Audio

THE AUTHORITATIVE MAGAZINE ABOUT HIGH FIDELITY · OCTOBER 1973 60¢ ® ♣
23602

JAZZ at Newport/1973

Cassette Tape Tests

High Fidelity From Cassette Systems

Check:

- CRAFTSMANSHIP
- VERSATILITY
- SPECIFICATIONS
- PERFORMANCE
- POWER
- FEATURES
- CRITICS' REVIEWS
- DEALER RECOMMENDATIONS
- VALUE
- MUSIC REPRODUCTION
- PIONEER OWNERS
- RELIABILITY
- WARRANTY
- REPUTATION
- SERVICE

and you'll reach the inevitable conclusion...

Incredible as it may seem, six years ago only the most avid followers of authentic sound reproduction were familiar with the Pioneer name. Yet, Pioneer's reputation for quality craftsmanship has been 35 years in the making. And it's continually being enhanced with each new component introduced. Case in point. Pioneer's outstanding AM-FM stereo receivers. They're the superb result of everything we've learned about sound and quality sound reproduction.

Reliability through exhaustive quality control.

Pioneer builds each receiver as though it was one-of-a-kind. To begin with, we produce virtually every part that goes into our receivers on our own production lines. So we know we're putting in the best there is. Until it's a completed unit, each receiver is continuously checked and inspected every step along the way. (A receiver in production travels on the average of twice the length of a football field. You can imagine how many quality checks it undergoes.) Still, that's not where our quality control stops. Because each receiver is then subjected to another rigid round of inspection before it's shipped to your Pioneer dealer. As a result, the Pioneer receiver that ends up in your home is as trouble-free as a receiver can be. To top it off, Pioneer backs it up with a full two-year warranty on parts and labor.

All the versatility you need — plus.

Pioneer designers are people-oriented. You'll appreciate this when you see that each receiver has more than a full complement of connections for every music source available: records, tape, FM, microphone, and 4-channel. You can do your own tape-to-tape duplicating and even make listening tests of different phono cartridges and speaker systems.

Conceptual diagram

Consistent power throughout the bandwidth.

Not This

Consistent power to spare.

Merely comparing the power capabilities of different brands of receivers does not tell you what's behind the power. Not only do these Pioneer receivers provide more comparable watts for your high fidelity dollar, they also deliver consistent power throughout the most vital listening area — the 20 — 20,000 Hz bandwidth. This is important. It means you get better bass response plus greater across-the-board frequency response with absolute minimum distortion.

Great specs + top sound = outstanding performance.

To many hi-fi buffs top performance means great specifications and impeccable waveforms. However, most people listen first and check the specs later. Whatever your modus operandi, you'll be more than delighted with Pioneer's outstanding performance.

Here's a mini spec list:

SPECIFICATIONS	SX-828	SX-727	SX-626	SX-525
IHF Music Power 4 ohms	270 watts	195 watts	110 watts	72 watts
RMS @ 8 ohms. Both channels driven @ 1KHz	60+60 watts	40+40 watts	27+27 watts	17+17 watts
FM Sensitivity (IHF) (the lower the better)	1.7uV	1.8uV	2.0uV	2.2uV
Selectivity (The higher the better)	+75dB	+70dB	+70dB	+45dB
Capture Ratio (the lower the better)	1.5dB	2.0dB	2.5dB	3.0dB
Power Bandwidth	All exceed by a wide margin the usable sound frequency spectrum			
INPUTS:				
Tape monitor	2	2	2	2
Phono	2	2	2	Phono/Mic.
Auxiliary	1	1	1	1
Microphone	2	1	1	Phono./Mic. (as above)
OUTPUTS:				
Speakers	3	3	3	2
Headsets	2	1	1	1
Tape Rec.	2	2	2	2

Easy-to-use features increase listening enjoyment.

All four receivers share many basic features for simplified operation, such as loudness contour, FM muting, click-stop tone controls, mode lights, signal strength meters, and a super wide FM dial scale. With Pioneer's wide variety of models to choose from, you're bound to find just what you're looking for in the way of sophistication and refinements.

Unanimous acclaim from the experts.

Stereo Review: "Pioneer's moderately priced SX-727 has a degree of operating flexibility and electrical performance previously found only in some of the most expensive receivers . . . The array of operating features is impressive . . . In its flexibility and in many areas of its measured performance it is somewhat better than much of the competition at its price level."

Audio: "We find the SX-727 to be a rugged, reliable instrument that certainly represents state-of-the-art receiver technology in its design and performance."

Hi-Fi Stereo Buyers' Guide: "This (SX-828) excellent performer features full power output at all frequencies . . . excellent reception of weak FM signals . . . selectivity was excellent."

High Fidelity: " . . . Solid quality . . . Pioneer has avoided a make-do approach in the SX-626; we wish we could say the same for all under $300 receivers."

Stereo Review: "...We were especially impressed by the solidity and precise 'feel' of the SX-626's controls. Clearly, nothing has been skimped in the mechanical design and construction of this receiver. It is a joy to use, a very good value in every respect."

A Pioneer receiver costs less than you'd imagined.

Normally you'd expect to pay a lot more for such quality, performance and features. But not at Pioneer. We believe sensible pricing goes hand in hand with craftsmanship. Let your capable Pioneer hi-fi dealer give you a complete comparison demonstration. It's the only way to find the best in high fidelity and the best high fidelity for you.

SX-828 — $469.95; SX-727 — $399.95
SX-626 — $329.95; SX-525 — $259.95.
Prices include walnut cabinet.

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Audio

OCTOBER 1973 Vol. 57, No. 10

FEATURE ARTICLES

EQUIPMENT PROFILES

RECORD REVIEWS

AUDIO IN GENERAL

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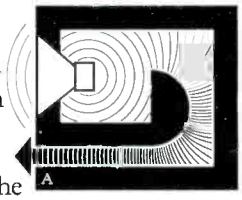
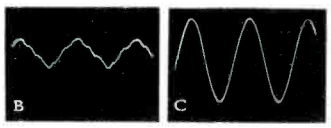
Now BIC Venturi puts to rest some of the fables, fairytales, folklore, hearsay and humbug about speakers.

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 Venturi principle (pat. pend.) transforms air motion velocity within the speaker enclosure to realize amplified magnitudes of bass energy at the 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, 90dB. Note poor waveform.

C—Output of Venturi coupled duct, (under the same conditions as Fig. B.) Sound pressure reading 111.5 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's 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.


Biconex horn

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: a dynamically acting tonal balance 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 midrange, 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 tweeters angularly positioned to increase high frequency dispersion (160° x 160°). Size: 26¼ x 15¾ x 14¾". $239 each.

Sturdily constructed enclosures are finished in genuine oiled walnut veneer. Removable grilles in choice of 7 colors. Optional bases for floor standing placement. Write for informative brochure.

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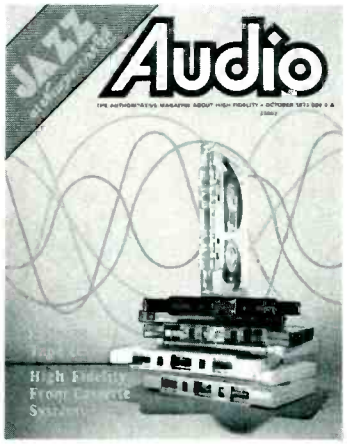
coming in November

John Eargle on Equalizers in the Home.

Martin Clifford on Bias Requirements in Cassette Recorders.

Equipment Reviews Include: AKAI 46D cassette recorder Sony 7065 receiver



About the cover: This month our editorial theme is cassettes, and our cover artist decided to give his impression of how signals are placed on tape. There has been an enormous amount of work on both cassette tapes and recorders over the past few years, and the results are quite comparable to open-reel recorders of the same price level. Our tests of 23 cassette tapes begin on page 40.

Audioclinic

Joseph Giovanelli

Record Player Used With a Timer

Q. I have recently purchased a manual turntable and a Shure M91ED cartridge. When listening to records at night, I sometimes fall asleep in the middle of one, which results in the turntable's being left on for hours with the cartridge tracking in the end groove. Rather than continuing this unnecessary stylus wear, I have considered buying a timer which would shut off both the amplifier and the turntable at some prearranged time. This, however, would result in the stylus remaining on the record without its rotating, for a considerable length of time.

Would this have any deleterious effect on stylus or records? If so, what would they be?—Michael Carrano, Cahokia, Illinois.

A. If your turntable is belt driven, there will be no problem in having it turned off by way of a timer. The stylus, resting on the surface of the disc overnight, will not be harmed. Just remember that it is there, and remove it carefully first thing in the morning.

Remember that the disc, being left on the turntable all night, will have lots of time to collect dust. Therefore, be sure to remove as much of this dust from the surface of the disc as possible BEFORE YOU REPLACE IT IN ITS JACKET.

Not all turntables are driven by belts. Some are driven by idlers, wedged between the motor shaft and the inner rim of the table. If you have one of these, you must not leave the idler engaged when the table is not turning. If you do, pressure from the motor shaft will cause flat spots to develop on the idler's surface which may not be removed during operation of the table. The irregular motion of the idler, caused by the flat portions, will be heard as added background noise when records are played.

With a turntable of this sort, turning it off with a timer is not a good idea.

Tuner Signal Loss

Q. While playing my FM stereo receiver, I noticed that the volume was decreasing steadily. I also noticed that the reading on my signal strength meter dropped from a normal reading of 6 (on a scale of 0 to 10) to almost 0. As a result, I am led to believe that there is something wrong with the tuner section of my receiver. The amplifier still works perfectly on the phono input. I would appreciate it if you could advise on what is wrong with the tuner and what steps can be taken to remedy the problem—Gerard F. Tripptree, Bronx, N.Y.

A. I agree with your diagnosis that the loss of volume is the result of some problem in the tuner section of your receiver. There are any number of things which could produce the results that you have described. It could be that the main resistor feeding voltage to the tuner has increased in value, thus depriving the tuner section of its proper operating voltage. It could also be that the bypass capacitor associated with this same resistor has become leaky. A leaky capacitor causes excessive current to flow in the resistor, with a loss of operating voltage.

If you still hear normal, interchannel hiss, all of the above can be ruled out. The tuner is receiving proper voltage. The absence of interchannel hiss, however, does not necessarily prove the above either. Such a situation may be caused by a defective i.f. transistor or IC. If hiss is nearly normal, I suggest that you check the r.f. and oscillator circuits. Defective transistors in these circuits can cause the loss of signal as can defective r.f. bypass capacitors or open resistors.

In addition, it is always well to check for cold solder connections or small cracks in the printed circuit board foils.

Voltage regulator elements associated with the tuner circuit could be defective, leading to loss of operating potentials at some points in the circuit, again resulting in a loss of signal.

I suggest that you obtain a service manual for your receiver and use it to check for proper voltages and resistances.

Just how far you can proceed with this kind of trouble shooting will depend on your background. I certainly think anyone who is capable of working on equipment should obtain service notes when he buys his equipment. If none are available, I would personally be strongly tempted not to buy the equipment.

The Technics SA-5400X. 4-amplifier 4-channel and 4-amplifier 2-channel.

Technics doesn't force you to choose between 2-channel or 4-channel. We give you both in one unit. The SA-5400X.

It's a very impressive 4-channel receiver. Each of its 4 amplifiers delivers 11 watts RMS, 8Ω, each channel driven. And its full discrete capabilities include jacks for a CD-4 demodulator. Plus jacks for both 4-channel and 2-channel tape sources. And two tape monitor circuits.

There are also two different matrix decoding circuits that can handle all the popular matrix methods.

The SA-5400X is a great 2-channel receiver, too. Because it has Balanced Transformerless (BTL) circuitry. Our special way of strapping the front and rear amplifiers in tandem for 4-amplifier 2-channel. Which more than doubles the power per channel in stereo. Producing 25 watts RMS per channel (each channel driven) at 8Ω.

The amplifiers all have direct-coupled circuitry which vastly improves their low-frequency performance and power bandwidth. And a special phono-equalizer circuit so you can use virtually any kind of phono cartridge efficiently.

There's also a very potent FM section that boasts sensitivity of 2.0μv (IHF). With a 4-pole MOS FET and IF amplifiers whose ceramic filters yield 65 dB selectivity.

We knew you'd have a hard time trying to make up your mind about which kind of receiver to buy. So we put both 2-channel and 4-channel in one easy-to-afford unit.

The SA-5400X. The concept is simple. The execution is precise. The performance is outstanding. The name is Technics.

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Technics
by Panasonic

Channel Imbalance

Q. I own an 8-track car stereo tape player. I notice that one channel is substantially weaker than the other. When I adjust the balance control all the way to the right and then to the left, the left channel does not match the right channel in volume. Also, when the volume control is turned all the way down, the right channel still is heard "loud and clear" if the balance control is adjusted to favor that channel. The left channel remains quiet. I know that both channels should remain quiet when the volume is turned all the way down.

What causes this peculiar behavior?—Gary De Bouver, Detroit, Mich.

A. At this time I would not want to say that your cartridge has shorted out or if something else has gone wrong. Cartridges short out so rarely that I suggest you make some other checks before giving up on it.

Do you have a mode switch accidentally set in its "mono" position?

Are you using a Y connector to mix two channels into one for making mono recordings? This arrangement can result in the loss of separation on the main outputs of some music systems.

Are there loose strands of wire shorting "hot" leads in the tonearm's shell? Look for solder bridges or for loose strands of wire which can short between the terminals (under the table) which interconnect the leads from the tonearm and the cables which feed the amplifier.

If all these checks prove negative, see if you can borrow a cartridge known to be good. Insert it into your shell as a final check to see if separation returns. If separation has returned, the problem really is in your cartridge. I have seldom seen an occurrence.

Cartridges and Load Resistance

Q. I have just purchased a Sansui 2000A tuner amplifier. It has provisions for both a 50 K ohm cartridge and for a 100 K ohm cartridge. My turntable is a Dual 1219 with a Shure M91E cartridge. The recommended load impedance for the cartridge is 47 K ohms per channel. Which phono input should I use?—Carter Rhodes, Midville, Ga.

A. You should use the 50 K ohm phono input for your 47 K ohm cartridge. This slight difference between what is called for by Shure and what is supplied by Sansui is negligible and cannot be heard.

European Equalization

Q. I often purchase imported phonograph records, mainly from Germany and England. These discs would have the European equalization. My amplifier has RIAA equalization. Am I losing quality when playing back these discs? If so, is there any way to correct the situation?—Louis Hone, Montreal, Canada

A. As far as I know, European discs are equalized just as ours are. Therefore, you should not encounter any problems in this regard when playing them.

NOTE

From time to time this column receives suggestions from readers with the thought that such suggestions would benefit other readers. The following is one such item:

Dear Mr. Giovanelli:

Sometimes an electrostatic speaker will produce audible output even though unconnected to a signal source. This output sounds like "snapping" or "crackling."

This is caused by corona discharge from the high voltage supply for the speaker. It may take place within the speaker itself. (The 2,000-6,000 volts are insulated by only 0.001 inch of air in the wiring or in the power supply.)

Cause: high humidity, insulation breakdown, dust, cat hairs, etc.—anything that will provide a path for the high voltage to discharge or arc.

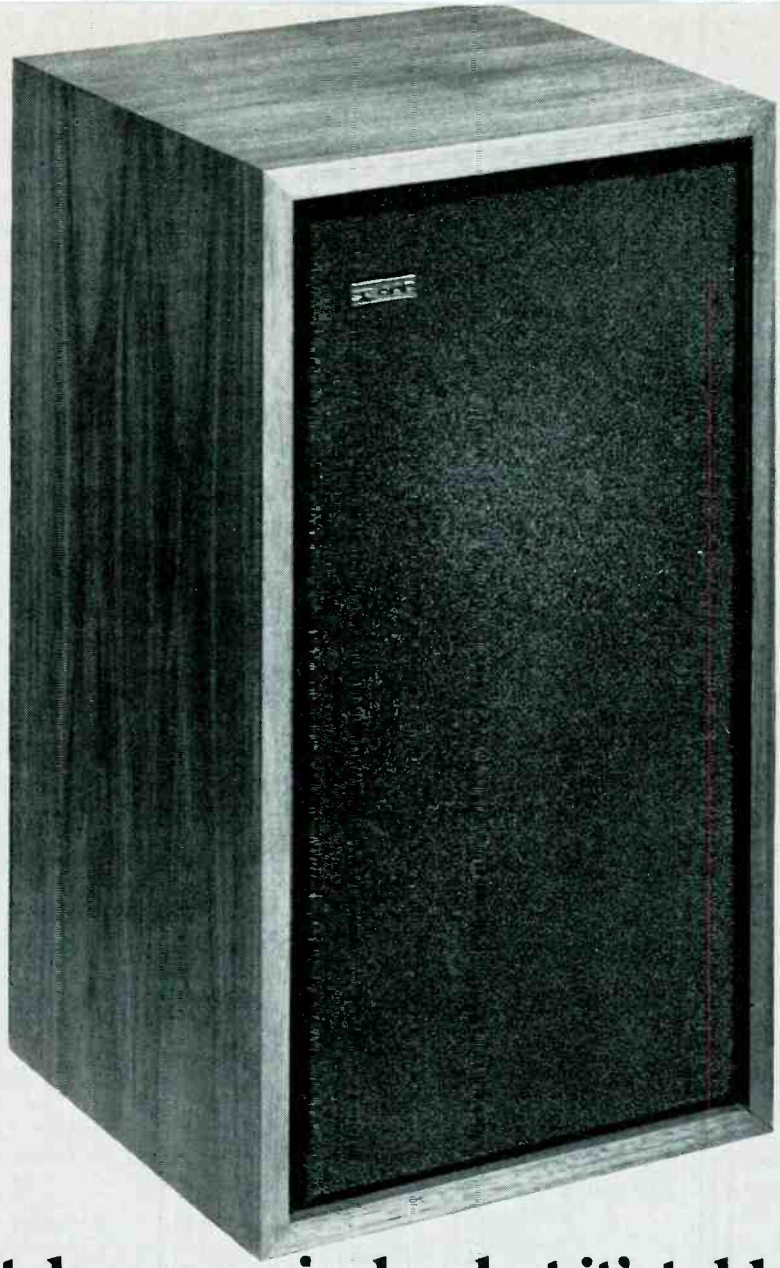
Locating: in a dark room, look inside the enclosure. (No hands, please.) You will see the arc or a blue glow of discharge.

Remedy: if the wiring has broken down, coat the wires and power supply components with high-voltage dope. (General Cement Company makes a product called Corona Dope.)

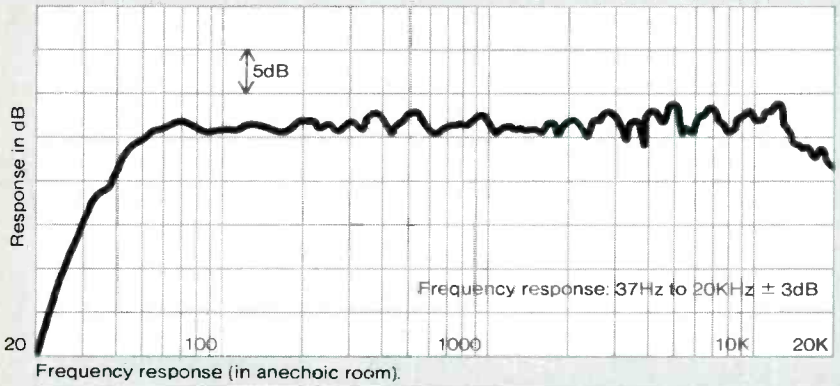
If the arcing is in the speaker and if the speakers can be taken apart, do so. Clean the speakers with a lint-free brush or cloth. Do this in a dust-free room.

In any event, let the speakers stand with the power disconnected for several days before getting into them. This will permit the high voltage to reduce to zero.—Captain John C. Wiles, Jr., Niceville, Fla.

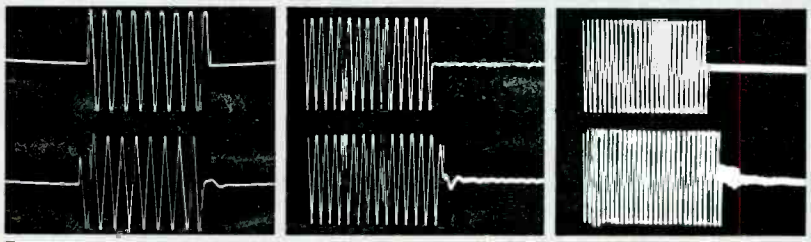
If you have a problem or question on audio, write to Mr. Joseph Giovanelli, at AUDIO, 134 North Thirteenth Street, Philadelphia, Pa. 19107. All letters are answered. Please enclose a stamped self-addressed envelope.



It does precisely what it's told.



Frequency response (in anechoic room).



Tone bursts at 500Hz, 1200Hz, 15,000Hz
Virtually identical waveforms from signal generator above and speaker below demonstrate superior transient response.

The new ADC-XT 10.

If you believe, as we do, that the ultimate test of any speaker is its ability to produce a true audible analog of the electrical signal fed to it, you'll be very impressed with the new XT 10.

The XT 10 is a two way, three driver, system employing a newly developed ten inch, acoustic suspension woofer with an extremely rigid, light weight cone and a specially treated surround that permit exceptionally linear excursions.

Matching the XT 10's outstanding low frequency performance are two wide dispersion tweeters that extend flat frequency response to the limits of audibility (see accompanying frequency response curve) and significantly improve power handling capacity.

All three drivers are mounted in a beautifully finished, non-resonant, walnut enclosure. And in place of the conventional grille cloth is an elegant new foam grille.

An extraordinarily accurate transducer, the XT 10 is characterized by very flat frequency response, excellent high frequency dispersion and extremely low distortion. Finally, it is distinguished by outstanding transient response assuring exceptional clarity and definition.

As a result, the ADC-XT 10 rivals and in many instances, surpasses the performance of units costing several times as much.

But why not experience for yourself what a truly well behaved speaker sounds like. Audition the XT 10 at your ADC dealer now.

For more detailed information on the ADC-XT 10 write: Audio Dynamics Corporation, Pickett District Road, New Milford, Conn. 06776.

ADC Audio Dynamics Corporation

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Tape Guide

Herman Burstein

Pan Pot

Q. I would like a control that would permit me to use one microphone on Channel A or Channel B or both. I guess this would employ a pot which would gradually allow the signal to pass from Channel A, to AB, to B.—Louis Hone, Montreal, Canada

A. If you have a stereo preamplifier cable of being fed from a mike, you can use its balance control as a panpot. Set the preamplifier to MONO and feed the mike in the normal manner, with the gain advanced to provide reasonable output with the balance control in the mid position. The outputs of the preamplifier can then be fed into your stereo recorder. The position of the balance control of the preamplifier will determine the apparent location of the microphone in the sound field.

All of this assumes that your preamplifier has provisions for a microphone. The microphone should not be connected to a phono input because the frequency response of such an input is not flat. There will be considerable bass boost and treble cut.

An alternative arrangement would consist of using a Y connector. One of the ends of the Y would be terminated in a receptacle which could accept your microphone. The other two ends of this Y connector would be terminated in plugs which could be connected to your recorder or mixer. Thus, we have a system whereby one microphone will feed into both channels of your recorder. By adjusting the relative levels of the inputs controls for these channels, we have a method for adjusting the effective position of the microphone in the sound field.

I think it would be difficult for you to obtain a special pan pot for use directly with high impedance microphones. Further, I do not like the idea of connecting a potentiometer directly into a microphone circuit. The adjustment of this potentiometer would result in the introduction of noise.

R.f. Interference

Q. Is there a practical method of shielding an audio system from r.f. interference? I am about 45 miles from a defense radar installation whose signals modulate very distinctly when my audio gear is operated in any mode. I also pick up radio dispatched commercial services. The problem, which is shared by my friends, is most noticeable on the high gain inputs such as phono and microphone. The noise is very bothersome when I am recording a program, because then I get the extraneous signal on the tape, and in addition pick up more interference during playback.—Stephen Bruce, Mt. View, Calif.

A. To eliminate r.f. interference, you might try using small capacitors (roughly around 10 to 50 pfd) between the input point of the audio signal and ground. However, the interference might also be getting into your equipment at following stages, and it may be necessary to follow the same procedure at these later stages as well.

Car Speaker Sound Level

Q. I have an 8-track car stereo tape player. There are two 4-inch speakers in the front and two 6x9 speakers in the rear. The rear speakers are louder than the front ones. Could you tell me what is wrong?—Marion Segler, Gary, Indiana.

A. The difference in level appears to be due to the fact that the rear speakers are more efficient. To cut down the level of the rear speakers, you can use L-Pads, obtainable from your local audio store or from electronic mail order houses. These pads usually come with instructions for mounting.

Meters, Response & Heads

Q. How does one set the VU meter so that it is reading the recording level properly? For my tape recorder, the adjustment can be made by turning a pot, but I have noticed that the reading varies with frequency even though the input to the circuit is kept constant. What is the best frequency to use? What should one see on a 'scope connected to the output of the tape system when the recording level is set too high?

What should be considered to be good frequency response (±1 dB) of a good quality tape deck?

Is there a book that explains interchangeability of tape heads? Are they like phono cartridges in that the electrically similar types can be interchanged (e.g. one magnetic cartridge can be interchanged with another magnetic)?—William R. Lafferty, Wilmington, Del.

A. An accepted way of setting the VU meter is to have the pointer 0 VU at a recording level such that a 400 Hz signal results in 1% harmonic distortion on the tape. Alternatively, you can purchase a test tape which contains such a signal, equate your recording signal level at 400 Hz with the test signal, and adjust the VU meter to read 0. To equate the two signals, you adjust the recording signal until it produces the same playback output as does the test signal. If the recording level is too high and you are recording and playing a low-frequency signal, you should be able to see a distorted waveform on the 'scope. However, if your signal is a high-frequency one, you will still get a sine wave on the 'scope, because the harmonic distortion products are outside the capability of the tape system.

A high quality tape system should be able to provide response flat within approximately 1 dB between about 40 and 16,000 Hz at 7½ ips, and between about 40 and 10,000 Hz at 3¾ ips, along with high S/N and low distortion. The upper response limit can be considerably extended at both speeds if one is willing to let distortion rise and/or signal-to-noise ratio decline.

Your question about interchangeability of tape heads might better be addressed to a manufacturer of heads, such as Nortronics. In a general manner, I can say that tape heads are not interchangeable in the way that phono cartridges of the same type are.

Tape Squeal

I have been a victim of this horrendous defect of Scotch 203 for a long time and with three entirely different tape recorders. The squeal is due to "sticktion" of the lubricated tape surface to the small-diameter tape guides after they warm up a little. The fol-

Picture your system on the tube.

The Heathkit AD-1013 Audio-Scope—seeing is believing

A professional-grade oscilloscope that visually monitors stereo and 4-channel discrete and matrixed systems. Now you actually can see channel separation, phasing, relative signal strengths, multipath reception, center tuning of receivers and tuners, and more. And in easy-to-build kit form you save virtually hundreds of dollars over what you would normally pay for an instrument this reliable and versatile.

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You can build the Heathkit Audio-Scope even if you have never built a kit before. Most components mount on one large, roomy circuit board — and point-to-point wiring is held to a minimum. At this low kit price, it's well worth your time. Because when it comes to an unbelievable audio system, one picture is worth a thousand words.

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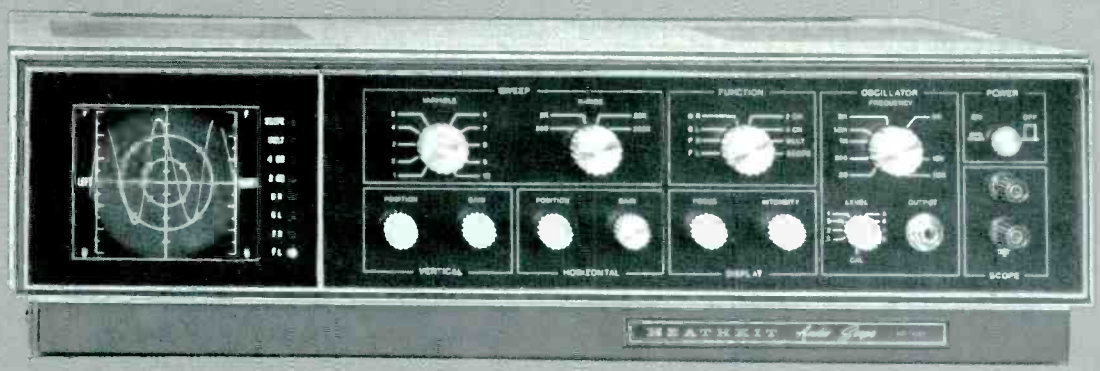

SPECIFICATIONS

AD-1013 SPECIFICATIONS — FRONT PANEL — Scope Input: Vertical Sensitivity; 25 millivolts P-P/cm. Input Impedance: 100 kΩ. Frequency Response: 5 Hz to 200 kHz ±3 dB. **Audio Oscillator Output:** Range: 20 Hz to 20 kHz. Voltage Level: 2 mV to 3 volts (rms) (variable). Output Variation: .25 dB 20 Hz to 20 kHz. Output Impedance (front panel jack); Approximately 600Ω. Calibrator Voltage: 1.0 volt P-P ±5%. Total Harmonic Distortion: 1% or less. **REAR PANEL — Oscillator Output Impedance:** 600Ω. **Multipath Input (Scope Horizontal and Scope Vertical):** Sensitivity: 25 mV P-P/cm. Input Impedance: 100 kΩ. **Left Front, Right Front, Left Back and Right Back Inputs:** Sensitivity: 25 mVP-P/cm. Input Impedance: 100kΩ. Frequency Response: 5 Hz to 200 kHz, ±3 dB. **4-Channel Input:** Sensitivity: 1 volt P-P/cm. Input Impedance: 500Ω. **GENERAL — Triggered Sweep Generator:** Range: 10 Hz to 100 kHz. Power Requirement: 120 or 240 volts AC, 50/60 Hz, 15 watts with no accessory load. AC Outlet (on rear panel): Unswitched. Dimensions (overall): 5⅛" H x 18½" W x 13½" D.

ATTENTION AR-15 AND AJ-15 OWNERS: In less than an evening you can add multipath provision to your equipment. The AR-15-1 Adaptor Kit makes your AR-15 or AJ-15 compatible with the AD-1013 above, or any DC-coupled oscilloscope, for observing multipath conditions which may be limiting the quality of your FM reception.
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lowing measures help: (1) Use a quiet blower (Rotron and similar) to keep tape contact surfaces cool. (2) Wrap a layer or two of teflon adhesive tape around all tape guides on the feed-reel side and between heads. (3) Try tape of other makes, although I must admit Scotch 203 is a beautiful tape.—Alex Azelickis, Morton Grove, Ill.

To other readers who have also written in with advice more or less along the above lines, let me express thanks and apologies for not being able to print their exact comments.

Misalignment Spillover

Q. I have a Revox 6-36 stereo tape recorder. I use this monophonically. When I record on channel 1 (outside tracks 1 and 4) the machine records a sputtering sound on the adjacent *tracks (inside tracks 2 and 3); thus when I record on track 1, the sputtering sounds are recorded on track 2. What could be the cause?*—John Napoliello, Philadelphia, Pa.

A. It may be that there is noise in the channel 2 electronics, and that due to adjacent channel "spillover" or to vertical misalignment of the record head with respect to the playback head, this noise is being recorded on the adjacent channel.

