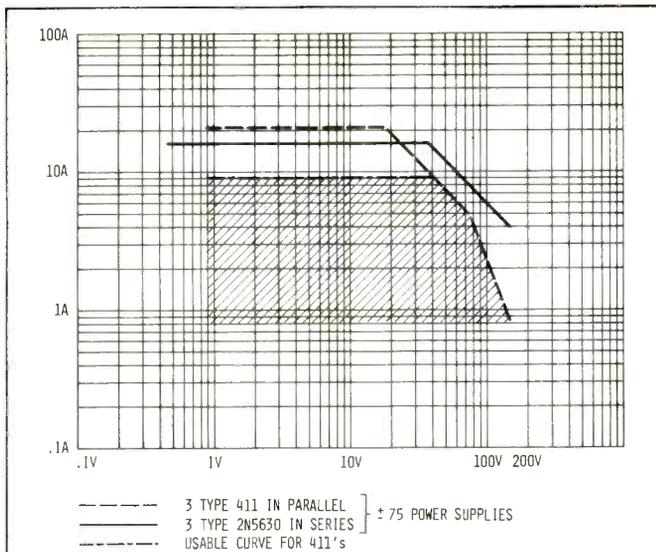


Fig. 2—Composite soar curves for three devices of each type; TC is 25° C.

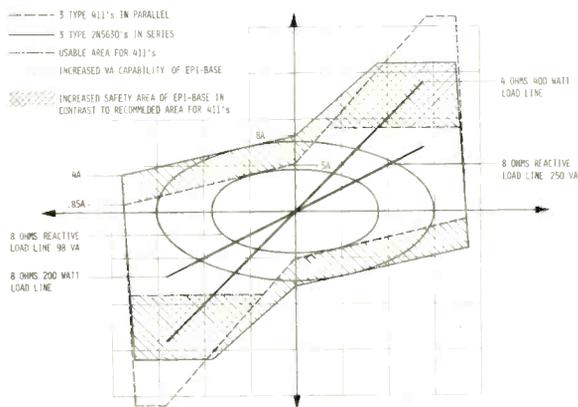


Fig. 3—Load line capabilities of three type 411's in parallel and three type 2N5630's in series for both resistive and reactive loads.

gain-bandwidth product than either of the other types, which must be used in the quasi-complementary format. As the result of lengthy development, these epi-base devices are now available in much higher breakdown voltages than were previously available. This automatically means more ruggedness in the safe-operating area, which has been extended further into the high voltage region. At S.A.E., we use these devices only in series connection in our output stages, rather than in the more commonly used parallel connection, and we have found that it is almost impossible to initiate secondary breakdown, which is the most common cause of all amplifier breakdowns.

### Performance

Figure 1 illustrates the safe-area capability of one epi-base device versus one triple-diffused type 411. Figure 2 shows the difference between three epi-base devices in the series configuration versus three type 411 devices in the parallel configuration. Since the saturation losses for the triple-diffused devices are enormous, they can only be safely used in the shaded area and are practically useless outside these limits. Figure 3 shows the load line capabilities of the two different configurations for both resistive and reactive loads. As can be seen, the epi-based device has considerably better load line capability over the triple-diffused. In use, this means that amps incorporating these devices, as all new S.A.E. amps do, are capable of driving any load angle at full rated power from 0 degrees to 90 degrees. Further, we have found in testing that they will deliver a full-power 20 kHz square wave into a 1  $\mu$ F capacitor with no instabilities with less than 0.5 per cent distortion.

Further circuit refinements can be seen in Fig. 4. As shown, all of the circuitry is fully complementary push-pull from input to output using full complementary differential inputs and full complementary series-connected outputs using epi-base Darlington output devices. With this particular approach, there are no bias shifts when the amplifier is driven by transient low frequency information, which results in undesirable low frequency modulation noise with single-differential-input circuitry. For this latter, it is sort of like a person with one wooden leg or a sprained ankle who favors one side.

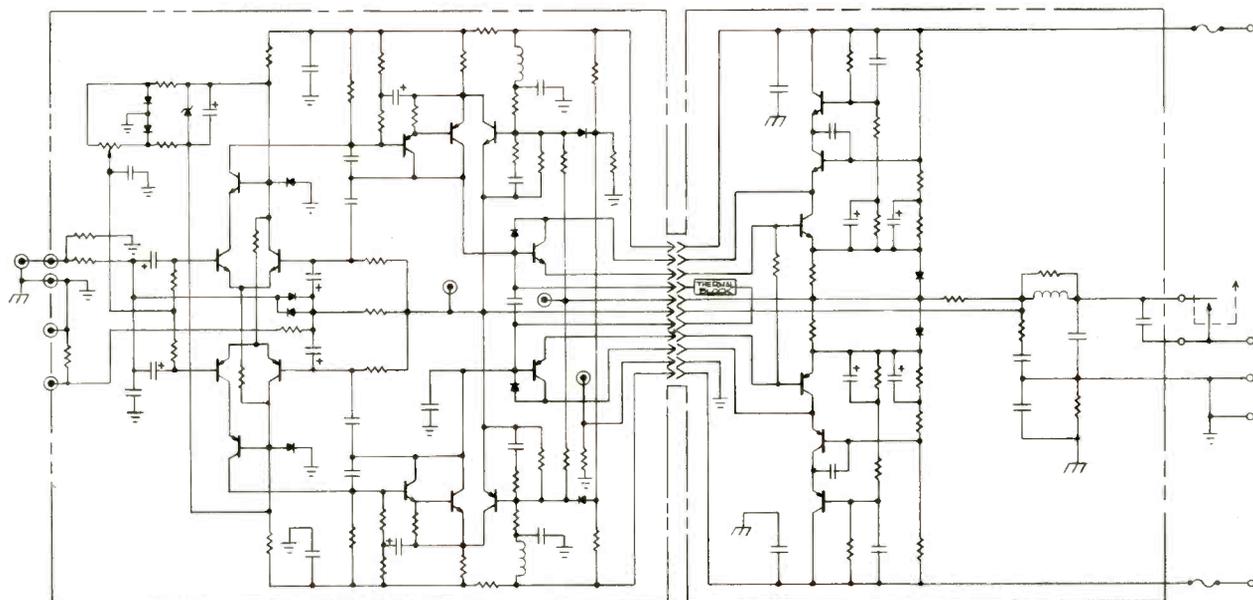


Fig. 4—Schematic of Mk IIIC and CM power amplifiers.

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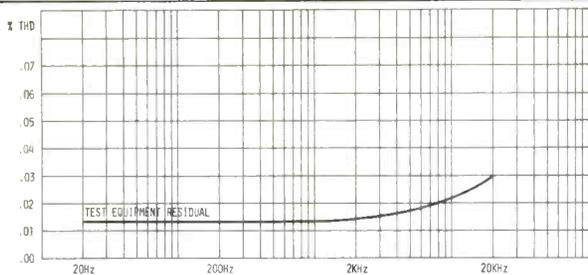


Fig. 5—THD at 8 ohms, full power 40 V rms.

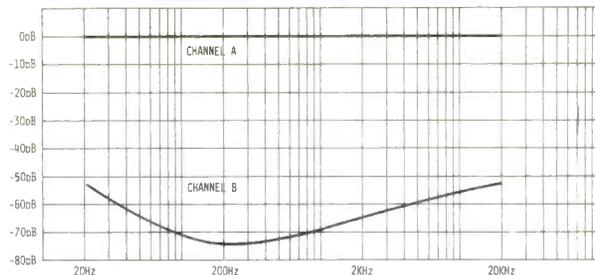


Fig. 8—Crosstalk at 8 ohms, full power 40 V rms.

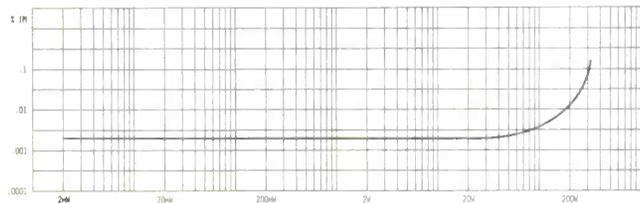


Fig. 6—IM distortion at 8 ohms, full power 40 V rms.

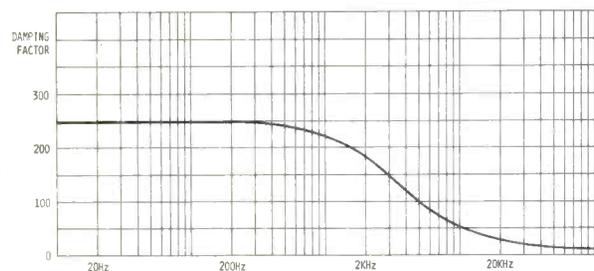


Fig. 7—Damping at 8 V rms.

Another innovative refinement to the circuitry is the integrated circuit bias regulator which does away with the possibility of runaway while at the same time maintaining accurate tracking of the output stage quiescent current. This means that there is no shifting of the operating points after prolonged operation, which with most designs causes *over-compensation*, resulting in classic cross-over notch increase. This, of course, results in long-term listening fatigue. This characteristic can be verified by examining the IM curve, which is flat all the way down to the milliwatt region, and, indeed, it should be if there are no cross-over products. THD and IM curves are shown, and for all practical purposes these are the residuals of the test equipment.

Other parameters attained with this design include a damping factor of 250, which we feel is far beyond the minimum necessary, and a power bandwidth to over 150 kHz. We have found the design to be quite stable, and we have driven it into hard overload with frequencies up to

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If you're looking for the best combination of features, performance and value . . . look no further. Glenburn delivers just that.

### The features . . .

- Tone arm damping in manual and automatic modes . . . up and down
- Tone arm height and stylus pressure finger adjustments . . . no tools required
- Automatic tone arm lock
- Cartridge and dust cover and base standard . . . Nothing else to buy.

### The performance . . .

- Lowest tripping and tracking forces available under \$100
- Largest turntable bearing in the industry
- Exclusive uni-planar mechanism . . . results in smoother, quieter turntables by putting most moving parts on a single plane.

### And, the value . . .

All these unsurpassed features and improved performance available in four great new automatic turntables . . . All priced under \$100. Prove it to yourself. At your nearest Glenburn Dealer. He'll help you choose a Glenburn automatic turntable to fit your needs as well as your pocketbook.

Sometimes you have to pay a little less to get a lot more.



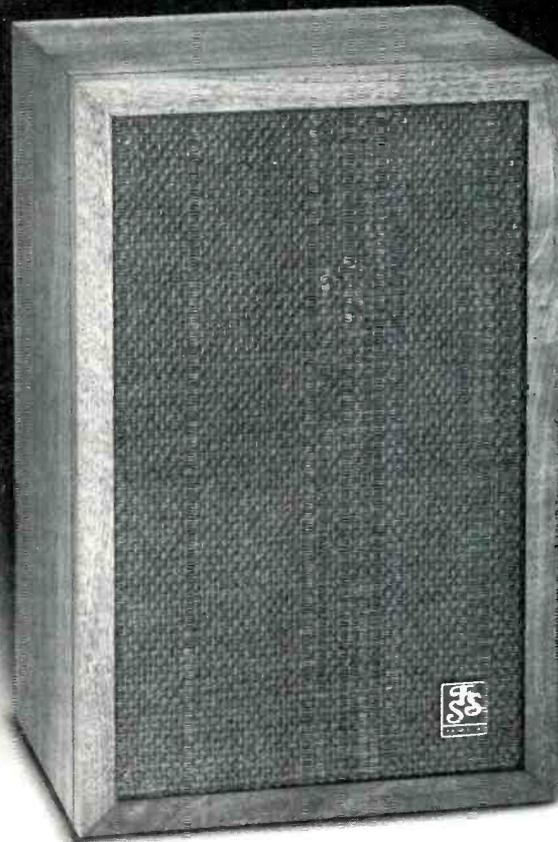
**G GLENBURN** better by design

GLENBURN/McDONALD, INC., 787 Susquehanna Ave., Franklin Lakes, N.J. 07417 • (201) 891-8250

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# NOT FOR SALE

AT ANY PRICE



## We Earned Our Top-Rating

The **Fairfax FX-300** was recently top-rated over 20 leading medium-priced speakers by one of the most respected consumer reporting organizations in the world.

**That's something money can't buy!** Like any of the nationally advertised brands we topped, we could make all sorts of claims and super-claims for Fairfax speakers, including a number of **SPEAKER FIRSTS** we have to our credit. We could follow the pack and excerpt reviews or we could spend lots of money to buy endorsements.

However, at Fairfax, our money goes into the speaker. And we think you will agree with "The Report Money Can't Buy"—the investment is well worth it. But in order for you to agree that the **FX-300** is the most accurate sounding speaker (rated at 8 ohms with a minimum of seven watts RMS required) you will have to listen to ours and compare it to theirs—any of the 20 other speakers we topped and then some.

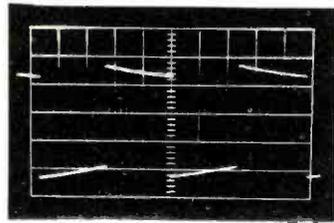
Visit your nearest audio dealer and ask to hear the **Fairfax FX-300**, and compare it to any other speaker in its price range—even some costing considerably more.

If your dealer is not a Franchised Fairfax Dealer, have him contact us and we will send him a pair of **FX-300** speakers for your evaluation—at our expense. Only Fairfax has the confidence in their product, and your judgment, to make such an offer.

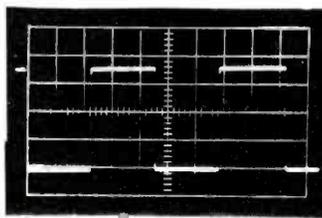
**FAIRFAX INDUSTRIES, INC.,**  
900 Passaic Avenue, East Newark, New Jersey



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B



C

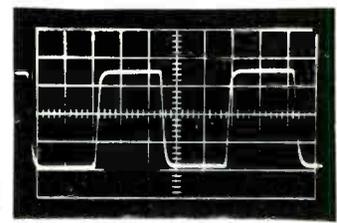


Fig. 9—Square wave response at A, 20 Hz; B, 2 kHz, and C, 20 kHz. All at 8 ohm 200 watt output.

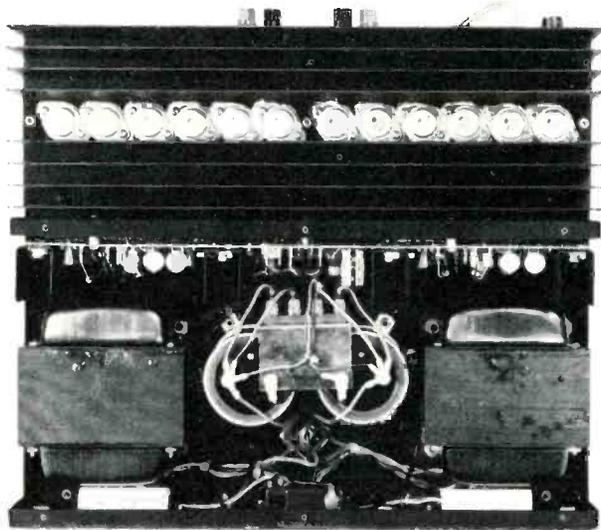


Fig. 10—Showing method of heat sinking.

20 kHz and loads from 4 ohms up without oscillation, blown fuses or other sorts of misbehavior. We think the square wave photos speak for themselves.

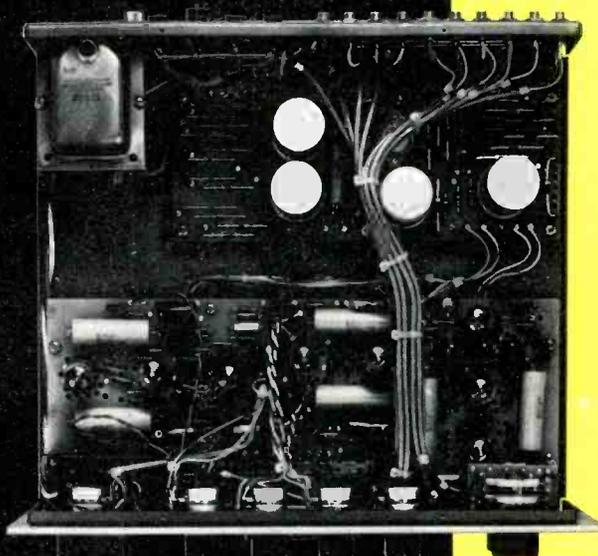
### Construction

We call our construction method "Unisink," and believe that it is as different as the circuitry, as the entire amplifier—less the power supply—is made in a single unit, including the entire heat sink, output stage, and the low level stages. There are *no* wires, except for the four power supply wires, as everything is mounted on two p.c. boards, each of which can be popped out in less than a minute. The main virtue of this is, of course, repeatability, but we have found the design to be extremely reliable, with less than 0.8 per cent total failure rate among consumers.

The heat radiator works on the principle of heat expansion, rather than the more common convection principle. This is quite effective and allows us to set the thermal cutout at 70° C., rather than the more usual 85 or 100° C. Cooler operation, of course, means longer life.

But what does it sound like? Well, during the initial listening period, we couldn't believe our ears, but since we're prejudiced, we suggest that you don't believe us either. Instead, we suggest you go listen for yourself.

## the extra margin of quality



SP-3 Preamp

One look at an Audio Research component tells you that here is audio equipment built *for* perfectionists, *by* perfectionists. Meticulous design . . . highest quality materials . . . packaged with the kind of craftsmanship that's all but disappeared today.

Audio Research equipment isn't just well-engineered . . . it's "over-engineered." Every element, from the chassis to the smallest electronic device, is chosen to exceed performance requirements by a wide margin. Our manufacturing techniques, too, go far beyond commonly accepted audio industry standards.

Few products anywhere are made with such attention to quality and reliability. So when you visit your Audio Research dealer it'll pay you to look as well as listen. If perfection is your goal, we think you'll agree: there's no substitute for Audio Research components.

## audio research corporation

Box 6003 / Minneapolis, Minn. 55406 / Tel: (612) 721-2961

Check No. 5 on Reader Service Card

Add the new Sony SQA-2030 decoder / amplifier and two speakers to your present stereo system and you're into four channel. And what four channel!

Full logic IC circuits increase separation—side to side, front to back. SQ records and broadcasts are reproduced with rock-and concert-hall realism. Matrix recordings and broadcasts, other than SQ, discrete four channel tapes (with a quad deck), retain the excitement of the original performance. Even stereo records take on new depth.

And the SQA-2030 gives you something extra—a built-in stereo

amplifier. It delivers 18+18 watts, RMS into 8 ohms at every frequency in the audio range (20-20,000 Hz)—plenty of power to drive your back channel speakers. It's distortion-free (THD less than 0.8%). And it's easy to enjoy. Once you've balanced your system, the SQA-2030's master volume control is about all you'll have to adjust.

Thanks to new integrated circuits, developed and manufactured by Sony, this full logic decoder, control center and stereo amplifier is housed in a cabinet about half the size of a standard receiver. It costs just \$239.50.

Sony offers two other choices to go four channel. The full logic

SQD-2020 has all the quality and control convenience of the SQA-2030 plus four calibrated VU meters to help you balance your system visually. If your stereo system has high power output, add a basic amplifier of equal power plus two speakers. The SQD-2020 costs \$229.50.

Add full logic SQ to an existing four channel system. Or upgrade stereo to four channel (an integrated amplifier and two speakers are required).

The full logic SQD-2070 is an inexpensive choice, \$89.50.

Go four channel with Sony. It's very logical. **SONY®**

## Introducing the \$240 full logic decoder. With an amplifier to boot.



# Compatible Quadra-Direction Discrete Stereo System

## Part II

Fumitaka Nagamura\*

IT HAS GENERALLY been believed that disc records with transmission inherently limited to two channels are not readily adaptable to multi-channel transmission of information, but it is due to the conception that the two transmission axes of discs are required to be independent of and unrelated to each other. To the contrary, full understanding of the two axes that are at right angles to each other leads to the possibility of discs serving as a medium capable of recording an infinite number of channels of information.

Additionally, as when recorded these channels form a circular and continuous spatial distribution, relative sequential positions of original sound sources remain unrelated in their recorded form.

Thus, it is meaningless to segregate discs by channels of information recorded thereon, such as two- and four-channel discs, and it is only the number of channels in reproducing equipment that places any limitation on the overall channel handling capability. Under this philosophy there is no basis for assigning the nomenclature "two-channel" to recordings of conventional front-only stereo, and "four-channel" to those of surround, or 360° stereo, as both such recordings can be reproduced in four or more channels by QDCS. However, for the sake of conformity with traditional nomenclatures, the former will be referred to simply as "stereo" in this article, and the latter as "quadraphonic" which is distinguished from four-channel reproduction of conventional stereo discs.

These aspects are not derived from any particularly new principle, as the 45/45 disc system itself has been founded on the same basis. Only, by limiting reproduction to two channels, discs have virtually been regarded exclusively as media for two mutually independent transmission channels, so that no more than half, i.e. 180°, of the fully circular, 360° continuously distributed recordings of information on discs, has been correctly reproducible, and the true merit of disc recordings has never been fully appreciated.

\*President, N.F. Farrd Systems Corp.

However, a gradually but steadily increasing revelation of the inherent capabilities of discs has been inevitable, and on the recording side, a glimpse of the truth appeared in an analysis of physical motions of disc cutter tips during RM (regular matrix) and other matrix recordings, but recognition of "discrete vectors" was never attained.

On the reproducing side, no such revelation has been made, and all reproduction has had to stay within the severe restriction of two-channel detection.

Only by breaking through the traditional two-axis detection (pick-up) concept, have new advancements in disc reproduction been made possible. It, at long last, provides a most direct method of reproducing from discs in multichannel, and marks the birth of a direct reproduction system in multichannel, comparable to the conventional reproduction in two channels.

### Reproduction of Original Sound

In this article, the original sound is defined as something frozen at the time when its record is cut, and it encompasses not only the natural sound field but also sound fields created exclusively in reproduction. Therefore, once recorded, the sound is considered to have been endowed with life as a piece of art, so that it is a mandatory requirement to avoid any unilateral distortion of signals picked up from discs, such as varying relative signal strengths and changing or shifting localization of sounds reproduced, even if such artificial processes happen to be free from any undesirable audiopsychological effect.

### Discs as Media Between Original and Reproduced Sound Fields

The ideally reproduced sound field should be a replica of the original sound field with no distortion and in the highest possible fidelity. Therefore, discs as media to connect the two fields must record and maintain balanced and correct information in a miniaturized form.

However, with regard to provision for directional localization of reproduced sound images, the conventional two-channel stereo system does not provide a balanced distribution and therefore may be termed irrational. To elaborate, while reproduced sound images can best be localized by magnitude ratios of their vector components detected along detection axes of pick-up cartridges, there always exist two vectors corresponding to any given magnitude ratio of outputs along the L and R axes of the two-channel cartridge. For instance, as shown in Fig. 11 (A), a vector equidistant from the L and R axes and in phase, denoted by H, invariably represents the front center, FC. However, there exists another vector, V, also equidistant from axes L and R, only in opposite phase.

This latter vector has been interpreted as a non-localized sound in reproduction, but if the listener is to be located in the center of a sound field as shown in Fig. 11 (B), and the reference point is at the front center, its conjugate point to

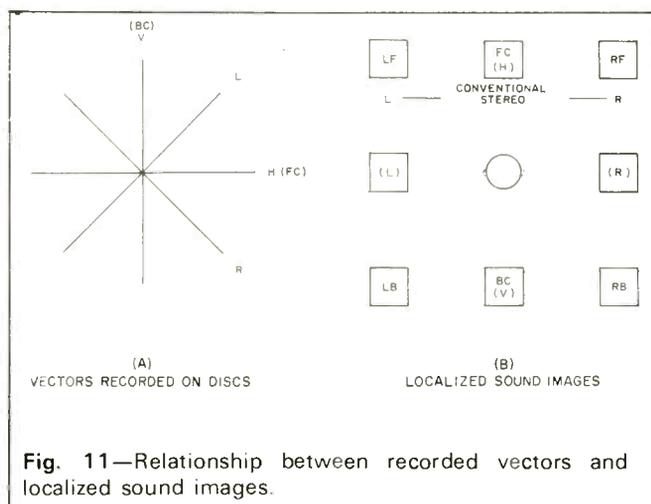
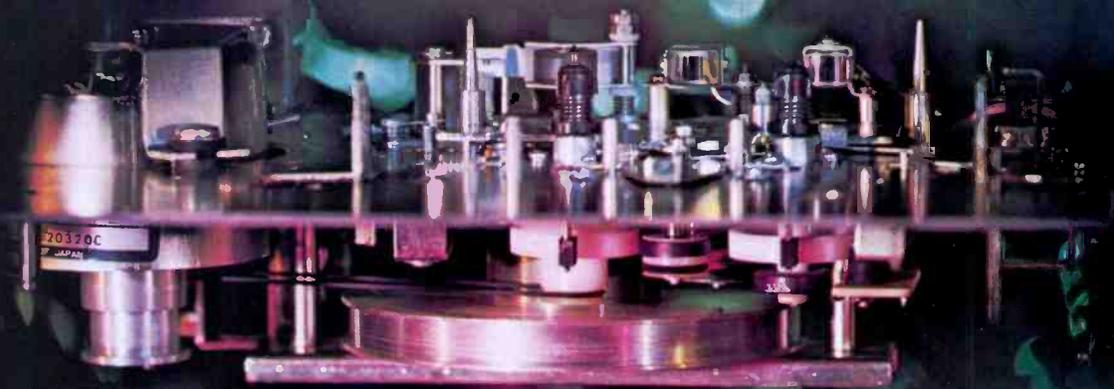


Fig. 11—Relationship between recorded vectors and localized sound images.

**After you come up  
with a totally new  
transport system giving  
wow and flutter of  
less than 0.07%  
and you announce the  
fantastic Teac 450  
cassette deck...**



**what do you do for an encore?**

# THE TEAC 360S

It has all the advanced technology  
and the performance of the 450  
at a lower cost.





PEAK LEVEL

REC



CrO<sub>2</sub>  
HIGH  
NORMAL  
BIAS EQ

MIC  
LINE  
INPUT

OUT  
MPX FILTER

OUT  
RECORD  
CAL TONE

OUT  
DOLBY NR

L R  
RECORD

L R  
OUTPUT

TEAC  
360S  
STEREO  
CASSETTE DECK

ON  
OFF/AUTO



POWER

TEAC  
DOLBY SYSTEM

L MIC R PHONES

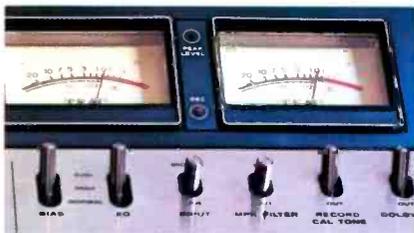
# and the family.

## A word about electronics.

The electronics section of the 360S reflects the same kind of creative attention we've given the 450. There are separate, three-position bias and equalization switches for varying types of tape, mic/line switching, a memory digital counter to reduce your "search"



time, a tape run indicator to let you check the tape flow from across the room, a Light Emitting Diode serving as a peak level indicator supplementing your VU meter during recording, and automatic shut-off when your tape ends. The kind of sophisticated electronics you'd find in a reel-to-reel deck from TEAC.



## And as for Dolby\*..

We're glad you asked. The Dolby Noise Reduction circuitry on the 360S has a multiplex filter (MPX) for recording from an FM stereo broadcast, but which can be switched out, effectively extending the frequency range while taping from records or mic. In addition, the 360S Dolby system is enhanced with eight external Dolby calibration controls to enable you to optimize your cassette deck for a particular type of tape. TEAC overlooks nothing!

### DOLBY NOISE REDUCTION SYSTEM

The Dolby Noise Reduction System virtually eliminates tape hiss generated during the recording and playback process. Dolby "encoding" consists of increasing low level, high frequency signals. This "encoded" signal is then recorded. Tape hiss is inevitably introduced at this point. When a Dolby-processed tape is then played back through Dolby circuitry and "decoded", the boosted high frequency signals are returned to their original levels, and the tape hiss is reduced approximately 10 dB.

# 450

## The Cum Laude.

In describing the 360S we've already told you a lot about the 450, which shares the same transport drive system and the same incredible 0.07% wow and flutter. But there's still a lot to say.

The 450 has mic/line mixing. This feature of reel-to-reel decks now gives new sophistication to a cassette deck. Professional slide controls allow you to mix two line inputs and two mic inputs to create voice and stereo instrumental composites.

The 450 adds new flexibility to Dolby circuitry. On other cassette decks, when you monitor a Dolbyized signal being recorded, the monitor signal is altered by the high-pitched emphasis generic to the Dolby coding process itself. However, in the 450, an exclusive DOLBY FM/COPY switch decodes the signal without disturbing the recording process—letting you monitor with perfect TEAC/Dolby fidelity.

The 450 has an automatic output stabilizing network that maintains Dolbyized levels despite changes in line levels.

The 450 has solid-state triggering devices. Solid-state switching and the elimination of relays further enhance reliability.

The 450 has an automatic timer circuit. You can plug into an external timer and control your entire system when you're not there. The 450 will turn on automatically, come out of pause, record, then shut off any connected component, as well as its own electronics, at the end of the tape.



\*Dolby is a trademark of Dolby Laboratories, Inc.

# AC-9

## Drive Yourself Happy.

Why limit yourself to enjoying your cassettes at home only? It's easy to grab a couple of cassettes whenever you head for the car. Your favorite music can change your whole attitude about driving. And about a lot of things.

The TEAC AC-9 with 12 watts RMS (6 watts per channel) will fill your car and your head with tremendous TEAC stereo sound and make *any* trip more of a trip.

The AC-9 has automatic reverse providing continuous playback—or you can reverse manually at any time. It also features solid state printed IC construction, a servo drive motor, and a shock-proof cassette loading system providing perfect tapehead to tape contact, free of variations due to road shock and vibrations.



As far as music is concerned—you *can* take it with you. So check out the TEAC AC-9 or its more modestly priced traveling companion, the TEAC AC-5.

With TEAC doing so much for studios and homes there's no reason not to have the same quality of sound in your car.

### AC-9 Specifications:

Track: 4 track 2-channel Stereo  
Wow and Flutter: 0.25%  
Frequency Response: 40-10kHz  
Fast Winding Time: Approx. 80 sec/C-60  
Power Output: Total 12W (6w x 2)  
Power Requirements: 12VDC, negative ground 0.5A  
Dimensions (WHD): 7<sup>7</sup>/<sub>8</sub>" 2<sup>5</sup>/<sub>8</sub>" 8<sup>5</sup>/<sub>8</sub>"  
Weight: 6.4 lbs.  
Mounting hardware  
Cleaning kit  
Power leads and speaker cords

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## What does 0.07% WRMS record and playback wow and flutter mean, and how did the 360S get that way?

The 360S got that way because the 450 is that way, and the 360S is really the 450 with a few of the extras (and some of the cost) missing.

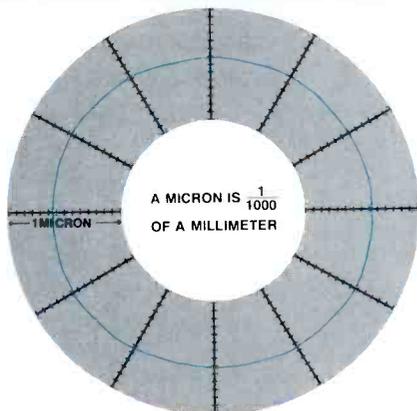
As for WRMS (weighted root mean square) record and playback wow and flutter—it is a measurement of audio noise made on a scope to display unwanted sounds caused by mechanical variations and subtle imperfections in the tape drive elements—in both record and playback functions.

As the result of TEAC's totally new cassette deck transport drive system, the 450 and the 360S measure *less* than 0.07% record and playback WRMS wow and flutter—a measurement achieved by no other cassette deck in the world. This statement, of course, isn't opinion—it's a provable statistical fact. Compare wow and flutter measurements and you'll find that our 0.07% places the TEAC 450 and 360S in a class with the finest professional *reel-to-reel* decks.

To understand the whole story, let's look at the parts.

### Some capstans look round. Ours are round.

The capstan contacts the tape and controls its flow. If the capstan shaft has variations in roundness (even microscopic variations), the tape will flow at irregular or alternating (flat/round) speeds. These variations in tape speed are magnified electronically and perceived as "flutter" or "wow" sound effects.

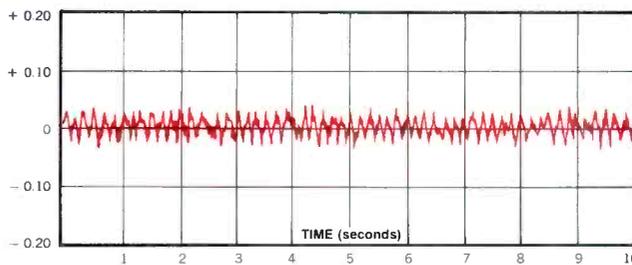


Actual "Roundness" tolerance

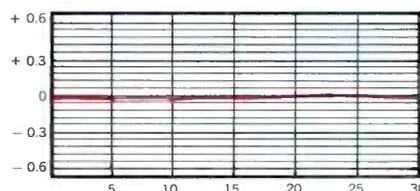
They interfere with and distort the sound of music—particularly the higher frequencies. (You've undoubtedly been bothered by the whine-y and blurbly guitar and piano sounds on most cassette decks.) Well, TEAC's new capstan shaft is machined to a critical tolerance of 0.15 microns. By the way, a micron is 1/1000th of a millimeter.

So that shows you where *our* head is at.

The diagram on this page shows this 0.15 micron tolerance factor enlarged 4000 times, as compared to a normally "round" capstan shaft.



(Actual wow and flutter chart shows WRMS measurement of considerably less than 0.07%.)



(Actual tape speed chart using TEAC test tape with 3 kHz signal is extremely constant over 30 minute time span.)

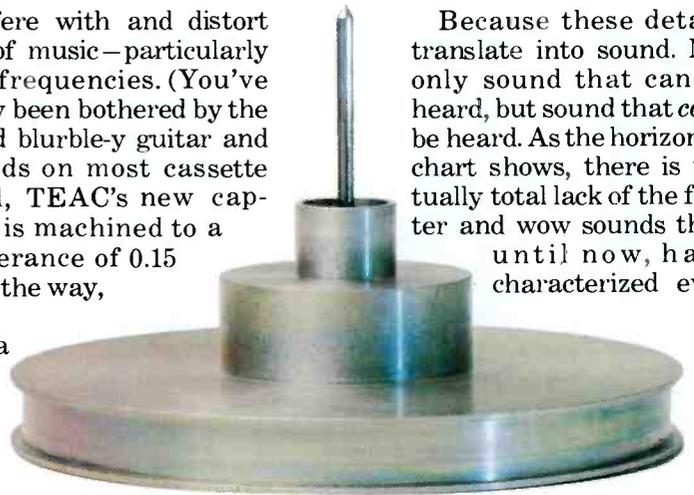
### They said our flywheel would never get off the ground.

Our new transport drive system has an exceptionally large flywheel (93 mm) with twice the mass of any other TEAC flywheel. This unusual weight provides greater inertia and stability, and works in concert with the other transport drive elements to dramatically smoothen the tape flow—thereby dramatically improving the sound.

### What's it all about?

Why this obsession with microscopic tolerances and details of precision that only an engineer's mother could love?

Because these details translate into sound. Not only sound that can be heard, but sound that *can't* be heard. As the horizontal chart shows, there is virtually total lack of the flutter and wow sounds that, until now, have characterized even



the best cassette decks.

The microscopically perfect roundness of our capstan shaft, the heft of our flywheel, the critically machined slipclutch, the

perfectly balanced torque between takeup and feed, the dynamically balanced increased inertia provided by our outer rotor motor (it rotates on the outside of its mag-

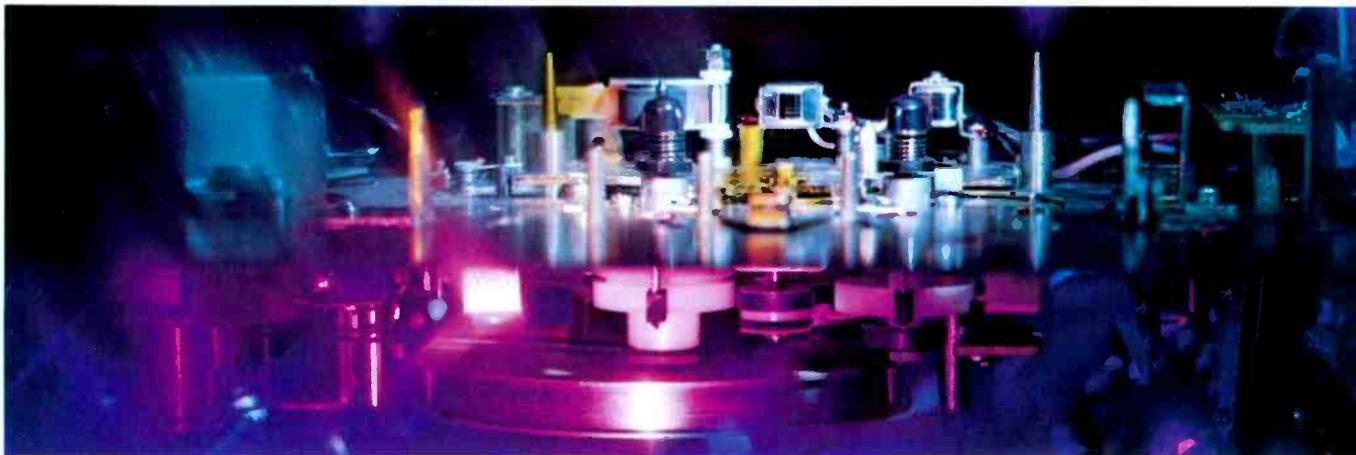
netic field, rather than on the inside as with conventionally designed motors), the eight balanced pressure points by which the cassette itself is held in perfect position, the new unstretchable flat drivebelt—all add up to a total control system for tape flow that is mechanically more perfect than any ever before achieved in a cassette deck.

It all translates into sound. The presence of pure sound. And the absence of unwanted sound.

### What makes TEAC so nutty on perfection?

We don't know. But we've always been that way. We were the first to create a three-motor, three-head transport system for consumer reel-to-reel decks. And we're one of the few—if not the only—to manufacture all of the critical parts such as heads and motors. We have this thing about Leadership. So we keep sharpening, improving every nuance. By now TEAC performance and reliability are legendary.

That's probably why we do it: it's a good feeling.



# 360S

**Specifications:**  
**2 Heads:** Erase and Record/Playback, 4-track 2-channel stereo.  
**Motor:** Hysteresis Synchronous  
**Wow and Flutter:** 0.07% (WRMS) Record and Playback  
**Frequency Response:** 30-16kHz ( $\pm 3$ dB 30-15kHz), CrO<sub>2</sub> Tape, 30-13.5kHz ( $\pm 3$ dB 30-13.5kHz) Hi-Fi Tape, 30-11kHz ( $\pm 3$ dB 30-11kHz) Standard Tape  
**Signal-to-Noise Ratio:** 60 dB (Dolby Process), 50 dB  
**Rewind and Fast-Forward Time:** Approx. 95 sec/C-60  
**Level Indicators:** Two VU Meters, Peak Reading Indicator  
**Input:**  
 2 Microphone 0.25 mV/-72dB (600-10k ohms)  
 2 Line: 0.1V, 50k ohms or more  
**Output:**  
 1 Stereo Headphone Jack 8 ohms  
 2 Line Output 0.3V for load impedance of 10k ohms or more  
**Power Requirements:** 117 V. AC, 60 Hz, 17.5W  
**Dimensions (WHD):** 17 $\frac{3}{4}$ " 4 $\frac{3}{4}$ " 10 $\frac{1}{4}$ "  
**Weight:** 16 $\frac{1}{2}$  lbs.  
 Input-Output Connection Cord  
 Fuse  
 Silicone Cloth  
 Cleaning stick

# 450

**Specifications:**  
**2 Heads:** Erase and Record/Playback, 4-track 2-channel stereo.  
**Motor:** Hysteresis Synchronous  
**Wow and Flutter:** 0.07% (WRMS) Record and Playback  
**Frequency Response:** 30-16kHz ( $\pm 3$ dB 30-15kHz), CrO<sub>2</sub> Tape, 30-13.5kHz ( $\pm 3$ dB 30-13.5kHz) Hi-Fi Tape, 30-11kHz ( $\pm 3$ dB 30-11kHz) Standard Tape  
**Signal-to-Noise Ratio:** 60 dB (Dolby Process), 50 dB  
**Rewind and Fast-Forward Time:** Approx. 95 sec/C-60  
**Level Indicators:** Two VU Meters, Peak Reading Indicator  
**Input:**  
 2 Microphone 0.25 mV/-72dB (600-10k ohms)  
 2 Line: 0.1V, 50k ohms or more  
**Output:** 1 Stereo Headphone Jack 8 ohms  
 2 Line Output 0.3V for load impedance of 10k ohms or more  
**Power Requirements:** 117 V. AC, 60 Hz, 17.5W  
**Dimensions (WHD):** 17 $\frac{1}{2}$ " 6 $\frac{15}{16}$ " 10 $\frac{5}{8}$ "  
**Weight:** 21 lbs.  
 Input-Output Connection Cord  
 Fuse  
 Silicone Cloth  
 Cleaning stick  
 Plastic cover

## ...and the rest of the family.

Quality TEAC cassette decks with fewer semi-professional features and therefore priced somewhat lower. Cassette decks for every system.