Receiving Dolby Broadcasts

Q. Please explain how I can hook up a Dolby B decoder to my FM stereo tuner or receiver in order that I can receive Dolby-processed FM broadcasts. —Michael Libretto, Brooklyn, New York

A. To receive Dolby-encoded FM broadcasts, the simplest approach is to substitute the Dolby decoder for a tape recorder, making use of the "tape out" and "tape monitor" jacks on your equipment. This will eliminate some of the problems which could come up when using a separate FM tuner rather than an integrated receiver.

The jacks on your Dolby decoder normally used in conjunction with the output of your tape recorder are connected to the "tape out" jacks of your sound system. The jacks on your Dolby decoder which normally go to a power amplifier input, high level aux. input and the like, now go to the "tape monitor" jacks of your sound system. If your Dolby processing equipment is equipped with separate recording facilities, they may be disregarded at this time.

The only problem is that you will have to wait for a time when the station employing the Dolby system is transmitting calibrating tones for Carefully mark the calibration knobs so that you can accurately reset them whenever you wish to use the decoder with your FM equipment. In this way you can use your Dolby equipment for any other purpose and at any time you can once again listen to Dolby-processed FM broadcasts without waiting for calibration tones.

If you plan to record such broadcasts, feed the tape machine with no Dolby circuits used. The programs are already encoded so no further encoding is required or desirable. However, the tape must be played with the Dolby decoding circuits activated. Be sure to record at proper levels, established during the calibration of your tape machine and Dolby processor. This will allow you to decode the broadcasts properly when playing back the tape.

Microphone Connection

Q. I have a pair of relatively expensive microphones with 50,000 ohms impedance, which I purchased for use with the Miranda Nocturne Tape Recorder. I have added a Concord Mark III deck, with an input impedance of 20,000 ohms. Its manufacturer recommends a mike with an impedance of between 6,000 and 20,000 ohms and an operating level between -70 and -50 db. Would either the mikes or the deck be harmed by using the mikes directly with the Mark III? If not, what would I lose in quality?—George W. Ferguson, Metuchen, New Jersey

A. I doubt very much that any of your equipment could be harmed by the connection you describe. If you connect your high impedance microphones to an input impedance of 20,000 ohms, I think that the principal adverse effect will be a loss of sensitivity. However, your microphones may have enough sensitivity so that, together with the gain of the tape deck, the loss is tolerable. There may also be an increase in distortion; offhand, I cannot tell whether this would be a noticeable increase, although I am inclined to doubt that it would be.

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.

This is "one powerful set!"

"It was in the area of audio amplification, however, that we got our biggest surprise. The S-7200 is one powerful set."

This quote from Audio Magazine, May 1973, evaluating the Sherwood S-7200 AM/FM stereo receiver, surprised us.

Not that the reviewers found it to be such a powerful set. But that they found it so surprising.

The fact is, most people who are into Hi-Fidelity components, are discovering that Sherwood delivers on its claims. And then some.

Or, to quote further from the review:

"The 40 dB mid-band separation figure is exceeded by 3 dB."

"With a signal as little as 5 uv, quieting had already reached an impressive 52 dB."

"THD in mono exceeded published claims, reaching a low figure of just 0.2% at mid-audio frequencies."

"Our power amplifier tests were confined to 8-ohm loads, but at that, the Sherwood S-7200 exceeded its claims and pumped nearly 43 watts into each load, with both channels driven."

"Based upon a 40-watt rated output per channel, power bandwidth extended from 10 Hz to 40 kHz, quite a bit better than claimed. At the audio limits of 20 Hz and 20 kHz, 1% THD was reached at 36 watts per channel and 40.5 watts respectively, while at all power levels below 40 watts, THD remained well under 0.5% for all audible frequencies."

"The loudness-volume control of the S-7200 deserves special mention. The tracking of the two sections of this control was excellent—with no more than 1 dB variation all the way down to 60 dB from the full clockwise position—which means that high quality potentiometers are used in this all important control."

But in the end, it is the power of Sherwood receivers that normally turns people on.

"Using low efficiency speaker systems in our main listening area, we just could not overdrive the amplifier portion at any desired listening level—and we mean all the way up to over 100 dB sound-pressure levels."

Which perhaps brings us to this point. If there is one impressive factor about Sherwood receivers, it is that they often not only outperform their specs: they almost always out-spec competition.

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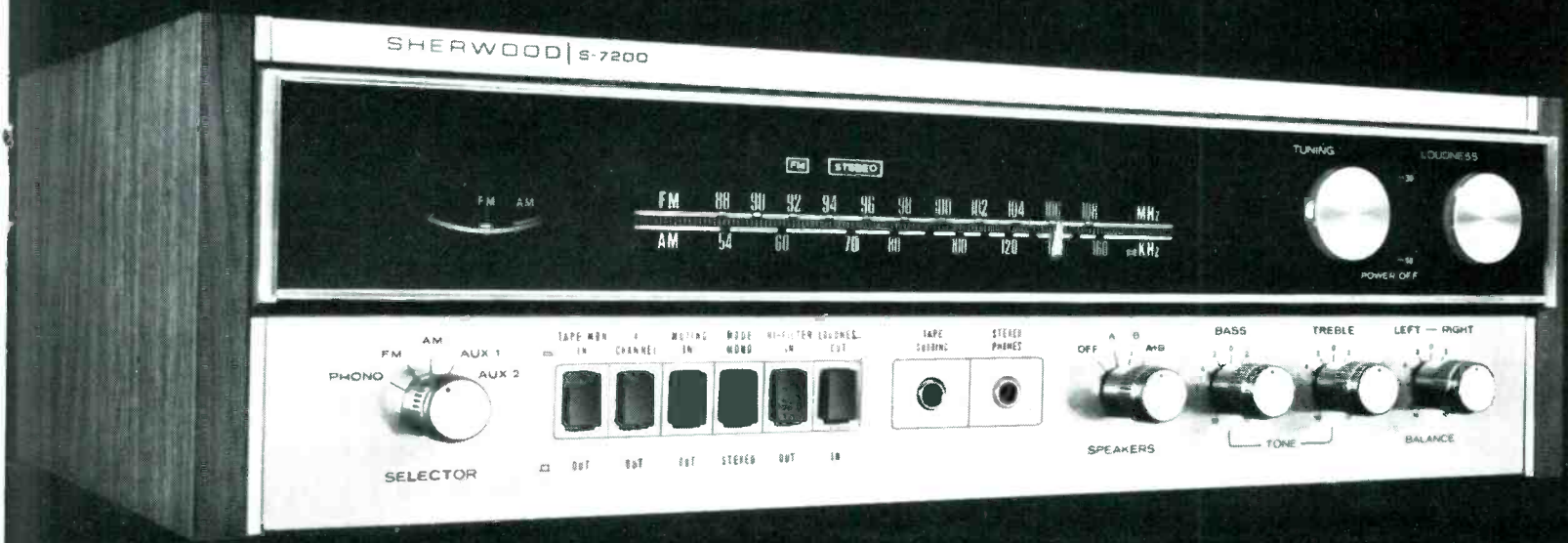

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Behind The Scenes

Bert Whyte

THE OTHER day I was leafing through the pages of that venerable British publication, *The Gramophone*, and I came across a wonderful "letter to the editor," in which the writer was heartily condemning quadraphonic sound. "Sound around me . . . a concert hall experience?" he asked. Then he went on to say that "the only sounds I ever hear behind me at a concert are the coughing of my fellow concert-goers and the whispering of bored ushers."

It goes without saying that this "Bah! Humbug!" attitude is not too unexpected. People have always resisted change. The transition from mono to stereo began in 1958 and it is only in the past several years that record manufacturers in this country ceased production of mono discs. Some of my friends in the European hi-fi press have told me in no uncertain terms, that Europe still is quite substantially a monophonic market.

Be that as it may, and with all due respect to our fustian friend in *The Gramophone*, quadraphonic sound is an idea whose time has come. Certainly the advent of the universal four-channel receiver at the CES is indicative that we are well and truly beginning the era of quadraphonic sound. It is well to remember that in this space age, things can happen a great deal faster than was the case in 1958. New developments in four-channel stereo are frequent these days, and the time factor in turning a laboratory exercise into a commercial product is remarkably brief. A case in point is the use of Dolby B-Type noise reduction in stereo and quadraphonic 8-track cartridges.

Readers of this column know I have been advocating this idea for some time. In my report on the CES, I related that 3M/Wollensak had two cartridge units fitted with Dolby B circuits, and that Ampex Stereo Tapes made available a Dolbyized demonstration cartridge. Now, in short order, I learn that by the time you read this, Columbia, and EMI (England), will be issuing both 2- and 4-channel Dolbyized cartridges, and Hispavox (Spanish Columbia) will be issuing 2-channel stereo cartridges. I now have a Dolby level set cartridge, Catalog #54, which is the same 185 nWb/m flux level as the open-reel standard. With the Dolby B chip now available, it is obvious we will soon have cartridge units capable of Dolbyized quadraphonic playback. Thus in retrospect, from the time I started to nag about the need for Dolbyized 8-track cartridges to the actual appearance of such a product (plus Dolbyized playback equipment) is slightly over a year. That's what I call space age hustle!

I have always maintained that one of the big problems with quadraphonic sound is that most people who are exposed to it rarely get a proper demonstration of the true worth of the medium. Admittedly, the configurations of many hi-fi dealers' showrooms aren't conducive to good speaker placement. And the noise levels in these places is definitely inimical to demonstrations of ambient-type quadraphonic. The more venturesome dealers have invested in special four-channel stereo sound rooms. A few of them are really splendid facilities, but it is becoming apparent that even when the effort is made in furnishing such amenities, their value is negated by lack of sales personnel who are knowledgeable about quadraphonic sound and by poor utilization of the various formats of four-channel stereo music. It is obvious that as we get further into the quadraphonic era, special training in this medium is going to be a requisite for dealer personnel. Part of this training may have to originate with the manufacturers of quadraphonic hardware, or become a function of their sales reps. The training classes at the Society of Audio Consultants in New York could also be a most significant factor. And I repeat again, some method of getting loan equipment into the home of the customer is unquestionably the best way to convince him about the virtues of quadraphonic sound.

My personal involvement with quadraphonic sound is quite extensive (as you may have noticed!). I have many people visit me, some of whom have never heard any kind of quadraphonic sound, and others who have heard it, but were either unimpressed or even soured on the whole idea. Of course I have friends who are "believers" too! In any case, I am equipped to give these people a good quadraphonic demonstration, whatever their cultural or economic levels. For example, I am currently utilizing the following equipment: An Ampex 440-4, running half-inch wide tape at 15 ips through four Dolby A361 units. Commercially recorded tapes in this format are not available so you must either make your own live recordings or be a member in good standing of the "Intra-Industry Tape-Swapping, Chowder and Marching Society." Some splendid recent acquisitions are a rousing *1812 Overture*, the Bartok *Concerto for Orchestra* and *Petrouchka*. Needless to say, this is discrete four-channel stereo and Grade A . . . all the way!

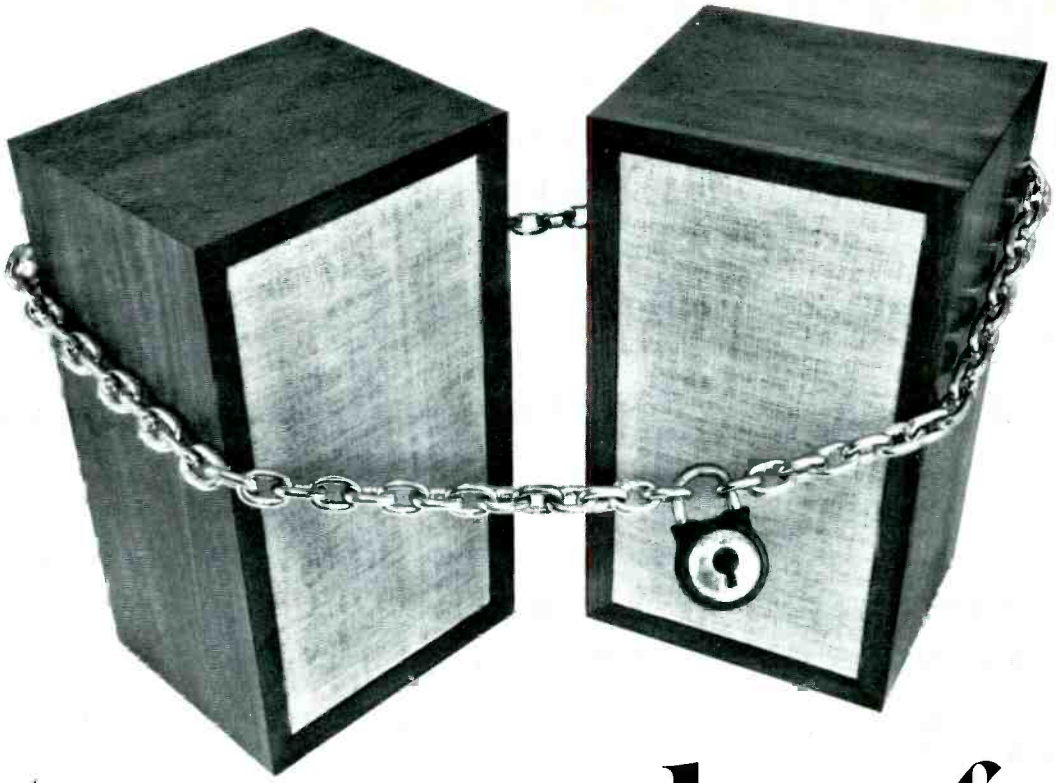
For quarter-inch discrete four-channel stereo tapes, I use the big Crown 844-4CX, running through four channels of Dolby 505 B-Type noise reduction for things like the Vanguard "fore and aft" Dolbyized quadraphonic recordings. Incidentally, Ampex Stereo Tapes will soon be issuing open-reel Dolbyized four-channel tapes.

Four-channel eight-track cartridges are nicely handled by a Wollensak 8060 unit which, by the way, I have just checked out with the new Dolby level set cartridge and soon will bring you a report on recording Dolby cartridges.

On the disc aspects of quadraphonic sound, my QS matrix recordings are decoded by a Sansui QS 500, the SQ matrix recordings through the full/wave matching logic section of the Lafayette LR-4000 receiver. CD-4 discrete quadraphonic discs are played back with a Panasonic demodulator using either the Audio-technica AT20S cartridge or the new Stanton 4DQ780 cartridge. The cartridges are mounted in a Rabco SL8E radial-tracking servo arm, and the turntable is the Technics by Panasonic SP-10. I must take a moment to tell you that this is a most extraordinary turntable, utilizing a direct-drive brushless DC motor and a servo speed control system. The wow and flutter are at a 0.03% WRMS level and rumble is a totally inaudible −65 dB (DIN A). Most important is that vertical rumble, which can raise hob with stereo and quadraphonic recordings, is also inaudible. The 33⅓ and 45 rpm speeds can be adjusted plus or minus 2% with a strobe light indicator to tell you when you are "on the nose." The SP-10 turntable is mounted on a special shock-mounted base (model SH-10B1). Rarely have I been as satisfied with a hi-fi product as with this beautifully finished turntable. The motor is completely silent and placing your hand on either the turntable framework or the wooden base reveals no vibration whatever. Playing recordings with heavy bass at high level with the turntable practically next to a speaker elicits not the tiniest hint of acoustic feedback.

As you can see from the foregoing line-up of equipment, I should be capable of handling any kind of quadraphonic eventualities.

My fancy disc playback equipment has been kept busy the past few days, since the first batch of Elektra/Nonesuch



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Your amplifier is probably too weak to break the chains that bind your speakers. An underpowered amplifier will lock your stereo system into clipping during low frequency passages or on musical peaks, forcing you down to a less than realistic listening level.

The key to the solution is a high-powered amplifier, specifically, the Phase Linear 400. Listen to Julian Hirsch of Stereo Review: "Anyone using a low efficiency speaker system with an amplifier in the 30 to 50 watt class cannot approach a realistic listening level without severe clipping."

The Phase Linear 400 will unlock music you never dreamed existed in your favorite records. How long has it been since you've had a dream fulfilled? Listen to the Phase Linear 400 at your dealer's soon.

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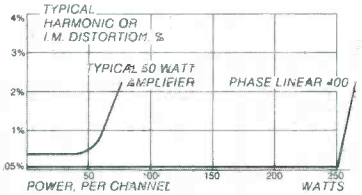

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CD-4 records finally arrived. These are the first CD-4 records from other than RCA or JVC, and the overall impression I have formed thusfar, is that Elektra/Nonesuch know what they are doing. On an album entitled "Stardrive," EQ5058 Elektra, which is a sort of far-out semi-rock, pseudo-spaceship type music featuring the electronic synthesizer of Robert Mason, it is obvious the original intent was a quadraphonic recording. Although it is true that instruments can be placed anywhere in the four-corner scene of surround sound, you usually can tell if a quadraphonic recording was the result of taking some sixteen-channel stuff out of the vault and hoping the quad mix will be acceptable, versus the deliberate instrumental positioning and arranging for maximum dynamic effects in a quadraphonic original. Good clean sound throughout this disc, apparently at or close to standard stereo level and with a solid bass line. On another Elektra Quadradisc, "The Best of the New Seekers," EQ5051, we have an excellent vocal group, 3 male, 2 female, who along with appropriate instrumental background harmonize on some pleasantly innocuous ballads. The main point is that here again is audible evidence of care in arranging and positioning with quadraphonic sound in mind. Bright, clean sound, nicely articulate voices, good level and bass. Turning to classical material, we have Kurt Weill's *Suite from the Threepenny Opera*, coupled with Darius Milhaud's *La Creation du Monde* on Nonesuch Quadradisc HG1281. Conductor Arthur Weisberg and the Contemporary Chamber Ensemble do a thoroughly workmanlike job on these two disparate pieces of music. Yes, both works have so-called "jazz" elements incorporated into the scores, but in my opinion each represents a different milieu. The fine engineering was the work of my good friend, Marc Aubort, of Elite Recordings. Marc has found a certain church in New York with superbly spacious acoustics, which, however, with just the right mike placement, allows for excellent orchestral detail as well. This is ambient style quadraphonic recording, and the enhancement of the principal "up front" information is masterfully handled by Marc, so that at a rest in the music where the sound has a chance to naturally decay, your ears perceive the sound progressing from front to rear. Here too, nice clean sound, fine instrumental balances, with normal levels and good bass. I have saved mention of record surfaces until now. The pop recordings were beautifully quiet, but alas, the classical disc was full of spits and sputters. It is said that the lubricant in the CD-4 compound (and in the case of RCA with the anti-static material as well) will, under certain circumstances having to do with the heating/cooling cycle during the pressing process, deposit out in the record grooves in the form of tiny crystals. When the stylus encounters these crystals, you get the sputtering and popping sounds, even though the record is brand new from its shrink-wrapped sleeve. Lou Dorren of Quadracast and CD-4 chip reknown, says that after playing an offending record several times, and then cleaning it with some special "glop" he concocted, the noise disappears. Lee Kuby of Harman/Kardan has a bottle of this stuff and says he will let me try some. (He's a lot nearer to me than Lou). I understand RCA has a new compound, with superior overall characteristics to what is used at present and that with this material this noise problem has been licked. Undoubtedly, with all the cooperation among the Quadradisc people, Elektra will be privy to the information on this compound.

In the meanwhile, 9 more new Elektra/Nonesuch CD-4 discs to audition, and on the basis of what I have heard thus far, they are off to a good start.

Sony was the first electret condenser microphone and still is.

Since 1969 when Sony manufactured the first condenser microphone using the electret principle of capsule polarization, they've been expanding and improving the line. (Just because you're first doesn't mean you stop trying.) The result—Sony's NEW ECM-280 and ECM-250 Cardioid Condenser Microphones that deliver all the accuracy of studio-quality sound. Both feature unidirectional, cardioid pick-up patterns to minimize background noises and acoustical feedback. And each incorporates FET electronics that insure low noise, high sensitivity and stable performance.

The NEW ECM-250 from Sony offers excellent frequency response characteristics and the lowest possible distortion at maximum sound pressure levels. Plus a built-in protective windscreen makes the versatile ECM-250 ideal for outdoor miking.

The Sony ECM-280 has a bass roll-off switch (a feature found in only the most sophisticated professional studio microphones). When the kettle drum's got too much boom or the speaker's voice has too much resonance, one simple setting will remove those low frequencies to balance out the entire frequency range. (And the additional windscreen makes noise-free outdoor recordings a snap.)

These incredible NEW Sony microphones are just two in a complete line of condenser microphone models with prices as pleasing as their performance. As low as $19.95. Listen to the difference in Sony microphones and all the exciting Sony tape recording equipment at your Superscope dealer. Sony was and is the first.

SONY. Ask anyone.

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Editor's Review

MAYBE IT'S JUST a sign of the times, what with Watergate, the Soapbox Derby champ being busted (or is it washed out?), mass murder/sex crimes, two dollar devaluations, food so expensive you can scarcely afford to buy it, but I seem to have had a rash of complaints about audio gear lately. What struck me as odd about the complaints was that they were about equipment and manufacturers I knew to be good and reliable. Further, fully three-quarters of the complaints were for alleged poor service either before or after the sale, and I could see no reasonable basis for the complainers thinking that they ought to have been treated differently, since they would only have gotten worse service.

There probably is something I don't understand about all this, and I used to put such things down to what my father called the innate animosity of inanimate objects. (We need not go into the fact that I tend to use simpler, plainer, more descriptive Anglo-Saxon words.) But I am beginning to wonder now—perhaps I'm getting old—whether or not we've a right to expect a very complicated machine, such as a receiver, to work right the first time and every time thereafter. Indeed, the very expectation that such machines *ought* to work in that fashion is something of a tribute to the engineers who design systems for putting all that stuff into one relatively little box. After all, who ever said that a turntable had to work as well as a hammer. (No, wiseguy in the back row, that's not what turntables do to records.)

Mostly what my complainers wanted was to have their hands held until the pain and shock of a broken expectation went away. They got that, with an apology from me for perhaps having told them that the equipment they bought after reading our equipment profile would never break down or produce more than 1 per cent THD under any circumstances.

The fact of the matter, as I have indicated above, is that we have come to expect and do actually receive an extremely high level of performance from audio equipment. Further, the state of the art seems to be advanced every couple of years and it is becoming more and more difficult to attain that level of performance at all, let alone consistently.

I'm not suggesting that we ignore shortcomings of components, but rather that we be a bit more tolerant of the service rep. Everybody knows all the jokes about complaint windows, but I've never seen the owner of a smoking amp joke at all. I certainly wouldn't want to have a job where my only relief from checking transistors, resistors, and capacitors was to have such a guy holler at me. Maybe the next time you take your busted component to be serviced, it might be nice to thank the guy behind the counter for doing something you can't or don't want to do yourself.

Electronics Design Contest

Motorola HEP Semiconductors has announced a "Design-In," an electronic project design contest offering scholarships totaling $9,000. Open to students, experimenters, technicians, inventors, teachers, and professional engineers, the contest will run until December 31st of this year.

There are two general categories, with professional engineers in one and everyone else in the other, and equal prizes are being offered for both. Grand prize in each category is a $2,500 scholarship; first prizes are $1,000 scholarships; second prizes, $500 scholarships; and two third prizes in each category are $250 scholarships.

First elimination judging will start at the close of the contest, with judging based on originality and simplicity of design, usefulness of the project, convenience and ease of construction, and suitability of design. Parts must cost less than $100 total and must include at least two HEP semiconductors.

Contestants selected for semi-final judging will be provided with all parts required for their project at no cost and will then be expected to construct their projects for final judging by a panel of electronics experts. Contest rules and entry blanks are available from any HEP supplier.

"Aw, Gee Whiz" Dept.

According to a wire service story, the Clark Equipment Co.'s Industrial Truck Division in Battle Creek, Mich., has installed an anechoic chamber to test lift trucks for noise emission levels. Said to be one of the first of its kind to be used in assisting in the design and manufacture of material handling equipment, the chamber has a "silenced" ventilation system which completely changes air in the room every minute, allowing the instruments to be monitored while a truck is running.

Thank goodness for that silenced vent system. I wouldn't want to be overcome by a lack of emission controls while testing noise controls. *E.P.*

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HIGH FIDELITY FROM CASSETTE SYSTEMS

M. B. Martin*

THE PURPOSE of this article is to discuss a relatively small number of factors which affect the quality of recording and reproduction from cassette tape. The discussion is confined to considerations which came to light as part of the work of developing a new cassette tape and no attempt is made to completely analyze the cassette recording system.

The modern cassette tape system has reached a point where high fidelity sound recording and reproduction is a proven fact and effective competition with the phonograph disc is technically feasible. The development from the high noise, low quality system to the present state has been unusually rapid; one of the reasons being that the standards of tape speed and recorded track width have been adhered to, thus permitting technical development to be applied to improving quality and not to achieving greater economy of tape or providing a larger number of tracks per unit width. In the past, technical improvements in magnetic recording have, to a large extent, been applied to the economics of the system; whereas, with phonograph records, the standards have been fixed over long periods of time permitting developments to be applied to the improvement of quality thus, at the consumer level, the phonograph record has always been able to compete with tape from a quality of sound viewpoint, as well as being a more easily handled medium at a lower price per playing minute.

As part of the design project for a new cassette tape, the cassette recording system was analyzed to better understand demands made upon the recording media by the hardware and current recording standards. The work included a study into the effects of noise reduction systems, the relationships between recording head gap length and coating thickness, and some brief investigation into the energy spectra of music. The latter investigation confirmed the belief that, in many ways, the best method of testing to provide the most meaningful results, in relation to music recording, is to use as the signal source pink noise, the energy of which reduces at the rate of three dB per octave as frequency increases .

The Test System

Much of the data presented was generated by the use of white or pink noise as the signal source and a General Radio Real Time Analyzer, Type 1921, as the detection system. Frequency response curves, music spectra, and spectrum analysis of noise are printed out by the analyzer on an X-Y Plotter. When white noise is used as the signal source, the analyzer is adjusted to have a sensitivity which reduces by 1 dB for every third octave with increasing frequency; under these conditions a system with a flat frequency response will produce a horizontal line printout. When pink noise is used, the analyzer is set to a flat response so that a system with a flat response will also produce a horizontal line printout.

The frequency response data presented here was analyzed using an integration time of eight seconds, system and tape noise spectra were taken with an integration time of eight seconds, and a variety of integration times up to 32 seconds were used for the analysis of music spectra. This method of taking data has a number of significant advantages; two worthy of mentioning are:

1. Families of related curves can be plotted in a period of time short enough to permit the exclusion of system drift effects from consideration as affecting measurement accuracies.
2. The use of pink noise tests the tape and system under conditions which are a good approximation to those generated by modern music incorporating electronic synthesizers, heavy percussion, and electronically assisted string instruments.

All data presented in this article was taken on recorders which have very low electronics noise and, therefore, the signal-to-noise performance is dependent on the tape characteristics alone. Unfortunately, in real life, this is not always the case; the author has seen more than a few so-called high fidelity cassette recorders where the electronics noise predominates. With modern solid state circuitry, this is unforgivable particularly when, as so often happens, the recording amplifier is so noisy that the recorded noise completely obscures the bias noise of the tape. Obviously, with such a machine, there is no way that a better tape can improve the situation.

Tapes

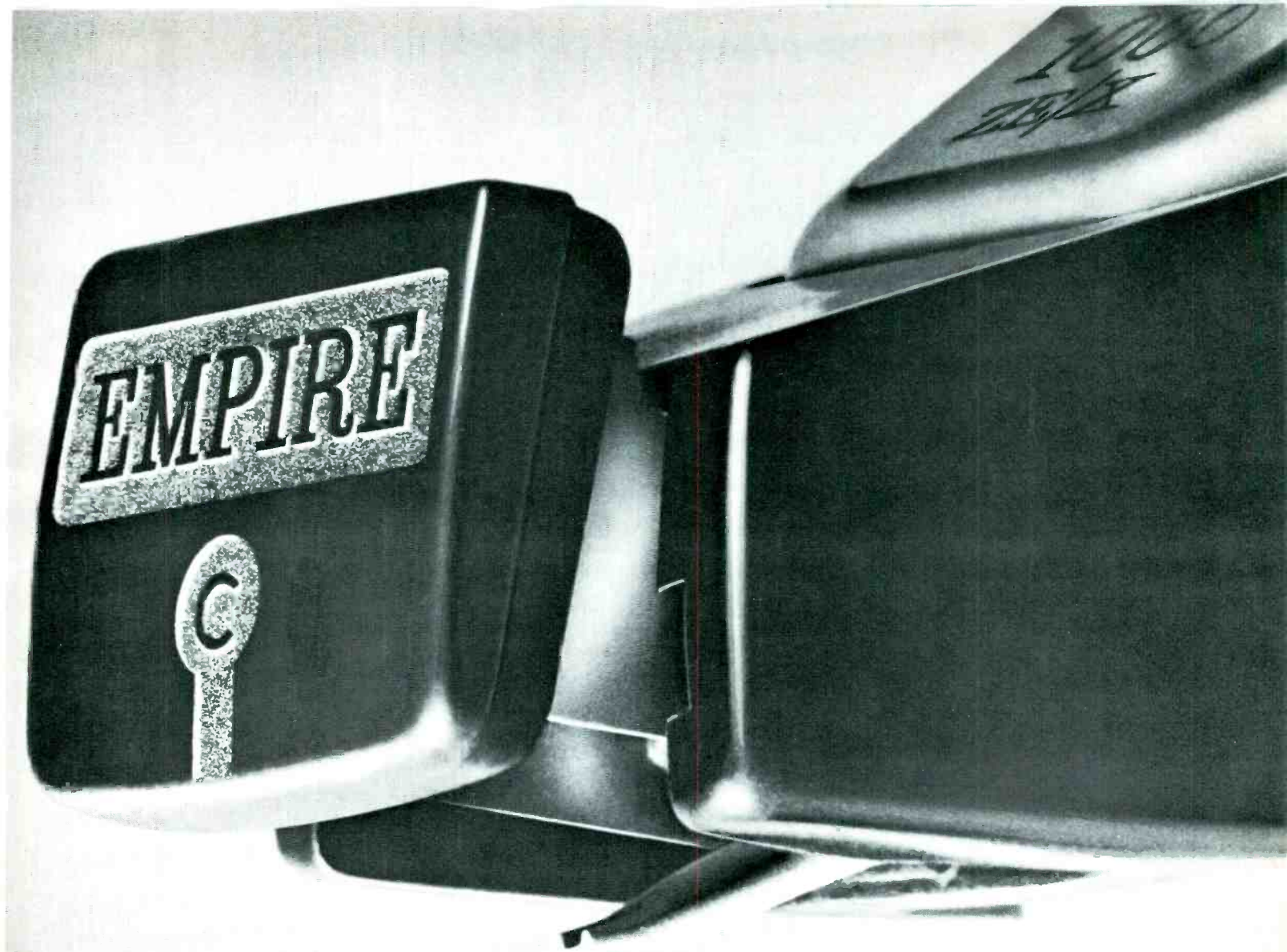
Reasonable high fidelity recording and reproduction can be achieved with four classes of tape. Listed in order of appearance on the market as cassette tape, they are:

1. Low noise, high output tapes;
2. Chromium dioxide tapes;
3. Chemically modified gamma ferric oxide tapes—cobalt or Fe_3O_4 (magnetite) doped particles, and
4. Highly developed gamma ferric oxide tape such as MRX_2.