# 250S

# 160

# 140



# TEAC

The leader. Always has been.

TEAC Corporation of America  
 Headquarters:  
 Dept. A-20, 7733 Telegraph Road, Montebello,  
 California 90640  
 TEAC offices in principal cities  
 in the United States, Canada, Europe,  
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the listener is at the rear center, and two positions always exist that are equidistant from the two reference points FC and BC. These represent positions straight to the sides, L and R. This observation embodies perfect symmetry without any duplication.

In other words, when considering the original sound field as a finite field confined within a concert hall, the center of the front left and right is the front center, and lines extended therefrom in the rear direction along the hall walls in equal

distances invariably meet in the rear center. In applying this situation to conventional stereo, a sound source moving from the front center to the rear center reverts to the front in reproduction, though becoming non-localized due to the phase relationship that gets reversed in the process. Nonetheless, sounds emanate from the front left and right speakers, which must be termed a self contradiction.

To eliminate the contradiction, symbols in Figs. 11 (A) and (B) may be shifted, preserving symmetry and balance, to positions denoted by corresponding symbols in ( ). Reproduction in two channels in this format would place the L and R speakers to the sides of the listener, and thus could not fulfill the original objective of front localization.

Despite the above contradiction, no serious inconveniences have thus far been experienced, but it is due to overemphasis placed in recording on front localization and no effort made to record side or rear localization. Besides, in actual practice, vectors recorded in stereo discs are concentrated heavily toward the horizontal axis, or the front center, rather than along the L and R axes.

Advances in recording technique, however, have tended toward recording applause and reverberations in opposite phase in order to express a live hall. This practice inadvertently managed to fulfill partially the foregoing symmetry of sound fields. It goes to prove that the 2-2-4 effect has not been purely accidental as has been generally believed.

The foregoing situation leads to the necessity of reviewing interrelations among microphone setting and mixing, disc cutting, and localization of sound images reproduced from stereo discs which are to be localized in front of the listener.

Fig. 12 (A) shows the case of a multi-microphone recording, and Fig. 12 (B) that of a two-microphone recording. As shown, there appears to be a difference in their localization patterns. In (A) sound localization is ideally recorded and cut into the disc, but when one considers the numerous musical instruments that are recorded, there is a limit to the expression of localization by only two speakers. In (B), on the other hand, recording and disc cutting reflect some ambiguity of localization caused by phase differences in sounds reaching the two microphones, but even with only two speakers, the phase differences contribute to a partial simulation of grandeur of a large concert hall.

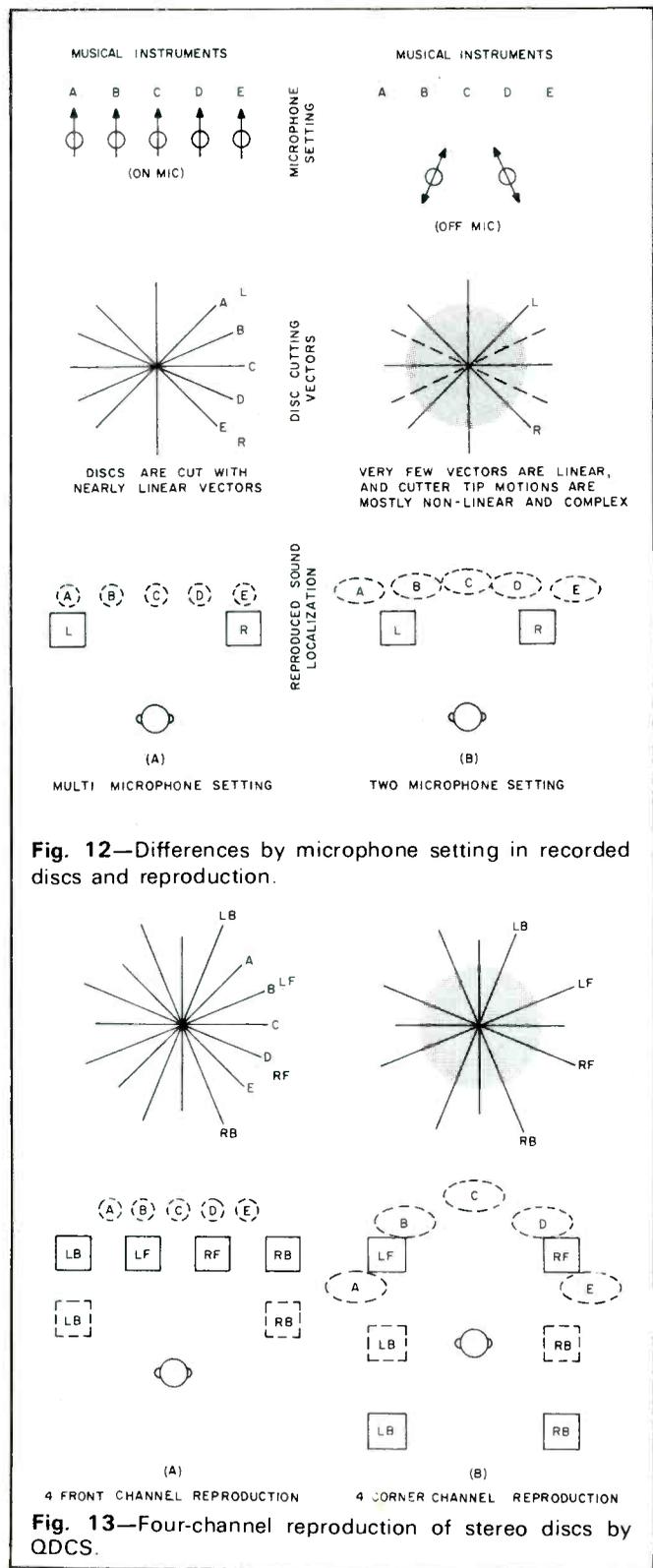
Contemporary mixing is believed to have developed its phase controlling technique as a result of experiences in the foregoing two extreme cases. Our philosophy of symmetry and balance exemplified in QDCS shows, as explained below, that such experience-based approaches have progressed along the correct avenue.

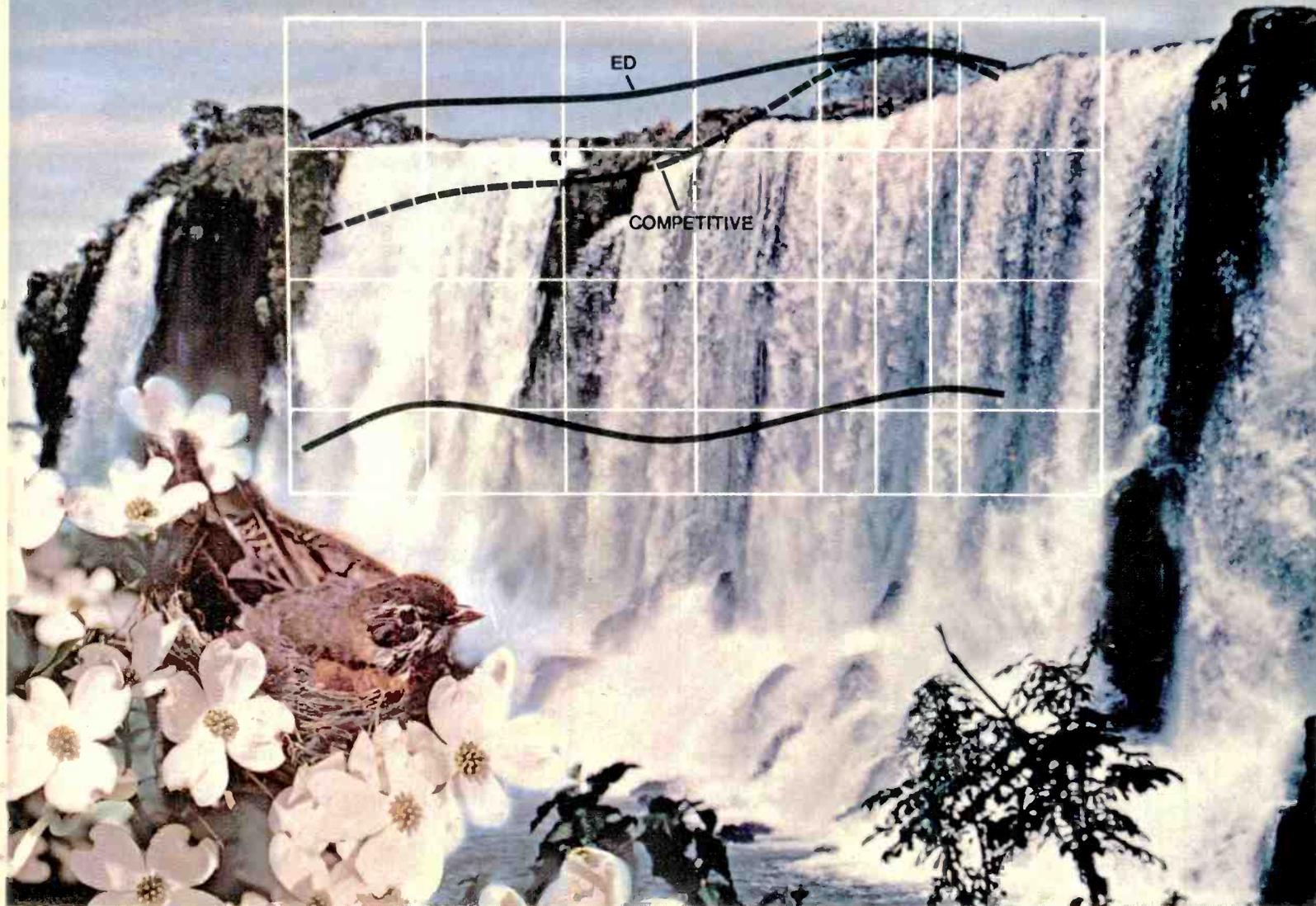
Firstly, four-direction detection and reproduction of signals recorded per Fig. 12 (A) make possible a more clear-cut localization, by virtue of the increased number of front speakers, as shown in Fig. 13 (A).

Secondly, signals recorded per Fig. 12 (B) involve complicated phase relationships and cause cutter tip motions that cannot be expressed by linear vectors. As a result, vectors outside the L and R in-phase axes are cut on the disc, so that reproduction by a four-direction detection provides a sound field effect more satisfactory, as it is enhanced by the added rear speakers.

It should also be mentioned that even in multi-microphone recordings in studios, phase shifting and addition of echoes take place in practice, and that these artificial additives should basically provide compatible recordings to natural sound field recordings. Correlation of Fig. 11 (A) and (B), thus, falls in line with natural laws of physics.

However, deliberate recordings of rear localization still fall short of clearly distinguishing between the front and rear, as long as conventional two-channel cartridges are used, such as in matrix reproduction, as these are incapable of the





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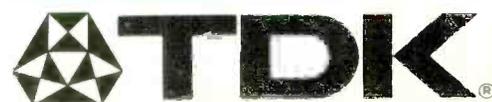
#### \*The Importance of Dynamic Range.

Dynamic range, represented graphically in the chart above, is the difference between a tape's sensitivity and its noise characteristics, over its full frequency response range. The broader a tape's dynamic range, the greater is its ability to record and reproduce wide variations in signal strengths at different frequencies. In other words, a tape with broad dynamic range can record very loud sounds without distortion, and very soft, delicate sounds without audible hiss, over the full frequency response range. Tests prove that TDK's ED cassettes have a much broader dynamic range than competitive so-called "hi-fi" cassettes.

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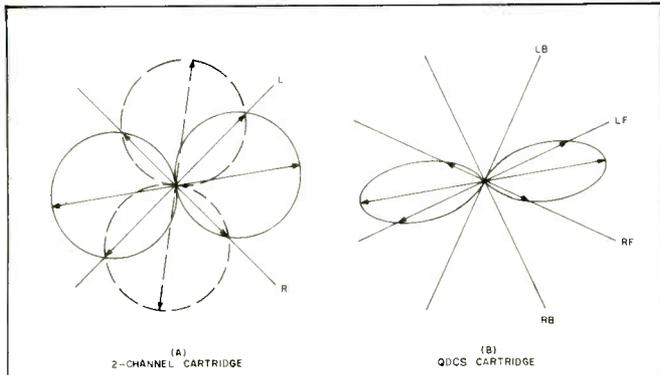


Fig. 14—Comparison of detected vectors by 2-channel vs. QDCS cartridges.

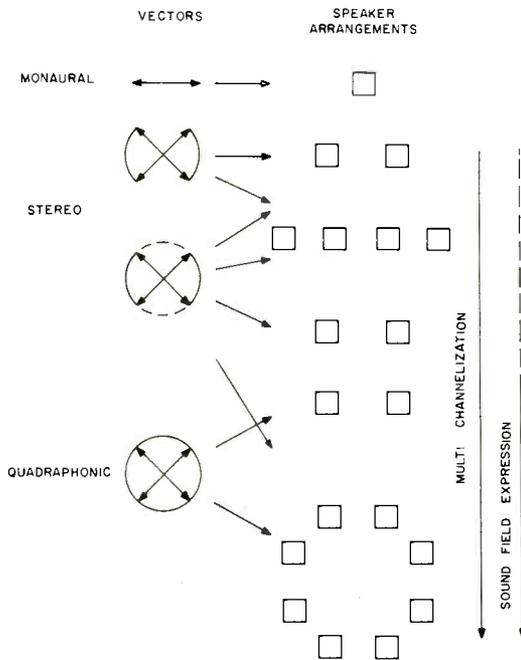


Fig. 15—Optimum speaker arrangements vs. historical flow of disc cutting techniques.

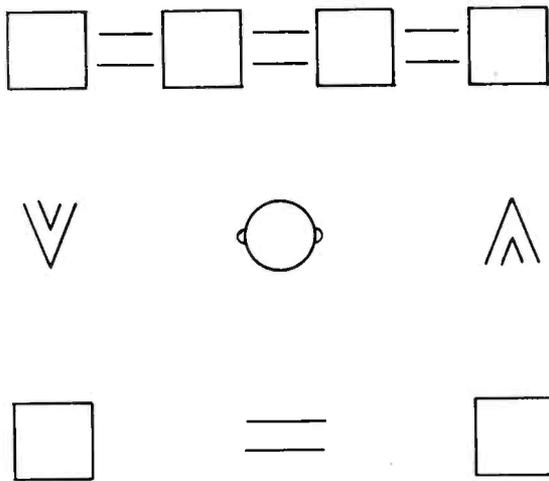


Fig. 16—Six-channel reproduction of stereo discs and phase relations.

distinction by means of the most important factor for localization, i.e. magnitude ratios of vector projections. This problem is overcome, as shown in Fig. 14 (B), by QDCS which detects one and only one ratio of vector projections for any one of the sound sources. No ambiguity of localization, therefore, ever takes place.

Thus analyzed, it follows that the natural approach to fulfill the law of balance and symmetry invariably contributes to more desirable advancements. Only, with discs, as long as conventional two-channel cartridges are used, the approach is not truly effective as their detection axes fail to follow the correct detection directions, even though signals are recorded on discs in perfect balance and symmetry. This is the background for the effectiveness of our four-direction detection.

As a result, QDCS eliminates all contradictions relative to localization, for all disc records, be they monaural, stereo, or quadraphonic, and systems and discs under QDCS possess complete compatibility, so that only one type of discs suffice to satisfy needs of all types of recording and reproduction.

Illustrated in Fig. 15 are interrelations among the foregoing classifications to facilitate understanding of the fact that all disc recordings are based on the same principle.

### Characteristics of QDCS Cartridges

QDCS cartridges developed in disregard for compatibility as component parts have features useful in certain specialized applications, in addition to the four-channel capabilities for which they were specifically designed. These features are unrealizable by conventional cartridges and may be summarized as follows:

#### (1) Monaural Playback of Quadraphonic Discs

By arranging for:

$$M = LF + RF - 90^\circ LB + 90^\circ RB \quad (1)$$

rear channels can be reproduced in phase with each other, eliminating any rear center losses, and therefore suitable for monaural broadcasting.

#### (2) Stereo Reproduction of Quadraphonic Discs

By arranging for:

$$L = LF - 90^\circ LB \quad (2)$$

$$R = RF + 90^\circ RB$$

rear channels being in phase, no rear center losses take place even when monaurally receiving stereo broadcasts.

By (1) and (2) above, it is possible to avoid suppression of rear center sounds, necessitated in current matrixed discs for the sake of good monaural playback, as long as QDCS cartridges are used.

#### (3) Multichannel Reproduction of Stereo Discs

As shown in Fig. 13 (A), by placing four speakers in front and driving them in phase, localization of all sound sources can be correctly reproduced without duplication. Such a reproduction provides a more faithful and clear cut localization of sound images than is possible with the current two-channel system, and also a substantially broadened service area. Furthermore, as shown in Fig. 16, by addition to the foregoing four front speakers of two rear channels outputting phaseshifted  $-90^\circ LB$  and  $+90^\circ RB$  at adequate levels, a highly satisfactory ambience effect can be achieved.

#### (4) Multichannelization

By combining signals from adjacent channels of the four detection channels, and by placing a speaker at a spatial location appropriate for the combined signal, indirect reproduction of channels existing in between becomes possible. Thus facilitated will be further multichannelization by the use of playback matrices.

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## Reproduction Sound Fields by QDCS

Figures 17 (A), (B) and (C) show relationships between disc cutting vectors and reproduced sound localization when reproducing in eight channels. Signs in between channels denote phase relations between main signals (not necessarily overriding signals but those that should be correctly localized) and adjacent channel crosstalk, and those in between every other channel similar phase relations when reproducing in four channels. The complete symmetry of main and crosstalk signals is another manifestation of the inherent superiority of the QDCS system.

Also shown in Fig. 16. are the phase relations when the stereo disc of Fig. 12 (B) is reproduced in six channels. Reproduction such as this has not come about accidentally, but are realization of hitherto unrecognized basic properties of the disc record. Thus interpreted, it should be readily appreciated that QDCS has proven to be a rationalized and sophisticated form of the current stereo system.

Just as the 45/45 stereo system has been developed into a direct discrete system, so can this QDCS system be developed into a further stepped-up direct discrete system.

(To be continued)

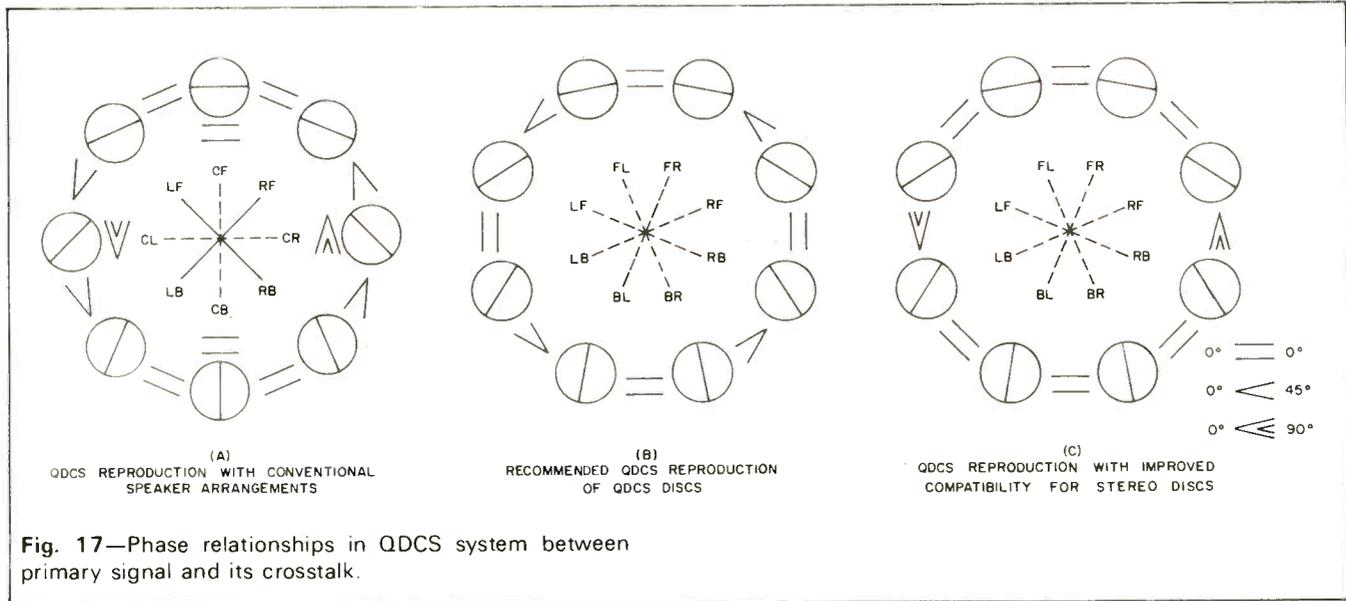
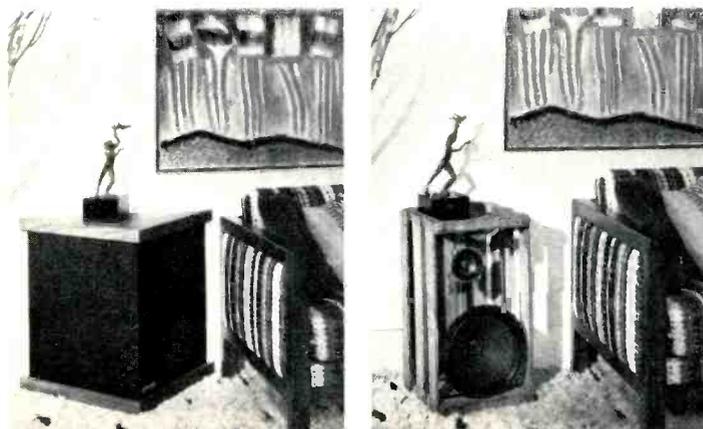


Fig. 17—Phase relationships in QDCS system between primary signal and its crosstalk.



# Tri-Planer Speaker Systems\*

## The alternative to the "Orange Crate"



Standards infrequently change and if they do, the change is set apart as the new standard. Only rarely does something come along that is daringly different enough to set it apart from the norm. INNERMEDIA now offers the discerning audiophile an alternative to the "box". The new tri-planer systems provide a full-dimensional listening experience never before thought possible.

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Borrowing from solid state technology, the audio world has been broadened by the introduction of the new piezoelectric tweeter.

Basically, as an alternating voltage is applied to a piezoceramic disc, it bends with the polarity, driving a compression loaded cone. This speaker requires no crossover as power is not dissipated at low frequencies.

Moreover, as there is no need for a voice coil or magnet structure, a high audio output is possible from low power input.

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# When two loudspeakers sound different, at least one of them is wrong. Maybe both.



**Unpleasantly Distorted Reproduction**

Which is better: the Rectilinear III, at \$299, or a comparably priced but totally different-sounding speaker by another reputable manufacturer?

The ready answer to that question by a nice, clean-living salesman or boy-scout hi-fi expert is: "It's a matter of taste. Whichever you prefer for your own listening. They're both good."

*We want you to know how irresponsible and misleading such bland advice is.*

Think about it:

A loudspeaker is a reproducer. The most important part of that word is the prefix *re*, meaning *again*. A loudspeaker produces again something that has already been produced once. Not something new and different.

Therefore, what it correctly reproduces should be identical to the original production. And *identicalness* isn't a matter of taste.

For example, it isn't a matter of taste whether the body shop has correctly reproduced the original color of your car on that repainted fender. Nor is it a matter of taste whether your mirror correctly reproduces your visual image. Is the reproduction identical to the original or isn't it?

Okay. We know. The ear is less precise than the eye. And in the case of loudspeakers, it's usually impossible to compare the reproduction and the live original side by side. Furthermore, the speaker is only a single link in a whole chain of reproducers. But these



**Seductively Distorted Reproduction**

problems only complicate the matter without changing the basic principle. *The reproduction is either right or wrong. Two different-sounding reproductions can't both be identical to the original.*

The common fallacy is to call the reproduction wrong only when it's obviously unpleasant (fuzzy or shrieking highs, hollow midrange, etc.). But what about a pleasingly plump bass, lots of sheen on the high end, and that punchy or zippy overall quality known as "presence"? Equally wrong. And, because of the seductive "hi-fi" appeal, much more treacherous.

To glamorize the original that way amounts to having a built-in and permanently set tone control in your speaker. For some program material it can be disastrously unsuitable. Like the funhouse mirror that makes everybody look tall and thin, it's great for short and fat inputs only.

At Rectilinear, we design speakers to approach facsimile reproduction of the input as closely as is technologically possible. We restrict the "taste" factor



**The Truth: Undistorted Reproduction**

to twiddling the tone controls of our amplifier in the privacy of our home. Not in our laboratory.

The Rectilinear III is our best effort to date in this direction.

And our inspiration for it was a totally different and rather impractical design: the full-range electrostatic speaker.

Any serious audio engineer will tell you that electrostatics are inherently superior

to conventional speakers in producing an output that's identical to the input. This superiority is due to scientifically verifiable characteristics, such as flatness of frequency response and low time delay distortion.

The trouble is that electrostatics create tremendous problems with amplifiers, have difficulty playing *really* loud without distortion and are also somewhat deficient in bass. But—they're accurate, undistorted "mirrors" of sound.

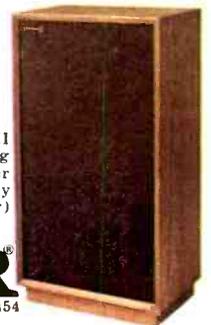
The Rectilinear III is the first successful attempt to give you this electrostatic type of sound in a conventional speaker without any of the above problems.

It allows you to hear what composers, musicians and record producers have created for you and not what some speaker manufacturer thinks will please you.

So, next time you're in a store and you hear another \$299 speaker that sounds different from ours, you'll have an idea which of the two is wrong.

And which is the one to buy.

Rectilinear III  
floor-standing  
speaker  
(6 drivers, 3-way  
crossover)



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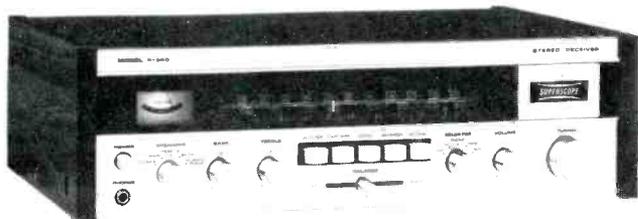
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# Equipment Profiles

## Superscope R-350 AM/FM Stereo Receiver



### MANUFACTURER'S SPECIFICATIONS

**TUNER SECTION:** IHF Sensitivity:  $2.8 \mu\text{V}$ . ( $50 \mu\text{V}$  for 55 dB quieting). THD, Mono: Less than 0.6%; Stereo: Less than 1.5%. **Capture Ratio:** 3.0 dB. **Selectivity:** Greater than 40 dB. **IF Rejection:** 75 dB. **Image Rejection:** Better than 45 dB. **Spurious Rejection:** 84 dB. **AM Suppression:** Better than 35 dB. **AM IHF Sensitivity:** Better than  $40 \mu\text{V}$ . **FM Frequency Response:** 20 Hz to 15 kHz  $\pm 1.5$  dB. **Stereo FM Separation:** 35 dB @ 1 kHz.

**AMPLIFIER SECTION:** **Power Output:** 25 watts/channel continuous, both channels driven, 8 ohm loads. THD: Less than 1.0% @ 1 kHz. **Power Bandwidth:** 15 Hz to 40 kHz. **Frequency Response:** 20 Hz to 20 kHz  $\pm 1$  dB. **Phono Response:** RIAA  $\pm 1$  dB. **Noise:** AUX, -70 dB. **Phono Noise:**  $4 \mu\text{V}$  (56 dB below 2.5 mV). **Input Sensitivity:** Phono, 2.5 mV; High Level, 160 mV. **Loudness Control:** +8 dB @ 100 Hz, +3 dB @ 10 kHz. **Bass Control:**  $\pm 10$  dB @ 100 Hz. **Treble Control:**  $\pm 10$  dB @ 10 kHz.

**GENERAL SPECIFICATIONS:** **Dimensions:**  $16\frac{3}{8}$  in. W. x 5 in. H. x  $12\frac{5}{8}$  in. D. **Weight:** 20.25 pounds. **Price:** \$279.95.

From the people who bring you Sony tape recorder products and Marantz components comes a new line, bearing their corporate name, Superscope. The top-of-the line Model R-350 stereo receiver sells for a bit less than the Marantz 2220, one of the low-end models in that better known line, and therein lies the apparent objective in the introduction of this new brand—the design and production of components devoid of some lesser frills but offering excellent value for their price. The new line is designed in the U.S. and produced in Japan, as are most of the Marantz products, for that matter.

The new line bears little resemblance, physically, to the products of its corporate cousin, but has a distinctive look of its own, as can be seen in the photo of the complete receiver shown above. A light gold anodized front panel of extruded aluminum is surrounded by an included stain-resistant walnut-grain cabinet. The normally blacked-out

dial area lights up in a bright magenta color when power is applied. Startling, at first, this bright color is certainly more visible at a distance than the more subdued shades of color used on many competitive products. The dial pointer is separately illuminated in red when AM or FM reception is selected, and illuminated words denote AM or FM reception. A similarly illuminated large signal-strength meter at the left of the dial area is operative in both AM and FM tuning. Below the dial area are the operating controls which include a separate power push-push switch, a speaker selector switch (including positions for PHONES, MAIN, REMOTE, BOTH and QUADPHASE, about which more later), bass and treble controls, program source selector switch, volume, tuning knob, and a horizontally mounted slide-type balance control. Five centrally located pushbuttons perform such secondary functions as high-filter introduction, tape monitoring, mono/stereo switching, loudness circuit and FM muting. The large tuning knob is coupled to a smooth-acting flywheel arrangement. A phone jack at the lower left of the panel completes the front panel layout.

The rear panel, shown in Fig. 1, includes refinements not normally encountered in a receiver selling for so low a price. There are, for example, push-type speaker binding posts which retain the stripped ends of speaker cables in place by spring action after they are inserted, preventing shorts and eliminating the use of any tools. Besides the usual antenna terminals (300 ohms for FM), phono, tape and aux input and tape monitor jack pairs there is a 4-channel FM detector output jack for possible future use with a discrete FM four-channel adaptor if and when the FCC approves a system for such broadcasts. A ground terminal, switched and unswitched convenience a.c. receptacles, a line fuse and the usual pivotable AM ferrite antenna complete the rear panel layout.

As can be seen in the photo of Fig. 2, the entire tuner section, including the stereo multiplex decoder circuit, is constructed on a single large p.c. board which is solidly mounted to the metal chassis. Power amplifier circuitry is mounted on a vertically positioned p.c. board which is

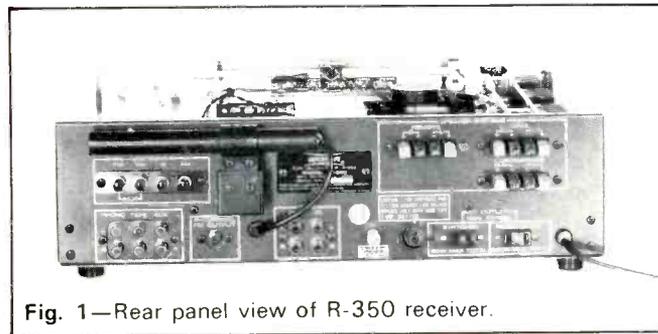


Fig. 1—Rear panel view of R-350 receiver.

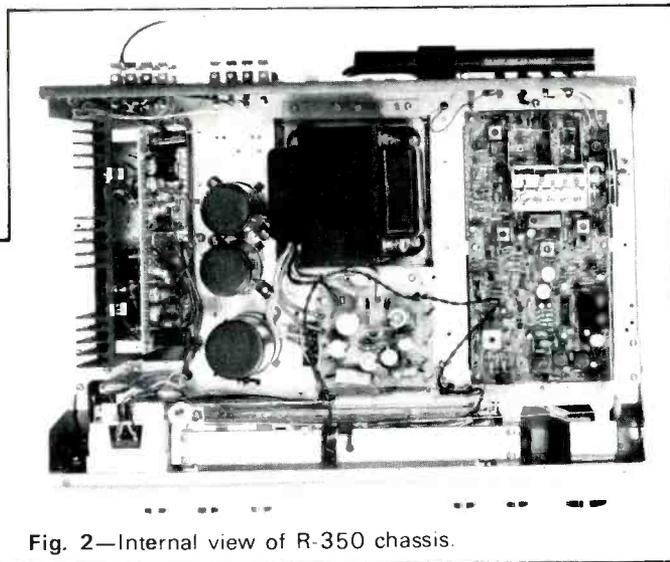


Fig. 2—Internal view of R-350 chassis.

mechanically fastened to a fairly large heat sink containing the four type 2SC14450 power output transistors. Other separate p.c. modules include those for preamplifier, tone and voltage amplifiers, power supply components, pushbutton switching circuitry and dial lamps. An FET is used as the r.f. amplifier in the FM front end, which incorporates a three-gang tuning capacitor. Bipolar transistors are used for the rest of the circuitry, with the exception of the stereo multiplex decoder section which employs a 16-pin integrated circuit. Power amplifiers are capacitively coupled to the speakers (2200  $\mu$ F) in a conventional transformerless output arrangement powered at just under 54 volts on the upper collectors of each pair of NPN output devices. In all, there are 39 transistors, 24 diodes, 2 IC's and 1 FET in this receiver. A 4700  $\mu$ F capacitor is used as the main filter in the high-voltage power supply.

### Laboratory Measurements

Our measurements of the tuner section of the R-350 reflect some of the new measurement requirements proposed in the first draft of the new IHF Tuner Measurement Standards now under consideration by the Institute of High

Fidelity. Referring to Fig. 3, the measured IHF sensitivity was 2.6  $\mu$ V as against 2.8  $\mu$ V claimed by the manufacturer. The 50 dB quieting signal strength measured was 4.3  $\mu$ V while 55 dB of quieting was achieved at just over 10  $\mu$ V of input signal, considerably better than the 50  $\mu$ V listed by the manufacturer. THD at the 50 dB quieting point was already down to a low 1.5%, while ultimate THD at 1000  $\mu$ V measured 0.4%. Note, however, that the mono THD characteristic shown in Fig. 3 is a bit unusual in that for signal strengths from around 10  $\mu$ V to 100  $\mu$ V, THD is actually lower than it is for stronger input signals of around 1000  $\mu$ V.

Note that in stereo, THD reaches a low of 0.8% at 1000  $\mu$ V of signal input. This characteristic is plotted only down to 30  $\mu$ V, because that is the signal level at which the circuit automatically switches over to stereo operation. In our opinion, this threshold is set too high and, under typical listening conditions, may result in monophonic reception of signals broadcast in stereo that would be perfectly acceptable and sufficiently noise free in stereo mode. Muting level, too, was set too high by the manufacturer at 40  $\mu$ V or so and anyone interested in receiving the maximum number of acceptable station signals would do well not to use this feature, or at least to defeat it when seeking distant signals.

Ultimate S/N measured 71 dB, a very respectable figure indeed. This cannot be compared with manufacturer's claims, since that specification is omitted by the manufacturer. Capture ratio measured exactly 3 dB at 100  $\mu$ V, and 3.5 dB at 1000  $\mu$ V, conforming well to Superscope's claims. Image rejection was 55 dB while AM suppression was a bit better than claimed, measuring 40 dB. Spurious rejection fell a bit short of claims, at 80 dB, while i.f. rejection measured exactly 75 dB, as claimed.

Figure 4 depicts stereo separation and mono and stereo distortion versus frequency for the R-350. We were, frankly, amazed at the ability of this particular IC circuit to maintain excellent separation over the entire audio spectrum. While mid-band separation measured 34 dB, a bit short of the 35 dB claimed, of far greater importance is the fact that separation in excess of 30 dB is maintained all the way from 50 Hz to 15 kHz—a very rare accomplishment in stereo tuner sections! The three key separation figures for 100 Hz, 1 kHz and 10 kHz were 34 dB, 34 dB and 33 dB respectively. Distortion in mono measured 0.55%, 0.4% and 0.6% at 100 Hz, 1 kHz and 7.5 kHz respectively, while in stereo the key frequencies of 100 Hz, 1 kHz and 5 kHz resulted in distortion figures of 0.85%, 0.8% and 0.8% respectively, with no significant evidence of "beats" at the higher frequencies measured.

### Amplifier Measurements

Amplifier performance of the R-350 is somewhat conservatively stated by the manufacturer, too. Rated THD of 1.0% was attained with 30 watts per channel output, as shown in Fig. 5. At rated output of 25 watts per channel, THD measured a mere 0.1% while IM measured 0.2%. Rated IM was not reached until each amplifier channel was putting out 28 watts. While THD tended to rise slightly at low listening levels, it remained well below the low-power claim of 0.5% even down to 0.1 watts output per channel. The amplifier section is not quite capable of 25 watts per channel output at the low frequency 20 Hz test point, as shown in Fig. 6, but of course no claims for such performance are made by the manufacturer who quotes only mid-frequency performance in accordance with IHF current standards. At half-power, however, distortion remains well below 0.5% for all audio frequencies. Power bandwidth, as shown in Fig. 7, extends from 15 Hz all the way to 48 kHz as against the 40 kHz claimed by the manufacturer, and measurements of

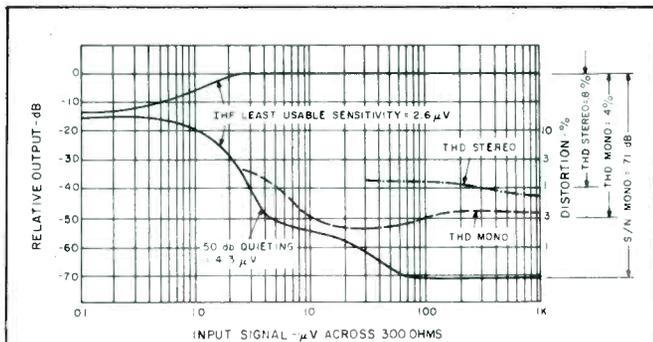


Fig. 3—Quieting and mid-band THD characteristics.

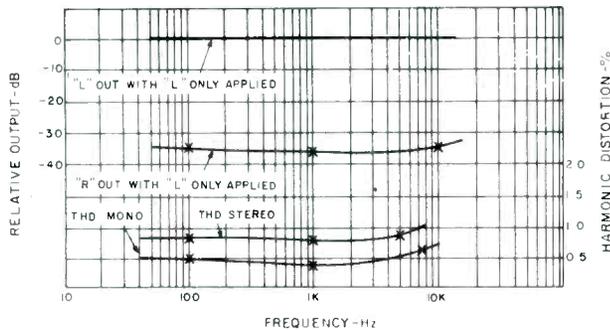


Fig. 4—Separation and distortion vs. frequency.