The characteristics of the tapes are determined by the magnetic particle used. Within each of the four categories, there will be differences in performance from manufacturer to manufacturer determined by the differences in the processing and formulations of the binder system used by each company.

Cateogry 1: Low noise, high output tapes, use a magnetic particle which is unmodified gamma ferric oxide (γF_2O_3). The improvement in performance over the earlier ferric oxide tapes is achieved by a reduction of particle size and some improvement in shape. The particle still is troubled by the

*Memorex Corporation



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presence of protuberances known as dendrites and holes and the important length/width ratio varies from 4:1 to 6:1.

Category 2: Chromium dioxide[2], is a synthetic compound with magnetic properties that are, in some ways, superior to those of ferric oxide. The fundamental particle size is approximately the same as the irom oxide particles in category 1, but its shape is almost perfect, being a single crystal with a length to width ratio of 8:1 with no dendrites or holes. In addition, the coercivity is higher, 500 oersted as compared with 300 approximately. As a result of the better shape, the particles can be more accurately aligned in the direction of tape travel which, with the high coercivity, results in a much improved magnetic performance at the short wavelengths; i.e., high frequencies.

Category 3: The chemically modified gamma ferric oxide particles, are, in size and form, the same as the pure ferric oxide used in category 1. The improvement in performance is obtained by the addition of carefully controlled small amounts of impurities; either metallic cobalt or magnetite (Fe_3O_4), another oxide of iron. The effect of these impurities is to raise the coercivity of the particle and increase its magnetic efficiency. The formation of the crystal is not improved. Additionally, there is a tendency for chemical instability which results in some magnetic instabilities under certain conditions which can easily occur in practical use. There have been several short-lived attempts to make tapes from these types of particles over the past 38 years. Time alone will tell whether today's particle chemists have solved the problems.

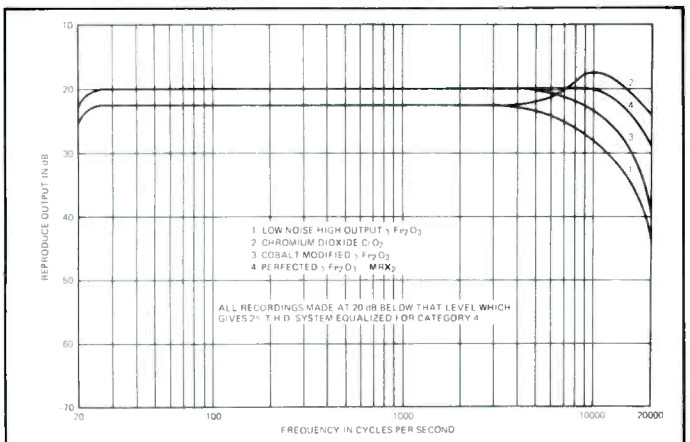

Fig. 1—Comparison of frequency response.

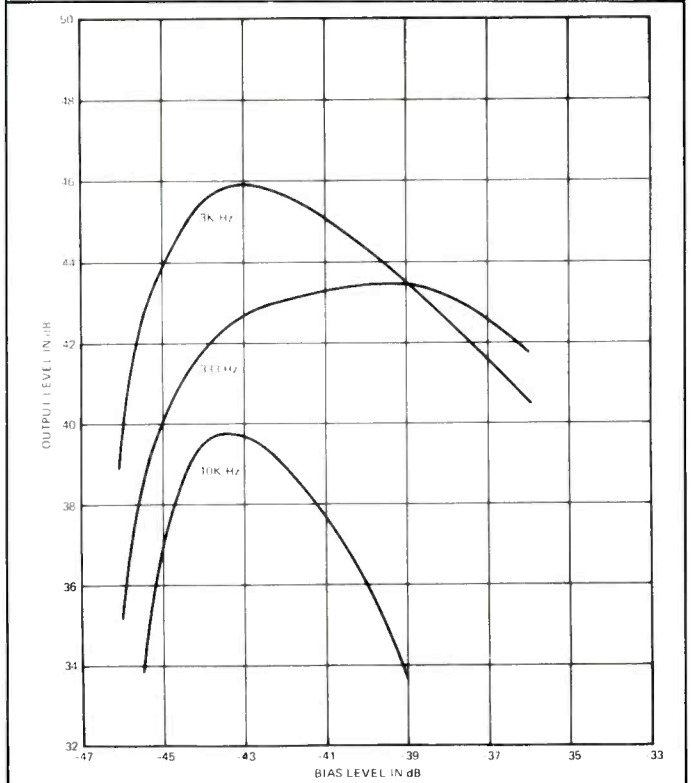

Fig. 2.1—Output/bias level for low noise, high output tape.

Category 4 uses a pure ferric oxide particle chemically identical with that used in category 1 which means that it has all the inherent stability and other properties which have made γFe_2O_3 the only wholly successful magnetic compound of iron for tape since its introduction in 1936. The improved performance is obtained entirely because of a perfected crystal shape with a length/width ratio of approximately 10:1. The absence of dendrites and holes gives the tape designer the capability of increasing the magnetic density and, hence, the magnetic efficiency of the coating. Much better orientation is also achieved and the resulting tape is considerably more efficient at all frequencies. Because of the better particle packing, dispersion, and orientation, the undesirable modulation noise effects caused by magnetic discontinuity are significantly reduced. At the time of writing, we believe MRX_2 is the only cassette tape containing this magnetic oxide.

Figure 1 shows the differences in the frequency response of these four categories of tape at 1⅞ ips when recorded with the bias carefully optimized for each and the signal recorded at a level 20 dB below that level which gives 2% total harmonic distortion at low frequencies. For the purpose of showing the differences in response between these tapes, the recording pre-emphasis was maintained at the optimum for the perfected gamma ferric oxide. The chromium dioxide essentially has the same output; i.e., the same sensitivity at low frequencies as the low noise, high output tape, whereas the cobalt modified and the perfected particle have a higher output at the long wavelengths resulting from approximately 2 dB greater sensitivity and the ability to accept a higher recording signal. The perfected particle also has a greater efficiency at the high frequency or short wavelengths which result in up to 8 dB more sensitivity at 10 kHz at 1⅞ ips when compared with high output, low noise ferric oxide tapes and about 2.5 dB less sensitivity than chromium dioxide tape.

Figure 2 gives typical bias output curves for each of the four types of tape at three signal frequencies, 333 Hz, 3kHz and 10 kHz. The optimization points for the three ferric oxide tapes are very similar provided the criteria of optimization is that over-bias which reduces 10 kHz signal by 3½ dB. As is well known, chromium dioxide requires approximately 40% more bias current to provide adequate biasing field. Decreasing the bias slightly would obviously improve the high frequency performance; however, this is undesirable from the point of view of long wavelength distortion and it also increases the susceptibility to drop-outs caused by surface asperities.

As with any other magnetic recording system, the highest biasing frequency possible should be used to minimize modulation noise and beat effects. The data given later in this article was taken with a bias frequency of 102 kHz and the even harmonic distortion present in the bias waveform was 0.05% second harmonic. This low even-order harmonic distortion is essential to minimize the effects of d.c. noise and second harmonic distortion of the signal due to unbalanced bias waveform.

Equalization

The standard replay equalization for cassettes operating at 1⅞ ips has a bass roll-off created by a circuit with a time

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constant of 1590 microseconds and a high frequency boost with a 120 microsecond time constant. Recently, a second equalization standard has been proposed to permit fuller use of the characteristics of modern tapes, specifically chromium dioxide. The new proposed standard has a low frequency roll-off of 3180 microseconds with a 70 microsecond equalization curve at the high frequency and recorders are now on the market which use this proposed standard.

The two replay characteristic curves are shown in Fig. 3. The old standard has the advantage that with improved high frequency performance of tapes, the high frequency compression generated by tape overload is significantly reduced because of the reduced recording pre-emphasis required to produce a flat frequency response. However, under these conditions, the use of chromium dioxide would not significantly improve signal-to-noise ratio of the system when compared with the same system using low noise tape; it would only result in an extended frequency response and reduced modulation noise. The proposed new standard improves the signal-to-noise ratio at the expense of the greater risk of high frequency compression; however, with chromium dioxide, this compression is no worse than with low noise, high output ferric tapes using the 120 micro-second equalization curve. Excellent results can be achieved by using the same recording pre-emphasis for both chromium dioxide and low noise tape

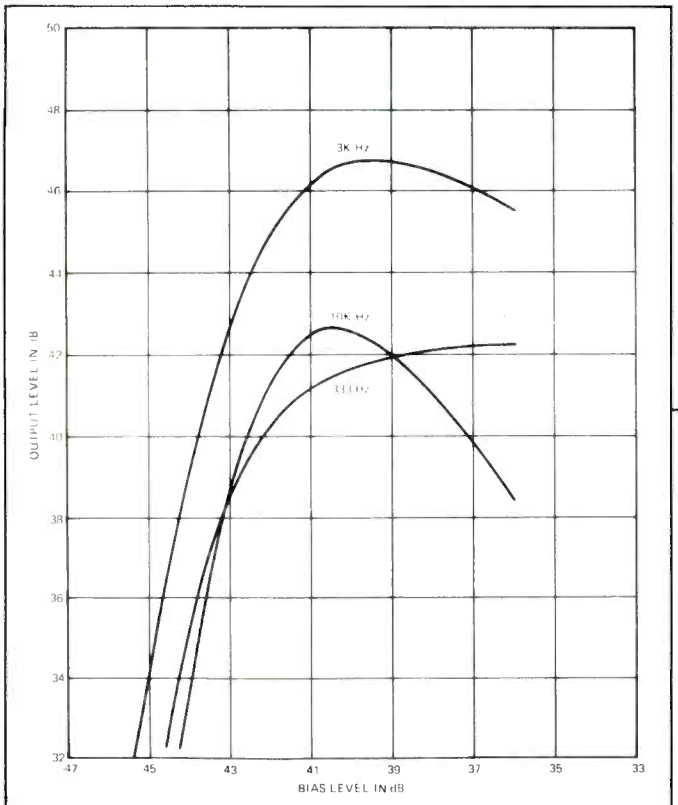

Fig. 2.2—Output/bias level for chromium dioxide tape.

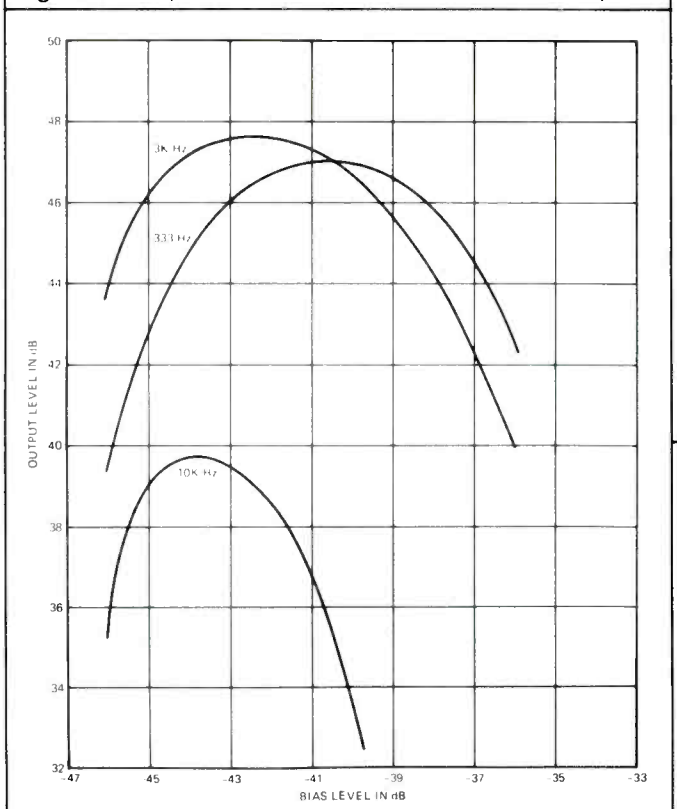

Fig. 2.3—Output/bias level for cobalt modified tape.

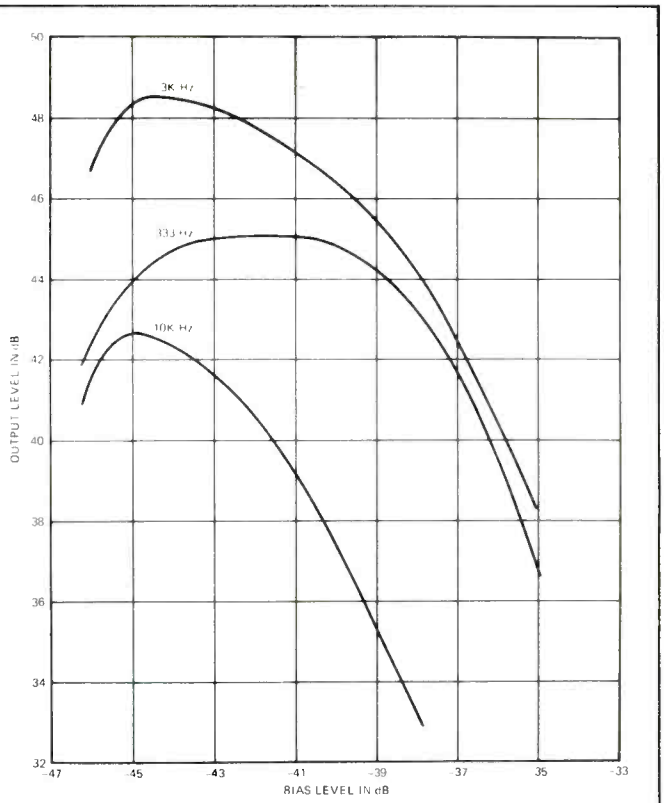

Fig. 2.4—Output/bias level for improved gamma ferric oxide tape.

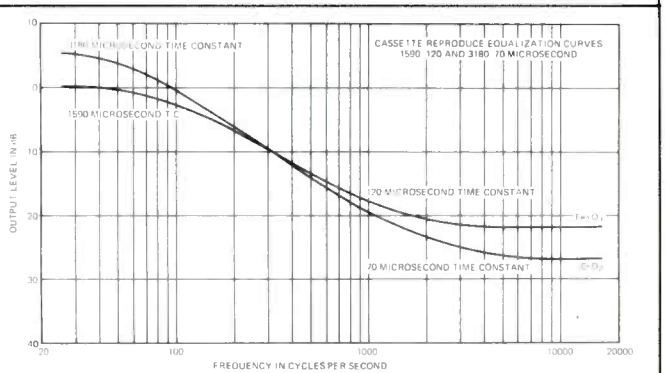

Fig. 3—Equalization energy standards.

Manufacturers often talk and write about performance specifications, particularly their wide frequency range, as an indication of their equipment's quality. But how does this relate to "listening quality"? Speaker manufacturers publish nearly identical specifications—but these are of interest only as theoretical abstractions, since no one can significantly relate them to "listening quality."

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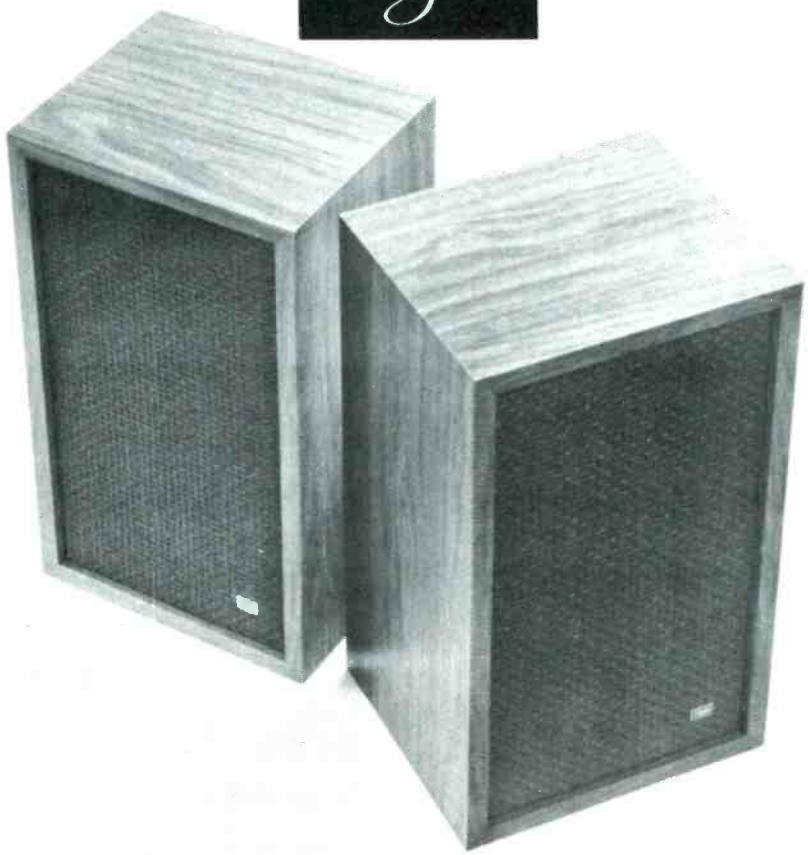

by switching the bias and replay equalization leaving the recording pre-emphasis the same for both tape types.

The change at the low frequency end reduces the risk of low frequency distortion. A good case can be made for eliminating all low frequency pre-emphasis in the recording process and, thus, removing the need for the roll-off at low frequencies on replay. With modern solid state circuitry, the elimination of power line generated noise is relatively simple and inexpensive. The reason for the low frequency de-emphasis on replay was to simplify the electronics designers' problems with hum. The reason no longer exists with cassette tape and the heavy bass which is characteristic of much modern music makes it painfully difficult for a duplicator to record a satisfactory cassette without low frequency overload. The elimination of this bass equalization would significantly assist in this problem.

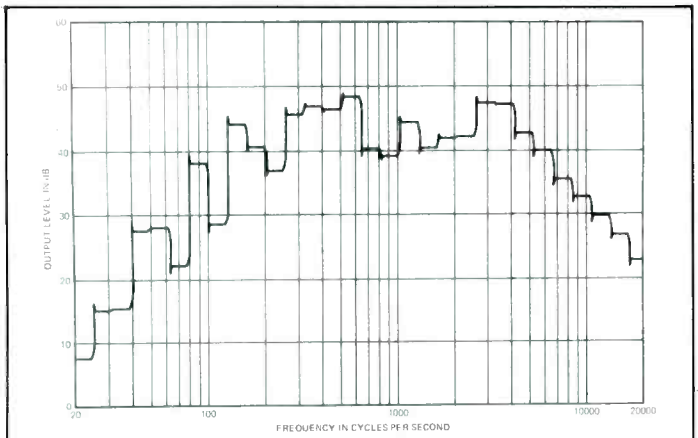

Fig. 4—Recorded frequency spectrum for cymbals in Holst's *Planets,* DG 2530-102.

Fig. 5—Recorded energy spectrum for *Mendocino,* Polydor 24-4508.

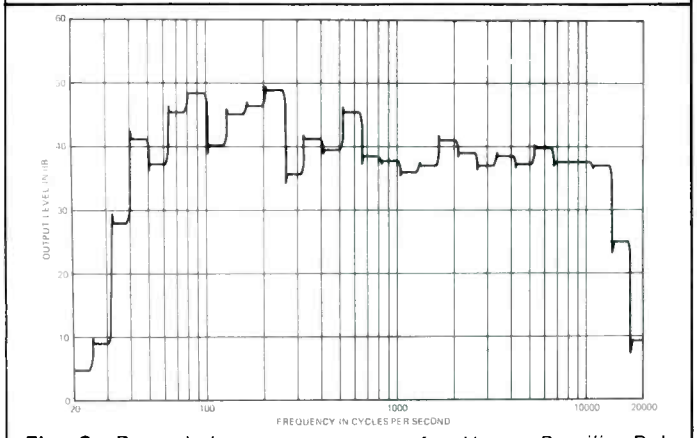

Fig. 6—Recorded energy spectrum for *Happy Brasilia,* Polydor 24-4509.

Music

Before considering further the demands placed upon cassette tape by equalization and signal-to-noise ratio improvement systems, it is appropriate to examine the energy spectra of the musical sources available. The most likely source of high quality signal within the scope of the home user is the phonograph record; few users have a better source of quality music, such as high speed master tapes, and with the average standard or quality exhibited by today's FM broadcasters, even when they are transmitting from tape, the transmission quality is such that it rarely reaches the fidelity available from even moderate quality discs.

Analysis of the spectra of two or three disc selections by means of the GR Real Time Analyzer gave the spectra shown in Figs. 4 through 6. Figure 4 is the spectrum of a cymbal crash from Deutche Grammophon's recording of the Boston Symphony/Steinberg performance of the Holst *Planets* Suite. As can be seen, there is considerable high frequency energy to the limits of the analyzer at 20 kHz and the energy from 125 Hz through 5 kHz approaches a horizontal line which, with the setting of the analyzer used, means that the energy was reducing at the rate of 3 dB per octave with rising frequency. Figure 5 is from a record made by a combination using a wide variety of percussion instruments with very strong electronically generated bass. In this record, energy is concentrated around the bass tones at 80 Hz and falls off fairly rapidly up to the limits of 10 kHz where apparently the record cuts off. Figure 6 is of some Latin American music, using heavy orchestration with percussion, electronic instruments and brass; this disc has an energy spectrum approaching that of pink noise. These examples by no means represent an exhaustive study; however, they do point to the fact that discs can easily be found with a very wide recorded bandwidth and high energy levels at the extremes of the band. The duplicator of music cassettes obviously has to cope with tape masters having energy at high levels over the whole of audible band which present a formidable problem to him.

It would appear from these analyses that the use of pink noise to study the behavior of a recording system is a test technique with greater validity than the use of pure sine waves at discrete frequencies.

The use of recording pre-emphasis which rises at high frequencies at a rate greater than 3 dB per octave will eventually result in tape overload when trying to record, from records such as those analyzed, if the record level indicators do not take account of the modified frequency characteristic created by the pre-emphasis. "Flat" level indication presumably is used by equipment designers on the assumption that musical spectra still conform to the classical spectra published in most of the literature which show considerably reduced energies at the very low frequencies and at frequencies above 5 kHz. Modern orchestration involving the use of synthesizers and electronically reinforced instruments has changed the picture.

The Compromise

The problem of establishing good high fidelity performance and the choice of equalization resolves itself into a compromise between tape overload or compression at the short wavelengths and a good signal-to-noise ratio. Pre-emphasis in the recording mode reduces the replay equalization necessary at the price of the reduction in high frequency performance at high signal levels with, consequently, high inter-

modulation distortion; the benefit of this choice is that the reproduced tape noise is lower than with a system where most of the equalization for high frequency losses is done on replay.

Within the limits of the existing standards, the biggest contribution the tape designer can make is to increase the sensitivity of the tape and/or maximum usable output from the tape at all frequencies, without deteriorating the fundamental bias noise of the tape or the frequency response and, thus, provide greater output on playback. The tapes developed with this aim include categories with chemically modified particles and the improved gamma ferric oxide particle. As has been stated, chromium dioxide does not increase the sensitivity of the tape over the whole band but does provide much improved performance at the very short wavelengths (i.e., the high frequencies); therefore, it does not meet the goal. The cobalt and magnetite doped gamma ferric oxide particles provide a much increased sensitivity at all frequencies and the improved gamma ferric oxide, of the MRX_2 type, gives a greater improvement in the performance at the short wavelengths. All three types will give an improved signal-to-noise ratio by virtue of replay output which is increased by as much as 4 dB.

The improved gamma ferric oxide tape of category four has the added advantage of significantly improved short wavelength performance which enables the recording pre-emphasis to be reduced by up to 8 dB at 10 kHz at 1⅞ ips. Thus, with this type of tape, not only is there an improvement in signal-to-noise ratio, there is an improvement in high frequency overload or compression. As will be seen in the following discussion, this reduction in compression improves the situation when signal-to-noise reduction systems such as the B Dolby are used; it results in improvements in system tracking when compared with the response errors which can occur with tapes which have significant compression problems.

Noise Reduction Systems

For practical purposes, this discussion is limited to the B Dolby signal-to-noise improvement system, since other systems are either similar in behavior or are not seriously affected by the behavior of the recording system. Also, the majority of the machines equipped with a noise reduction system use Dr. Dolby's circuitry and the only "stretched" pre-recorded cassettes in production by duplicators use the B Dolby mode.

During the recording process, the Dolby circuit detects the high frequency levels of the incoming signal. When these signals are below a pre-determined level, the gain of the amplifier is increased to boost the high frequencies before they are recorded; in addition, the frequency at which the boost starts is varied in relation to the HF signal level. The maximum boost at the lowest HF signal level is in the order of 10 dB. No account is taken of the low frequency signal level; low frequencies are recorded unmodified. On replay of the recording, the process is reversed.

From the viewpoint of the tape, the Dolby provides a variable high frequency pre-emphasis, the degree of which is dependent on the high frequency signal level; the lower the level the greater the pre-emphasis. A difficulty with this system is that the degree of tape magnetization does not take account of frequency, but responds to the sum of the energy at all frequencies at any given instant. Therefore, if one has the situation where the low frequency signal level is very high, approaching the usable recording limits, and riding on this high level of bass there is a high frequency signal at lower level, such as sibilance on a voice or a quietly brushed cymbal, the Dolby circuit will boost the level of these high frequencies and can drive the tape further into high frequency compression. On replay, because of the recording errors, the high frequency signal level is lower than it would have been if there had been no compression; therefore, the Dolby will react to this low level and reduce the gain at high frequencies by an amount which is greater than the boost which was applied during the recording process. The result of this tracking error is a loss of brilliance and an increase in distortion which is not a fundamental fault of the recording system, neither is it a malfunction of the signal-to-noise improvement device.

Figure 7, Curve A, shows the transfer characteristics of a cassette system at 10 kHz using low noise, high output tape. Curve B is the transfer characteristic of 10 kHz recorded and played on the same system in the presence of an 80 Hz tone recorded at "0" level, that is, at the same level as the pronounced energy peak shown in Fig. 5. Curve C is the transfer characteristic of the same 10 kHz signal in the presence of 80 Hz at "0" level but with the use of B Dolby. The increase in compression at the "0" level at 10 kHz caused by the presence of the 80 Hz signal is 1.0 dB and the use of Dolby gives a further response error of 2.0 dB. A more significant problem is probably the increase in distortion; the lower frequencies will produce audible harmonic distortion and the high frequencies whose harmonics are outside the system pass band produce intermodulation products within the replayed bandwidth.

If compression effects described above are to be avoided using conventional tapes and a Dolby stretcher, the recording level must be reduced. This, in turn, reduces the replay level and decreases the basic signal-to-noise ratio which, of course, reduces the effective improvement achieved by the use of the Dolby.

Another effect, which can easily be avoided with the self-contained recorder, but is a little more difficult to establish control over with pre-recorded cassettes using the B Dolby characteristic, is the effect generated when the recorded bandwidth is greater than that which can be reproduced. Most recording systems are capable of recording to shorter wave-

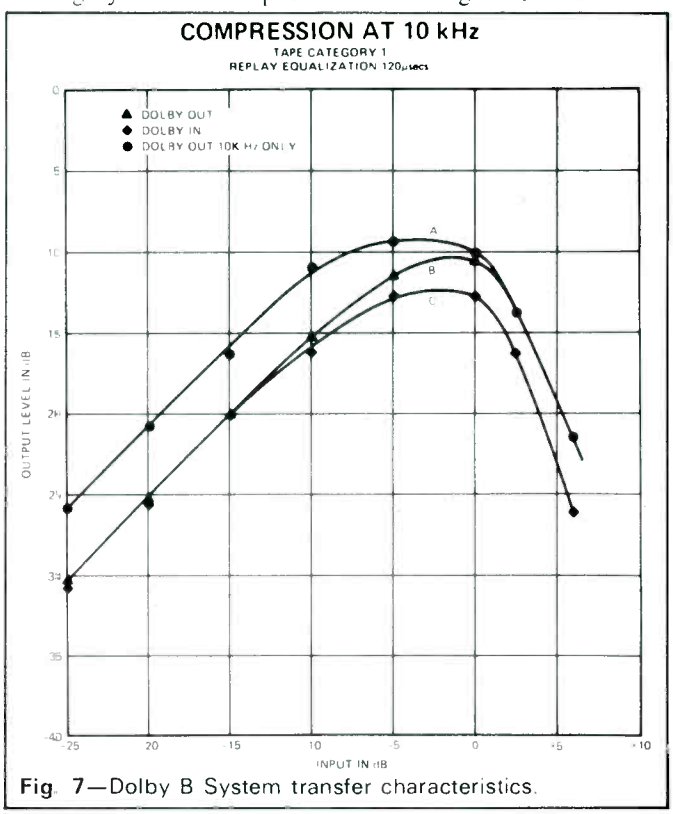

Fig. 7—Dolby B System transfer characteristics.

lengths than the replay channel of the recorder can satisfactorily reproduce; the limitation being the replay head gap length. If a wide band signal is received by the recorder such as that shown in Fig. 4, the lower high frequency levels; i.e., from 12 to 20 kHz, will be sensed by the Dolby and be pre-emphasized before recording. If now the recorder only reproduces up to 12 kHz, these signals will not be received by the Dolby circuit on replay. Therefore, the Dolby loop is not correctly closed and there is no corresponding reaction from the replay circuit to correct the level change generated in the recording mode. In a severe case, this tracking error results in a frequency response with a significant dip at low levels in frequencies around 5 kHz as shown in Fig. 8. The frequency responses shown in Fig. 8 are taken at 10 dB intervals with the top one at a level equivalent to maximum recording level. Responses B and D are taken with the recording bandwidth wide open and A and C were the controlled recording bandwidth. The mid-frequencies would not be significantly boosted during the recording process, but on replay the B Dolby HF gain reduces to its minimum because of the much reduced high frequency energy in the replay signal. A possible solution to this problem for the duplicator is to limit the bandwidth which activates the Dolby, during the recording of music cassettes, to about 10 kHz. With a cassette recorder, another solution is to design the recording amplifier to have the same bandwidth as the replay system.

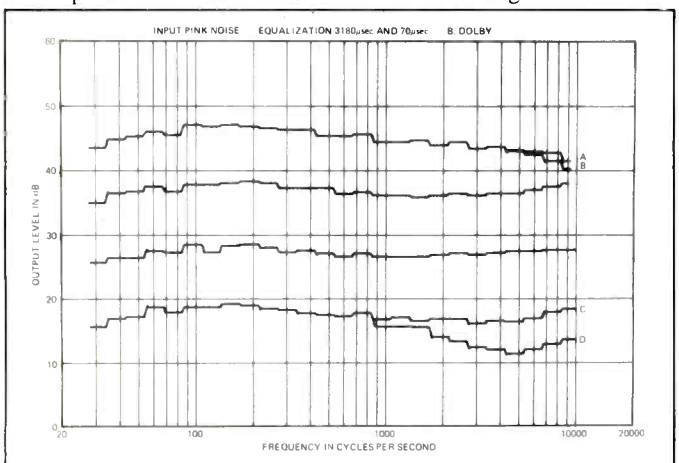

Fig. 8—Bandwidth mistracking.