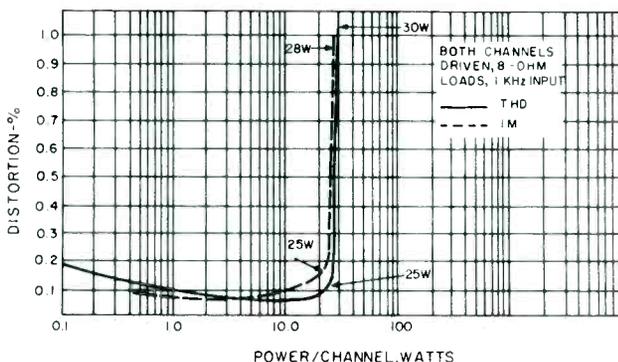


Fig. 5—Mid-band power output vs. distortion.

this characteristic were based upon Superscope's nominal 25 watt rating and a THD of 1.0%.

### Quadraphase Speaker Connections

The R-350 is equipped with an extra pair of speaker connection terminals on the rear panel which they call Quadraphase. An extra pair of speakers connected to these terminals and placed at the rear of the listening room will provide the listener with a quasi four-channel effect not unlike that obtained with the familiar Dynaquad circuit promoted by Dynaco during the early flurry of four-channel activity which preceded more conventional four-channel technology as we know it today. It is to Superscope's credit that at no point in their instruction manual or in their advertising material do they imply that this arrangement provides "real" four-channel reproduction. In fact, they are careful to state clearly that "The Quadraphase position on the selector switch simulates four-channel sound from regular stereo sources when two additional speakers are connected to the rear panel Quadraphase outputs." If you own two extra speakers and hook them up in this way, you may get a "poor man's introduction to quadraphonic sound" and we cannot fault Superscope for this feature, particularly since it does not add materially to the cost of the set. Since the R-350 is equipped with a proper set of tape monitor input and output jacks, there is nothing to prevent you from adding a four-channel decoder (or a CD-4 demodulator) and an extra back-channel amplifier at a later date if you want to convert the R-350 to true quadraphonic capability and that is all to the good.

Figure 8 shows the tone control, filter and loudness control characteristics of the R-350 and the various responses conform nicely with accepted practice for these controls. Bass and treble controls affect both left and right channels at the turn of a single knob in each case.

Phono hum was acceptably low at -62 dB with respect to a 2.5 mV input signal at 1 kHz required to produce full power output. High level input requirements were 160 mV and, with this reference signal, residual hum and noise was 70 dB as claimed. At minimum volume setting, residual hum and noise measured -80 dB. Volume control tracking for both channels was accurate within 1 dB all the way down to -60 dB from full volume setting. Phono overload occurred at an input of about 80 mV which, in theory, would yield a dynamic range of about 88 dB were it not for the lower noise limitations imposed by the phono preamplifier characteristics.

### Listening Tests

We put the R-350 through its paces in both the FM and Phono modes and found the performance generally as good as that of receivers selling for as much as \$100.00 higher. As mentioned earlier, the high muting threshold interfered with our ability to "log" the usual high number of FM signals when that feature was employed. Specifically, using an outdoor directional antenna, we logged 45 usable signals with the muting feature not activated. This dropped to 30 signals when muting was employed. Stereo was received from 20 signals, though we know that another 8 or so were, in fact, transmitting stereo programming at the time of our tests. This discrepancy results from the high stereo threshold set for this model. While only a single peak-reading meter is employed, it is accurately calibrated and helps to tune to center of channel—though not as effectively as a center-channel meter might do. Record reproduction was crisp and noise-free at our preferred listening levels (about 90 dB), and we used both high-efficiency and moderately low-efficiency air suspension systems in our tests. With two

pairs of low efficiency systems connected and used simultaneously (not for "quadraphase," but for multi-room installations), there were still adequate sound levels achieved with barely audible distortion on really loud peaks. If higher efficiency speakers had been used in this arrangement, there would have been power to spare.

### Summary

The Superscope R-350 is a reasonably priced stereo receiver that meets just about all its claims and should rank high in the list of "under \$300" receivers that constitute such an important place in the audio component market. It is easy to use and, though it lacks perhaps the last measure of circuit sophistication, design, construction and performance are all honest. The three-year warranty offered by Superscope for this and its other new products should not be overlooked either. This warranty applies to all parts used in the receiver.

*Leonard Feldman*

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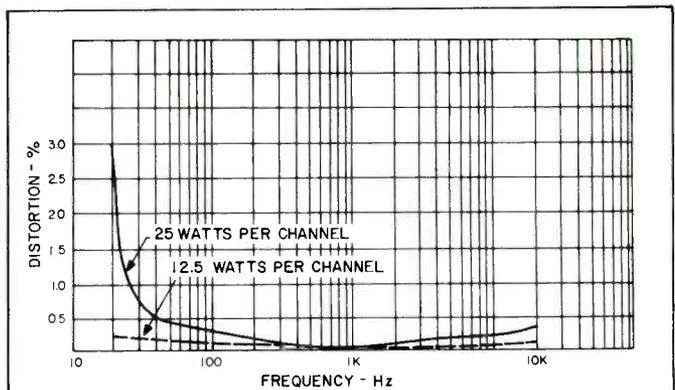


Fig. 6—Distortion vs. frequency.

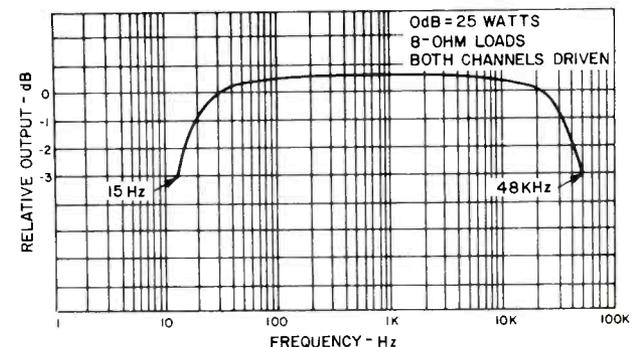


Fig. 7—Power bandwidth.

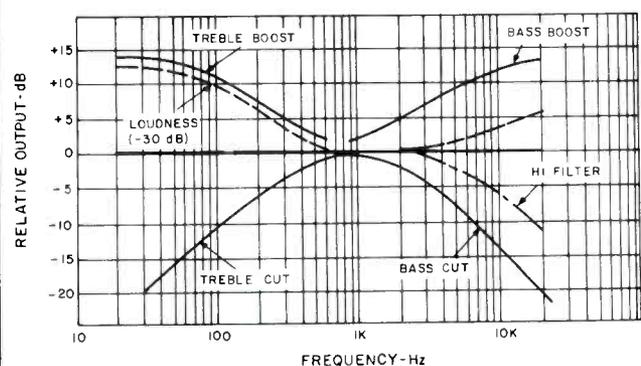


Fig. 8—Tone control, loudness and filter range.

## BSR 710/X Total Turntable



### MANUFACTURER'S SPECIFICATIONS

**Speeds:** 33 and 45 rpm. **Wow and Flutter:** Less than 0.1% DIN. **Rumble:** Less than 55 dB DIN. **Minimum Tracking Force:** 1/2 gram. **Record Stack:** 6 records. **Record Sizes:** 12-, 10-, or 7-in. **Dimensions:** 17<sup>1</sup>/<sub>8</sub> in. W x 14<sup>9</sup>/<sub>16</sub> in. D x 8<sup>3</sup>/<sub>4</sub> in. H with base and dust cover. **Price:** \$150.00 (incl. cartridge).

The 710/X might be considered an economy version of the top-of-the-line model 810 which we reviewed in June, 1972. The main differences are a lighter platter—4 pounds against 7, and ball-bearing pivots for the tonearm instead of gimbals. Appearance is almost identical with the same black motor board and contrasting satin-finish panel and pushbutton controls. Three of these adjust the arm for 7-, 10-, or 12-inch records and the other three are labelled STOP, SINGLE-AUTO and MANUAL. Behind them is the viscous-damped cue lever and next to it is a knob which adjusts the set-down position of the arm from a minimum of 5<sup>1</sup>/<sub>2</sub> inches from the record center to a maximum of six inches. Near the arm mounting is another knob—the anti-skating control which has scales for conical and elliptical styli. Tracking force is set by a control on the arm mounting and the dial is calibrated in steps of one gram up to four grams.

The speed control is at the front, to the extreme left, and it consists of a rocker-type lever centered in a vernier adjustment ring. Like the 810, the 710/X employs what BSR calls "a sequential cam system" which consists of eight pre-programmed cams located on a shaft running parallel with the chassis. The motor is also similar—a four-pole synchronous type that can be used on 120 or 240 volts by a simple wiring change. An additional motor pulley is supplied for 50 Hz line frequencies—thus the 710/X can be used in most parts of the world without too much trouble. Also supplied is a short

spindle (called a stub) which replaces the long automatic spindle for manual operation. In this mode, the arm is positioned by hand but the motor stops automatically when the record has been played. If the selector switch is set to AUTO instead of MANUAL, the record will repeat—until you get tired of it and push the STOP button. Accessories supplied with the 710/X include a strobe disc, stylus brush, stylus overhang locating gauge and adaptor bracket, manual 45 rpm adaptor, and slide-in cartridge carrier.

Our model came complete with a Shure M91E cartridge which we replaced with an ADC-XLM for some of the tests.

### Measurements

Wow and flutter measured a low 0.06% and 0.08% respectively. Rumble measured -35 dB (unweighted) corresponding to an ARLL (audible rumble loudness level) of about -59 dB. The vernier speed control gave a total variation of five percent. The cueing lever was nice and smooth in operation but tended to be a little slow if used at the maximum position. Calibration of the tracking force dial was very accurate and tracking error itself was under 0.5 degrees per inch over the whole record. There was no speed variation with change in line voltage from 85 to 135 volts. Cycling time measured 17 seconds from a standing start and 12 seconds from trip to set down in the automatic mode—a little slow, we thought.

The 710/X was very easy to set up and even the absolute beginner will have no difficulty in understanding the well-written instruction manual. Using the M91E, we found the optimum tracking to be just under 1<sup>1</sup>/<sub>4</sub> grams with the anti-skating dial set for two grams. No trouble was experienced from acoustic feedback (the suspension coils are foam damped and placed on rubber shock mounts). Changing cartridges is simple—the slide adaptor is lined up with an alignment post mounted on the motor board. When this is done and the cartridge fixed, a stylus cleaning brush is mounted on the post. The anti-skating adjustment is not at all critical and tracking force should be set for about 1<sup>1</sup>/<sub>4</sub> to 1<sup>1</sup>/<sub>2</sub> grams for cartridges like the M91E.

How does the 710/X compare with the 810? Well, rumble, wow and flutter figures were not significantly inferior and the only real difference concerns the extra friction of the arm mounting. We could track down to one gram without trouble, but if you want to use a super cartridge like the Shure V-15 Mk. III, ADC-XLM, or Empire 1000 ZE/X tracking at 3/4 gram, then the extra expense of the 810 is justified.

Incidentally, the unit can be bought without base, dust cover and cartridge. Designated model 700, this unit is priced at \$129.50.

*George W. Tillet*

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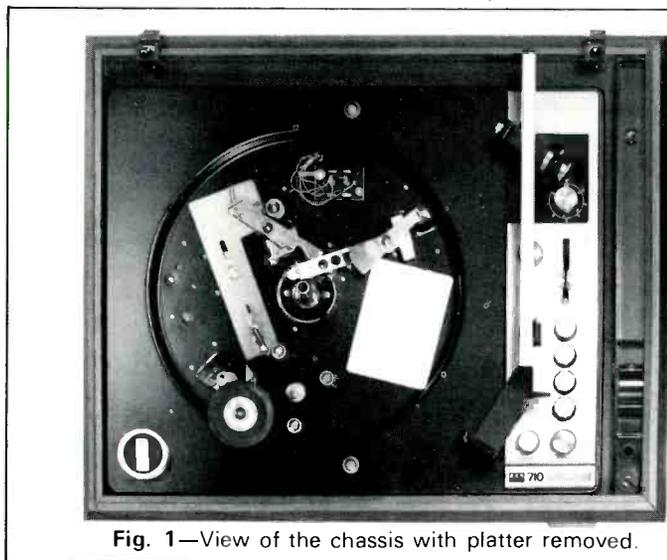


Fig. 1—View of the chassis with platter removed.



Fig. 2—View of the 710/X arm mount.

# A DEMONSTRATION OF QUADRIPHONIC SOUND

Put your left index finger gently in your left ear.  
You're listening to monaural sound.

You cannot distinguish the direction of any individual sound source.  
They're all mixed together. This is the kind of sound an ordinary  
radio gives you.

Now cup both your hands behind your ears, palms  
facing forward.

You're listening to stereo.

You are able to distinguish the  
direction of any individual sound  
source in front of you.

This is the way you listen  
to your stereo system.

Like a spectator at  
a concert.

Now take your  
hands away from  
your ears.

Sounds are coming at you from all around you. You are able to distinguish  
the direction of any individual sound source.

You're listening to the equivalent of quadriphonic sound.

This is the way you hear in real life. Quadriphonic is natural sound.

If you decide to go with a quadriphonic sound system in your  
home, this Harman/Kardon 900+ multichannel receiver is as far as  
you can go.

It's the world's most advanced four-channel receiver.

It has every kind of four-channel circuitry built in. Apart  
from 4 speakers and a turntable, there is nothing to add.  
No accessories to buy.

Owning the 900+ doesn't mean you have to dis-  
card your stereo albums. It will actually play them  
better than ever with a unique "Enhanced Stereo"  
feature.

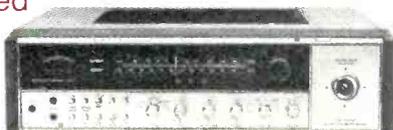
But most importantly, the 900+ carries  
Harman/Kardon's traditional wideband circuitry. It  
reproduces not only the frequencies you can hear  
but also those you cannot.

This is terribly important. Because the fre-  
quencies you cannot hear have a marked effect on  
those you can.

This wideband philosophy gives Harman/Kardon  
receivers their stunning realism.

For an even better demonstration of quadri-  
phonic sound, listen to the Harman/Kardon  
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## Altec Concept EQ 5



### MANUFACTURER'S SPECIFICATIONS

**System Type:** Acoustic suspension with active equalizer. **Frequency Response:** 30 to 20,000 Hz. 2 dB (with equalizer). **Power Rating:** 100 watts. **Impedance:** 8 ohms. **Crossover Frequencies:** 800 and 4000 Hz. **Dimensions:** 25 $\frac{1}{8}$  in. H x 15 in. W x 10 $\frac{1}{2}$  in. D. **Weight:** 30 lbs. each. **Price:** EQS speaker, \$180.00; EQE equalizer, \$125.00; EQ 5 system (two EQS speakers and one EQE equalizer), \$475.00.

The use of program equalization to enhance or diminish selected portions of the frequency range is so commonplace in sound processing that it is referred to in engineering parlance only by the letters EQ. The Altec Sound Products Division of University Sound has borrowed this terminology to name their equalized speaker system, Concept EQ. The primary purpose of the electronic equalization supplied with this speaker system is not, however, the artistic embellishment one seeks in a recording studio. Rather, it is intended to make the sound more natural when heard in a conventional listening room.

The speakers are relatively small, measuring 15 x 10 $\frac{1}{2}$  x 25 inches. They are finished on four sides in walnut and have a sculptured black foam grille. Electrical connection is made to two push type terminal posts in a recessed cavity in the rear. No speaker controls exist on the cabinets, and the terminals are clearly marked by both letters and color.

The foam grille appears to be bonded with adhesive to a more solid grille in front of the speaker cones. This reviewer is firmly in favor of such a solid backing which protects the speaker cones from mechanical damage from such causes as the fingers of inquisitive toddlers. However, a gentle tug on the foam is sufficient to break the adhesive bond, leaving an unsightly foam edge protruding. Efforts at poking the foam back into place are fruitless. The natural household solution

to such a problem would be to glue it in place, which is acoustically unsatisfactory. Therefore, this reviewer recommends neither pulling on the foam nor handling the speaker by grasping the solid-appearing foam grille.

The electronic equalizer is a two-channel, solid-state unit mounted in an attractive walnut cabinet. A two-pin a.c. plug is supplied with a generous amount of cord. No on-off switch is provided since the unit is meant to plug into a pre-amplifier utility outlet and be turned on and off with the pre-amplifier. Four front panel controls are multiposition switches. Three of the controls are for adjusting equalization of LOW, MID BASS, and HIGH frequencies. The fourth switch is for selecting one of three modes of operation, equalizer OUT, which bypasses all equalization; equalizer IN, which places the equalization in speaker reproduction only, and TAPE which equalizes speaker reproduction and tape recorder playback but does not equalize signals which the preamplifier may send to a tape recorder.

A very complete service manual is provided for the equalizer, a good thing in view of the rear panel complexity of contemporary receivers and preamplifiers and the requirement to wire into and out of the tape monitor positions. Care is needed to assure that proper connection exists, and this is no place for hasty hookups. An alternate solution, not mentioned by Altec and which quickly presents itself, is to place the equalizer between the preamplifier and power amplifier. We do not recommend doing this even though the specifications of the equalizer are adequate to do an excellent job in this position. The reason for this caution is an equalizer turn-on and turn-off output voltage transient which will produce an annoying sound and possible speaker damage if a d.c.-coupled power amplifier is used.

### Technical Measurements

The active equalizer supplied with the concept EQ 5 could be looked upon as a very special tone control circuit intended to complement the performance of this particular speaker design. The LOW FREQUENCY switch equalizes response in the 20 Hz to 150 Hz band with the major effect at 30 Hz. The MID BASS switch gives additional control at 80 Hz and the HIGH FREQUENCY switch works primarily above 5 kHz. Both the LOW and HIGH FREQUENCY switches have positions marked 0, -3, and -6. The MID BASS has the five positions of +6, +3, 0, -3, and -6. Because of the substantial interaction of the LOW and MID BASS response, it is unreasonable to plot all possible combinations. Figure 1 shows the separate effects of the LOW FREQUENCY and HIGH FREQUENCY controls with the MID BASS set to its 0 position. The curves are separated by 10 decibels for clarity in this plot. There is actually nearly a 2 decibel increase in level when the equalizer is switched into operation, which adds some psychological effect in a before-after comparison. Figure 2 is a measurement of the MID BASS control alone with the LOW FREQUENCY control set to -6 and the HIGH FREQUENCY control to 0. The effect of this control at 80 Hz is quite evident.

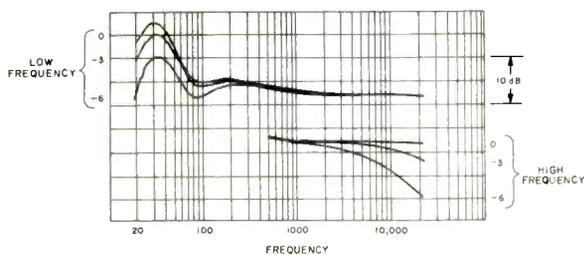


Fig. 1—Equalizer response for low and high frequency control.

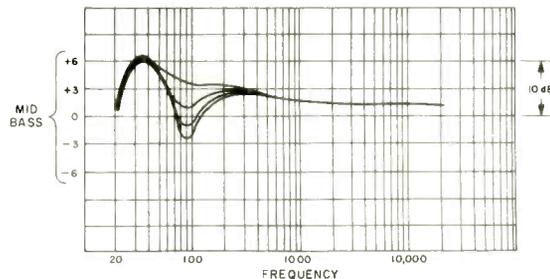


Fig. 2—Equalizer mid bass control.

Harmonic distortion at 1 kHz and one volt rms measured 0.03 per cent and was composed primarily of second harmonic components, which is well within Altec's specification. Signal to average noise power in a 20 kHz band measured 75 dB for a rated output of 1.5 volts rms and was mostly 60 Hz and 120 Hz with a stronger low frequency flicker component which proved to be inaudible in the recommended hookup.

The Concept EQ 5 is rated as an 8 ohm unit, and this is quite close to measurement shown in Fig. 3. The maximum impedance is 31 ohms at 54 Hz.

The anechoic frequency response was measured without the equalizer, since the effect of equalization may be seen by referring to Figs. 1 and 2. The one-meter, one-watt on-axis response for this speaker is shown in Fig. 4. Even without equalization, the low frequency response is relatively uniform down to below 70 Hz where it then rolls off at nearly the expected 12 dB per octave. The narrow dips in amplitude at 1400 Hz and 2200 Hz are due to driver interaction as evidenced by the phase response. The response is substantially non-minimum phase only in the range from 1 kHz to 3 kHz and at around 9 kHz.

An unusual effect was noticed as the speaker was rotated. Figure 5 shows the response at an angle of 15 degrees off axis, corresponding to this speaker being used as a right channel of a stereo pair. Figure 6 is the measurement for the other 15 degree position corresponding to a left channel. Note the difference in phase calibrations between Figs. 4, 5, and 6. Unlike most speakers, the 15 degree off-axis response is better than its on-axis response.

Sensitivity is quite good and a sound pressure level of 94 dB is maintained for one watt input over most of the usable frequency range.

The three-meter response is shown in Fig. 7 for a direct on-axis position and a 30 degree left stereo channel position. This is the frequency response of the first 10 milliseconds of sound when the Concept EQ 5 is placed on a rug floor and flat against a wall. The listening position is three meters in front of the speaker and one meter above the floor. No other room reflection components exist except the floor, ceiling and wall against which the speaker is placed. This is thus the "early" sound for this configuration. The equalization was set to a position of -3 for the LOW FREQUENCY, 0 for the MID BASS, and 0 for the HIGH FREQUENCY. The reason for choosing this mounting position is based on the results of the listening test performed prior to any technical measurement. The curves in Fig. 7 are displaced 10 dB for clarity.

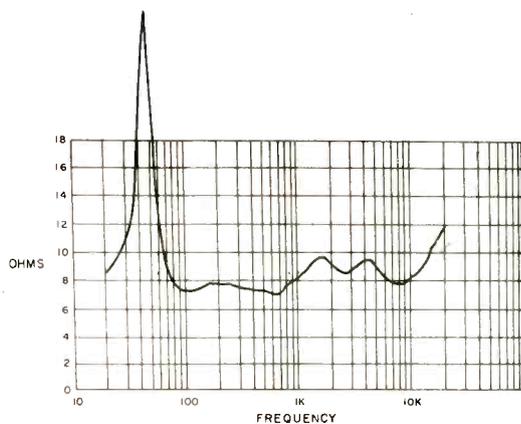


Fig. 3—Impedance plot.

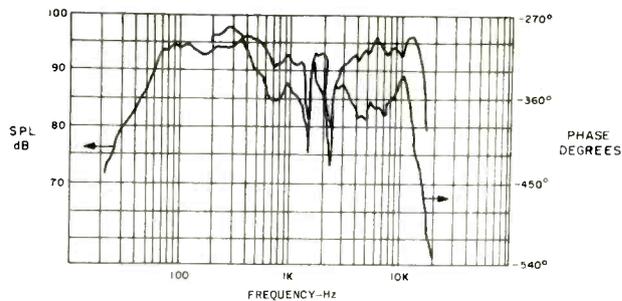


Fig. 4—One-meter anechoic response measured on-axis with one watt input.

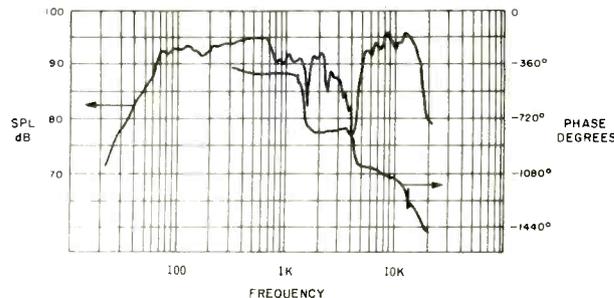


Fig. 5—One-meter anechoic response measured fifteen degrees to the left of center with one watt input.

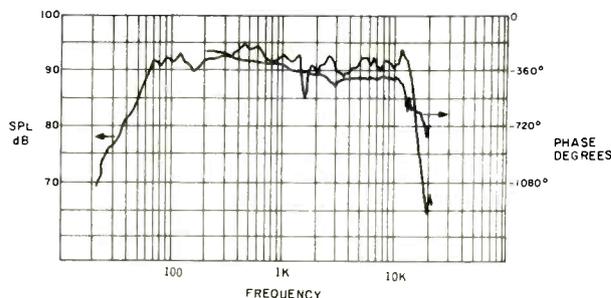


Fig. 6—One-meter anechoic response measured fifteen degrees to the right of center with one watt input.

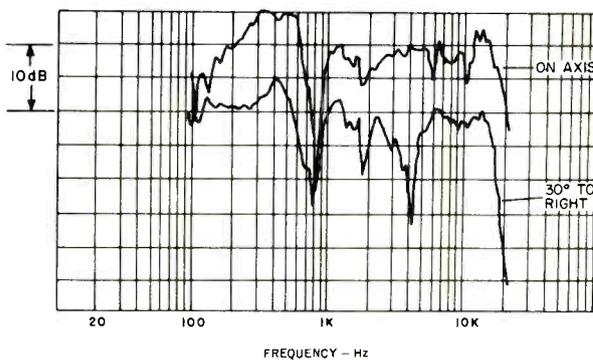


Fig. 7—Frequency response due to first ten milliseconds of sound in a preferred room position measured at three meters. Curves displaced 10 dB for clarity.

Figure 8 is the measured harmonic distortion for the musical tones  $E_1$ ,  $A_2$ , and  $A_4$ . The mid frequency distortion is extremely low for a speaker in this price range right up to the rated 100 watts. The low bass distortion is also quite low and remains below 5 per cent at levels as high as 100 dB SPL. However, the rapid rise of odd harmonic warns that the driver is beginning to run out of capability at this level. In view of the substantial bass boost available in the equalizer, care should be exercised if an amplifier rated for more than 100 watts is used. The sensitivity of this speaker is such that a 30 to 50 watt amplifier should give all the sound normally required.

In the signal suppression test, a musical note at one level is mixed with white noise at a 20 dB higher average level. The power in both signals is then raised until measurement indicates that the tone is being modulated by the noise so as to be reduced from its value before noise was added. It is

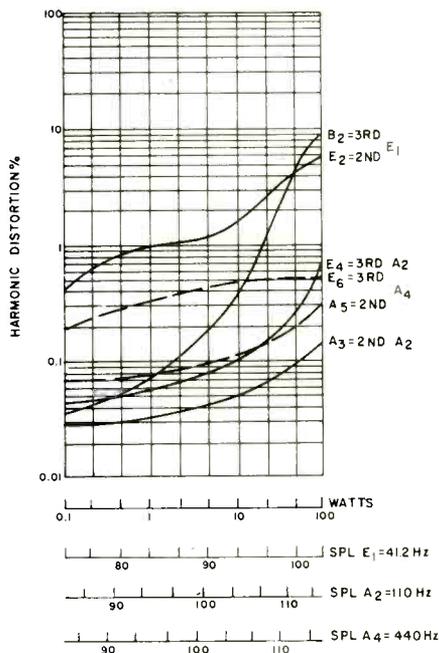


Fig. 8—Harmonic distortion for the musical tones  $E_1$ ,  $A_2$ , and  $A_4$ .

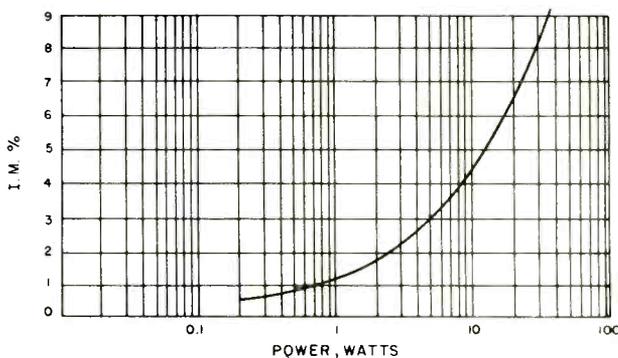


Fig. 9—IM of  $A_4$  by  $E_1$  mixed 1:1.

a measure of the ability to handle crescendos. In the Concept EQ 5, a 440 Hz  $A_4$  note was reduced 1/2 dB by noise with an average power of 60 watts and peaks approaching 600 watts. At 3 kHz, 1 dB suppression occurred at peaks of 528 watts and average of 50 watts. The peak noise power at which 3 kHz began to show a reduction was 33 watts. The conclusion is that crescendos can be handled in excess of 100 watts, but some cross modulation will occur above 33 watt peaks. This is still quite loud for a speaker with the efficiency of the EQ 5.

Figure 9 is the IM distortion of the musical tone  $A_4$  by  $E_1$  fed at equal levels. A power level of one watt at each of these frequencies produces a voltage corresponding to an average power of 4 watts if a single tone with the same peak voltage were to be applied. At this level the IM is 2.5 per cent. Most of the IM in this speaker is due to phase modulation for such low frequencies.

Figure 10 is the polar energy response. The unusual dissymmetry which produced the effects shown in Figs. 5 and 6 is also evident in this plot. Both Concept EQ 5 units had this behavior in the plane of symmetry normally used to make anechoic measurements. The polar pattern suggests that much of the higher frequency sounds will be relatively directional with some changes in timbre with angle. The substantial low frequency response of the on-axis measurement of Fig. 4, together with the relative omnidirectionality of lower tones implies that room sound may be richer in lower frequency reverberation than higher frequency reverberation, particularly if there is any substantial drapery. This, together with the bass boost of the equalizer, may make the sound bottom-heavy in some rooms. The correction is to use conventional preamplifier tone controls if this is found to be the case.

Figure 11 is the time-energy plot, which is the response to a shaped pulse band limited to contain only frequencies from d.c. to 20 kHz. This is an on-axis measurement. The contribution at 4.3 milliseconds is at a time which would correspond to a cabinet back wall reflection for midrange components. The midrange dips in Fig. 4 correlate reasonably well with the arrival times of Fig. 11.

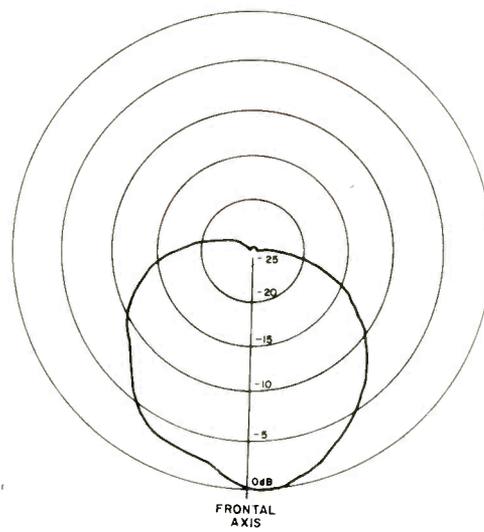


Fig. 10—Polar energy.

## Listening Test

A properly built acoustic suspension system will put out a lot of bass if you drive it hard, and that is exactly what the Concept EQ 5 does. The close to 17 dB of 30 Hz boost available when switching the equalizer on can make you run to save the crockery when a really low note comes along. In anything but a center floor mounted position, the bass is much too overpowering at the maximum equalizer position. Experimenting with speaker location soon made us settle on a wall mounting position.

Placing the speakers up in a bookshelf configuration did not produce stereo imagery acceptable to this reviewer. The problem seemed to be due to polar beaming which caused a stereo shift and a timbre change with change in listening position. It was not until the units were placed down on the floor that the sound imagery was reasonable accurate. The majority of listening was done with this wall mounted floor position.

The most balanced sound appeared to occur for this configuration with an equalizer LOW setting of -6, a MID BASS of -3 and a HIGH of 0. At no time did the top end require any roll-off, although in a moderately "live" room the HIGH control might prove useful. Certain instruments, such as kick drum and tom tom, still seemed "bumpy" even with this minimum bass compensation, but a minor touchup with the normal preamplifier tone controls set that right.

After listening to this combination for a while, it is a shock to switch the equalizer out. I had privately wondered at the wisdom of a bypass switch position, as one presumably had purchased the equalizer and speakers as a set. When you switch the equalizer out, it is a good reminder why you bought that configuration in the first place. Something like the early days of stereo when you invited a neighbor over

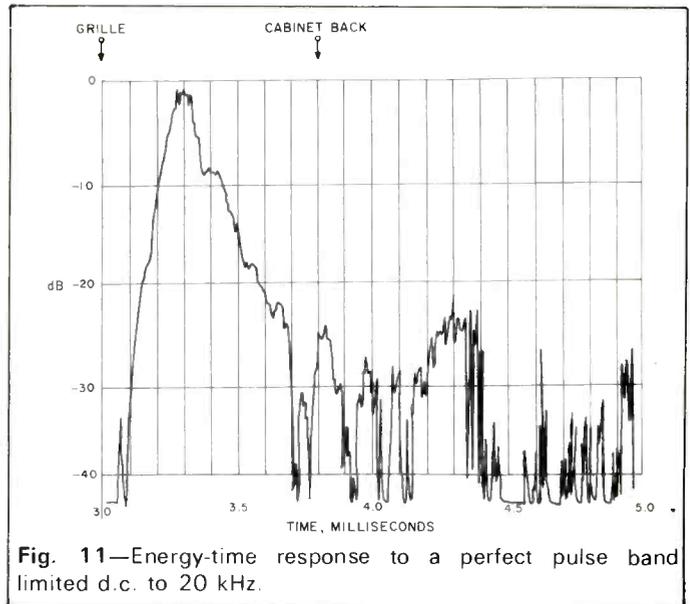


Fig. 11—Energy-time response to a perfect pulse band limited d.c. to 20 kHz.

to listen and just as he got used to the sound you switched to "mono" to see the look on his face.

Much of the apparent sound image appears to come from the position of the speaker or in the stereo "picture window" plane containing the two speakers. It gives the impression to this reviewer of a foreshortening of the sound image.

The Concept EQ 5 is certainly capable of delivering a lot of sound and backed up by a 50 to 100 watt amplifier makes an excellent moderately priced choice for rock music.

*Richard C. Hevser*

Check No. 60 on Reader Service Card

## Thorens TD-125AB Mk II



### MANUFACTURER'S SPECIFICATIONS

**Speeds:** Three, 16 $\frac{2}{3}$ , 33 $\frac{1}{3}$ , 45 rpm. **Wow and Flutter:** 0.06%, weighted according to DIN 45507. **Rumble:** -48 dB unweighted, -68 dB weighted according to DIN 45539. **Drive System:** Electronically controlled, 16-pole synchronous motor with belt drive. **Power Requirements:** 110-130 V or 220-250 V, 50/60 Hz, 15 watts. **Dimensions:** 18 in. W x 14 in. D x 5 in. H. Length is increased by 2 in. when fitted with 16 in. tonearm. **Weight:** 32 lbs. **Prices:** \$310.00; TX-44 dust cover, \$15.00; TX-25 hinged dust cover, \$30.00.

We reviewed the original Thorens TD-125 more than three years ago, in June 1969 to be precise, and we placed it in the highest category then, an opinion which has been confirmed by the many thousands of enthusiastic owners of this deluxe turntable. A few months ago, Thorens released the TD-125 AB Mk II which has some significant improvements—not in overall performance, because that would be nearly impossible—but rather in facilities. For instance, there is an automatic arm-lifting device, and the arm itself is the new lightweight, TP-16, which has a plug-in cartridge shell and a magnetic anti-skating system. The adjustment control is at the right of the arm pivot, and there are four scales calibrated for conical and elliptical styli and for wet and dry records. (There's Swiss efficiency and thoroughness for you!) Stylus pressure is adjusted by a small thumbwheel located at the top of the arm pivot. Calibration is from 0.5 grams up to 4 grams in quarter gram steps.

At the front of the unit are three sliding-bar controls; the one on the left controlling the speed (16 $\frac{2}{3}$ , 33 $\frac{1}{3}$ , and 45 rpm), the second the ON/OFF switch, and the third the cueing device. A strobe indicator is at the center with a vernier speed control just in front. The 12-in. non-ferrous platter is in two parts with the drive belt going into the smaller inner section. Both are dynamically balanced, and they fit together precisely. Like its predecessor, the Mk II uses a long sleeve bearing with two highly polished contact surfaces and a single steel-ball thrust bearing. The motor and arm are mounted on springs, isolating them from the controls and base. Motor speed is low—25 rpm at 33 $\frac{1}{3}$  rpm record speed—which permits the use of a large motor pulley for a good drive ratio, as well as reducing rumble.

Now for a look at the electronics: in essence, this consists of a Wien bridge (see schematic) connected in a positive feedback circuit with a power amplifier. The frequency, or speed, is determined by changing the values of components in the bridge arms. As the motor presents an inductive load, its reactance increases with frequency, so the voltage has to be increased too. At 16½ rpm, the motor input voltage is 6.4 V, but at 45 rpm, 12 volts are required. The original 125 used all discrete transistors, but the Mk II employs two 709 IC's

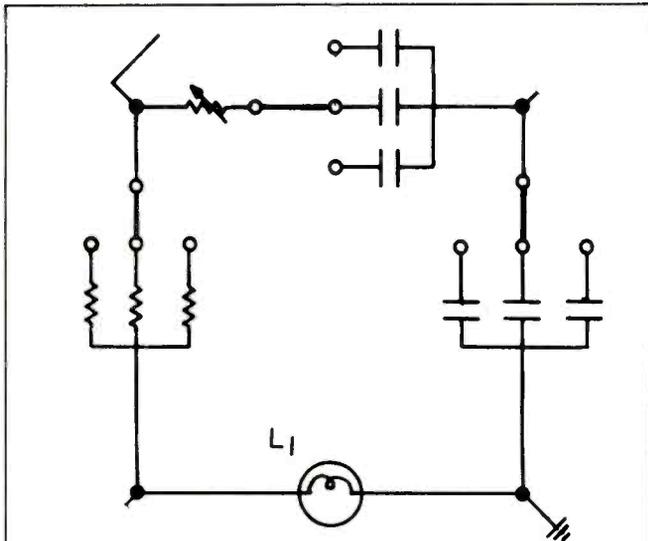


Fig. 1—Showing the basic Wien bridge arrangement as used in the TD-125AB Mk II. The variable control is the speed adjustment. L<sub>1</sub> is a stabilizing lamp.



Fig. 2—Closeup of arm mounting.

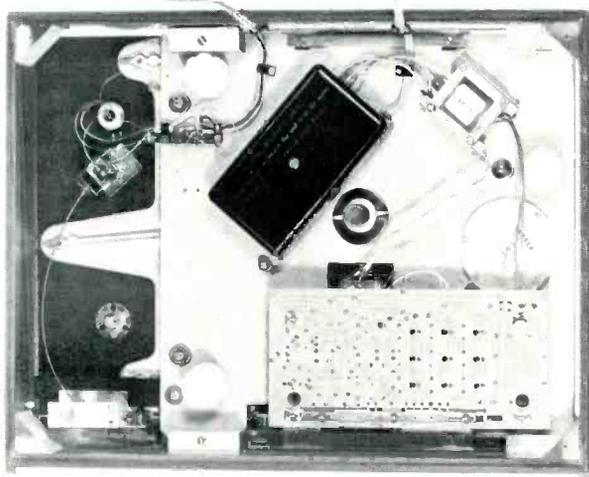


Fig. 3—Underside of the machine with the protective cover removed.

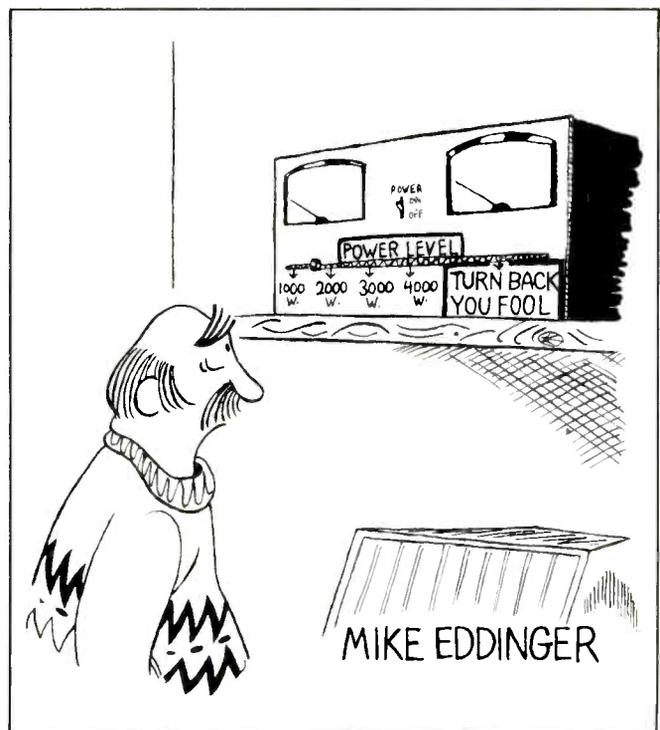
with four power transistors that easily supply the five watts or so for the motor. This, incidentally, is a 16-pole synchronous type.