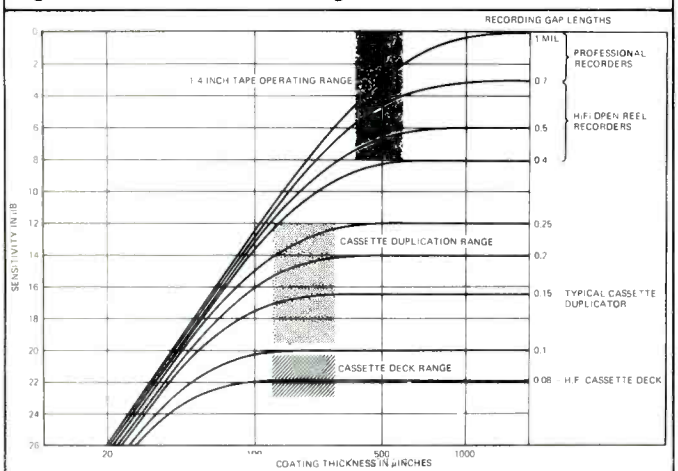

Fig. 9—Recording gap length effects.

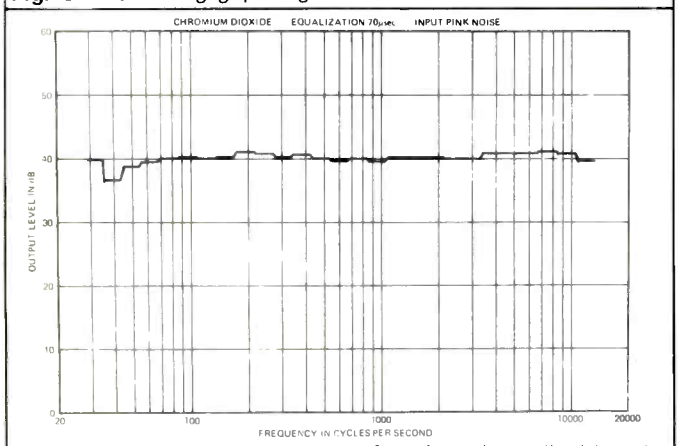

Fig. 10.1—Frequency response for chromium dioxide with pink noise input.

Recording Gap Length

The full presentation of the study into the gap-length/coating thickness relationship will be published as a separate article. However, it is appropriate for the purposes of this article to publish the theoretical relationships shown in Fig. 9. These have been verified experimentally. As can be seen with recording gaps which are shorter than the coating thickness, the performance of the tape/record head combination is not dependent on the coating thickness because they do not utilize the whole coating. Gaps which are significantly longer than the coating thickness record through the whole of the magnetic layer and, therefore, the sensitivity of the system at long wavelengths is coating thickness dependent.

Apart from the fact that a duplicator operates at speeds which are much higher than 1⅞ ips, the principal difference between recording on a duplicator and a consumer cassette recorder lies in the dimension of the recording head gap. Most duplicators use special record heads whose gaps are in the region of 150 microinches to 400 microinches long, whereas the consumer machines use dual purpose heads which have a gap whose dimensions are determined by the desired replay performance. On high fidelity machines intended to record and play frequencies up to 15 kHz, an 80 microinch or smaller gap is essential. Typical cassette tape coating thicknesses lie in the range from 120 microinches for C-120 product to 250 microinches for some C-60's.

The development of higher efficiency ferric oxide particles of the type used in MRX_2 tape gives the tape designer the freedom to optimize the coating thickness for overall performance on a duplicator at coating thicknesses considerably thinner than has been the former practice. This has several advantages:

1. The coating thickness can optimize to the biasing requirements at the short wavelengths without sacrificing distortion and output at the long wavelengths and this bias can be adjusted to be approximately the same as with conventional gamma ferric oxide tapes when using a typical duplicator record head. Because of the improvements in the oxide, the output available from the thinner coating is 4 dB greater than with high output low noise tapes at low frequencies and 8 dB at high frequencies.

2. The same coating thickness can be used for all configurations.

3. The thin coating of approximately 130 microinches does not sacrifice any performance when used in a blank cassette on a consumer machine.

Practical Systems

Two separate high fidelity systems have been used for tape evaluation and the parameters chosen for both systems are based on the study described and utilized consumer type cassette decks carefully adjusted to meet our requirements. Most of the listening tests and demonstrations of recorded quality have been performed without the use of any noise

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.

The exceptional engineering and manufacturing care that go into every Dual turntable may take years to appreciate. Only then will you actually experience, play after play, Dual's precision and reliability. And how year after year, Dual protects your precious records; probably your biggest investment in musical enjoyment.

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.

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reduction system; although some testing has been carried out to determine whether the data presented earlier is, in fact, important in relation to what is heard. The recordings used were made from very high quality 15 ips stereo masters and which have recorded signals at significant levels to 20 kHz. There is little doubt that where the high frequency energy is present in the input signal, the variable frequency response generated by the B Dolby System is audibly worse than with the same tape and recorder used without the Dolby in circuit. Apart from this reason, the noise reduction system was not used because the objective of our study was to evaluate tapes under development; for this purpose it is better to compare tape performance with as little intrusion from electronics as possible.

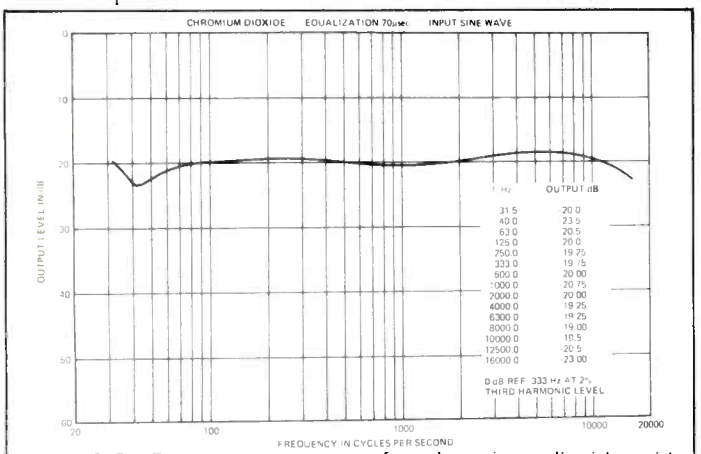

Fig. 10.2—Frequency response for chromium dioxide with sine wave input.

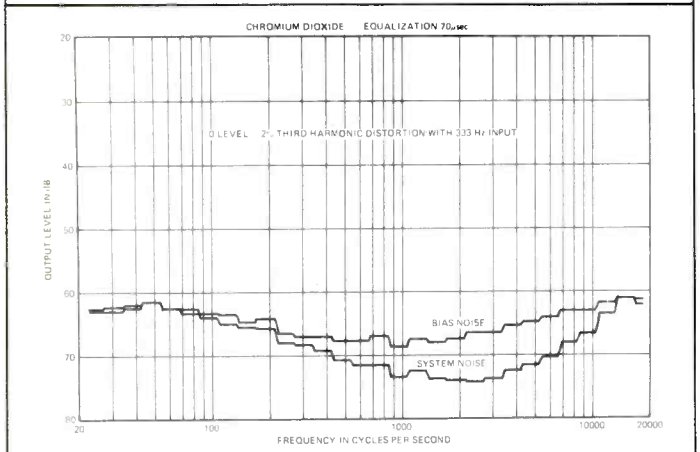

Fig. 11—System and bias noise for chromium dioxide.

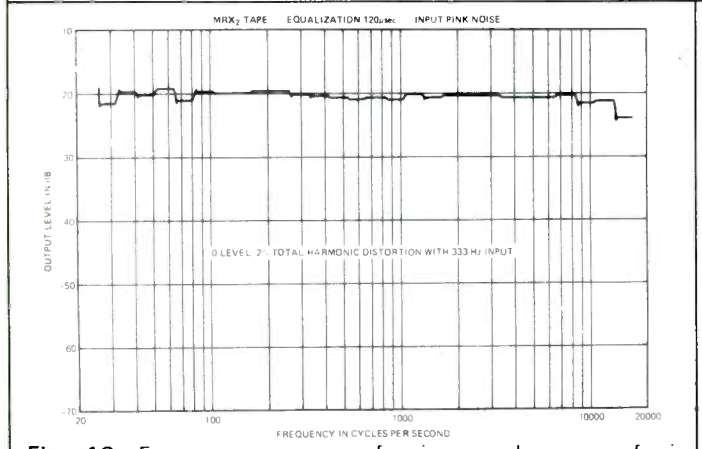

Fig. 12—Frequency response for improved gamma ferric oxide tape.

The first system was designed for chromium dioxide and incorporated the new proposed replay equalization at 3180 microsecond bass curve and 70 microsecond treble curve. Figures 10 and 11 respectively give the frequency response and the noise spectra of this system using Memorex chromium dioxide tape. As a matter of interest, the response is presented in the form generated by the noise/analyzer system and the more conventional presentation taken manually with sine wave signals. The dip in the response at 40 Hz is caused by the contour of the record/play head. The unweighted signal-to-noise ratio is 53 dB referred to 333 Hz at the level which gives 2% total harmonic distortion. At mid-frequencies, the slot noise is –65 dB.

The second system used for the improved gamma ferric oxide MRX_2 used the standard replay system of 1590 microseconds bass curve and 120 microsecond HF curve. The response of this system is shown in Fig. 12; Fig. 13 shows the spectra of the bias and the system noise. The unweighted signal-to-noise ratio is 52.5 dB referred to 333 Hz and 2% total harmonic distortion and the slot noise is 71 dB at mid-frequencies. The excellent signal-to-noise ratio of the MRX_2 ferric oxide system is due to the 2 dB extra sensitivity of this tape at long wavelengths plus the capability of accepting 2 dB more recording drive without the bias noise having been deteriorated in comparison to low noise high output tapes. Thus, the unweighted signal-to-noise ratio is 4 dB better than one would obtain from standard ferric oxide particles. The slot noise at mid-frequency is 6 dB better than with chromium dioxide but because the 120 microsecond replay equalization was used for MRX_2 and the 70 microsecond for chromium dioxide, the final signal/noise ratios are approximately the same. However, MRX_2 exhibits less high frequency compression than chromium dioxide when the two tapes are equalized in these differing manners.

Acknowledgements

The author wishes to acknowledge the excellent experimental work carried out by Mr. Roy F. Nelson of Memorex Corporation, Audio/Video Group, without which this article would not have been possible. The curves for the recording head gap/coating thickness relationships were calculated by Mr. E. D. Daniel.

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[1] *Acoustical Tests and Measurements,* Davis; Published by Howard W. Sams and Company, Inc.; Page 60.

[2] *Chromium Dioxide Audio Cassette Tape,* Jordan, Kerr and Dickens; *Journal of the Audio Engineering Society,* January/February 1972.

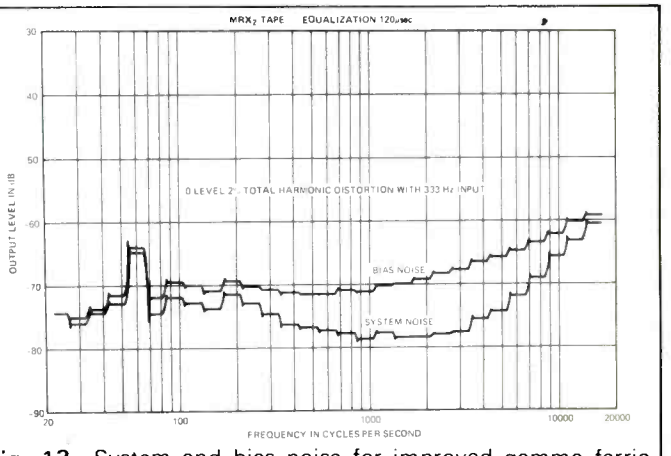


Fig. 13—System and bias noise for improved gamma ferric oxide tape.

Dolby B-Type Noise Reduction System - Part 2

Robert Berkovitz and Kenneth Gundry*

The Dolby B-Type Noise Reduction System

The Dolby B-Type circuit is a specialized form of compandor which avoids the usual deficiencies of compandors. The operational principle of the B-Type system is complementary low-level compression and expansion in a frequency range which varies in bandwidth as the signal changes.

Most objectionable noise encountered in home listening is at middle and high frequencies, from about 500 Hz to the upper limit of audibility. In the interest of circuit economy, the action of the B-Type circuit has therefore been limited to this range. A feedback control circuit adjusts system parameters automatically as a function of signal level and spectrum, so that the system's action complements the psychoacoustic masking of noise which occurs naturally in the course of the program. A block diagram of a Dolby type of noise reduction system is shown in Fig. 3. The circuits used for encoding (during recording or transmission) and decoding (during playback or reception) are quite similar and can be considered as the same circuit, switched to operate in either mode.

The compression and expansion characteristics of the Dolby B-System are fixed and are referred to Dolby Level, a specific internationally standardized reference level. In the case of cassette tape, Dolby Level is a flux of 200 nWb/m; in FM broadcasting, Dolby Level is ± 37.5 kHz deviation.

Figure 4 is a block diagram of a switchable (encode-decode) B-Type circuit. There are two paths which the input signal follows: a *main path* (at the lower part of the figure) in which no change other than linear amplification occurs, and a *secondary path*, a variable filter through which only low-level, high frequency components of the input signal are allowed to pass. To encode the signal, the output of the secondary path is combined with signal in the main path *additively:* this boosts low-level, high frequency portions of the signal. Decoding is accomplished by feeding the secondary path from the circuit output, which is opposite in phase to the input (note phase inverter in Fig. 4); the secondary path is then part of an a.c. negative feedback loop which reduces output, i.e., the output of the secondary path is combined with the main path *subtractively.* In the decode mode, therefore, the circuit reduces the level of precisely the same information which was increased in level during encoding.

*Dolby Laboratories, Inc.

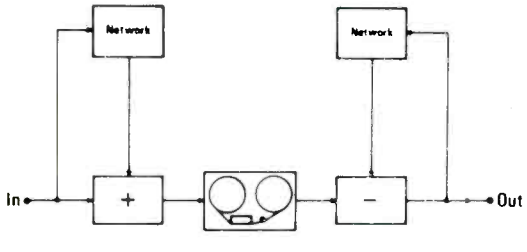


Fig. 3—Block diagram of Dolby type noise reduction circuit as used in typical record-reproduce chain.

As Fig. 4 indicates, the action of the B-Type circuit is controlled by the output of the filter in the secondary path. Above a fixed threshold level, the bandpass of the filter, in turn, is modified by the d.c. feedback loop.

At very low levels, i.e., below the threshold, which at high frequencies is about 40 dB below Dolby Level, the output of the filter is not sufficient to generate d.c. feedback; consequently, the output of the secondary path is simply proportional to signal level within the filter pass band. The output of the circuit is then essentially as shown in Fig. 5.

As signal level rises above the threshold level, the rectified filter output is returned to the FET gate where it is applied as negative feedback, raising the filter cutoff frequency so that the output of the secondary path, while still increasing, no longer does so in proportion to the change in signal level. As signal level becomes even larger, the increasing d.c.

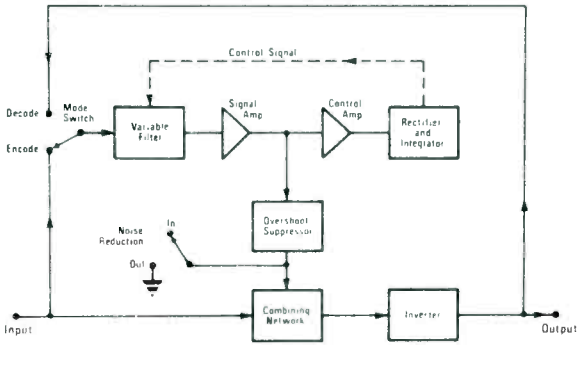


Fig. 4—Block diagram of Dolby B-Type noise reduction circuit. The configuration shown can be switched to encode or decode the signal.

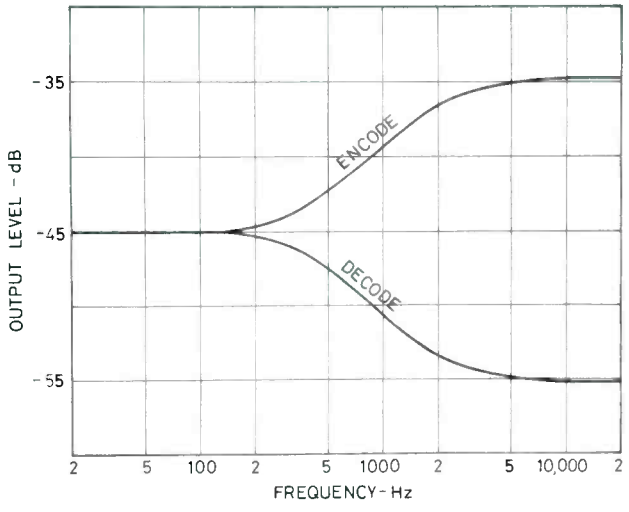


Fig. 5—Output of B-Type encoder and decoder circuits under low-level input signal conditions. The two operations are symmetrical and the result is an overall frequency response which is level.

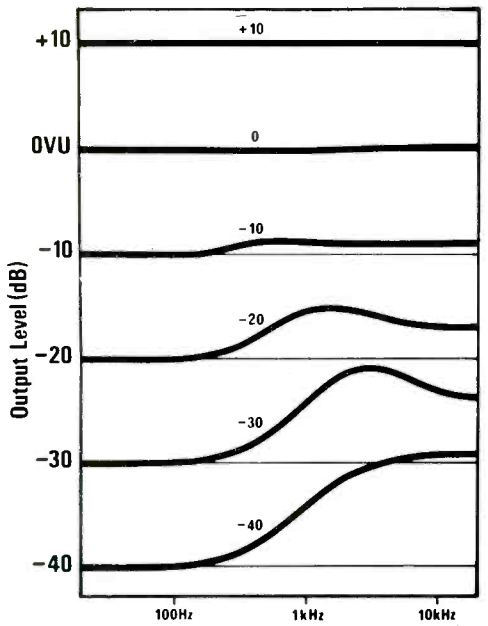


Fig. 6—Characteristics of encoding processor at several levels. The gradual reduction in boost with increasing level avoids possible tape overload.

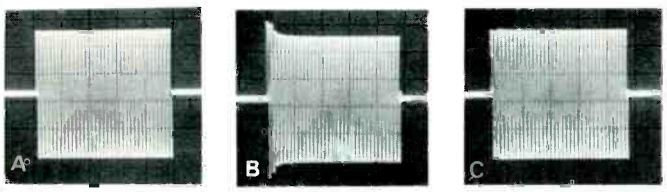


Fig. 7—Effect of the B-Type circuit on a tone burst; frequency = 3 kHz; burst duration, 12 milliseconds; low level = 40 dB; high level = +6 dB; (A) Input to system; (B) Encoded, (C) Encoded and Decoded.

feedback generated restricts the filter bandwidth further, and near Dolby Level the output of the secondary path remains relatively constant. The net effect is that the secondary path has no audible effect on output at low frequencies, and increasing effect with increasing frequency and decreasing level to about 40 dB below Dolby Level. At high levels, the effect of the extra signal is so small as to have no significance; at low levels, in the spectral region in which noise reduction is required, the increase during encoding is as much as 10 dB, and is of considerable importance.

The manner in which the secondary path changes from constant-gain to constant-output is determined by the adjustment of gain within the feedback loop. In addition, the exact variation in filter bandpass with changing level is set optimally by making the control amplifier frequency-dependent. The overall frequency response of a B-Type encoder circuit for different input levels is shown in Fig. 6.

A compandor operating over a wide frequency range must be designed to take into account the problem of noise modulation discussed above. If some high-level passages in the program differ sufficiently in frequency content from the noise components present, the latter will remain audible during the program in many cases. However, these passages cannot be increased in level when encoded, because of the danger of overmodulation. Under these conditions, compression may be applied intermittently, and high-frequency noise modulated audibly by mid-frequency components of the signal. The B-Type circuit overcomes this problem because it continues to function when a high-level signal occurs within its operating range; instead the feedback control shifts the range upward in frequency. This avoids the danger of overmodulation, but retains full noise reduction at frequencies higher than those masked by the signal.

The attack time of the B-Type circuit is dependent on the amount and rapidity of the signal change, due to the nonlinear design of the integrator, varying from about 100 milliseconds to as little as 1 millisecond. The recovery time of the rectifier-integrator is shorter than that of the human hearing system, about 100 milliseconds.

All compressors exhibit overshoot, including the B-Type

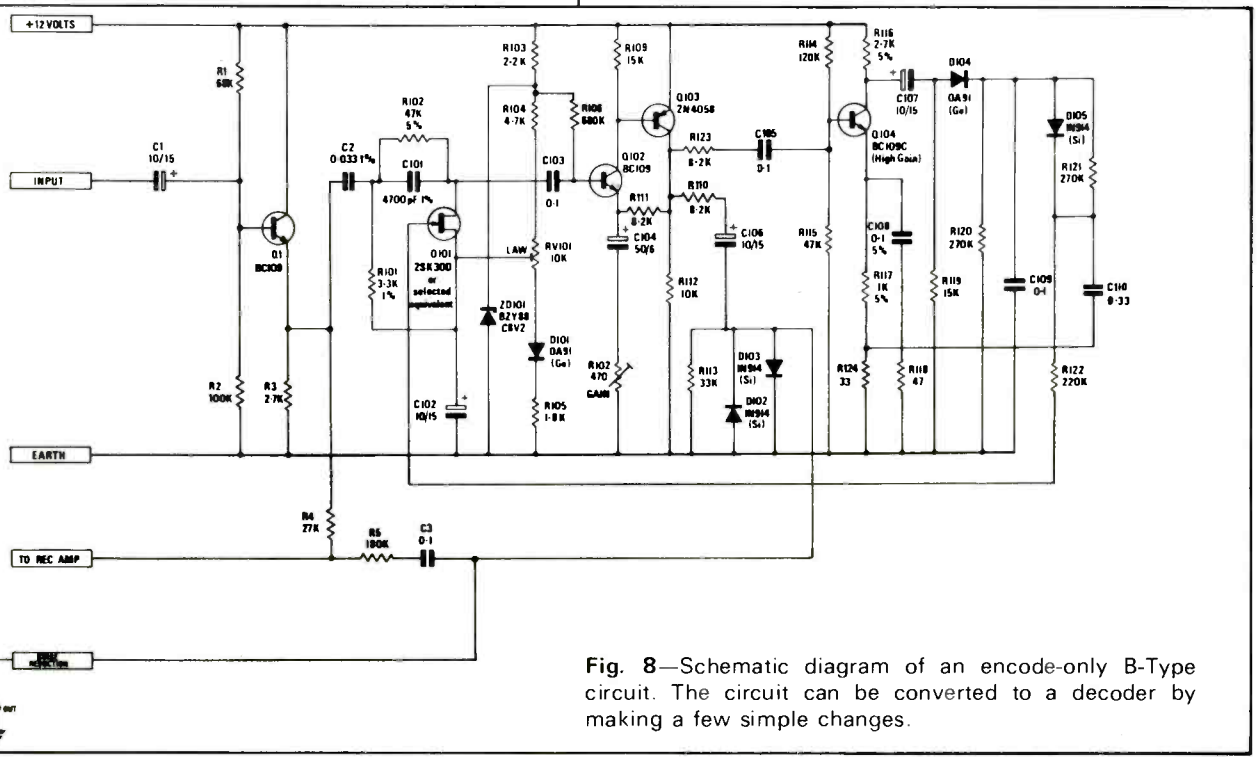


Fig. 8—Schematic diagram of an encode-only B-Type circuit. The circuit can be converted to a decoder by making a few simple changes.

circuit. However, the dual-path approach used makes it possible to reduce the amplitude of overshoots significantly. Overshoot, which can occur only in the secondary path (where it can be suppressed without affecting the main signal) is comparatively small, and essentially disappears when the signal is decoded again. When signal levels are low, or when changes in signal level take place slowly, there is no overshoot problem; when signal changes are large and rapid, diodes in the overshoot suppressor stage limit the peaks of the overshoot. Since this takes place in the secondary path, the result of the suppressor action is to limit overshoot to a relatively small fraction of the full-level main path signal. Further, by restricting overshoot suppression to the secondary path, it is possible to avoid introducing audible distortion to the encoded signal. Because a complementary action takes place during decoding, the small remaining overshoot in the encoded signal is eliminated, and as with other effects produced during encoding, the original signal is restored. Figure 7 shows the result of encoding and decoding a short burst of 3 kHz. which changes in level from −40 dB to +6 dB.

Figure 8 is a typical schematic diagram of an encode-only B-Type circuit; the circuit for decoding-only is similar. As can be seen, only five transistors plus an FET are required; the parts cost of the circuit is approximately $2.40.

Figure 9 is the schematic diagram of a B-Type processor which has been designed to integrate noise reduction with other tape recorder electronics requirements as much as possible. The resulting circuit provides 26 dB of gain, whether or not noise reduction is in use, bias and multiplex filtering, and meter and monitor amplifiers. In fact, the only additional electronics needed to complete the recorder are a bias oscillator, recording amplifier (one transistor) and a microphone and head amplifier (two transistors). With the active elements used in the record/play switchable processor shown (eight transistors and one FET), the total used in the recorder, for two channels, is 22 transistors and two FET's. The cost to a manufacturer of the components shown in Fig. 9 is about $3.20, excluding the bias and multiplex filter components, which are, of course, necessary in the circuits of any properly designed tuner and recorder.

Dolby Laboratories and Signetics have collaborated in the development of an integrated-circuit version of the B-Type circuit. The IC is expected to offer manufacturers economy of assembly, elimination of adjustments, and somewhat smaller space requirement than the discrete-component version.

The characteristics of Dolby B-Type noise reduction can be summarized as follows:

1. Program recovery characteristics, with regard to frequency response, phase response, transients, and signal dynamics, are theoretically perfect; in practice, this ideal is attainable to any desired accuracy. Distortion in practical B-Type circuitry is considerably lower than that of the tape recorders or tuners with which it is used. Any type of program material can be encoded and decoded without audible loss.

2. The circuit is simple, inexpensive, and small in size, either in discrete-component or IC form.

3. The circuit is easy to manufacture and use because of the absence of critical components or adjustments. The circuit can be quickly and easily calibrated during manufacture, after which further calibration is not required. In use, only a simple level adjustment is necessary if tape of significantly different sensitivity is substituted for that formerly used.

4. No modification of broadcasting or duplicating practice is required to incorporate B-Type encoding. The use of the noise reduction system often makes worthwhile other im-

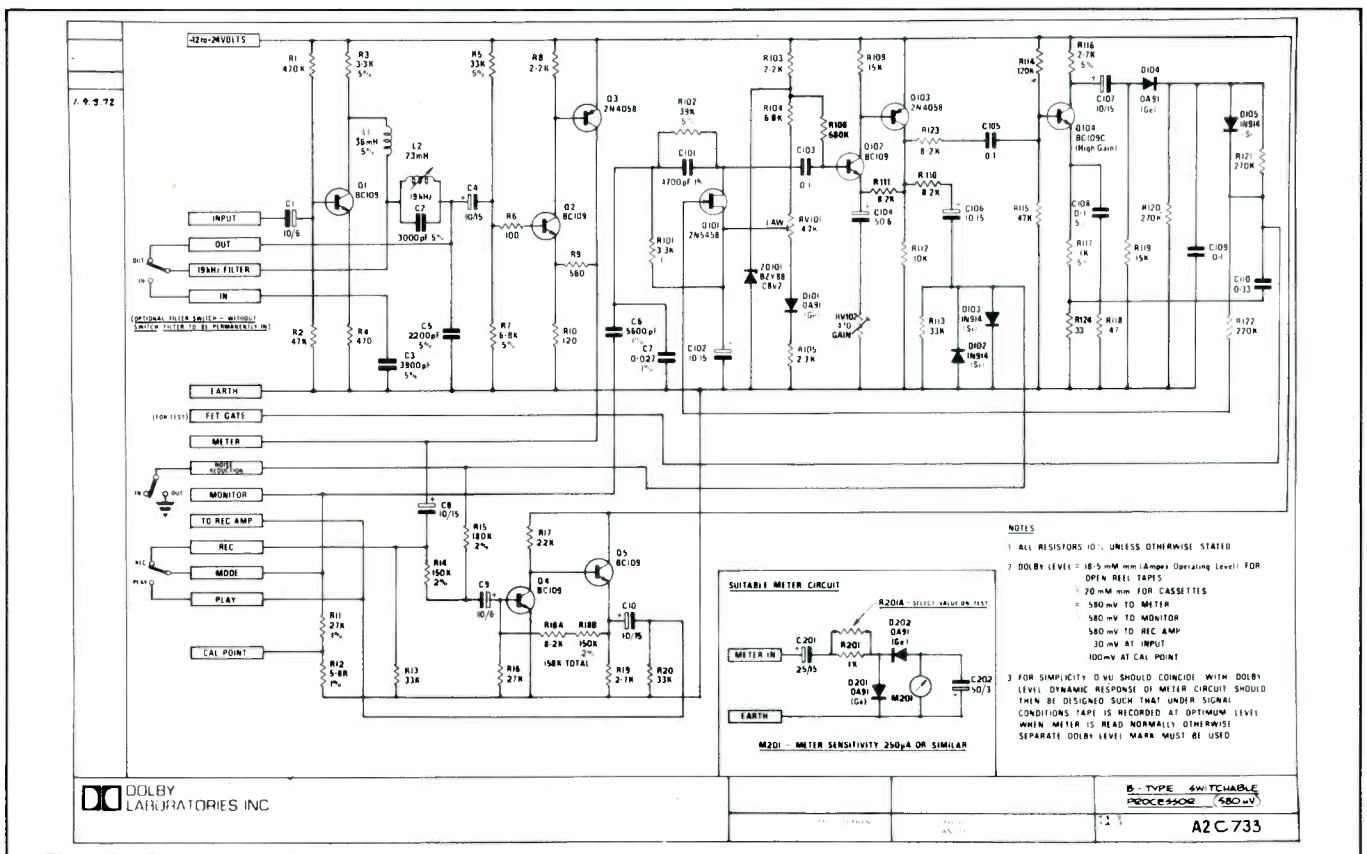


Fig. 9—Schematic diagram of complete switchable encode/decode circuit for use in tape recorder, including HF filtering, meter drive, monitor output and 26 dB of gain. Only a few more parts need be added to make complete record/play electronics for one channel of the recorder.

provements, however, such as extension of frequency response and dynamic range, or reduction of distortion by use of lower modulation levels, or some combination of these.

Effects Upon Noise Spectra

Figure 10 is a multiple exposure of the screen of a 1/3-octave real-time analyzer, allowing a direct comparison of the noise spectra at the output of a high-quality cassette recorder when different kinds of tape were used with and without the Dolby B-Type noise reduction circuit. Curve 1 is that produced by C90 ferric oxide tape; curve 2 is that of C90 chromium dioxide tape; curve 3 is produced by the same tape used for curve 1, but the B-Type circuit is switched "in," and curve 4 represents the noise spectrum of the chromium dioxide tape with the circut in. The tapes shown were biased before the measurements were made; no changes in gain or other control settings were made during the tests, other than to set equalization differently for the chromium dioxide tape from (70 microsecond). In fact, most of the improvement in noise level obtained when chromium dioxide tape is used appears to be due to the change in equalization; if this change is not made, there is little advantage in chromium dioxide tape from a noise point of view. On the other hand, the combination of chromium dioxide tape, 70 microsecond equalization, and B-Type noise reduction results in an excellent noise figure, 57 dB below Dolby Level in the example in the photograph (DIN 45405).