### Measurements

The rumble level was approximately the same as the older model, -46 dB unweighted using the NAB standard. This corresponds to -64 dB by the ANSI "A" weighting or about -66 dB with ARLL weighting, which certainly puts it into the professional class. Wow and flutter came out at 0.07 per cent, again an exceptionally good figure. Arm resonance with an ADC-XLM cartridge was just under 8 Hz, and the rise in output was only 3.5 dB. Calibration of the tracking pressure dial was extremely accurate—being only 0.1 gram out at 3 grams. As might be expected, there was no discernible speed change with variation in line voltage from 95 up to 120 V. The speed control gave a variation of +3% and -2.5% at 33½ rpm and +4.5% and -3.5% at 45 rpm. Maximum tracking error was a shade under 0.5 degrees per inch, the average being nearer 0.3 degrees per inch—a remarkable achievement. The arm lifting device worked very smoothly with positive cueing—in fact, all the controls performed as they are supposed to and the unit was a real delight to use. Styling is clean and completely functional and workmanship is first class. For most of the tests, a Shure V-15 Mk II and ADC-XLM cartridges were used. Some tests were also carried out with CD-4 discs using an Audio-technica AT-20SL cartridge, and here I ran into a problem. The lead capacitance of the 125 is around 270 pF—ideal for most stereo cartridges but too high for CD-4 models which must maintain a response up to 50 kHz. So owners of these cartridges must change the connecting leads for special low-capacity types, otherwise operation may be erratic. Apart from this small criticism, which applies to the majority of turntables and changers anyway, I have nothing but praise for the Mk II. It is a worthy successor to the Mk I, and it can be recommended with complete confidence. At \$400.00, it is not cheap but in my opinion, it is worth every cent.

George W. Tillett

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MIKE EDDINGER

# Canby's Capsules

Edward Tatnall Canby

## The Plucked String

**Julian Bream '70s.** (Richard Rodney Bennett, Alan Rawsthorne, Wm. Walton, Lennox Berkeley). With Melos Ens., Atherton. **RCA ARL-1 0049**, stereo, \$5.98.

The genius of guitar and lute turns to 1970s British music—engagingly. Two generations. Bennett's Side 1 Concerto is smoothly non-tonal, a fluent and well laid out serial-type piece with ever-interesting colors, the guitar integrated into the whole. Side 2 is all solo, 3 older-generation men: An anguished *Elegy* by Rawsthorne, sly Latin tidbits ("alla cubana") by a humorous Walton, near-flippant mandolin-style Variations by Berkeley. Solid stuff, easy listening—perfect guitar.

**Zabaleta. Harp Music of the Renaissance.** **Everest 3340**, sim. stereo, \$4.98.

"Some of the music is astonishing. . . 150 years before Bach." say the notes. Harpish provincialism (good music comes from a lot further back than that)—but this is an excellent and musical harpist, well and quietly recorded. 16th and 17th c. Spanish music. Modern concert harp.

**Popular Koto Melodies of Japan.** **Everest 3347**, stereo, \$4.98.

An uncomfortable mix for my ear, the "traditional" (i.e. old standard) oriental-type tunes arranged with lugubrious Western harmonies in the minor, not really proper to the Koto. Good movie music, maybe! It's that sort, anyhow.

**Susann McDonald Plays the Romantic Harp (French).** **Klavier KS 525**, stereo, \$5.98.

She's good—and it's a pleasure to hear the modern (19th c.) harp where it belongs, in music of French inspiration. McDonald's harp really flows—Fauré, Pierné, Salzedo, Tournier, Godefroid, et al., all good harp composers. The recording is DBX'd up to the disc. You can have a DBX-encoded disc, for 100 dB, if you have a DBX decoder.

**Sergio & Eduardo Abreu—2 Concertos for 2 guitars.** (Castenuovo-Tedesco; Santorsola). **Columbia MQ 32232**, SQ Quadraphonic, \$6.98 (also stereo).

Two young Brazilian brothers and a pair of very unlike concerti—I prefer the more modern Santorsola, an older-generation Brazilian; he is tonal but dissonant, full of good orchestral color and counterpoint; it's a real piece. Castenuovo-Tedesco (the New German Castle?), long a U.S. resident, writes old-fashioned light stuff (1962), mixture of maybe Percy Grainger, Brahms and Robert Russell Bennett, tossed into a harmless fluff. OK if you like it. The brothers do nobly in both.

## Acoustics

**The Complete Rachmaninoff, Vol. 1, Acoustic Recordings (1919-24).** **RCA ARM3-0260** (3 discs), mono, \$17.94.

Rachmaninoff, pianist and composer, neatly bridged the acoustic/electric change-over, for some nice multiple comparisons. These acoustics are surprisingly informative as music, if minus the fi. Some are Edisons, rounder, fuller. Best music is (a) Rachmaninoff (b) Chopin. The acoustic 2nd Pf. Concerto was incomplete—the missing side is tape-edited in here from later electrical version. Neat trick.

**Complete Recordings of Enrico Caruso.** **Murray Hill 920328**, (14 discs), \$15.95.

"All 238 Arias, Ballads, Neapolitan Songs, etc."—and don't think I've played them all. If you want the saturation treatment, superbudget, better grab quick while the vinyl shortage lets you.

**Caruso—59 Recordings, 9 Never Before Released.** **RCA ARM4 0302**, mono, \$23.92.

Add nine more to the 238 in the "complete" Murray Hill Caruso album! RCA's modest 4 LPs come from the Original Source—RCA inherited the Victor wax masters. The extra nine were unissued for various reasons, but not usually because they were inferior. (Even if so, they'd be interesting.)

**Complete Recordings of Mattia Battistini.** **Perennial 3001/8** (8 discs) mono. (P.O. Box 437, New York)

Battistini's 100 recordings on eight separate LPs—he's no Caruso, but a fine baritone in his day. His opera recordings are here remarkably well restored (I've sampled two of the eight discs). Caruso loved high drama and hi-jinks; Battistini is more dignified and sober on records (though he cut a figure on stage, they say); which makes him less colorful. He sings out of tune—but so did everybody in those days. Part of the style.

# Canby's Capsules

Edward Tatnall Canby

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## Super-best

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**Mozart: Serenade in B Flat, K. 361 "gran partita."** Netherlands Wind Ens., De Waart. **Philips 839 734**, stereo, \$6.98.

One of the absolutely great Mozart works in a stunningly beautiful, superbly recorded performance—one of the great recordings of our time. Often known as Ser. for 13 Winds—but one is a string bass. Vast, expansive wind sound. Hey—why do these Philips recordings “decode” so gorgeously into quadrasonic via SQ?? Are they slipping something in?

**Tchaikovsky "1812" Festival Overture.** Commentary by Deems Taylor. **Capriccio Italien.** Minneapolis Symphony, Dorati. **Mercury SRI 75001**, stereo, \$6.98. (Golden Imports)

Curious! Encouraged by the excellent “Kubelik Legacy” mono Mercury reissue, Philips is bringing out more of the once-famed U.S. Mercury recordings—but now imported from Holland, at a premium price. Well—worth it. This is the celebrated real-bells-and-cannon “1812,” with illustrated account by Deems Taylor of the cannon and bells (Riverside Church, NYC) recording sessions. I’d take this part any day over the actual “1812” itself.

**Beethoven-Liszt: Symphony No. 9 (complete); Liszt: Festival Cantata.** Richard and John Cantiguglia, duopianists. **Connoisseur CSQ 2052**, SQ quadrasonic, \$6.98.

Here is the all-around finest two-piano recording I have ever heard, bar none. First, the Contiguglia brothers, the most profoundly *musical* pair of piano virtuosi of this century, with brains and taste as well as fingers. And this Liszt transcription of the big Symphony, unplayed for a century, is uncanny—the finest job of two-piano recording I know. Not only separation of two unlike pianos, within a perfect over-all ambience, but even separation *within* each piano, as in large concert grands. The two-way play between the performers was a major Liszt feature, perfectly reproduced—and in SQ too. The Liszt Cantata, one piano 4-hands, is lesser fare though with Beethoven quotes (Archduke Trio) incorporated.

**Future Sound Shock.** Enoch Light & the Light Brigade. **Project 3 PR 5077**, SQ quadrasonic, \$5.98.

Ah don't shock easy, Enoch, but ah *likes* this!! A snazzy, mod-jazzy, brassy sound with everything from cowbells to sitar, stunningly recorded, loud and clean, with better SQ separation than Columbia. Also in other quadr. versions.

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## All Over the Lot

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**Ives: The Celestial Country (1899).** Vocal soloists, Schütz Choir of London, London Symphony, Farberman. **CRI SD 314**, stereo, \$5.98.

No apologies, CRI! The record notes sort of run this early Ives down; *not* necessary—it may not be violently dissonant, etc. but in other ways it is the purest Ives, and very much of its time, that bumptuous beginning of a real American school via such men as Chadwick and Loeffler in Boston, MacDowell in NYC, Ives' teacher Horatio Parker at Yale. Fun-music stuff and Farberman, long-time Ives man, gets dedication out of the British performers.

**Bach: The Brandenburg Concertos (Original versions).** Academy of St. Martin-in-the-Fields, Marriner. **Philips 6700 054** (2 discs), stereo, \$13.96.

All but one Concerto (they say here) were rewrites of known earlier chamber works, for solo instruments; here are those earlier versions. Much the same but, following the annotations, you'll find many interesting diffs. Performers brilliant, nervous—not too good for the music.

**Baroque Harpsichord.** (Bach, Gibbons, Couperin, Scarlatti). Wm Neil Roberts. **Klavier KS 524**, stereo, \$5.98.

A forceful but somewhat heavy-handed player, a curiously twangy instrument (with notes out of kelter), recorded too close with an over-boomy bass. I liked the Bach Partita No. 1, and the Gibbons (hardly Baroque); the Scarlatti is weighty but strong-minded. Didn't like the Couperin much. No lift.

**Colin Tilney plays English Virginal Music.** Argo **ZRG 675**, stereo, \$5.95.

Generally for one-keyboard, one-stop small harpsichord, virginal music depends on sprightly, virtuoso rhythms and counterpoint to keep up interest—this splendid record explores the more brilliant and profound music of the British school, by Byrd, Bull, Gibbons, Farnaby, etc., turn of the 16th c. Two modern replica instruments, Flemish and Italian.

# Wood's Forest

Sherwood L. Weingarten



IT'S BEEN CALLED the boob tube, the idiot box, a vast wasteland and a host of other things that can be printed only by the underground press on asbestos. But television every now and then does provide a moment of brilliance, becoming an arena in which talent isn't merely devoured but instead showcased properly.

The frequency for such, unfortunately, is normally about once a year; in recent months, oddly, near-perfection was achieved *twice*, in both instances by superstars (each of whom truly deserves the title).

If truth be known, both shows—and the subsequent original soundtrack albums—restored my faith. For I'd decided some time ago that *Sammy Davis Jr.* and *Barbra Streisand* had sold out, respectively masked their best talents in favor of exploiting that which would produce the most revenue. Apparently I erred.

*Sammy* (MGM, SE-4914) unleashes an avalanche of memories for the aging listener. The long-forgotten Will Mastin Trio comes back into focus; so does the Sinatra Rat Pack. Most clearly, you remember fondly the link between them, a sawed-off guy whose talent made midgets of most of those around them, the junior Davis.

Davis, of course, was one-third of the trio that also included his father and uncle; as for the Pack, he was

at the core, along with such luminaries as Dean Martin, Peter Lawford, Shirley MacLaine and Frank himself, the chief rodent.

Sammy was a phenomenon, able to mimic the voices of countless personalities with an acidity and brightness that were peerless. He was able to dance rings around many whose formal training exceeded his by more years and foot-miles than he liked to admit. Later, he became an accomplished actor, perhaps one of the most underrated.

And he sang. Not really well, but with a style and flair.

On stage, he was excitement personified, able to hold an audience in the palm of his hand, breathlessly awaiting his next burst of energy.

Time and fate, however, seemed to demand their tolls. He lost an eye in a bizarre accident caused by a desire to beat the clock at its own game. He fought racial prejudice at every turn, making his life no easier by converting to Judaism. Booze had a price, and so did all the searing words asking what truly made Sammy run. But the biggest dues-collector was Old Man Time, who asked first for the legs and then the voice and finally, it appeared, the performing integrity.

Davis seemed to settle for the path of least resistance, perhaps the only one left, and he started emphasizing production numbers, much as Sinatra

had done. It all became very slick, so not too many noticed the absence of soul.

Some of his albums all too obviously were the product of the years clawing his way to the top, the years fighting to stay there, and, mostly, the fatigue. Too often they had no rough edges, but no life either. Dull, with only brief moments of a vitality that was. Technically perfect, but mirroring too clearly what had been lost.

But the recent video show, and the album that captures most of its excitement and flavor, was a turnabout. The old fire was rekindled, fanned by some previously hidden source of vitality to warm every viewer, every audiophile. His own private energy crisis had been solved.

The TV and vinyl packages covered the gamut of his life, from a childhood film performance in which he sings (*I'll Be Glad When You're Dead*) *You Rascal You* to a poignant, contemporary *I've Gotta Be Me*. Sandwiched between are a rocker, *Get It On* (his legs held up nicely for the visually-oriented dance number); a meaningful dedication to "all the black hoofers" who *didn't* make it, via *Mr. Bojangles*; and a *tour de force*, a four-tune medley from George Gershwin's *Porgy and Bess* in which he assumes two roles.

One of the TV program's highlights, a boxing ballet from his *Golden Boy*

triumph on Broadway, is missing from the album, naturally. But what is there should be enough for anyone who can appreciate a living 47-year-old show business miracle.

Ms. Streisand, to complete the musical one-two punch, also had battled her way to the peak of success, only to virtually turn her back on the music that catapulted her to the top of the charts in a vain attempt to be what she's not, a serious actress.

**Barbra Streisand and Other Musical Instruments** (Columbia, KC 32655), however, returned her to the showcase in which she belongs, a musical framework that is unequaled by any female performer.

The thrush's recording history is not unique. Her first few LPs were marvelous outings of beauty, experiment and solid musicianship; then came a dry period, during which album slickness replaced inventiveness, the ordinary replaced the extraordinary. I

stopped listening, feeling that she'd burned herself out by giving too much too quickly.

Television, however, again proved the error, for this latest extravaganza in sound must be considered a rebirth, a test met well on a harsh battlefield.

The girl whose ego helped destroy her relationship with Elliot Gould seems almost guileless on *Piano Practicing*, the opening number. Still, she injects humor and potent vocal riffs to the otherwise routine scales. Here, as elsewhere in the show and on the vinyl, there are games played, sort of illusionist tricks that prove the voice is quicker than the ear; moreover, though, there is a wealth of exceptional music—so much so, in fact, that the audiophile would prefer the disc to be quadraphonic rather than plain ole stereo.

One of the best segments of the show is a 14-minute rhapsody of rhythm, a global tour of sounds. It's slightly choppy in that it is made up of bits and pieces, but the whole definitely is superior to, and merges all, the parts. Included are excerpts from *I Got Rhythm*, *Johnny One Note*, and *One Note Samba* (replete with sounds of India); these are followed by squibs from *Glad to Be Unhappy* (Japanese music appears), *People* (Turkish allusions dot the background), *Second Hand Rose* (juxtaposed with the flamenco sounds of Spain), and *Don't Rain on My Parade* (with a musical tribute to the American Indian), not to mention African rhythms and Scotch marching sounds.

The flip side of the disc, a duplication of the video opus except that Ray Charles is absent from the LP, offers unmatched variety. Its only flaw is the puerile, juvenile *The World Is a Concerto*, a gimmick-filled cacophony in which the so-called orchestra is overstaffed by practitioners of the washing machine, blenders, pop-up toasters, doorbells, electric shavers and the like. The world may be ready for such modern madness, but I'm not.

Despite all that Ms. Streisand can utilize modern instrumentation to advantage. This becomes clearly evident in *By Myself*, whereby electronic instruments neatly contrast with her playful but melancholy vocal approach, and *Come Back to Me*, featuring an overdubbed duet with herself.

*I Never Has Seen Snow* is a fully-orchestrated piece in which Barbra uses dialect that is good enough to almost make you forget she's white. *Auf dem Wasser zu singen* is a change-of-pace item, a German Romantic lied. *The Sweetest Sounds* is a beautiful ending to it all, carefully walking a



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tightrope between pure enchantment and schmaltz.

Recordings too frequently sound as if they'd been put together by a flesh-peddler rather than a producer. In both these instances, however, art is a result of heart. Maybe talent does out, after all. Hmmm. Wonder if anybody could pair Davis and Streisand on one album?

—**Goodbye Yellow Brick Road** (MCA, MCA 2-10003) is a two-disc set from **Elton John** that appears to be half superior, half filler. The title tune is a hit single, but by no means the best thing in the set. It's easily outclassed by *Funeral for a Friend*, an exciting piece combining jazz, classical and pop and spotlighting David Hentschel on ARP Synthesizer. *Funeral*, however, leads right into *Love Lies Bleeding*, an ordinary vocal that points up again, and again, and again, the banality of most of Bernie Taupin's lyrics. *Candle in the Wind* is a soft tone poem to the memory of Marilyn Monroe, and has its exquisite moments; *Your Sister Can't Twist (But She Can Rock 'N Roll)* is a driving throwback to the '50s that is superlative, and *Saturday Night's Alright for Fighting* is a musical pile-driver getting heavy airplay, deservedly.

—**Playin' Favorites** (United Artists, UA-LA 161-F) is country-folk in the traditional sense by the composer-singer who brought us *American Pie* and *Vincent*. **Don McLean** sings, plays guitar and banjo, and sort of glides along with OPs (other people's). The spark that's normally there when performing his own material is absent, somehow, on all dozen entries. Best is an instrumental, *Bill Cheatham Old Joe Clark*.

—**Tubular Bells** (Virgin, VR13-105) combines classical, jazz, pop-rock and what-have-you into one elongated composition by **Mike Oldfield**. The composer manages, too, to play piano, organ, guitars, percussion and glockenspiel on the disc, which utilizes 274 (count 'em) overdubs. Though basically a simple, thoughtful piece, the technical complexities tend to astound the listener. Though dull in spots, the minor masterwork could do to rock-classical music what *Tommy* and *Jesus Christ Superstar* did to rock-opera. The first side of the record, distributed by Atlantic, starts slowly, erupts unexpectedly (just prior to a humming choir and electric rock segment), then slides into a pleasant comedown marred only by a vocal announcement of what instruments are being played. The flip side is slightly repetitious, but aided well by a drum sequence in its middle and a countrified

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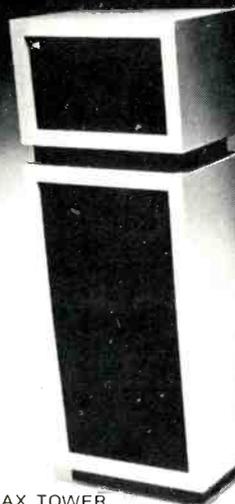
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section at the tail. Truly a quiet one-man thrill show.

—**Sweet Revenge** (Atlantic, SD 7274) adds humor to folk-rock, an unusual commodity and one that should be cherished. **John Prine** is the master who sings and accompanies his own songs with acoustic guitar. All but one of the dozen tunes are his, each folk-country with a dash of rock. The wit brings a smile, even when its sardonic or making a heavy point.