The advantages of B-Type noise reduction are also obtained when the system is used for FM broadcast transmission and reception, i.e., the improvement in signal-to-noise ratio obtained by use of the B-Type circuit is approximately the same as that produced by a 10 dB increase in field strength. The significance of this improvement can be appreciated when it is realized that such an increase would usually require an increase in transmitter power by a factor of ten. Considerable experimentation and broadcast experience in the USA have demonstrated, as one would expect, that the area in which listening is satisfactory is greatly extended by use of the B-Type noise reduction system. Several American classical music FM stations are already broadcasting full-time using Dolby B-encoding.

Compatibility

When any improvement is made in a system as widely used as the compact cassette system, it is highly important that the new development should be fully compatible with existing equipment. Improved cassettes must be playable on any machine which can play old-type cassettes, and fortunately this is true of Dolby B-Type cassettes. Such cassettes are subjectively compatible (i.e., generally pleasing to the listener) when played without decoding circuitry, to a great extent because of the unique approach taken in the B-Type circuit. Because most low-cost cassette machines are deficient in high-frequency response, the increase in low-level high frequency content in a B-Type cassette is usually welcomed by listeners with such equipment. Cassette recorders of higher quality, or the associated equipment with which they are used, contain tone controls which permit the balance to be adjusted to suit the taste of the listener. It is quite likely that many of the millions of B-Type encoded cassettes which have been made commercially are owned and played by listeners who are unaware of the special nature of the program material they hear. In any case, the subjective difference between encoded and other cassettes is sufficiently unobtrusive that none of the recording companies offering "Dolbyized" cassettes have found it necessary to offer old-type cassettes as an alternative.

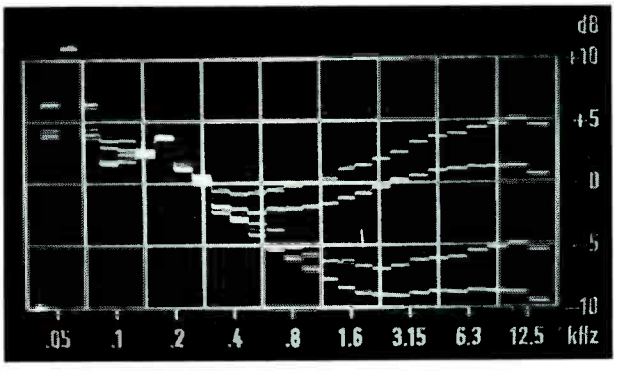


Fig. 10—Noise spectra at output of cassette recorder during playback of four kinds of tape. All tape was biased and control settings were the same for the four tests. (1) Ferric oxide C90 low-noise, —45.7 dB DIN 45405; (2) Chromium dioxide C90, —48 dB; (3) Same as (1) with B-Type noise reduction, —55 dB; (4) Same as (2) with B-Type noise reduction, —57.1 dB. All noise measurements referred to Dolby Level = 200 nWb/m.

It is worth noting that almost all pre-recorded cassettes are already compressed, for only in this way can the audibility of low-level passages be preserved in programs of wide dynamic range. B-Type cassettes differ mainly in that the listener now is able to remove the compression by pushing a button on his cassette machine restoring program dynamics and reducing noise. This is only possible because B-Type compression is standardized, while other types of compression vary considerably.

Commercial Use

Within a few years of its introduction, the Dolby B-Type noise reduction system has been licensed to most major manufacturers of consumer tape recorders. At the present time there are more than 40 licensees manufacturing over 100 different B-Type products. Licensee payments for use of the circuit are on a sliding scale, based on quantity, from a maximum of 50¢ (U.S.) to 10¢ per circuit. Royalty charges are typically 60¢ per stereo unit for a major manufacturer.

In addition, most of the pre-recorded cassettes now made in the United States, the United Kingdom and Japan are "Dolbyized," and many of the largest recording companies issue their cassette output in this form, among them Ampex and CBS in the United States, Decca and RCA in England, and CBS-Sony, Nippon Columbia, King, and Apollon in Japan. Pre-recorded open-reel tapes and 8-track cartridges are also becoming available. In the United States, a number of FM stations have already started to broadcast regularly in B-Type encoded form, and this procedure is under study in other countries as well. There is no royalty payable for encoding cassettes or other tape recordings, or broadcasts.

Conclusions

The reduction of background noise by the Dolby B-Type noise reduction system has contributed importantly to the improvement in quality of home tape recording and playback. It has helped to make the extension of frequency response, the reduction of wow and flutter, and other improvements worthwhile, particularly in cassettes. The unique characteristics of the B-Type system permit excellent noise reduction without program losses, noise modulation and other drawbacks which have afflicted earlier attempts to solve the noise problem. The simplicity and economy of the B-Type circuit facilitate its use in consumer products at all price levels. AE

From The Lab

George W. Tillett

SEVERAL READERS have asked me what I thought of the recent Consumer Report's tests on loudspeakers using a computer to evaluate the results. Briefly, what CU did was to feed the speakers with a pink noise signal and then take power response readings at 10 degree intervals in two perpendicular planes. At each angle, 30 readings were made, representing the rms value of 1,000 measurements in each of 30 one-third octave bands. The computer converted the data from decibels to sones and then it was transposed into simple percentages. Frequencies below 110 Hz were excluded because of room variations and differences due to positioning.

Now, I must admit that I was horrified when I'd read this far. A speaker with several 2 dB peaks could be lumped together with one having an enormous 15 or 20 dB peak somewhere in the spectrum. There would be no distinction between a peak at 150 Hz and one at 12 kHz or 7 kHz. And how do you grade coloration? As all speaker engineers know, tiny 1 dB peaks—or even smaller at certain frequencies—can cause quite severe colorations. The density of the enclosure material plays a large part in these variations which can hardly be measured much less evaluated by a computer!

However, on reading further I discovered that a listening panel was also used, and it was claimed that they confirmed the computer analysis "to a reasonable degree." Looking at the list of speakers tested, I can well believe it. None were really bad, and I can think of several other systems which would score quite high on the percentage tests but would sound abominable. Incidentally, the CU listening tests involved comparisons with a reference laboratory speaker using tapes originally made with that loudspeaker in an anechoic chamber—a method of evaluation which allows a high degree of accuracy.

So all-in-all, I would say that I wouldn't disagree with the CU conclusions, although I have strong reservations about those computer-derived percentages. The highest score was 89 per cent; my guess is that a speaker with a score of 100 per cent CU accuracy would still sound like a loudspeaker, that is it would still have some distortion and some coloration.

Measuring Wow & Flutter

The article by Robert Berglas aroused a great deal of interest, and most people saw the snags I mentioned in the footnote. Gary Flynn, of Atlanta, Georgia, writes: ". . . an instrument of this type (Heath-Schlumberger counter) measures the *average* frequency during the sampling period, which in the Heath instrument is 1 second. The flutter modulation of the 1 kHz carrier, however, since it is an a.c. signal like any other, has an average value of 0, and therefore has no effect on the average frequency of the carrier as read on the frequency counter."

D. E. Peter, of Hollywood, Calif., says: "To determine a peak-to-peak wow component at 6 kHz, the counter must count for about ¼ cycle of 6 Hz or 1/24th second. Assuming a standard flutter tape is used, the counter will count 3150 Hz x 1/24 second or 131.25 Hz. The 0.25 Hz will cause the output sequence to be 131 . . . 131 . . . 131 . . . 132 . . . 131. . . . The uncertainty in the last digit caused by the non-coherence of the counter clock and the counted frequency will cause a measurement uncertainty of ±0.760 per cent. In other words, the wow measurement will be obscured by noise if the wow is less than about 0.5 per cent, rendering the technique useless." As Mr. Peter says, a computing counter, such as the Hewlett-Packard 5360 series, could measure wow and flutter combined but this seems like a complicated way of doing things.

A. R. Collins, of the Acoustical Company in England, comes up with some different figures. He writes: "Firstly, the plus-or-minus one count ambiguity in the counter dictates that, with a 1 kHz reference signal, the accuracy of the reading will be subject to an error of plus or minus 0.1 per cent, assuming the 1 second gate time which is common on counters measuring frequencies in the region of 1 kHz. . . . To resolve wow components up to 6 Hz, the sample period shall be 1/12th second or less, in which time the counter will indicate 83 cycles. The plus or minus one count uncertainty will degrade the accuracy to worse than plus or minus 1 per cent. The use of a higher test frequency to permit the use of short gate intervals will improve the accuracy." Mr. Collins goes on to say that a phase-locked loop method is inherently a better technique for wow and flutter measurements than a digital system and one such application was described in *Wireless World* for December, 1971. The author is R. Ockleshaw, and some of his remarks on manufacturer's specifications would agree with those made by Robert Berglas. In brief, the PLL system produces an output voltage which is instantaneously proportional to the difference between the incoming frequency and a reference frequency. Any phase/frequency error is transformed into a changing d.c. level. The complete circuit uses three ICs plus a single transistor and should cost no more than $25.

Control I

This is a handy gadget made by HR Manufacturing, of 1917 57th St., Sarasota, in sunny Florida. This company formerly made the Rabco turntables and arms, now made by Harman-Kardon. What does Control I do? It switches off the amplifier, receiver, tape recorder, or whatever in the absence of a signal. Two wires are connected to the speaker sockets and the equipment to be switched is plugged into a socket at the rear of Control I, which in turn is plugged into the power outlet. That's all. I found that signals as low as 50 milliwatts would keep the unit switched on so you could use Control I for very soft background music. (Some very interesting applications here!) Switch-off time depended on the signal level and it varied between a few seconds up to just over 9 minutes after the cessation of the signals. The circuit uses 3 transistors and a heavy-duty relay and there is an override switch as well as a manual on-off switch. Price is $29.95. AE

901 SERIES II

Series II... a new listening experience

by BOSE®

501 SERIES II

Introducing the new...

BOSE 901 SERIES II

The original BOSE 901 was the product of a twelve year research program on acoustics.* The large sales that have grown from the worldwide acceptance of the 901 now support what we believe is the industry's most sophisticated team of researchers, dedicated to improving home music systems. All forms of loudspeakers, new and old, are studied.

The concepts of direct and reflected sound, acoustically-coupled full-range speakers, active equalization, and flat power radiation have emerged from the research as fundamental for optimum music reproduction. We doubt that these will change.

However, what is changing is the accuracy with which we can realize these concepts in a producible speaker design and the adaptability of the design to a wider range of home environments. The 901 SERIES II represents the combination of all the technological advances that have emerged from our research department over the past five years.

The 901 SERIES II features a completely new equalizer design. It provides a type of equalization for program source variations not available on other speakers. The new equalizer also enables the 901 SERIES II to adapt to a much wider range of room environments. The 901 SERIES II can even be played in front of drapes and still reproduce music with the proper frequency balance.

The new cone formulation in the 901 drivers provides an unprecedented uniformity of response. BOSE now employs a blue coloring and the BOSE logo to distinguish the basic cone material for special quality control measures, starting right with the manufacture of the cone material.

The 901 SERIES II represents a new height in precision control of audible performance in production speakers. This is thanks to the recent introduction of the SYNCOM™ II speaker testing computer, developed by BOSE specifically to measure performance parameters directly related to our aural perception of sound.

The 901 SERIES II carries a FIVE-YEAR warranty covering parts and labor on both the electronic active equalizer and on the speakers.

*If you would like to know about the research that developed the 901, and about the state-of-the-art of sound recording and reproduction, you will want to read Dr. Bose's articles in the June and July '73 issues of TECHNOLOGY REVIEW. A 20 page combined reprint of these articles is available from BOSE for $.50. Also we'll send you a complimentary copy of the 16 page, full-color 1801 amplifier brochure and information on the new BOSE 901 and 501 SERIES II speakers. Write Dept. OA and request the "complete literature package."

BOSE 501 SERIES II

The Design Goals of the new 501 SERIES II:

- To duplicate as many of the sonic characteristics of the 901 SERIES II as possible, within the cost constraint that dictates the use of a woofer-tweeter approach.
- To match the frequency balance of the 901 SERIES II as closely as possible, so that the 501 and 901 can be used together to produce a Direct/Reflecting® QUADRAPHONIC system that represents a large advance over conventional, direct-radiating QUAD systems.
- To increase the high-frequency power handling capability beyond that of the original BOSE 501.

How the goals were achieved:

- By designing a new tweeter that has *double* the magnet size of the original design.
- By using four additional circuit components in the crossover network.
- By 100% selection and matching of the woofers and tweeters with the SYNCOM™ II computer--the unique computer designed and constructed by BOSE CORPORATION and put into service in August, 1973, to achieve a new level of speaker performance.

The Performance:

You must be the judge. If our efforts have succeeded, you will know immediately when you A-B the 501 SERIES II with any other speaker up to the price of the 901 SERIES II. (If you make the test in a store, be sure to clear at least 20 inches on each side of the 501, so that its reflected sound will be free to bounce off the rear wall.)

BOSE®

The Mountain, Framingham, Massachusetts 01701

Cassette Tape Tests

CASSETTE RECORDERS have improved enormously during the past two or three years and the best Dolbyized models pose a serious challenge to open-reel machines in the same price range. However, because of the slow tape speed and smaller track width, they are much more dependent on the quality of tape and correct matching for best results. And heads have to be clean too!

One of the bugbears of cassette recorders is *tape saturation* which restricts the amount of high frequency signal that can be recorded on the tape. Even the best tapes show some loss in maximum output above approximately 5 kHz, and this is why it is necessary to keep high frequency signal levels well below the 0 VU mark on the meter. If this is not done, the tape saturation will tend to cut peaks and the recorded sound will be dull and lifeless. But if levels are cut *too* far, signal-to-noise ratio will suffer. Here the Dolby system helps considerably, but even so, it is essential to choose a tape having a high Maximum Recording Level (MRL) for best results.

Test Procedure

The machine selected for our tests was the Harman-Kardon 1000, which we included in our cassette recorder survey in August, 1972. We found it to be very suitable for our purposes because of its high standard of performance and because it is possible to measure both input and output signals without too much fuss. Both input and output controls are provided—this helps to select convenient reference points on the output meter. We used a Ferrograph Recorder Test Set which can measure distortion. Two other cassette recorders were used for cross-reference, a Pioneer CT-4141 and a JVC 1667.

Our first test was to measure the frequency response at 0 VU with a constant input. This was plotted in a graph and then we measured the distortion and output level, also at 0 VU level. Then we checked signal-to-noise ratio and finally made frequency measurements at -20 dB level. Frequencies below 400 Hz are not shown in the graphs as deviations were not significant.

Output

The Maxell UD was taken as a standard; the output was identical to the Scotch Highlander and TDK KRO. The actual figure for the Harman-Kardon 1000 was 480 mV for 0 VU recording level. So a tape having an output of -1 dB would produce about 415 mV; -2 dB, 390 mV, and -6 dB, only 240 mV.

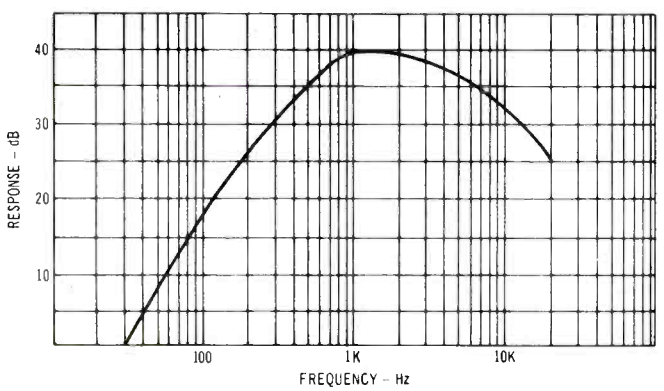


Fig. 1—ASA weighting characteristics.

3 dB Point

This is the frequency where the response has fallen by 3 dB. In general, the higher the frequency at which this occurs, the better the tape. However, distortion, signal-to-noise ratio, and headroom all must be taken into account.

Signal-To-Noise Ratio

Some authorities consider that a weighted noise factor is more accurate as it corresponds to what a person really hears. We wanted to isolate some of the noise due to the electronics of the record-replay amplifier so we used the ASA weighting characteristics as shown in Fig. 1. The reference figure is the standard 3% distortion level.

Distortion

Tapes having a low distortion at 0 VU will obviously have a greater headroom at mid-frequencies. However, variations among the tapes tested were not great.

Chromium Dioxide Tapes

As we have noted before, CrO_2 tapes are much more consistent—the variations between makes are quite small.

How To Choose The Best Tape

Recorders are factory adjusted to suit a particular tape and it is almost impossible to change bias current or equalization. But you may find a particular tape is deficient in treble response and so it is possible to improve matters by changing to one with a rising or extended high frequency response. If you do not have a Dolby or other noise reduction system, choose a tape with a high signal-to-noise ratio—plus adequate headroom. If you are using a tape with a low MRL, watch that VU meter!

Dropouts

With only two samples of each cassette (three at most), it was not possible to make a reliable estimate of dropout probability. For example, Sample A of Irish 261 had three dropouts but Sample B had none at all! Two were considered to be more dropout prone than the others; they were the DAK LN and the TDK 180 LN. The latter is extra thin and the makers do stress that there is a need for special care in handling.

Construction

Some cassettes were welded together; others used screws. Both methods have advantages. The welded construction—in theory—is more accurate and reliable, but the screw assembly does permit repairs to be made. Note that all cassettes tested were C-60's unless stated otherwise.

KLH is well into its second decade of manufacturing extraordinary high performance loudspeakers that don't cost an extraordinary amount of money. We've kept costs down by making every loudspeaker ourselves. And by selling a staggering number of them.

In short, we've had a lot of practice.

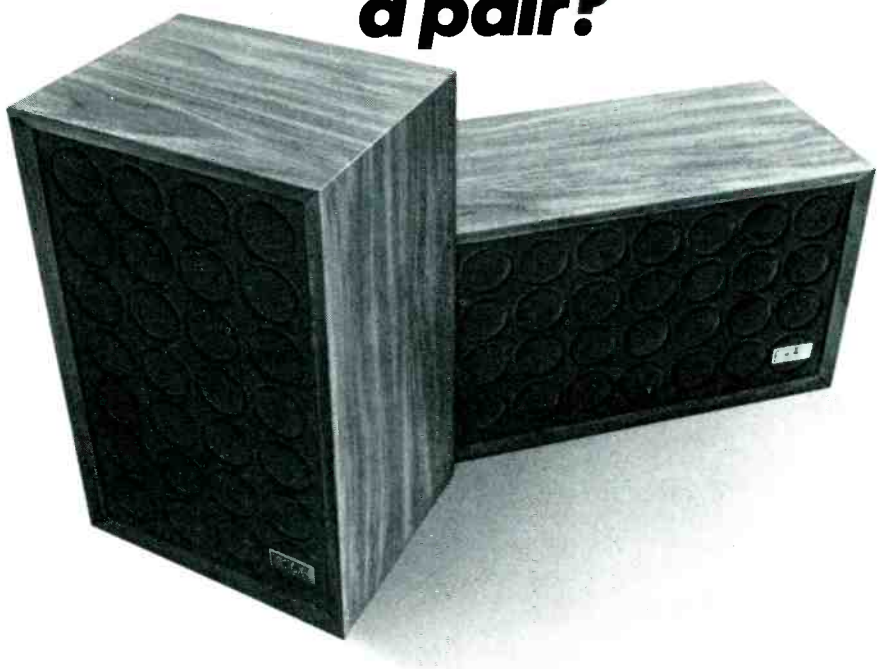
And that's perfect for you.

For now you can own a *pair* of our new Model Thirty-One loudspeakers for just $89.95†. Think of it. Two superb sounding full-range loudspeakers at a price you might consider fair for just one! A pair of Thirty-Ones deliver a truly inordinate amount of sound for their modest size. You can drive them to big listening levels with virtually any decent amplifier or receiver. They're handsome, featuring a new sculptured acoustically transparent foam grille. Rugged. And best of all, incredibly inexpensive. With the money you save, you might even trade-up to a better turntable or receiver, perhaps even get into quadraphonic sound. The Thirty-Ones can help make it happen. A pair is at your KLH dealer now. Listen to them soon. We're sure you'll agree that no one has ever offered you a better value in sound.

And we've had a lot of practice.

For more technical information, write to KLH Research and Development, 30 Cross Street, Cambridge, Mass. 02139. Or visit your KLH dealer.

What does it take to make an important new loudspeaker and sell it for $89.95† *a pair?*



Practice. A whole lot of practice!

KLH RESEARCH AND DEVELOPMENT CORP.
30 Cross St., Cambridge, Mass. 02139

†*Suggested retail prices—slightly higher in the South and West.*

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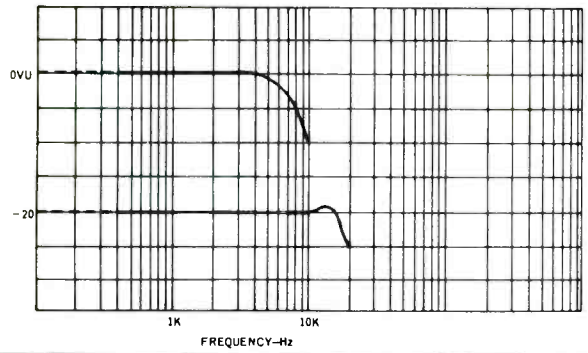
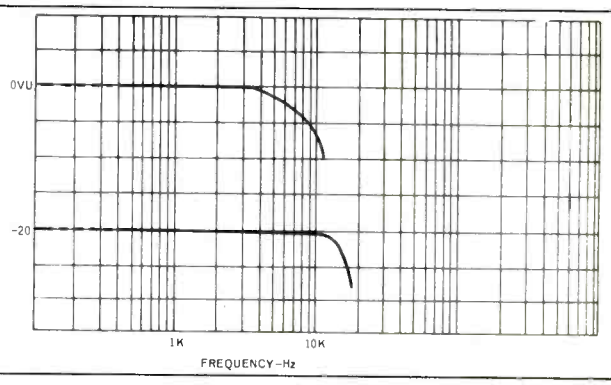
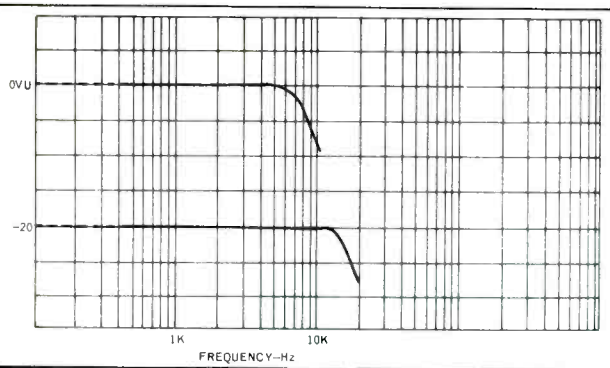
Chromium Dioxide (CrO_2) Tapes



Advocate (Advent) Crolyn
C-90, welded case. Output: −0.5 dB. Distortion at 0 VU: 2.5%. 3 dB Down Point: 16 kHz. S/N: 60 dB. Average headroom.

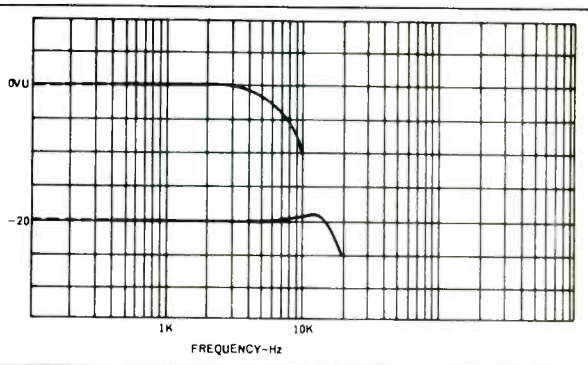
Ampex Series 363
Welded case. Output: −0.3 dB. Distortion at 0 VU: 2.5%. 3 dB Down Point: 15.6 kHz. S/N: 60 dB. Slightly above average headroom.

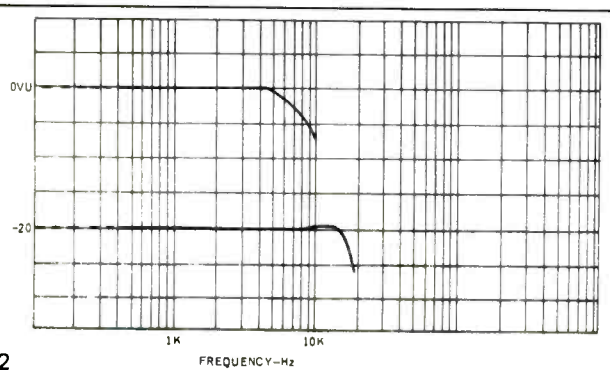




BASF Chromdioxid
Screw-assembled case. Output: −2 dB. Distortion at 0 VU: 2%. 3 dB Down Point: 15 kHz. S/N: 60 dB. Average headroom.

Norelco 400
Screw-assembled case. Output: 0.5 dB. Distortion at 0 VU: 2.3%. 3 dB Down Point: 15 kHz. S/N: 60 dB. Average headroom.





TDK KROM-O_2
Screw-assembled case. Output: 0 dB. Distortion at 0 VU: 2%. 3 dB Down Point: 16.5 kHz. S/N: 60 dB. Excellent frequency response.

SONY® 1055 and 5055
One good Sony deserves another

Sony offers you ten individual choices in tuners, amplifiers and preamps, plus an infinite variety of combinations. For every listening requirement in every price range. We're going to tell you about two new low-priced models that offer all the traditional Sony performance and value.

The Sony TA-1055 delivers 20+20W RMS continuous power into 8 ohms per channel, from 40Hz to 20kHz. The power you pay for is the power you get, at every frequency from low, low bass (where you really need it) right up to the highest highs. And these Sony circuit features keep that power clean and quiet—direct coupled differential output and wide range, integrated circuit phono preamp. It has all the operating features, including such luxury touches as two sets of tape output and monitor connections (use one for an SQ decoder) with direct dubbing, front panel Aux and MIC inputs and slide controls. $169.50*

The deserving tuner for the TA-1055 is Sony's ST-5055. Its sensitivity is 2.2μV IHF, moderate by today's standards, but when you combine it with a capture ratio of 1 dB, performance is outstanding. There's a high blend switch for quiet stereo reception of weak signals, built in AFC, signal-strength meter and switchable muting. $169.50*

Each is the lowest priced tuner and amplifier offered by Sony. Imagine the performance and value offered by the eight other models. Sony's wide selection of deserving amplifiers and tuners goes right on up to the ultimate combination of the super-powered 3200F, deluxe 2000F preamp, and 5130 tuner. Visit your dealer and audition these Sonys. You deserve it.

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* Suggested retail.

Sony Tuners and Amplifiers: now 10 great choices

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Five disturbing facts about loudspeakers no other manufacturer has the guts to tell you.

The Loudspeaker Jungle

1. There are approximately one hundred different makes of "high fidelity" speakers sold in the United States, confronting the buyer with an incredible clutter of names, types, claims and counterclaims.

Of the hundred, no more than twenty are relevant, in the sense that they represent some sort of serious engineering effort and manufacturing philosophy, whether successful or not.

The remaining eighty are opportunistic marketing ventures, big and small, responding to the merchandising needs of stores rather than to the listening needs of the public.

2. One reason for this commercial jungle is that anyone with no other qualifications than a few thousand dollars can go into the speaker business.

About nine out of ten speaker manufacturers, the good guys as well as the bad guys, buy their drivers (woofers, tweeters, etc.) from outside suppliers in the U.S., Europe and Japan.

There are only a handful of these "raw speaker" houses and they stand ready to make anything their customers specify, from the most sophisticated drivers to the cheapest, a hundred thousand units or just five hundred.

The typical speaker manufacturer is therefore merely a contractor with practically no overhead; he throws a Gundersen woofer and a Furuhashi tweeter into a Gonzalez cabinet and sells it as the one and only original Astrodynamic speaker system. (The names have been altered to protect the innocent.)

There's nothing *inherently* wrong with this way of making speakers, as long as a talented and experienced speaker designer is in charge from beginning to end.

At Rectilinear, we buy our drivers only from the best suppliers, who make them to our own rigid specifications to match the system designs we've developed. We make our own crossover networks and cabinets.

But not every manufacturer is like us.

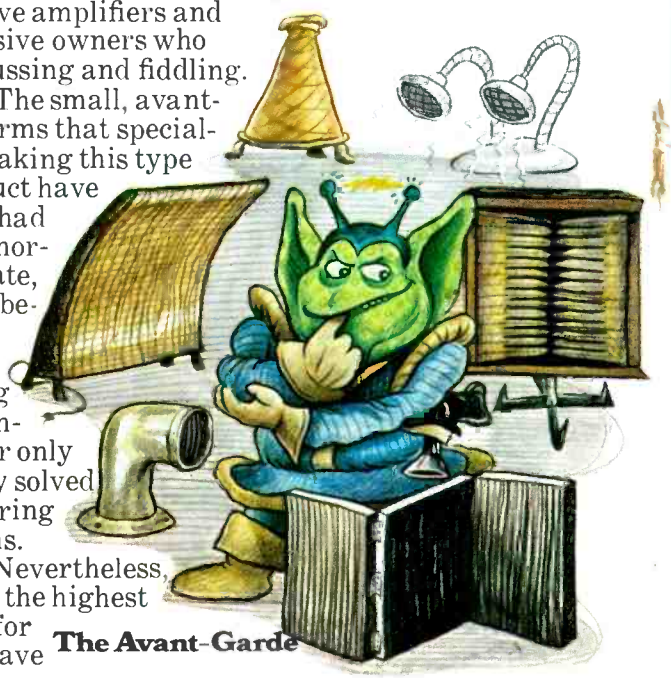
3. Among the approximately twenty technologically and ethically respectable speaker brands, some six or seven are relevant only to a small coterie of dedicated audiophiles.

These are the exotic designs, utilizing electrostatic or other unconventional drive principles as well as diaphragms of unfamiliar shape and construction.

In most cases, these speakers require special, expensive amplifiers and compulsive owners who enjoy fussing and fiddling.

The small, avant-garde firms that specialize in making this type of product have always had a high mortality rate, usually because of wishful thinking about unsolved or only partially solved engineering problems.

Nevertheless, we have the highest regard for these brave



The Avant-Garde

experimenters and consider it entirely possible that the future belongs to one of them.

But which one?

(Will you buy the first electric automobile when it comes out?)

The West Coast Sound

4. The thirteen or fourteen speaker makers who are both serious and reasonably conservative, and among whom we confidently number ourselves, are hopelessly split on the issues of sound dispersion and speaker "personality."

Some believe, and so far we're one of them, that a speaker should radiate sound only forward, over as wide an angle as possible. Others aim various drivers at the back wall or the ceiling, to bounce off the sound before it reaches the listener.

We feel that the arguments for the latter approach are unscientific and that the resulting sound is phony. No guitar is nine feet tall and twelve feet wide. (When somebody comes up with a reflective design that presents a correct spatial perspective, we may change our mind.)

As for personality or character, a speaker should theoretically have none, since it's a *re*producer, not a musical instrument. *When two speakers sound different playing the same program material, at least one of them is wrong. Maybe both.*

But they do sound different, even in this heavily screened group.

There's the West Coast sound, for example, favored mainly by California-based firms and characterized by sizzling highs, a huge bass and lots of so-called presence. Everything a bit overstated and larger than life.

The Polite New England Sound

There's also the polite New England sound, with its origins in the Boston area. Nice and smooth, neutral, everything in its place, nothing shrill, but somehow muffled and less vivid than real life.

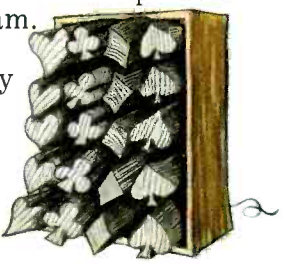
We believe that, despite their charms, both of these personalities are wrong. Only a totally characterless accuracy is right. What goes in must come out, no more and no less. Let the record producer create the type of sound you hear, not the speaker manufacturer.

Accuracy has a great deal to do with low time delay distortion, a much-neglected subject. Electrostatic speakers excel in this area. We could summarize our position by stating that Rectilinear aims for the accurate, electrostatic type of sound without giving you the problems associated with electrostatics.

The Accurate Sound

5. There's also a new impediment to accurate sound reproduction, in addition to the established schisms discussed above. We're referring to the epidemic of "three-dimensional" or "sculptured" speaker grilles made of polyfoam.

A speaker grille should be, above all things, acoustically transparent. There should be no audible, and virtually no measurable, difference in the output of the speaker with the grille on or off.



The 3-D Grille

But the foam material these newfangled grilles are made of is the same as the appliance people use for muffling the mechanical noises of air conditioners!

How a reputable manufacturer can use a *sound deadener* for a speaker grille is beyond us, but everybody seems to be doing it.

Until acoustically transparent three-dimensional materials become available, *our* grilles will remain prosaically two-dimensional.

RECTILINEAR SPEAKER SYSTEMS

Rectilinear III floor-standing speaker (6 drivers, 3-way crossover)	$299.00
Rectilinear III Lowboy (6 drivers, 3-way crossover)	299.00
Rectilinear XII bookshelf speaker (3 drivers, 3-way crossover)	149.00
Rectilinear Mini-III bookshelf speaker (3 drivers, 3-way crossover)	109.00
Rectilinear XIa bookshelf speaker (2 drivers, 2-way crossover)	89.00

So. Okay.

Besides Rectilinear, are there any sincere, serious, nonexotic speaker companies that make forward-radiating, personality-less, accurate-sounding systems without 3-D grilles?

We don't know of any.

In our own methodical way, we're unique.

One more thing.

We aren't telling you all this just for laughs.

Next time you're in a hi-fi store, use these five facts to guide you through the loudspeaker jungle.

And remember who told you.

RECTILINEAR®

Rectilinear Research Corp., 107 Bruckner Blvd., Bronx, N.Y. 10454
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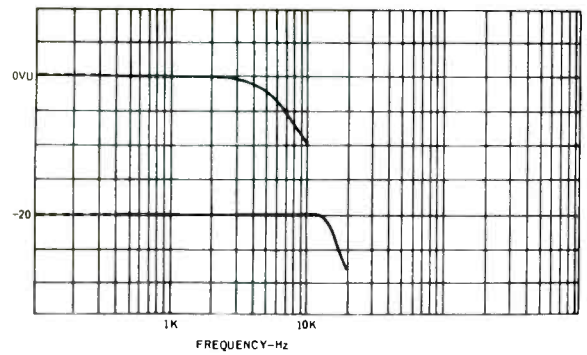
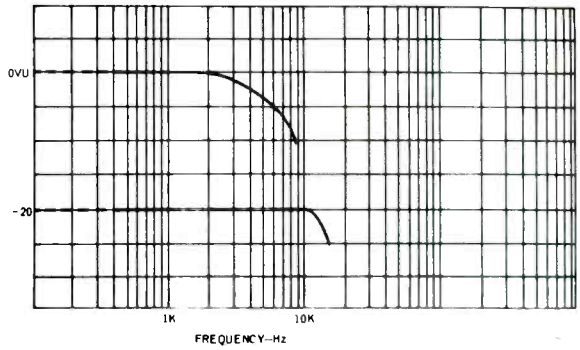
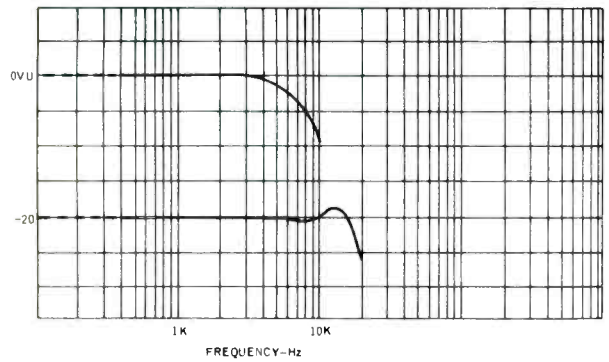
Ferric Oxide Tapes



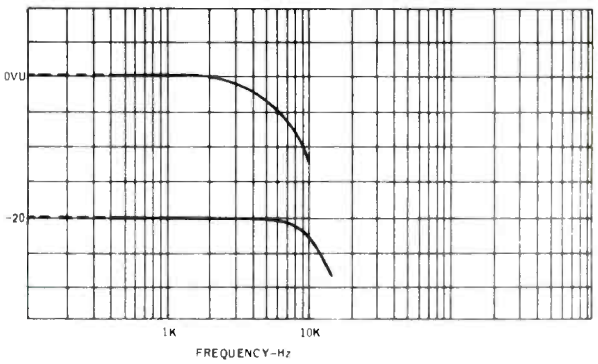
Ampex 20:20+
Screw-assembled case. Output: +1 dB. Distortion at 0 VU: 2%. 3 dB Down Point: 14.5 kHz. S/N: 55 dB. Average headroom.



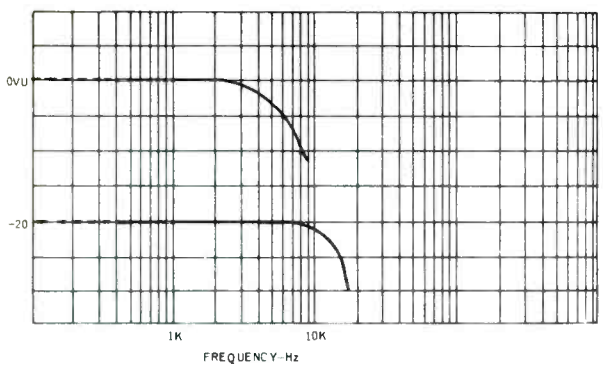
BASF SK/LN
Welded case. Output: -2 dB. Distortion at 0 VU: 2.5%. 3 dB Down Point: 12.5 kHz. S/N: 56 dB. Headroom 5 dB down at 6 kHz.



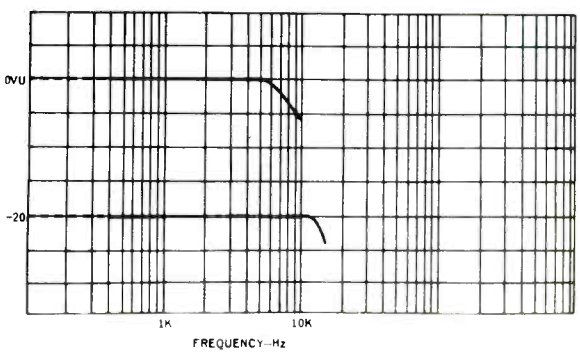
Capitol LN
Screw-assembled case. Output: -0.3 dB. Distortion at 0 VU: 2.2%. 3 dB Down Point: 16.3 kHz. S/N: 56 dB. Excellent frequency response; better than average headroom.



DAK LN
Welded case. Output: -0.5 dB. Distortion at 0 VU: 2.5%. 3 dB Down Point: 10.5 kHz. S/N: 52 dB. Slightly below average headroom; inexpensive general purpose tape.



Irish 261
Welded case. Output: -2 dB. Distortion at 0 VU: 2%. 3 dB Down Point: 14 kHz. S/N: 55 dB. Slightly lower than average headroom—down 5 dB at 6.5 kHz.



Maxell LN
Welded case. Output: -0.3 dB. Distortion at 0 VU: 2%. 3 dB Down Point: 13.5 kHz. S/N: 56.5 dB. Excellent headroom; 5 dB down at 9 kHz.

How Magnavox is helping to clear the air in Los Angeles.

The airwaves over Los Angeles are thick with signals from 78 FM stations, all squeezed into 20 MHz of spectrum.

Other urban centers are no better. But Magnavox has found a way through the sound smog, to help you find and pull in just the station you want—even if it's butted up against one that's lots more powerful.

Our bright idea: the 1500 Plus DTI, the first stereo FM/AM receiver with *digital* tuning. It counts, latches, decodes and displays in large glowing numerals the *exact* frequency you're tuned to—FM or AM—with the accuracy you'd expect from a digital computer. Which, in fact, is how we do it—after our MOSFET front end and ICs clear the air.

Once in, the scrubbed signal is boosted by an amplifier stage that typically delivers 50/50 watts rms (into 8 ohms) at only 0.5% distortion. Direct-coupled output, of course, for full damping at any frequency.

Other goodies: linear phase lump-constant filters for minimum distortion on FM, an active tone-compensation network, full-function jack panel, 4-channel matrix decoder, and a thermal protection circuit that shuts the set off if it's ever overloaded—then *shows* you why it shut off.

What price pure air? $399.95*. Other Magnavox high-performance receivers, with zero-center tuning meters, start at $229.95*.

Your Magnavox dealer is listed in the Yellow Pages. Visit him today, and hear what clear air sounds like.

Magnavox. You heard right.

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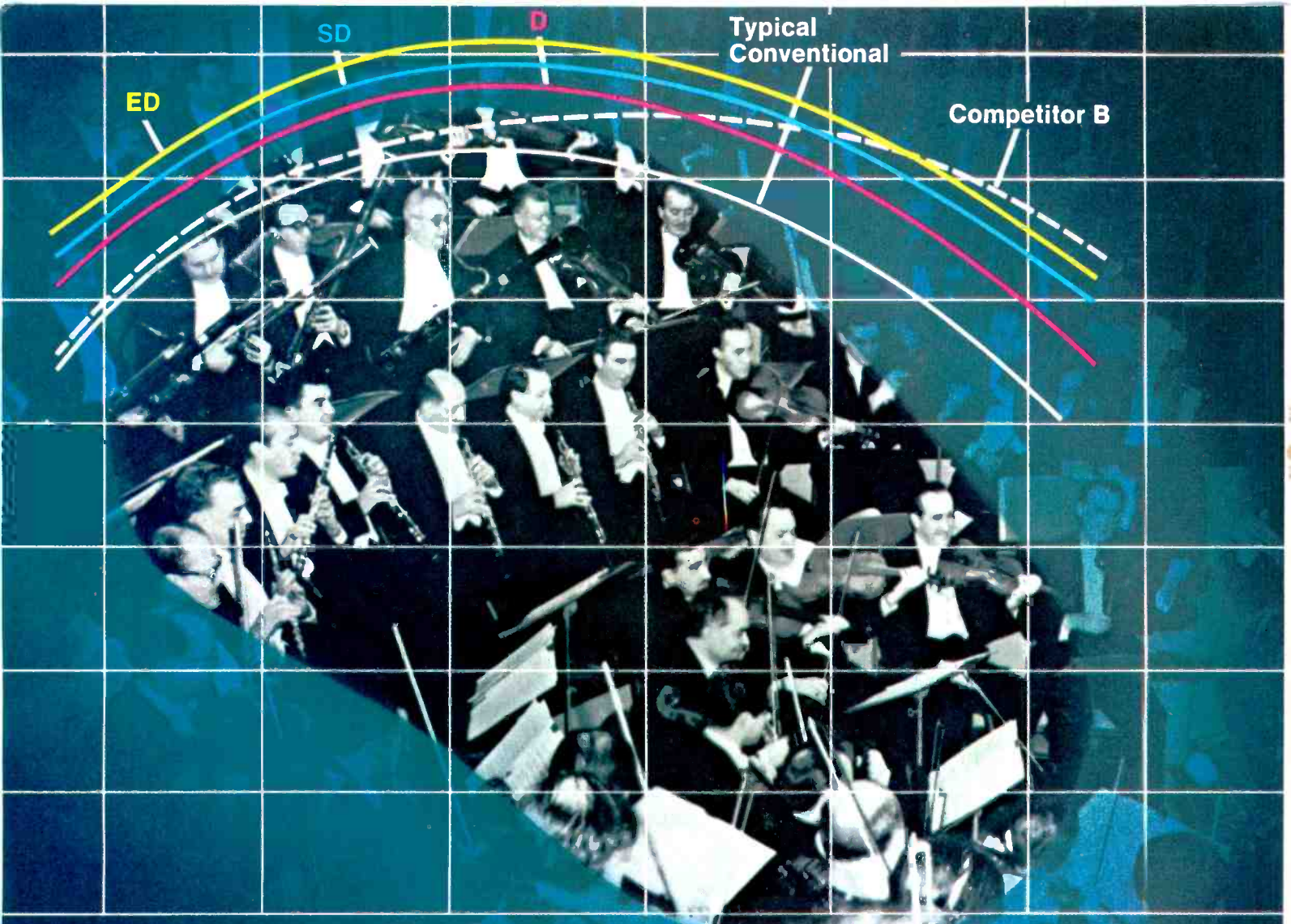


capture all the sounds of life on TDK's high-MOL cassettes

MOL stands for maximum output level. It is a tape's most important measureable characteristic — the ability to faithfully reproduce the richness, fullness and warmth of the original performance. Only your own critical ear can be a better judge of a tape's overall hi-fi performance capabilities.

A tape with high MOL lets you capture the subtle overtones, transient phenomena and important harmonics of "real-life" sound. High MOL provides high saturation levels which means you can record at higher inputs and handle the loudest and softest passages without audible distortion or hiss. Because TDK cassettes have the highest MOL values of any cassettes on the market today, you can capture the total experience of beautiful music and all the other sounds of real life.

TDK's EXTRA DYNAMIC (ED), SUPER DYNAMIC (SD) DYNAMIC (D) cassettes also offer the best-balanced characteristics of any cassettes (see facing page.) Add complete compatability with any recorder, plus fully-guaranteed mechanical reliability, and you've got the world's finest cassettes — TDK.

Enter TDK's dynamic new world of cassettes, for a totally new and different experience in sound reproduction quality. TDK's DYNAMIC-series ED, SD and D cassettes, plus the BRILLIANT-series KROM(KR) chromium-dioxide cassettes are available at quality sound shops and other fine stores everywhere.

the new dynamic world of

TDK®

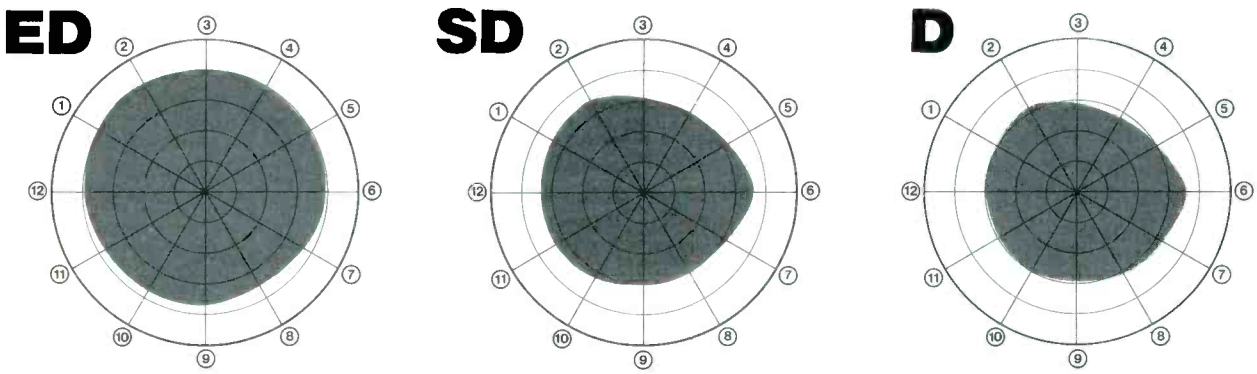
TDK ELECTRONICS CORP.
755 Eastgate Boulevard, Garden City, New York 11530

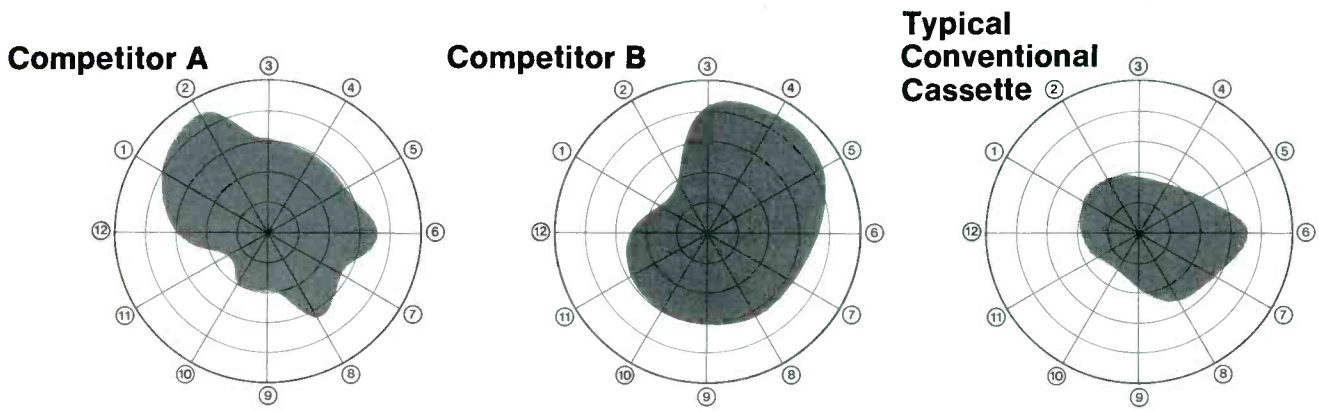
TDK's circle of tape performance

....a whole new way to evaluate tape

A tape's ability to provide "real-life" sound reproduction depends not only on its MOL (maximum output level) values and the familiar frequency response characteristics, but also on the value and proper balance of a number of other properties. TDK has arranged the twelve most important tape characteristics on their exclusive CIRCLE of TAPE PERFORMANCE diagrams, shown below. Each of the radii represents one of the twelve factors, and the outer circle represents the ideal, well-balanced characteristics of a "perfect" tape. The closer the characteristics of any cassette tape approach those of the ideal (the larger and more regular the pattern), the better the sound reproduction capabilities of the cassette. The goal is to reach the outer circle.

Compare TDK's well-balanced characteristics with those of the two leading so-called "hi-fi" competitive cassettes and a typical conventional tape. Judge for yourself which provides the best characteristics for true high fidelity performance.





1-MOL @ 333Hz
2-Sensitivity @ 333Hz
3-Sensitivity @ 8kHz
4-Sensitivity @ 12.5kHz
5-MOL @ 8kHz
6-Erasability
7-Bias Noise
8-Print-Through
9-Modulation Noise
10-Output Uniformity
11-Uniformity of Sensitivity
12-Bias Range

EXTRA DYNAMIC

for the discriminating audiophile, an entirely new dimension in cassette recording fidelity. Vastly superior to any other cassette, with unmatched performance on any deck. 45, 60 and 90-minute lengths.

SUPER DYNAMIC

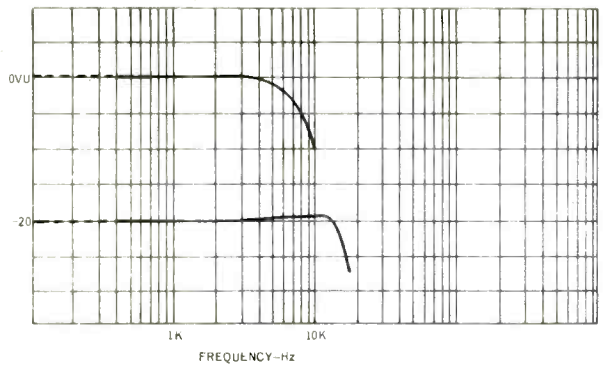
turned the cassette into a true high-fidelity medium. Outstandingly clear, crisp, delicate reproduction of the complex characteristics of "real-life" sound. 45, 60, 90 and 120-minute lengths.

DYNAMIC

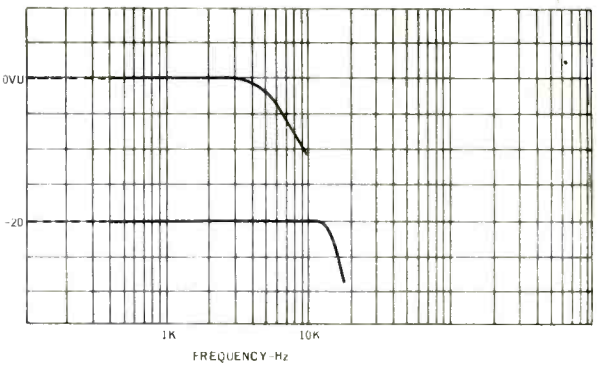
excellent hi-fidelity at moderate prices, with well-balanced performance characteristics superior to most "premium" cassettes. 45, 60, 90, 120 and 180-minute lengths — the world's only 3-hour cassette.

What is MOL?
MOL (maximum output level) is the output level obtained from an input signal of a given frequency which causes 5% distortion (average audible level) in the output. MOL varies with signal frequency.

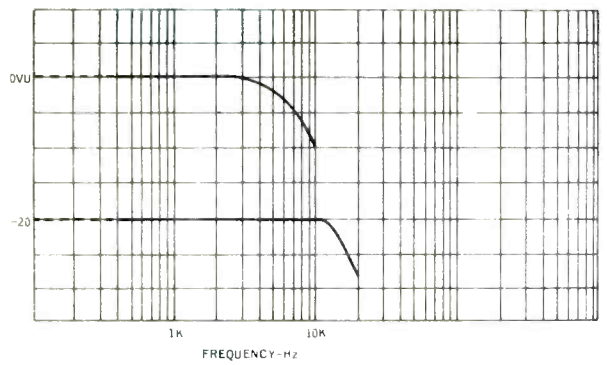
What Does the MOL Diagram (facing page) Show?
The large closed-loop area on the facing page represents a typical sound energy plot of high fidelity music; the curved lines represent the MOL characteristics of various cassettes. As long as the MOL curve is above the sound energy plot, no audible distortion occurs. Separation between the MOL curves and the energy plot is necessary to permit recording, without distortion, the occasional bursts of high-energy sound which periodically occur in musical passages.



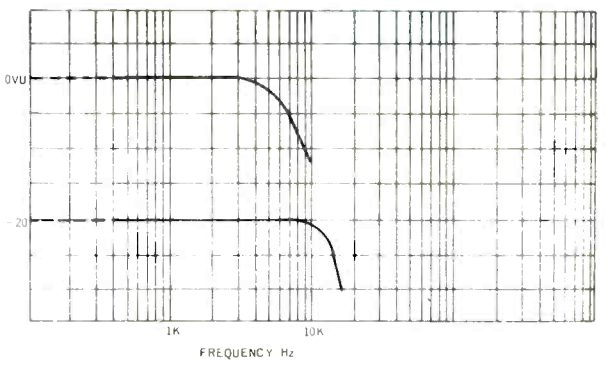
Maxell UD
Welded case. Output: 0 dB. Distortion at 0 VU: 2%. 3 dB Down Point: 13.5 kHz. S/N: 56 dB. Above average headroom.



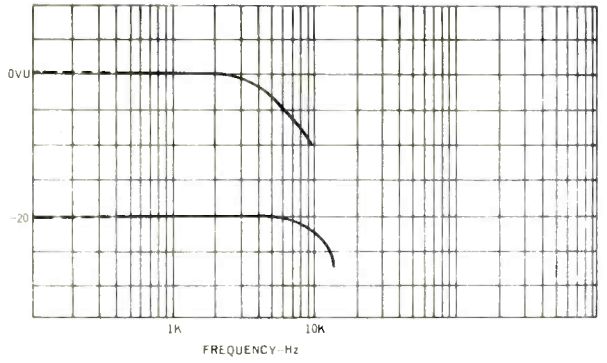
Memorex MRX$_2$
Non-standard plastic box; welded case. Output: +0.5 dB. Distortion at 0 VU: 1.6%. 3 dB Down Point: 15 kHz. S/N: 54 dB. Slightly lower headroom—down 5 dB at 6.5 kHz; excellent frequency response.



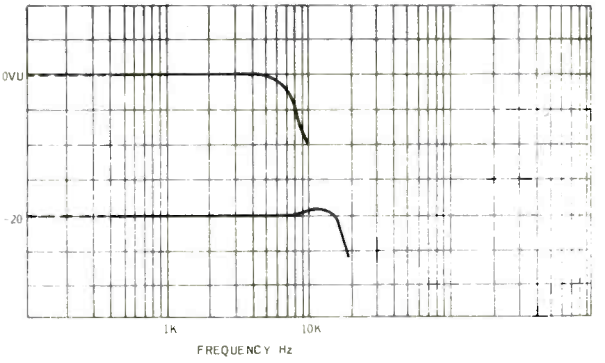
Primus 30
Welded case. Output: -0.5 dB. Distortion at 0 VU: 2.2%. 3 dB Down Point: 14.5 kHz. S/N: 52 dB.



Scotch Highlander
Welded transparent-plastic case. Output: 0 dB. Distortion at 0 VU: 1.5%. 3 dB Down Point: 12 kHz. S/N: 56 dB.



Scotch LN/HD
Welded transparent-plastic case. Output: -0.5 dB. Distortion at 0 VU: 1.5%. 3 dB Down Point: 11 kHz. S/N: 56 dB. Headroom slightly lower than average.



Sony LN
Welded transparent-plastic case, with auto-sensor. Output: -0.5 dB. Distortion at 0 VU: 2.1%. 3 dB Down Point: 15.5 kHz. S/N: 54.5 dB. Better than average headroom; excellent frequency response.

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From left to right: Model 100, Model 102, Model 103

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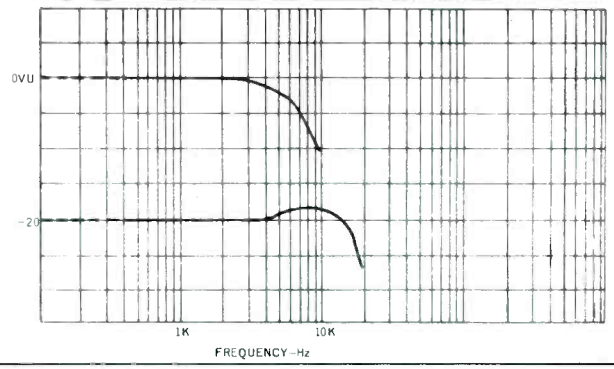
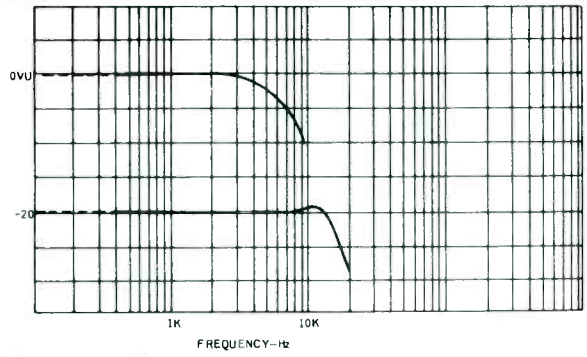
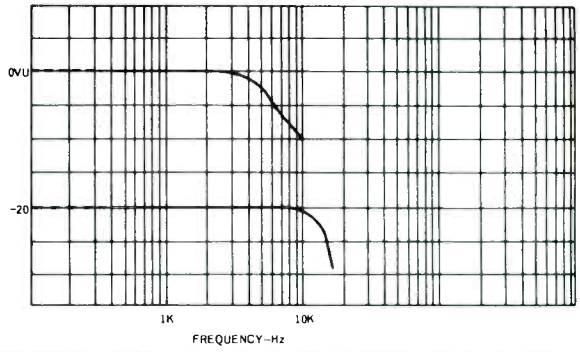
Sony UHF
Screw assembled case, with auto-sensor. Output: + 0.5 dB. Distortion at 0 VU: 1.6%. 3 dB Down Point: 13 kHz. S/N: 55.5 dB. Average headroom, excellent frequency response.

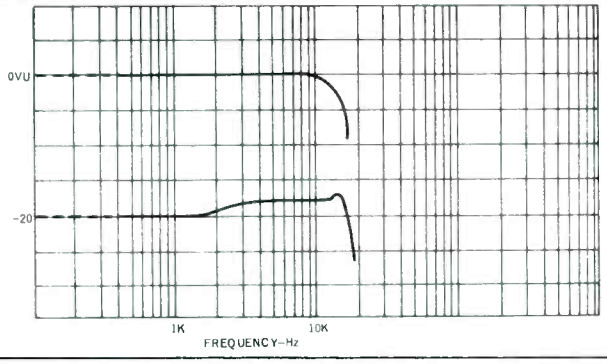




TDK ED
Screw-assembled case. Output: -0.5 dB. Distortion at 0 VU: 2%. 3 dB Down Point: 15 kHz. S/N: 56.5 dB. Average headroom.

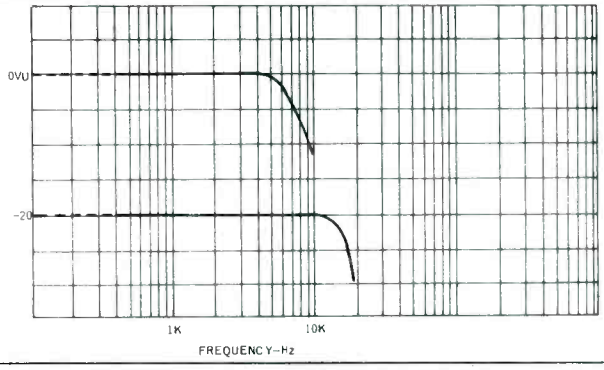
TDK LN
Screw-assembled case. Output: -0.5 dB. Distortion at 0 VU: 2%. 3 dB Down Point: 13 kHz. S/N: 55 dB. Slightly below average headroom.





TDK LN
C-180, screw-assembled case. Output: -11 dB. Distortion at 0 VU: 3%. 3 dB Down Point: 16.5 kHz. S/N: 52 dB. Playing time of 3 hours is achieved at the expense of output; thickness is less than 25 millionths of an inch; headroom is excellent.

Tracs Plus
Screw-assembled case. Output: -0.5 dB. Distortion at 0 VU: 2.2% 3 dB Down Point: 15.3 kHz. S/N: 55 dB. Average headroom.



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Equipment Profiles

Onkyo Model TX-555 Stereo Receiver

MANUFACTURER'S SPECIFICATIONS

FM Tuner Section

IHF Sensitivity: 2.0 μV. **S/N**: 70 dB. **THD**: Mono, 0.2%; Stereo, 0.5%. **Capture Ratio**: 1.5 dB. **Selectivity**: 75 dB. **AM Suppression**: 50 dB. **Image Rejection**: 70 dB. **I.F. Rejection**: 100 dB. **Frequency Response**: 30-15,000 Hz ±0.5 dB. **Stereo Separation**: 40 dB at 400 Hz.

AM Tuner Section

IHF Sensitivity: 40 μV. **S/N**: 40 dB. **THD**: 0.8%. **Image Rejection**: 40 dB. **I.F. Rejection**: 40 dB.