—**Ten Years Are Gone** (Polydor, PD 2-3005) joins blues, jazz and rock as only **John Mayall** can. Consistently good, the two-disc package offers 14 tracks that spotlight such stalwart musicians as Keith Hartley on drums, Blue Mitchell on trumpet and flugelhorn, Red Holloway on tenor and alto sax plus flute, Sugarcane Harris on violin, Freddy Robinson on guitar and Victor Gaskin on bass guitar. Mayall, of course, does the vocals and plays

professionally with rhythm, string and slide guitars, not to mention harmonica. All the tunes but one are Mayall originals, led by *Harmonica Free Form*, which ranges from mild to nitty-gritty, from jazzy to bluesy, from excellent to excellent. It's an 11:36 winner. The first side of the record, by the way, is studio-taped; the flip side is a live concert given at New York's Academy of Music.

—**Whatever Turns You On** (Columbia-Windfall, CQ32216) declares with enthusiasm that rock's best showcase is a quadraphonic arena. **West, Bruce & Laing** are the perpetrators of the musical diatribe, the first half of which is screaming, often excessive stuff, the second half of which is super. Leslie West, guitarist; Jack Bruce, bass player, and Corky Laing, drummer, spend Side One trying to see how many gimmicks can interfere with their playing. There is an overabundance of echoes, and it mostly comes off as being just electric instead of eclectic, a shrillness aimed at those who didn't go down with acid rock. By the flip side, though, they've really got it together, to re-coin a cliché, and are appropriately gutsy, driving and natural on *Rock 'N' Roll Machine*, *Scotch Crotch* and *Slow Blues*.

**John Denver's Greatest Hits** (RCA, CPL1-0374) features 11 self-penned tunes that are among the most-requested in the singer-composer's concerts. Best of the country-pop artist's outing are *Take Me Home*, *Country Roads*, *Follow Me*, *For Baby (For Bobby)*, *Rhymes and Reasons*, *Leaving On a Jet Plane* and *Rocky Mountain High*.

—**Occupation: Foole** (Little David, LD1005) scares me a little. **George Carlin**, an extremely funny man, is beginning to sound more and more like the late iconoclast, Lenny Bruce. There are times on this LP, distributed by Atlantic, that the resemblance in style is uncanny. Side one of the comedy album is highlighted by Carlin's reminiscences of growing up, peppered with a brilliant display of dialects and ethnic nuances; the flip side deals with bodily functions, dirty words and childhood clichés, hilarious if you take no offense.

—**My Merry-Go-Round** (Epic, EQ 32158) is a **Johnny Nash** outing that just misses being spectacular. There's lots of variety, with Nash doing his Jamaican reggae thing primarily, but spicing the album with Oriental, rock and soul influences. There are 10 quadraphonic cuts, topped by the title tune (which uses strings and chorus to good advantage) and the soulful *You Better Stop (Messing Around)*.



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# Jazz & Blues

## Martha Sanders Gilmore

**McCOY TYNER:** Song of the New World

**Musicians:** McCoy Tyner, piano; Virgil Jones, trumpet; Cecil Bridge-water, trumpet; John Faddis, trumpet; Garnett Brown, trombone; Dick Friffin, trombone, bass trombone; Diani Zawadi, euphonium; Julius Watkins, French horn; Willie Ruff, French horn; William Warnick III, French horn; Hubert Laws, piccolo, flute; Sonny Fortune, flute, soprano & alto saxophone; Bob Stewart, tuba; Jooney Booth, bass; Alphonze Mouzon, drums; Sonny Morgan, conga; Selwart Clarke, concertmaster; John Blair, violin; Sanford Allen, violin; Winston Collymore, violin; Noel DaCosta, violin; Marie Hence, violin; Julian Barber, viola; Alfred Brown, viola; Ronald Lipscomb, cello; Kermit Moore, cello; Harry Smyles, oboe.

**Songs:** *Afro Blue*; *Little Brother*; *The Divine Love*; *Some Day*; *Song of the New World*.

**Milestone, MSP 9049, \$4.98.**

There is not a shadow of a doubt that McCoy Tyner has proven to be one of the modern piano giants of his time—and ours. And this recognition has come to him just within the past few years. Tyner's *Sahara*, a Milestone release, was voted Record of the Year in the 1973 DOWN BEAT Critics' Poll and was nominated for two Grammy awards in 1973 for Best Jazz Performance by a Soloist and Best Jazz Performance by a Group.

Tyner's credits are probably not new to you. After having led his own seven-piece combo at the age of fifteen, Tyner joined the Benny Golson Jazztet in 1954 which included Art Farmer and Curtis Fuller, then joined John Coltrane's Quartet when it was only two weeks old, staying for six years, leaving it in December 1965. As a result of this association, Tyner is the leading figure to emerge from the post-Trane modal school that played in and around New York during the mid-sixties.

Tyner's style, a highly individual one, is a compilation of Bud Powell, Horace Silver, Red Garland, and Cecil Taylor all rolled into one but Tyner is nonetheless ever himself. In a sense he has synthesized and expanded upon their musical prowess, being of an orchestral, concertizing mind and playing with a tremendous depth of feeling, overwhelming force of attack which clearly

enunciates rhythm patterns, and a flawless elaboration of techniques and ideas. There is a remarkable density of sound and exuberant forward thrust to his art, an ability to get contrasting rhythms going between right and left hands that is almost super-human.

John Coltrane once said of Tyner: "First there is McCoy's melodic inventiveness . . . the clarity of his ideas . . . he also gets a very personal *sound* from his instrument; and because of the clusters he uses and the way he voices them, that sound is brighter than what would normally be expected from most of the chord patterns he plays. In addition, McCoy has an exceptionally well-developed sense of form, both as a soloist and an accompanist. Invariably in our group, he will take a tune and build his own structure for it. He is always, in short, looking for the most personal way of expressing himself. He doesn't fall into conventional grooves. And finally, McCoy has taste. He can take anything, no matter how weird, and make it sound beautiful."

This recording features Tyner in the company of reasonably large ensembles: strings, brasses, and woodwinds. However, they merely act as props for the formidable pianist and they, in that sense, water him down and more is the pity. Although the charts are all composed by Tyner and he functions here as a pianist, leader, composer, and arranger, they are in a sense over-arranged.

*Afro Blue* by Mongo Santamaria is the only one of the group which is not written by Tyner and is imbued with a mysterious, exotic atmosphere. It is strident, brassy, and percussive and features plenty of piccolo, the work of Hubert Laws. Like a wild African tribal dance it moves with Tyner in the lead, literally tearing up the keyboard and playing cascading arpeggios that tumble along. But the tune is sketchy, repetitive, and does not seem to lead us anywhere.

Jooney Booth plays a quixotic walking bass in *Little Brother* and there is lots going on. Tyner literally fills every crevice, startling pianist that he is while Virgil Jones achieves a very clear sound on trumpet that lingers nicely, never falling flat. The other horns are mere decorative items, only playing lip-service to the entire affair.

After a slow beginning by the string section which doesn't last very long

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McCoy Tyner picks it up and runs with the ball in *The Divine Love*, playing a galloping piano and displaying astounding technical facility. Highest marks however go to *Some Day*, a slow, lyrical ballad which showcases Booth on bass in a beautifully extended solo against Tyner's supremely confident piano and Mouzon's drums. It gains momentum as it goes along, Sonny Fortune taking a flute solo played a bit far back from the microphone. *Song of the New World* is a very fast tune that has a bright new world of tomorrow optimism about it but, in the final analysis, repeats itself.

The sound reproduction throughout this recording is sterling—clear as a bell!

This is certainly not McCoy Tyner at his best but he is nevertheless brilliant.

Sound A

Performance B-

### BACKDOOR

**Musicians:** Colin Hodgkinson, Fender bass; Ron Aspery, alto and soprano saxophones, flute; Tony Hicks, drums.

**Songs:** *Vienna Breakdown; Plantagenet; Lieutenant Loose; Askin' the Way; Turning Point; Slivadiv; Jive Grind; Human Bed; Catcote Rag; Waltz for a Wollum; Folksong; Back Door.*

**Warner Bros. BS 2716, \$5.98.**

The story goes that two supremely talented London session players made their escape from the city scene to the eerily atmospheric North Yorkshire moors where they were soon joined by yet another musical refugee. Thus was formed Back Door whose melodious musical mettle was tried and tested by Brian Jones, the landlord of a fifteenth century pub at Blakey Ridge called the Lion Inn who so believed in the threesome that he financed the recording of an LP and had 1000 copies privately pressed.

But when one copy made its way to Ronnie Scott's club in London the trio was quickly booked and their careers have literally taken off from there, the press having lavished sincere praise upon the group.

And no wonder when one listens to the astonishing Colin Hodgkinson who has virtually revolutionized the Fender bass like there was no tomorrow. What Hodgkinson has actually done is to treat the Fender bass as a lead instrument, freeing it from its formerly subservient role, not just playing rhythmic backup figures but creating long fluid lines with it and at times

accompanying himself such that it sounds like two basses rather than one, thereby contributing a pleasing variety of tone and texture to the whole.

Consider also the very skillful alto saxophonist and flautist Ron Aspery whose style lies somewhere between that of Ornette Coleman and Robert Johnson but is Aspery all the way just the same—both soothing and aggressive. And drummer Tony Hicks whose musical empathy is far-ranging, who never steals the show nor has prima donna fantasies and has been portrayed as “loose but can strike like a cobra.”

The twelve compositions included on this LP are all refreshingly brief—the longest *Slivadiv* clocked at three minutes, forty-five seconds—and written by Aspery and Hodgkinson. It is in this sense that they are individualistic, jazz and blues not normally lending themselves to the abbreviated forms of which this group is capable. By a judicious process of sub-editing they discipline themselves to present only their pared-down best.

And well done it is. *Vienna Break-down* is a hard-knocking, straightforward tune with some frantic but controlled alto saxophone by Aspery while *Plantagenet* features Aspery in a more gentle, controlled mood with Hodgkinson playing in counterpoint to him.

But *Lieutenant Loose* is all Hodgkinson on as intricate a lead bass as you will find as he treats it like a guitar, playing a duet with himself. *Askin' the Way* features Aspery creating Coleman-like complexities of phrase on alto against Hodgkinson's bass which echoes him emphatically. Hicks' drum drives it right along, tying it all up into the cohesive package it is.

*Turning Point* is a very unusual tune taken in a minor key, Aspery making a lovely alto entrance against Hodgkinson's bass obligati. Hicks' drums are missing but reappear in *Slivadiv* in which Aspery barks into his saxophone like a clucking chicken, Hodgkinson ending it with a wild bass scratch.

*Human Bed* is an ultra-musical experience in which Aspery plays a soft, smooth flute in this slow number. *Catcote Rag* follows in stark contrast to its predecessor, frenetic yet disciplined, the three instruments playing as one, while *Waltz for a Wolium* is subtle, sassy, full of surprises and replete with bent notes.

Hodgkinson adorns *Folksong* with graceful arpeggios that are ultimately lyrical. Once again Hicks' drum is absent.

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Performance A

Sound A

**THE COUNTRY GENTLEMEN:** Going Back to the Blue Ridge Mountains

**Musicians:** Charlie Waller, guitar; John Duffey, mandolin; Pete Roberts, guitar; Eddie Adcock, banjo; Tom Gray, bass.

**Songs:** *Going Back to the Blue Ridge Mountains; Going to the Races; Blue Bell; Dark as a Dungeon; Copper Kettle; Billy in the Low Ground; I Saw the Light; Tom Dooley #2; Brown Mountain Light; Electricity; Daybreak in Dixie; Mary Dear; Sad and Lonesome; Cripple Creek; Don't the Road Look Rough and Rocky?; Muleskinner Blues.*

Folkways, FTS 31031, stereo, \$5.98.

Hayseed and corn pone aside, the Country Gentlemen have slid along via their various musical merits from the country to the city and are here to stay without in any way compromising their traditional southern Appalachian roots. Up until a couple of months ago, one was able to catch the Gentlemen live week nights at a club in Georgetown called The Shamrock (straight out of the fifties and complete with old-fashioned beer signs), but now they have made their way up Wisconsin Avenue to the Red Fox in Bethesda.

In addition, the Gentlemen have travelled up and down the East Coast, having even performed at New York's infamous Carnegie Hall and having made a foray to Japan a couple of years ago. The Japanese let them know in no uncertain terms just how pleased they were with them, which the Gentlemen talk about even to this day. And incidentally, bluegrass has really rubbed off on the Japanese for they have even formed some groups of their own. Ah, the meeting between East and West.

In this Folkways recording, mastered live in the sixties, we have the Country Gentlemen at their best, the *original* Country Gentlemen, that is, which includes Charlie Waller, guitar, John Duffey, mandolin, Pete Roberts, guitar, Eddie Adcock, banjo, and Tom Gray, bass.

The beauty of bluegrass lies in its ebullient improvisatory nature which is superimposed over rather simple songs culled from all the media, re-

sulting in a thoroughly delightful and natural mixture of spontaneity and controlled discipline. Thus its kinship with jazz which travels over similar routes.

But in bluegrass, strings are king rather than reeds, horns, and drums. witness Eddie Adcock's deft plucking in a duet with John Duffey in *Cripple Creek* which begins with a slow countrified statement, then breaks into rapid-fire picking. Adcock's sophisticated approach to the banjo is further reflected in *Blue Bell*, an instrumental which features fellow cohort Duffey in some rip-snorting but all the same intricate mandolin. And *Going To the Races*, the first time ever recorded by the Gentlemen in 1957, is brimfull of excellent harmonics with Adcock again holding sway.

Notable also are the Gentlemen's very remarkable vocalizations and the exceedingly close harmonies they achieve voice-wise with Charlie Waller's clean luminescent tones ringing out over all. *Going Back To the Blue Ridge Mountains*, definitely influenced by gospel complete with choral response, has Waller in the lead and in *Dark As a Dungeon*, an old Merle Travis tune, Waller puts on a very convincing performance as he does in the fast-paced *Electricity* in which he sings as well as getting in plenty of guitar licks. And Waller's story-telling manner in *Brown Mountain Light* is indeed intriguing.

John Duffey's contribution as a singer is also worthy of comment. His virtuosity as a vocalist and actor is overtly displayed in *Muleskinner Blues* in which he summons those mules, hitting high notes all the while. *Mary Dear*, on the other hand, has Duffey depicting the tragic human waste of war.

Interspersed between these tunes of course is the cheerful, betimes corny banter of the Country Gentlemen as they introduce the songs. Although rechanneled for stereo, the reproduction sounds surprisingly natural as though it had not in fact been tampered with.

So climb aboard the Country Gentlemen bandwagon who copped the bulk of the Muleskinner News Bluegrass Awards for 1972 including Best Band of the Year, Best Blue Grass Singer (Charlie Waller), Best Vocal Group, and Best Album of the Year. Join their many admirers. You cannot lose with this one.

And I quite agree with the sleeve that "... the group deserves a Northern version of a rebel yell."

Performance A +

Sound B



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**ROY BOOKBINDER:** Travelin' Man  
**Musician:** Roy Bookbinder, guitar,  
vocals.

**Songs:** *Travelin' Man; Delia; Biscuits;*  
*Statesboro Blues; Weeping Willow*  
*Blues; Cincinnati Flow Rag II; Baby*  
*It Must Be Love; Bye Bye Baby*  
*Blues; Never Drive a Stranger From*  
*Your Door; That'll Never Happen*  
*No More; Bad Luck Blues; Missis-*  
*sippi Blues.*

Adelphi, AD 1017, stereo, \$5.95.

"This music, some borrowed, some given, and some made up by me, comes mostly from years ago; it means a lot to me and to my friends, some who play guitar, some who perform and make up their own music, and some who just like to listen a lot.

"Other songs on this record come from far away places and from men who are long gone. Some I learned from old records and some from my guitar playing friends. I'd like to thank those friends, for the good times, the good music, and for their friendship."

So writes the young white bluesman Roy Bookbinder on the sleeve of his *Travelin' Man* recording for Adel-

phi. And to hear him tell it and to hear him sing it, that's exactly what Roy is, having travelled down to Spartanburg, South Carolina to play for Pink Anderson, a great old Carolina bluesman who wrote the album's title tune and who used to make records for Columbia and travel the medicine shows.

Then Roy Bookbinder travelled north to visit Rev. Gary Davis, one of the greatest of the "East Coast" blues guitarists who sat around in his armchair in front of his heater, smoking a Tiparillo and teaching Bookbinder tunes such as *Delia*, a slow blues about a "gamblin' gal," and the melodically enticing *Cincinnati Flow Rag II*, the only pure instrumental on the entire recording which has a quiet sidling quality about it.

The release contains blues from veteran bluesmen who have now become legends such as Blind Boy Fuller's *Weeping Willow Blues* in which Bookbinder plays way up in the neck, Blind Blake's *That'll Never Happen No More*, coming around full circle with its tongue-in-cheek bawdy lyrics, and Blind Lemon Jefferson's *Bad Luck Blues* which is finally repetitive.

Roy Bookbinder sings out above his guitar filligree in an open, forthright fashion, playing a very full acoustic guitar and filling his spaces well. He has no trouble with the tricky intervals of Biscuit, singing:

*But don't put no more baking powder  
in your bread you see  
You know your biscuits are tall enough  
for me*

and in *Statesboro Blues*, a Blind Willie McTell original which has a get-along air about it. Bookbinder inserts some boogie-woogie as he does in *Mississippi Blues* which contains a very pretty boogie passage in midstream. A wealth of Bookbinder guitar carries *Never Drive A Stranger From Your Door* in which Bookbinder plays slide guitar, achieving a drone-like metallic effect.

Pure, unadulterated guitar and vocal sounds permeate these grooves although it appears as though an echo chamber is used in *Bye Bye Baby Blues* which has a curious resonance about it.

For the budding blues guitarist this is a worthwhile album to study and enjoy. It will be a learning experience for you as Roy Bookbinder has truly learned his lessons well.

Performance A

Sound A-

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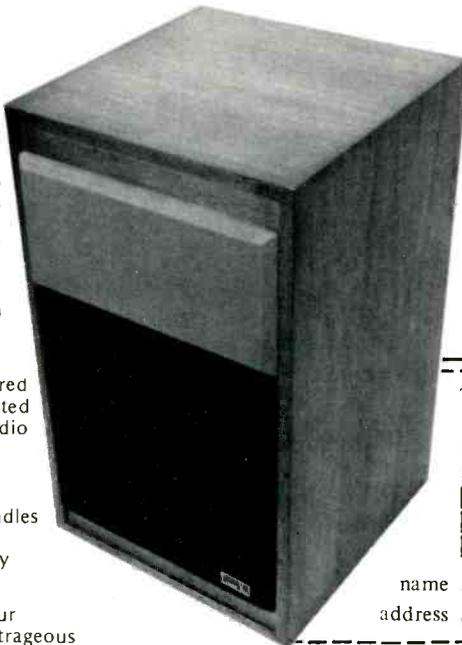
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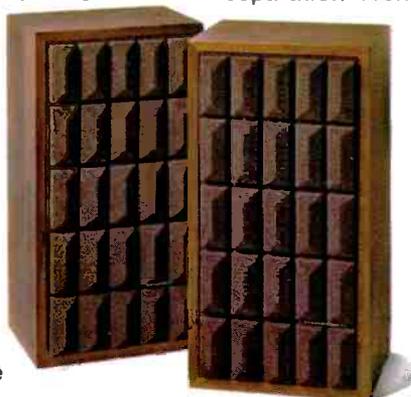
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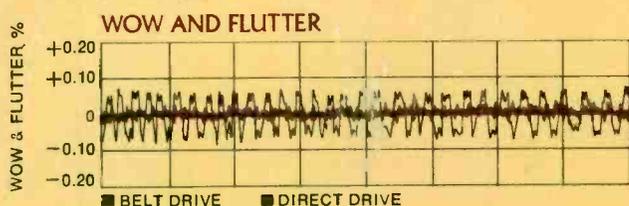
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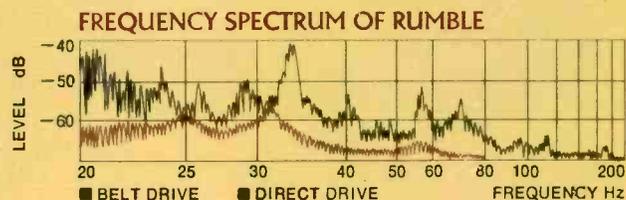
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\*SP-10: Audio, 8/71; Stereo Review, 9/71.  
SL-1100A: Stereo Review, 7/73; High Fidelity, 9/73.

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