Amplifier Section

Power Output: 40 watts continuous per channel, 8 ohm loads, both channels driven. **THD**: 0.3% at rated power. **IM Distortion**: 0.4% at rated power; 0.3% at 1 watt output. **Power Bandwidth**: 15-35,000 Hz. **Frequency Response**: 10 Hz to 35,000 Hz ±1 dB. **Damping Factor**: Over 100. **Input Sensitivity**: Phono, 2.5 mV; Aux, 100 mV. **Phono Input Overload**: 200 mV. **Equalization**: RIAA ±0.5 dB. **Tone Control Range**: Bass, ±10 dB at 100 Hz; Treble, ±10 dB at 10,000 Hz.

General Specifications

Power Requirement: 120 VAC, 60 Hz, 250 Watts, max. **Dimensions**: 18⅜ in. W. x 5½ in. H. x 15⅛ in. D. **Weight**: 28 lbs. **Price**: $399.95.

This entry from Onkyo is the first receiver of theirs we have had a chance to test and we were at once impressed by the fine external styling of the unit as well as by its neat internal layout and construction. The front panel is a heavy pale-gold-anodized casting, with solid end-cap posts which give the unit a very trim look.

The framed dial scale area, which also contains a single signal-strength meter active for both AM and FM, is blacked out until power is applied, at which time it is illuminated in bright green, with separate red illumination applied to the tip of the translucent dial pointer. Illumination to the meter face is applied only when a radio position (either AM or FM) is selected. Controls located along the lower section of the panel include a speaker switch (with settings for one or two pairs of speakers and an off position for headphone listening), dual-concentric, clutch-operated bass and treble controls, balance control, volume control and program selector switch. In addition, there are six push-push buttons which control such secondary functions as high and low cut filters, stereo/mono mode, tape monitoring, loudness compensation and FM muting. The usual stereophone jack is located at the extreme left of the panel, while the large tuning knob is positioned to the right of the dial scale. The FM dial scale itself is perfectly linear, with equal divisions between each MHz and, probably for this reason, Onkyo elected not to include a logging scale.

A view of the rear panel is shown in Fig. 1. Speaker connection terminals are well spaced and are of the binding post type which permit the stripped ends of the speaker cable to be inserted in a small hole and retained in place by tightening a screw terminal. There are antenna connections for 300 ohm, 75 ohm, and "local" FM (used when attenuation of overly-close station signals is desired). There is also a terminal for connection of an external AM antenna in the event that the included ferrite bar antenna proves inadequate for weak-signal AM reception. Input jacks are provided for phono, and two sets of Aux equipment. An interesting innovation in the record-out system is the incorporation of two pairs of Rec Out jacks. The first set operates as expected, in conjunction with the front panel tape monitoring switch and the play-

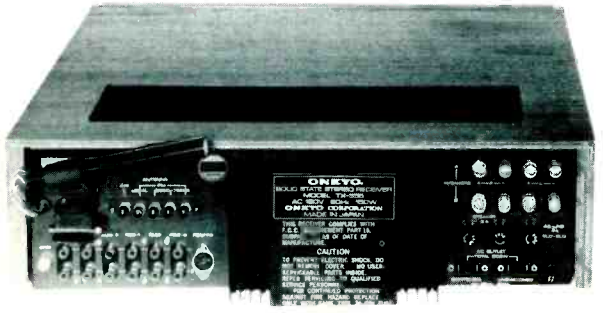


Fig. 1—Rear panel layout.

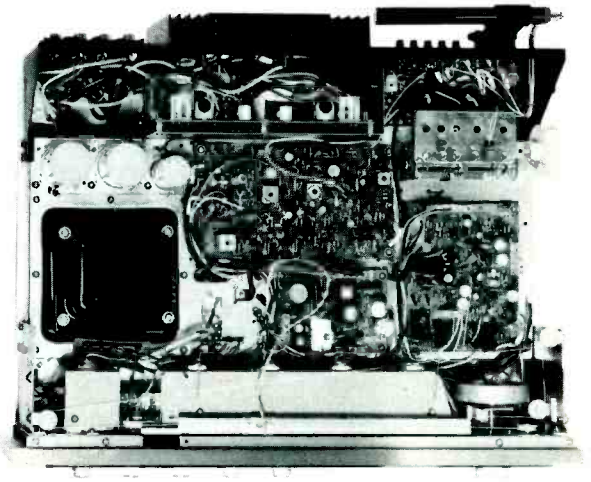


Fig. 2—Internal view from above.

back jacks on the rear panel. The second Rec Out jack set is located *after* the volume control and tone control circuitry, permitting the recordist to alter tone quality of the program prior to recording. This latter jack set does not permit tape monitoring, however. A DIN tape connector is also included, and it is wired in parallel with the Rec 1 and Playback jacks in the usual manner. A pair of speaker fuses, a line fuse and a switched and unswitched a.c. receptacle complete the rear panel layout.

Figure 2 shows a view of the inside of the chassis, and the modular construction is apparent. Several of the p.c. board modules are interconnected by multi-conductor plugs and sockets which permits easy servicing or replacement, if ever needed. The front-end features a four-gang tuning capacitor for FM (2 gangs for AM), double-tuned interstage circuitry and an FET r.f. amplifier. Three pairs of ceramic filters are used to set i.f. selectivity and a four-stage differential amplifier is used to achieve necessary gain and limiting functions. Negative-feedback type tone controls are used in the voltage amplifier section, while the power amplifier is completely direct-coupled right out to the speaker terminals. An electronic protection circuit is included to protect against short-circuits in addition to the speaker fuses already noted. Transients or "popping" sounds of turn-on and turn-off have been eliminated by another circuit which Onkyo calls a "transient killer circuit."

Tuner Measurements

As indicated in Fig. 3, IHF sensitivity was achieved for an input of exactly 3.0 microvolts. Fairly steep quieting was observed, with a 50 dB S/N reached for a bit over 4 μV input. Ultimate S/N reached 63 dB at just under 100 μV, while mono THD reached a low of 0.25% for signal inputs above 100 μV. Stereo THD reached a low of 0.28%, considerably better than the 0.5% claimed. Stereo threshold sensitivity is not adjustable on this receiver, and we found that it took some 30 μV of signal before the receiver "switched over" to stereo operation. In view of the fact that THD at this input level was already below 1.0% and quieting was quite good, Onkyo would have been well advised to factory adjust the stereo threshold to a lower setting—say about 10 μV or so—so that listeners might enjoy stereo reception for weaker signal strengths.

Stereo FM separation fell short of the 40 dB claimed by the manufacturer, as shown in Fig. 4. Mid-band separation ranged from about 30 dB to 33 dB, with separation decreasing to 25 dB at 50 Hz and about 24 dB at 10 kHz. Mono distortion at various frequencies is also shown in Fig. 3 and is seen to remain well below 0.5% for frequencies from 80 Hz to 9 kHz and below 1.0% over the entire useful audio range of FM transmission. Stereo THD is just a bit higher than mono THD (0.28% at mid-band frequencies) for most of the audio range, increasing because of non-harmonic related "beats" as higher frequencies were tested.

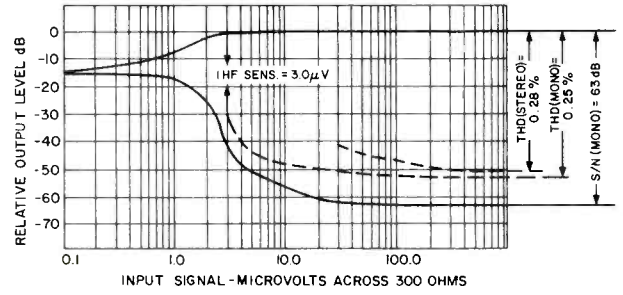


Fig. 3—FM performance characteristics.

Capture ratio measured exactly 1.5 dB with 1000 μV input, as claimed, and rose to about 1.8 dB for signals of 100 μV. Selectivity measured 70 dB, a very respectable figure even if short of the 75 dB claimed by the manufacturer. Frequency response was well within the $\pm$0.5% limits quoted by the manufacturer, indicating careful choice of de-emphasis components and i.f. design.

AM performance was typical of that attainable with two-section tuning (signal fed directly to converter), and the 40 μV sensitivity claimed was confirmed.

Amplifier Measurements

The Onkyo TX-555 power amplifier section is extremely conservatively rated and a winner in every sense. THD for all power levels right up to rated 40 watts per channel hovered just over 0.1% and did not reach rated THD of 0.3% until each channel was producing 46 watts, as shown graphically in Fig. 5. IM distortion remained below 0.1% for all power levels up to about 30 watts and reached its rated value of 0.4% at 49 watts output per channel. Based upon the manufacturer's rated output of 40 watts per channel into 8 ohm loads, power bandwidth extended from 10 Hz to 40 kHz, considerably better than claimed. Power bandwidth is plotted in Fig. 6. The power amplifier easily produced rated power

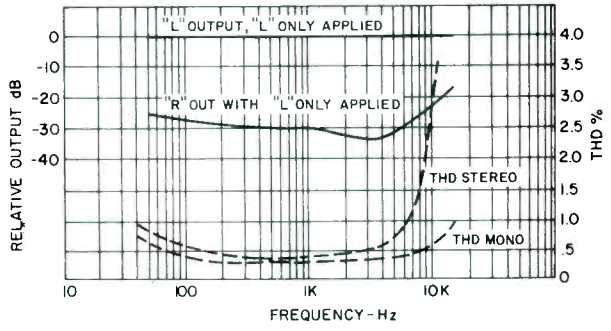


Fig. 4—FM separation and THD vs. frequency.

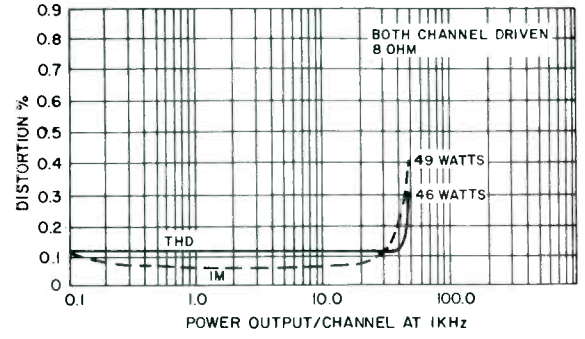


Fig. 5—THD and IM characteristics.

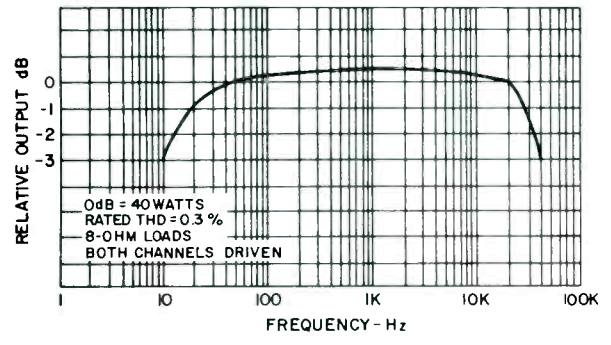


Fig. 6—Power bandwidth.

at all frequencies from 20 Hz to well over 20 kHz. Even at 20 Hz, THD measured 0.6%, as shown in Fig. 7. THD at half power and 1 watt levels was proportionately better at the frequency extremes as shown.

Phono input sensitivity was confirmed as 2.5 mV and, more important, the overload input signal capability was measured as 225 mV as against the 200 mV claimed. This is an extremely worthwhile feature, in that it insures absence of distortion when playing today's dynamically recorded discs with virtually any cartridge, regardless of its nominal output level. Phono hum and noise was measured as 60 dB below full output, with reference to a 2.5 mV signal input. Referenced to a 5 mV input signal (more typical), the hum and noise level becomes 66 dB and very acceptable. S/N ratio for the Aux input was 75 dB below rated output while residual hum and noise of the power amplifier was measured as 90 dB.

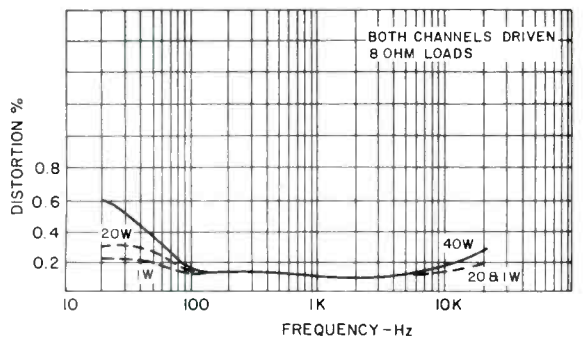


Fig. 7—THD vs. frequency.

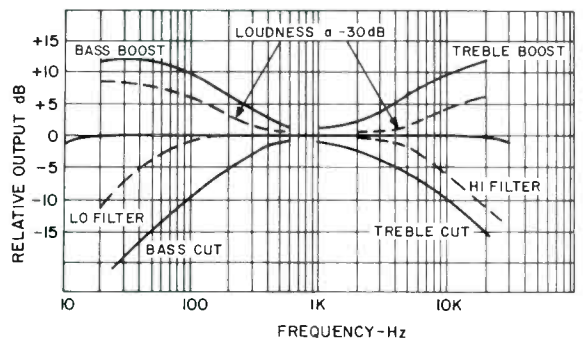


Fig. 8—Tone control, filter, and loudness control action.

Tone control range, filter action, and loudness control action with volume control set at -30 dB are all plotted in Fig. 8 and are seen to conform to manufacturer's claims and standard practice. The loudness control compensates both bass and treble extremes, with the treble emphasis being moderate. Overall frequency response, including low level amplification and tone control stages, extends from 9 Hz to over 30 kHz within 1 dB.

Listening Tests

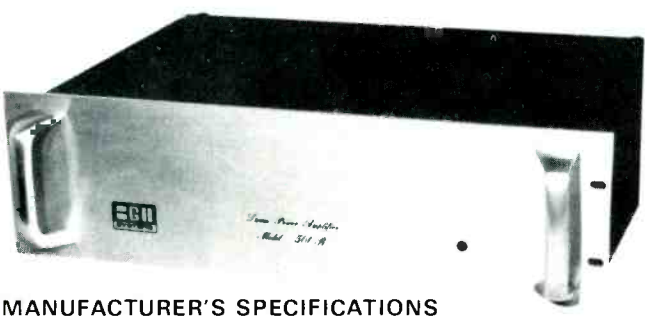
FM reception using the Onkyo TX-555 was highly satisfactory, with good quieting and distortion free performance on most all of the 45 stations we logged. We were not conscious that the IHF sensitivity and stereo FM separation measured less than some of the "super tuners" we have recently tested, which proves once more that these particular parameters are of lesser importance than we are led to believe. We were, however, aware of the high stereo threshold point, since some three or four stations (admittedly at great distances from our receiving site) were received in mono when we knew that they were broadcasting in stereo. Our field strength meter indicated a signal strength of 25 μV for the strongest of these, confirming that it does take more than 30 μV to "flip" this receiver into the stereo mode. Of course, most typical listening involves signal strengths greatly in excess of that figure—providing you use a reasonable FM antenna.

It was in the phono mode that this receiver really came into its own. Transient response seemed excellent and even our most dynamically recorded discs were heard without any discernible overload distortion or breakup. As for power output, it was more than adequate for our stereo pair of low-efficiency acoustic suspension systems which call for a nominal 20 watts of power per channel. Low-level listening was also very clean, sonic evidence of the low distortion figures observed during our lab measurements. Controls were smooth and easy to use, and volume control tracking was particularly accurate to below -60 dB from full volume.

At just under $400.00, the Onkyo TX-555 represents good value for anyone interested in a receiver in the 40+ watt per channel power range. At $469.95, the company offers another model (TX-666) which is reported to have somewhat better FM performance and 50 watts per channel output. If the higher powered set is as conservatively rated as this one, both receivers deserve serious consideration in their respective power classes. *Leonard Feldman*

Check No. 50 on Reader Service Card

BGW 500R Stereo Amplifier

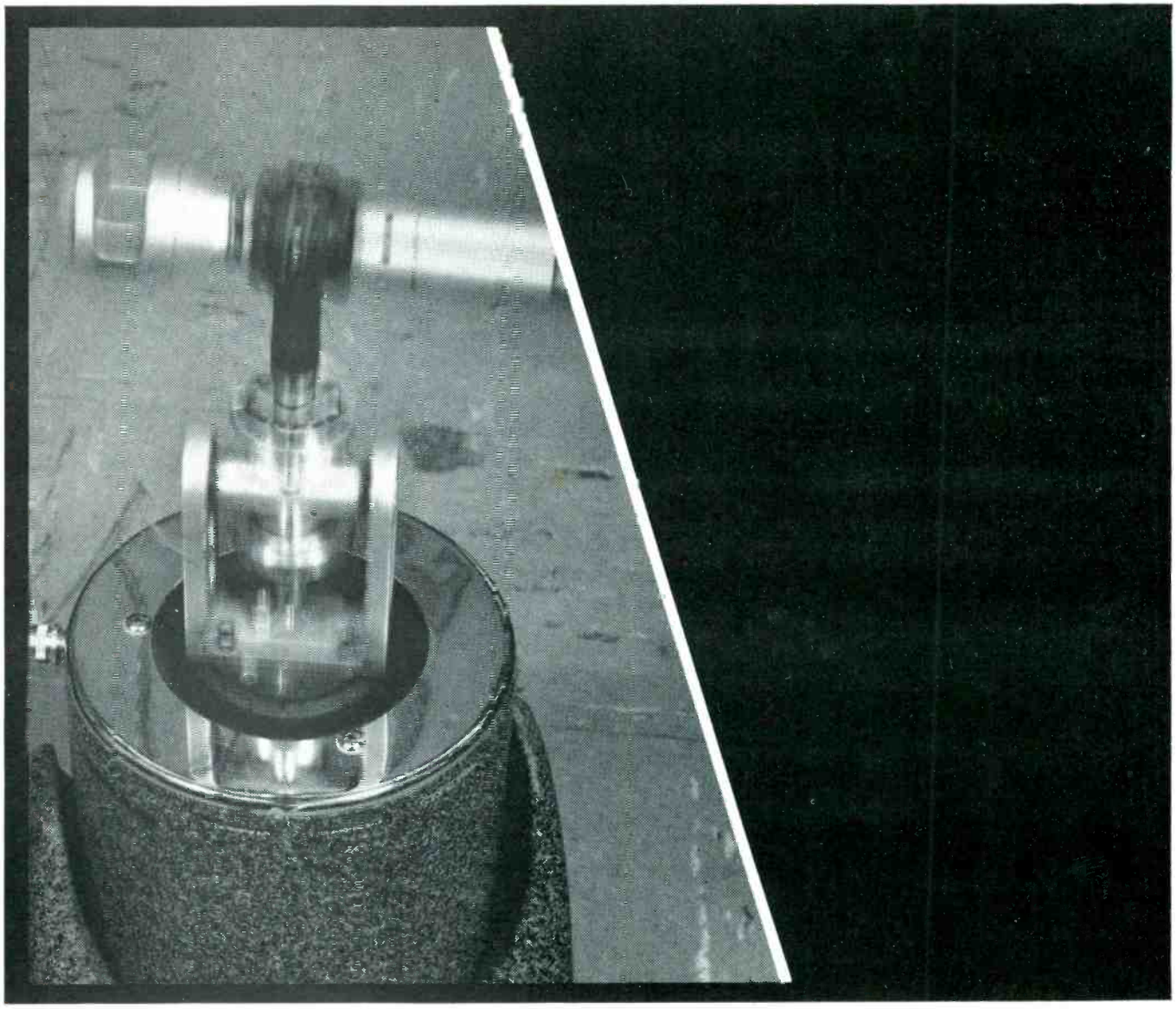


MANUFACTURER'S SPECIFICATIONS

Power Output: 200 watts per channel into 8 ohms; 300 watts per channel into 4 ohms. **Distortion**: Less than 0.2% at 200 watts; typically 0.01%. **Hum and Noise**: Better than 100 dB below rated output. **Input Sensitivity**: 2.0 volts. **Damping Factor**: Greater than 1000. **Frequency Response**: 2 to 65 kHz +0 -3 dB. **Dimensions**: 19 in. W x 11 in. D x 5¼ in. H. **Price**: $685.00.

The BGW 500R is a very professional looking piece of equipment with its chrome handles and rack-and-panel construction. Nothing is visible on the front panel except a tiny indicator light—and the BGW logo. The panel itself is very heavy, about 12 gauge I'd say at a guess, and the amplifier itself turns the scales at 42 lbs. No lightweight, this 500R! At the rear are two pairs of heavy-duty output terminals, two input jacks, and a circuit-breaker on-off switch. No fuses are used, which will not surprise our regular readers who will remember designer Brian Wachner's article in our February, 1973, issue. More about this later.

Under the black perforated metal shield, the layout is nice and clean. The output transistors are mounted on two heat-sinks, which run almost the whole length of the chassis across the middle. Behind them are two power transformers and the circuit boards are stacked vertically at the rear.



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Welcome to our chamber of horrors. Inside the Shure Quality Control laboratory, some of the most brutal product tests ever devised are administered to Shure microphones. The illustration above shows a "shaking" machine at work on a Shure microphone and noise-isolation mount. It's only one in a battery of torturous tests that shake, rattle, roll, drop, heat, chill, dampen, bend, twist, and generally commit mechanical, electrical and acoustical mayhem on off-the-production-line samples of all Shure microphones. It's a treatment that could cause lesser microphones to become inoperative in minutes. This kind of continuing quality control makes ordinary "spot checks" pale by comparison. The point is that if Shure microphones can survive our chamber of horrors, they can survive the roughest in-the-field treatment you can give them! For your catalog, write:

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Figure 2 shows the underneath view of one of the heatsinks, which incidentally are 14 inches long with a total radiating area of 560 square inches.

Fig. 1—Back panel.

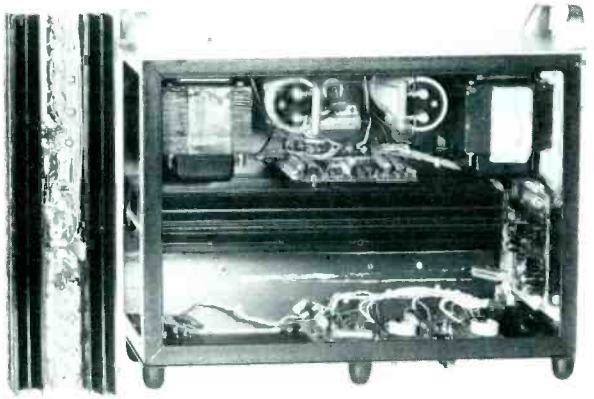


Fig. 2—Interior of the chassis with one output stage and heatsink removed.

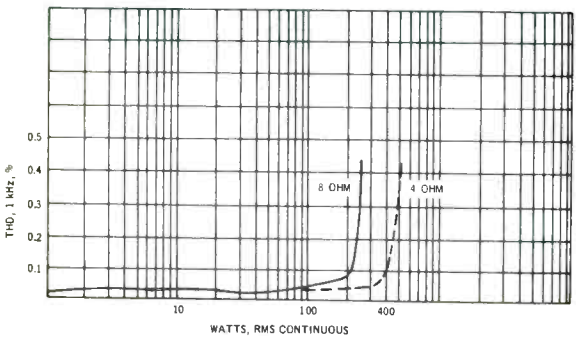


Fig. 3—THD versus watts at 4 and 8 ohms.

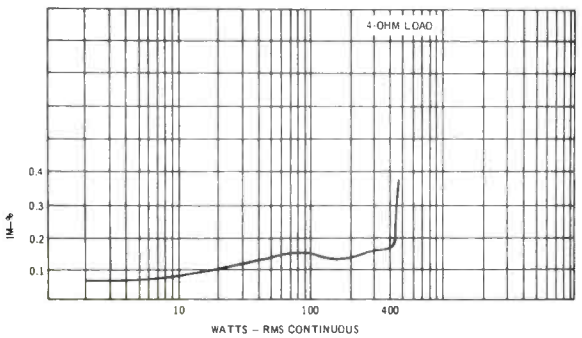


Fig. 4—IM versus watts with a 4 ohm load.

Circuit Description

Input stage is an LM 318 IC, which has a large overall negative feedback loop around it and a NPN-PNP pair, which is then followed by the power driver and output stages. Each output stage uses three NPN silicon devices—a total of 12 for the two channels. The power supply arrangement is a little unusual as two power transformers are used in a series-parallel circuit. In other words, the inputs are in parallel but the secondaries are in series. The Crowbar protection circuit employs a thyristor to discharge the energy in the capacitors and turn off the supply in the event of a short circuit or high overload surges. Two transistors are used to limit the current in the output transistors. The d.c. supply measured 75 plus 75 volts, and this dropped to 63 plus 63 volts under full load. In series with the power transformer primary is a 4 ohm resistor and a relay shorts out this resistor after a one second delay, thus preventing switch-on surges.

Measurements

Figure 3 shows the power output and THD for 8 and 4 ohm loads. Both channels were driven simultaneously, and it will be seen that the 500R delivers more than 225 watts at 8 ohms and over 400 watts per channel at 4 ohms. Nearly a kilowatt! IM distortion (60 Hz and 7 kHz, 4:1) is shown in Fig. 4. Full rated power is stated at 300 watts per channel into 4 ohms; this is a very conservative figure and we obtained nearly 400 watts per channel from 20 Hz to 20 kHz. Power bandwidth is quoted as being "less than 10 Hz to 20 kHz," but we found the 3 dB point to be above 40 kHz. Distortion versus frequency for 200 watts and 400 watts is shown in Fig. 5. Frequency response is shown in Fig. 6, the 3 dB points being 5 Hz and 90 kHz respectively. Square wave responses at 40 Hz and 10 kHz can be seen in Fig. 7. The high frequency waveform shows a slight rounding but there is no trace of overshoot—even with a simulated electrostatic loudspeaker load. Rise time is given as 5 microseconds. Hum and noise were not too easy to measure due to outside

(Continued on page 66)

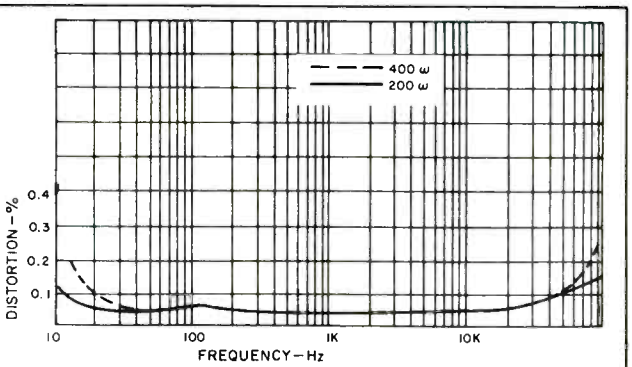


Fig. 5—Percentage distortion versus frequency at 200 and 400 watts output.

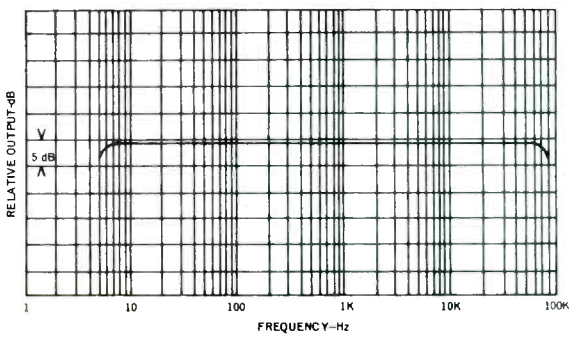
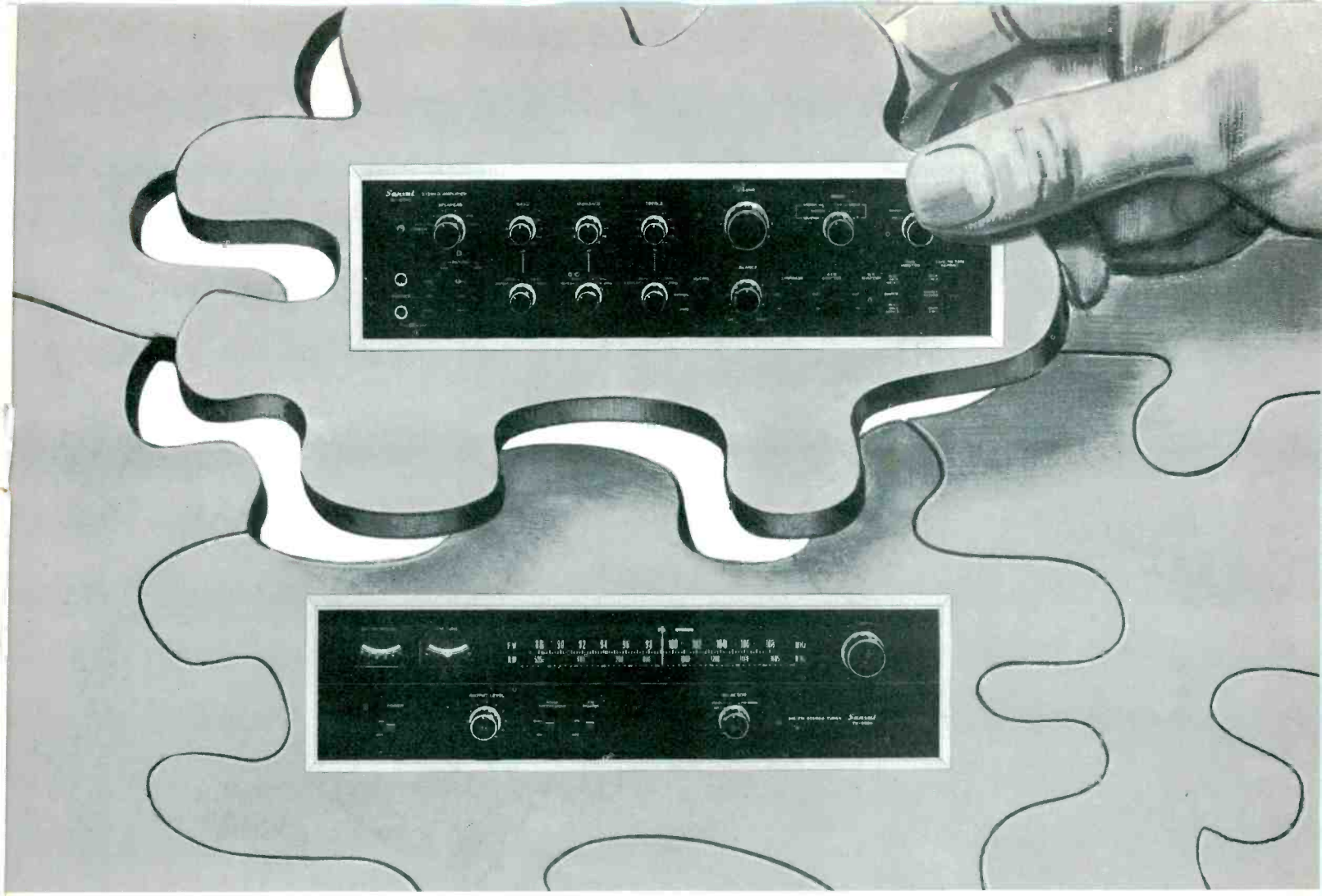


Fig. 6—Frequency response.



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Sansui, world famous for the finest in components, can now be put together like a jigsaw puzzle and meet the musical needs, power requirements and budget of the choosiest component connoisseur. Designed to conform to each other in style and size the new Sansui TU-9500 tuner (with IHF sensitivity of 1.7 μV and THD of less than 0.3% in *stereo*) matches the AU-9500 amplifier which delivers a massive 80 watts RMS per channel into an 8 ohm speaker.

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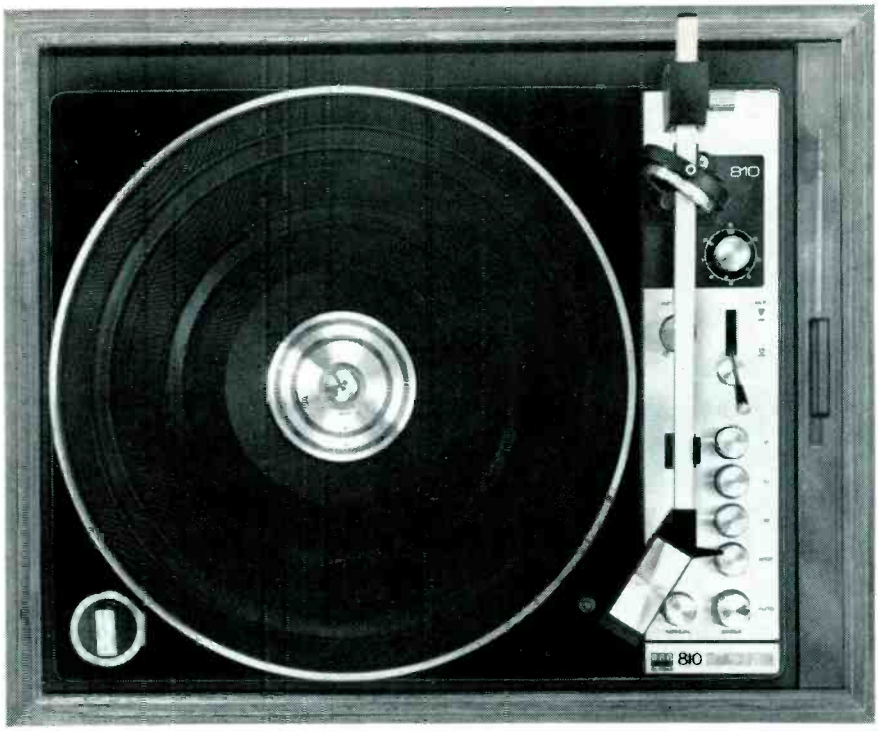

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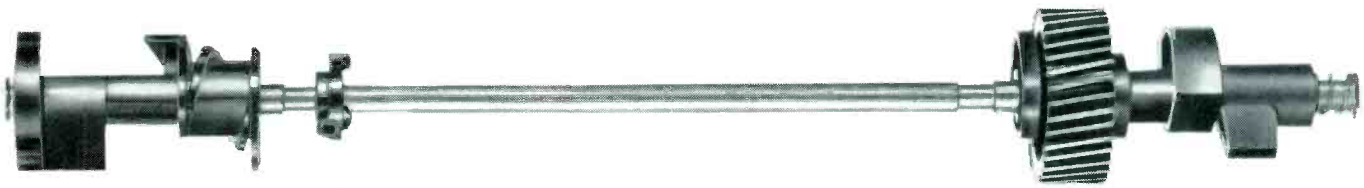

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Deluxe turntables from other companies do much the same thing, but they use many more parts—scads of separate swinging arms, gears, plates, and springs—in an arrangement that is not nearly as mechanically elegant, or as quiet or reliable; that produces considerably more vibration, and is much more susceptible to mechanical shock than the BSR sequential cam shaft system.

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BSR

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(Continued from page 58)

electrical interference, but it lies within 100 to 125 dB as claimed. Input voltage required was almost exactly 2.0 volts for full output.

Listening Tests

How did it sound? In one word, neutral. Which is how it should be. After all, distortion was virtually unmeasurable and it did not increase at low levels. There was no sign of crossover distortion even at milliwatt outputs and overload characteristics were excellent. Bandwidth and rise time were more than adequate; so was stability with complex loads.

Two preamplifiers were used, a Harman-Kardon Citation 11 and a Sony 2000F. Both gave first-class results. Bass was tight, treble smooth with no trace of stridency. Much of the program material consisted of master tapes and disc recordings of impeccable quality. Power was ample for a pair of AR LST's or EPI 400's. Unfortunately, we had to return our Magneplanar speakers just before we received the amplifier, so I missed the opportunity of comparing the 500R with the Audio Research 75+75 with those speakers. Perhaps later. . . .

Summing up: The BGW will unquestionably take its place among the top four or five high quality amplifiers. It is well made with the welded steel construction and all the components appear to be high grade. At $685, it is not cheap, but, after all, this is only 80¢ a watt! My only criticism concerns the lack of VU meters. Yes, I know the answer, but I still like the idea! I almost forgot; there is no switching thump. That relay really works. *G.W.T.*

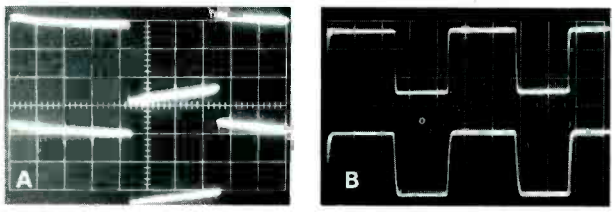
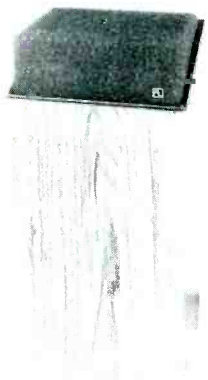


Fig. 7—Square wave response at A, 40 Hz, and B, 10 kHz.

Hegeman H-1 Loudspeaker



MANUFACTURER'S SPECIFICATIONS

System Type: Two-way, coaxially mounted. **System Components**: 8-in. bass, 1-in. dome tweeter. **Crossover Frequency**: 5 kHz. **Frequency Response**: 30-20 kHz. **Recommended Amplifier Power**: 20 watts. **Nominal Impedance**: 8 ohms. **Dimensions**: 26" H. × 11" W. × 8¾" D. **Price**: $114.00 ea.

The name Hegeman has been almost a legend in the high fidelity world for many years and such items as the Model 4 corner speaker and the original Citation amplifiers are still remembered with affection by older enthusiasts. As an innovator, Stu Hegeman is not satisfied with putting two or three standard loudspeakers in a box, juggling with the crossover and calling the result *A Revolutionary New System.* His H-1 is a little different, as we shall see.

It is a floor-standing column type of system measuring on 26 in. high by 11 in. by 8¾ in. deep. The finish is a teak vinyl and at the top is a charcoal plastic foam grille. The two loudspeakers are mounted underneath on an angled panel so the sound is projected upwards and forward. The bass unit is an 8-in. model with aluminum cone and 1-in. dome tweeter which also acts as a loading plug and diffuser for the low frequency unit. A small wooden dome is mounted under the grille just above the tweeter to improve dispersion. Crossover is mechanical—the bass speaker rolls off from 2 kHz so a simple capacitor is used to couple the HF unit. Input terminals and a level control are mounted in a recess at the rear. So far, the H-I is reasonably conventional—the unusual features of the design are concerned with the low frequency

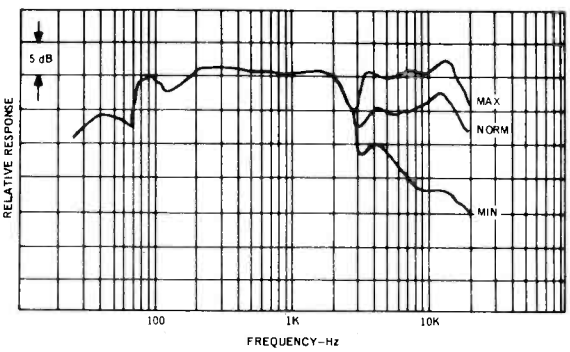


Fig. 2—Showing the effect of the level control.

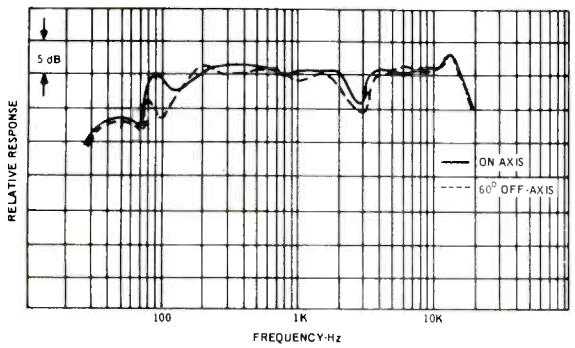


Fig. 1—Response measured with one-third octave pink noise, taken on axis and 60 degrees off-axis.

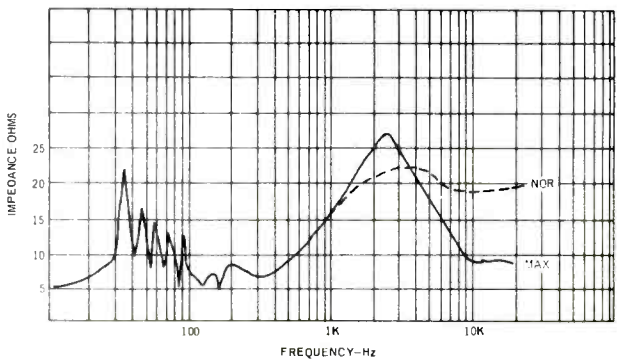


Fig. 3—Impedance characteristics. Note the influence of the tuned pipes.

"...the most powerful stereo receiver in its price class by a considerable margin..."

A challenging claim?

Not at all. Just a statement of fact by Hirsch-Houck Laboratories as published in Stereo Review, September 1973.

They're describing the new Pilot 254 and they go on to say, **"Our test measurements clearly showed that the advertised specifications for the Pilot 254 are not only honest, but quite conservative."**

Separating verifiable fact from advertising fiction is a testing lab's specialty. Making sure that every Pilot product meets or exceeds every one of its specifications is our specialty.

How well we do our part, may be judged from the rest of the Hirsch-Houck report.

The Pilot 254 specifications read: 65 honest watts per channel, 8 ohms, both channels driven. The Lab finds, **"At 1000 Hz, the outputs clipped (were overdriven) at 82 watts per channel..."**

We rate harmonic and I.M. distortion at 0.4% and 0.5% respectively. They find, **"At Pilot's rated 65 watts per channel output level, distortion was 0.1% to 0.15% from 20 to beyond 10,000 Hz, reaching a maximum of 0.25% at 20,000 Hz."**

In evaluating the FM tuner section, the Lab reports, **"FM tuner performance was well up to the standards of the audio section."**

We rate IHF sensitivity at 1.8 uV with harmonic distortion at 0.4% mono and 0.8% stereo. They find, **"...a 1.7 uV IHF sensitivity and only 0.16% harmonic distortion at almost any useful signal level with mono reception. The stereo distortion was about 0.5%."**

We list capture ratio at 1.5 dB. They find, **"The capture ratio was an excellent 1 dB..."**

And they go on to confirm the same outstanding performance figures for noise, stereo separation, image rejection and all the rest.

Finally, they sum it all up with, **"...we could not fault this fine receiver in any respect."**

Listen to the Pilot 254 and you will agree.

For the complete text of the report and additional information write: Pilot, 66 Field Point Road, Greenwich, Conn. 06830.

The Pilot 254 Stereo Receiver $429.00*

*Manufacturer's suggested retail price

PILOT

performance is more than great specs

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end. The enclosure is sealed, and it does not use a tube vent or any kind of port. In other words, it is *not* a reflex or an air-suspension system—it actually employs six stagger-tuned pipes which extend the low frequency response without introducing coloration. The principle has been used before but not, as far as I know, in a cabinet of this size.

Measurements

Figure 1 shows the response measured with one-third octave pink noise. As might be expected, dispersion was very good indeed—the variation at 60 degrees off-axis being quite small. Figure 2 shows the effect of the HF level control. Apart from a 5 dB dip at 3 kHz, the response between 100 Hz and 10 kHz was very smooth. There is a slight rise to 12 kHz, then falling off from 18 kHz. The impedance curve is shown in Fig. 3 and the influence of the tuned pipes can be seen quite clearly. Tone-burst responses are shown in Fig. 4. A is 100 Hz, B, 500 Hz, and C, 5 kHz. Figure 5 shows the low frequency distortion is exceptionally low for such a small enclosure. Power handling capacity was high—no less than 87 watts (continuous sine wave) at 40 Hz and 90 watts at 100 Hz. White noise confirmed the low coloration and wide dispersion.

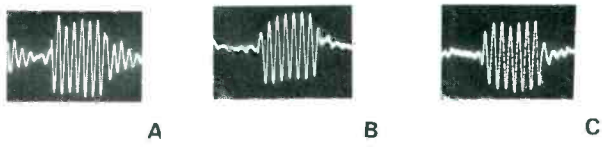

Fig. 4—Tone-burst characteristics at A, 100; B, 1000; and C, 5000 Hz.

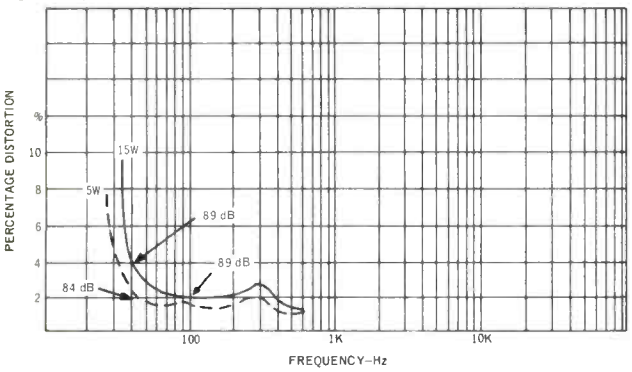

Fig. 5—Low-frequency distortion and some SPL figures for 5 and 15 watts.

Listening Tests

Sensitivity is about average and a power of 15 to 20 watts per channel is recommended. The receiver used for most of the tests was a Pioneer 727, which delivers more than 35 watts per channel, so there was ample power to spare. Best positions for the speakers were near the corners, close to the walls which act as reflectors. Overall sound quality was rather distant and withdrawn due to the 3 kHz dip. Bass was solid and remarkably clean and uncolored for such a small enclosure and a useful output was obtained to below 35 Hz. Stereo image was stable with a wide listening area. In short, the dispersion was an excellent compromise between directional systems with a restricted listening area and omni-directional systems which tend to produce a diffuse image. A Soundcraftsmen 20-12 equalizer easily compensated for the 3 kHz dip and the sound then had a more forward, lifelike quality, at least to my ears, but it is only fair to say that at least two people preferred the more distant, back row sound without the equalizer. *Chacun a son gout* . . . Summing up: the Hegeman H-I is an unobtrusive system with above average bass response and good dispersion. It will undoubtedly appeal to many people who want a floor-standing system of a reasonable size. *T.A.*

Check No. 56 on Reader Service Card

Jazz & Blues

Martha Sanders Gilmore

FOR TEN CONSECUTIVE days (June 29-July 8), the 20th annual Newport Jazz Festival/New York kept jazz fans humming and their feet tapping as over 1000 musicians performed in 56 events at 13 sites in and around New York.

On a rain-drenched Friday afternoon, the festival opened in the outdoor Wollman Amphitheater in Central Park, where fewer than 250 souls had gathered. It was a good beginning, said the 250, rising to their feet in applause of Gerry Mulligan's 17-piece ensemble, The Age of Steam. The Mulligan team broke right through the clouds with *A Weed in Disneyland*, "dedicated to the President of the U.S." Mulligan pumped out the steam on baritone, raising his leg in emphasis, while trombonist Bob Brookmeyer brayed in answer to him. Mulligan played a very stately *Waltzing Matilda*, treating it like an old southern song, then whirled us around the maypole in a frolicksome *Maytag*, which featured Jimmy Owens on a quick bristling trumpet solo.

Next up was vocalist Margie Joseph, all the way from New Orleans, who sang a rather lusty, slow-paced *Let's Go Where the Grass Is Greener*. Then the Newport Ensemble, which included producer George Wein on piano; Larry Ridley, bass; James Spaulding, reeds; Al Harewood, drums, and Roland Prince, guitar, played two modern sounding pieces, *Two Areas* and *Ginger Flower*, with Harewood setting the calypso pace in the latter. While Wein's solo was rather oblique, guitarist Prince played an effortless stream of notes that brought out the sun.

The quintet of Charles Lloyd then led fans down some rather beguiling paths, as Lloyd played tenor saxophone as if doing a rain dance. Lloyd, who doubled on flute, from which he got a very full tone, was so enmeshed in his music that he couldn't bother to look up. The Latin American sound of Gato Barbieri closed the afternoon and set umbrellas to bobbing with strong urgent tones and grand churning rhythms.

The original Benny Goodman Four's Friday evening performance at Carnegie Hall was an understandable sell-out, with folks sitting onstage and packed up to the rafters of the great hall. It was an evening of pure nostalgia and the first time the group had appeared on this stage since 1938 as bassist Slam Stewart joined Teddy Wilson, piano; Lionel Hampton, vibes; Gene Krupa, drums; and Benny Goodman, clarinet. The smash evening of memories included *Moonglow*, *Memories of You*, the Andrew Sisters' winner *Bei Mir Bist Du Schoen*. As an encore, the inimitable *Sing, Sing, Sing* spotlighted Krupa with Hampton

Photo by George Gilmore

The Original Benny Goodman Four, including Teddy Wilson, piano; Benny Goodman, clarinet; Slam Stewart, bass; Lionel Hampton, vibes, and Gene Krupa, drums.

scattering all over his vibes, while Goodman piped a happy tune.

Cornettist Ruby Braff and guitarist George Barnes preceded Goodman and crew in a very fine set, which evoked a light, tight, chamber music quality with Braff cutting the light fantastic in *Liza*.

Afterwards over at Philharmonic Hall, the B.B. King Blues Band was followed by Eddie "Cleanhead" Vinson playing a lean and sinewy alto saxophone, goateed and singing out in a rotund bass voice. Then Gatemouth Brown came on, a real cut-up who played a wailing harmonica, holding a high note an inordinately long time followed by Arthur "Big Boy" Crudup and son with some slow-moving guitar blues.

B.B. then brought the "master" on, none other than Muddy Waters who performed all sorts of pyrotechnics on guitar, projecting a stinging, waspish sound and receiving a standing ovation for *I've Got My Mojo Working*. But Willy May (Big Mama) Thornton was the evening's highlight, putting on a very commanding performance with her rendition of Janis Joplin's *Ball and Chain*. It was disappointing, however, that B.B. spent most of his time talking instead of playing.

A sunny afternoon with the odor of chestnuts wafting through the breeze brought fans out to hear the Guitar Explosion at the Wollman Amphitheater. The afternoon sessions under the sun truly recreated the feeling of the original festival and produced some of the best music of the entire 10 days although the crowds were regrettably small. Joe Puma and Chuck Wayne got the afternoon off to a roaring start with interwoven duets. In *Li'l Darlin'* Puma used a wah-wah and Chuck Wayne was all over his instrument with his busy-bee fingering, each obviously delighted in the other's company in a totally good-humored set.

The George Benson Quartet launched right into *So What* with Benson displaying much technical virtuosity, his fingers flying fleet as the wind. A rather contemplative *Summertime* was played by two contrasting guitarists, the restrained and cerebral Jim Hall and the more ebullient and outgoing Tal Farlow. Then Tiny Grimes, wearing a blue button hat for his first appearance at Newport, proved that he is a strong force in the guitar world with *I'll Remember April*. By striking contrast Pat Martino's young contemporary sound never went very far and was, in the final analysis, repetitive.

But Larry Coryell and Foreplay came on as redeemers. Coryell, who is known for his frenetic stop-and-go patterns, was joined by soprano saxophonist Steve Marcus on *Lolita.* Coryell played a mesmerizing solo on *Jovride* and it was a spellbinding experience indeed to hear his fusion of jazz and rock. Nonetheless, they saved the best for last in Roy Buchanan, an arresting, unforgettable stylist who, treating his guitar with great care, almost caresses his strings and draws out his notes.

Saturday night at Philharmonic Hall began with Sonny Rollins in superb form but who was unfortunately not permitted enough time. An imposing figure all in white, Rollins displayed his excellent intonation and ability in *There Will Never Be Another You* and *I've Never Been in Love Like This Before,* with Walter Davis playing a giddy piano. Then along came swinging Mary Lou Williams, who played with tremendous punch in a tongue-in-cheek *Autumn Leaves,* showing off her feverish left hand and getting a pretty sound out of the keyboard.

A very coherent set was played by Gil Evans' unorthodox and coloristic orchestra in which Evans exploited every member of his School for Scandal to their fullest. Shining lights, however, were Billy Harper, tenor saxophone; Marvin Peterson, trumpet; Trevor Koehler, soprano sax, and Howard Johnson, tuba. It was fascinating to watch percussionist Sue Evans go about her chores.

The icing on the cake was an absolutely devastating unaccompanied piano by Keith Jarrett who went on for 45 minutes. Jarrett incorporated strains of church music and cake-walk rhythms, as well as impressionistic and classical motifs.

Radio City Music Hall was filled to capacity for the midnight jam session which was broken down into three sets. The first featured some wild blowing by Howard Johnson on tuba and Freddie Hubbard on trumpet, but the trumpet duel between Jimmy Owens and Clark Terry in the second set brought the house down. The final set, featuring the more avant-garde jazz musicians, Don Cherry and Robin Kenyatta, was unfortunately only a futile attempt at music and resulted merely in noise.

On Sunday jazz buffs savored a boatride on the Hudson River to the tune of two Dixieland bands imported for the occasion. On the lower deck it was the Drootin Brothers from Boston while Percy Humphrey's Preservation Hall Band from New Orleans graced the upper deck, winding it all up just as the ferry was about to slide into its slip with *When the Saints Go Marchin' In.*

On hand Sunday evening at Philharmonic Hall was Duke Ellington with his 19-piece orchestra, a skillfully polished organization if there ever was one. The "piano player" featured himself in *Rockin' In Rhythm,* vintage 1929, while Russell Procope took a clarinet solo in *Creole Love Call,* from 1927. After Paul Gonsalves, the recognized hero of the Newport Jazz Festival, walked all over the stage playing *In a Sentimental Mood,* Harold Ashby submitted some graceful tenor sax in *Afro-Eurasian Eclipse.* A soprano all the way from Stockholm, Alice Babs, sang *Far Away Star* in an almost operatic voice with an incredible range. Mandrill, an incompatible second bill, depended more upon theatrics than sheer musicality.

The Hallelujah Chorus: The Life and Time of Ray Charles as written and narrated by James Baldwin was performed at Carnegie Hall. If there had been less of Baldwin and more of

Charles, the show would have been a success. The pomposity of Baldwin, who orated from a lectern, then came piano-side to ask Charles questions, was indeed a contrast to the engaging Charles who sang some of his hit songs such as *Eleanor Rigby*.

An afternoon of jazz for children and adults was decidedly designed for the latter, for what few children were present only came alive during the tap dancing portion with Baby Laurence, Buster Brown, Chuck Green, John McPhee, and L.D. Jackson who displayed their percussive talents foot-wise. Preceding them was Professor Longhair, a blues pianist from New Orleans, and the Milt Buckner-Jo Jones Duo. In *It's Three O'Clock in the Morning,* Buckner played only with his feet as Jones tapered it off to three cymbal knocks.

But the crowd truly woke up to the Charles Mingus Quintet as Mingus played his own bittersweet compositions with great gusto, emitting deep-throated solos in which he made his string bass fairly sing. His *Goodbye Pork Pie Hat* conveyed a Gershwin-esque quality, a very pretty piece instilled with all sorts of unexpected intervals.

Then, as though it were Halloween, Don Cherry and his Eternal Now came on, wearing all sorts of weird costumes and sporting colorful trappings. The music was likewise, geared to both the eye and ear as his troops spread themselves across the stage, ringing bells and gongs and blowing on conchs.

Jazz fans of all ages danced to the bands of Duke Ellington, Woody Herman, and Count Basie on Monday night in the Roseland Ballroom, while Tuesday afternoon was bright and clear with the crystalline tones of Marian McPartland's piano. In Ellington's easy-going blues *Things Ain't What They Used To Be*, Miss McPartland created some exquisite pianistic embroidery, then gave Roberta Flack's *Killing Me Softly With His Song* a simmering ballad treatment, finishing off with some boogie-woogie and ragtime in *Royal Garden Blues.*

The Modern Jazz Quartet, pristine and wearing pink shirts under black vests payed a tribute to the setting in *Skating in Central Park,* a subdued and restrained waltz in which pianist John Lewis played plenty of flatted fifths. Milt Jackson shone in *Bag's Groove* as bassist Percy Heath quoted from *The Hucklebuck.*

Much improved over last year, Stan Getz blew out a graceful *Spring Is Here* to honor the weather with mighty Jack DeJohnette managing his drums.

Then Mose Allison, that man from Mississippi, played some turbulent piano, singing and swinging in *Ain't That Just Like Living* and his crowd pleasing *Seventh Son,* full of wonders, witchcraft, and excursions into originality.

Ending the afternoon was the Horace Silver Quintet which featured the two Brecker brothers, Randy and Mike, on trumpet and saxophone respectively. Mike Brecker played a rather frantic sax solo in *In Pursuit of the 27th Man,* as Silver, with two adjacent notes together as is his custom, playing descending spaced-out runs that are his trademark in *Song for My Father* with the audience clapping along.

A unique concert, since it featured song writers rather than performers, was a Jazz Salute to the American Song performed by such artists as Stan Getz, Mabel Mercer, the Modern Jazz Quartet, Rahsaan Roland Kirk, Earl Hines, Art Hodes, Barbara Carroll, Dave Brubeck, and Gerry Mulligan playing the works of composers Duke Ellington, George Gershwin, Rogers and Hart, Harold Arlen, Fats Waller, Irving Berlin, Jimmy Van Heusen, and Alec Wilder (who was seated in the audience). For those who cannot find the melody in jazz, there could be no complaints as jazz artists winged their way from *Alexander's Ragtime Band* to *Come Rain Or Come Shine.*

The most enjoyable concert of the entire festival perhaps was Count Basie who introduced his present orchestra and that of the fifties. The roster read like a Who's Who in Jazz and the band sounded better than ever in *Speak Low, Sleep,* and *Poor Butterfly.* It was thoroughly spontaneous and uncontrived and the Count himself received a standing ovation.

At Louis Armstrong Memorial Stadium, about 100 jazz musicians payed a 4th of July tribute to the late Louis Armstrong before 8,000 people. The several trumpet men who played in honor of Satchmo included Clark Terry, Dizzy Gillespie, Erskine Hawkins, Jimmy Owens, Ray Nance, and Freddie Hubbard. Singers there in honor of Armstrong included Al Hibbler, Joe Williams, Helen Humes, and Ella Fitzgerald, who received the greatest round of applause. The four-hour show finally ended with a full-scale jam.

Conductor-arranger Michel Legrand put on a stunning performance at Carnegie Hall that evening with Stan Getz and Sarah Vaughan. Legrand conducted his slick orchestra with much enthusiasm in his own compositions such as *Shoes,* then teamed up

with Miss Vaughan in his smash hit *Watch What Happens*. One of the new breed of saxophonists Tom Scott also joined Legrand. But Miss Vaughan, wearing a sequined dashiki, once again proved why she is considered one of the top jazz singers on today's scene, singing such numbers as *Summer of 42*, *Alfie*, and *Wave*.

Further along that evening it was back to Dixieland at Philharmonic Hall in a program of New Orleans Ragtime and Stride piano which featured pianist Wally Rose, the Turk Murphy Quintet, and the Bob Greene Orchestra which dedicates itself to the music of Jelly Roll Morton. The band roared through *Alabama Bound*, *The Smokehouse Blues*, and *Steamboat Stomp*, which the crowd really loved. Another pianist back in New York after 26 years was Joe Turner, a very accomplished musician who played a full, bluesy piano in *Willow Weep for Me* and *Poor Butterfly*.

Seated onstage there followed Percy Humphrey's Preservation Hall Jazz Band, the epitome of collective improvisation which began its set with *Somebody Stole My Gal*, screamed on *Ice Cream*, played *Basin Street Blues* featuring clarinettist Albert Burbank, and finished off with *When the Saints Go Marchin' In*.

Central Park on Thursday afternoon was taken over by some of the more experimental jazz groups, such as the Art Ensemble of Chicago who sported a reported 350 instruments from the four corners of the world. It was—in a sense—primitive, as though the players were performing in slow motion. Lester Bowie blew his trumpet over the shrieks, gongs, and clatters and drummer Don Moye brought his arms around like a windmill's in an expressionistic performance that went on non-stop for 50 minutes.

Sam Rivers followed on tenor saxophone in a wild and frantic session in which Rivers chanted in between switching to flute, then sang and hummed while blowing his flute. Another 50-minute non-stop set. Then in blew Ray Barretto and his group of Latin musicians like a fresh breeze who played an utterly palatable rendition of Thelonious Monk's *Round About Midnight*. The genius of Archie Shepp rounded out the afternoon, Shepp playing more understandably and more conservatively than usual, bending low under the weight of his art in J.J. Johnson's *Lament* and Calvin Massey's *The Peaceful Warrior* in which Joe Lee Wilson sang.

A salute to Ella Fitzgerald with the Chick Webb Orchestra under the direc-

tion of Eddie Barefield brought out that "First Lady of Song" in her own composition *A Tisket, A Tasket,* who then replaced the orchestra with the notable pianist Ellis Larkins. Ella sang several Gershwin tunes, such as *Nice Work If You Can Get It* and *I've Got a Crush On You,* which she gave a jewel-like treatment. In between sets a jam session ensued with Roy Eldridge, Tommy Flanagan, Keter Betts, Freddie Waits, Joe Pass, Al Grey, and Eddie "Lockjaw" Davis.

Following Ella at Philharmonic Hall was Chuck Mangione in a session imbued with great dignity and taste by the young flugelhornist. His group displayed a very high degree of musicianship in *Please Treat Her Well* which featured Gary Niewood with beautiful tone on alto flute and Mangione, a thoughtful, uncluttered player. Mangione fairly scatted on his horn in *Land of Make Believe,* one of his own compositions which had a child-like quality about it.

Wearing a flowing black cape, John Blair appeared onstage as an apparition playing an electronic vitar which appears to be a cross between a violin and guitar. Blair was both fascinating to watch and listen to, and finished off with a dance. John Mayall reincarnated the rock and roll of the fifties in *Move On Down the Line,* playing electronic piano and harmonica, his hair flying.

The entire Brubeck family appeared in Friday afternoon's concert at the Wollman Amphitheater. Darius on keyboard, Chris on trombone, and Danny on drums were joined by father Dave in the familiar *Take 5.* Then came on Carmen McRae looking resplendent, a salty songstress who really handles a lyric. Charmin' Carmen hit a very low note in *Spring Can Really Hang You Up the Most,* then gave *Green Dolphin Street* a pure jazz feeling.

After blessing us all with a long stick adorned with rattles, Dizzy Gillespie commemorated the late Martin Luther King in *The Brother King,* with Mike Longo carving out a nice spot for himself on piano. The composition is comprised of lightly swinging passages interspersed by more pensive ones. Under the beautiful blue-skied canopy, Hubert Laws made an enthusiastic contribution on electric flute in John Coltrane's *Moment's Notice.* Laws then played *Amazing Grace,* stating it majestically and with great feeling and control.

Weather Report was good Friday evening with Joe Zawinul doing all sorts of miraculous things on electric piano and drummer Eric Gravatt coming in like a locomotive, working up quite a head of steam. Wayne Shorter's work on tenor and soprano sax was notable and it is always nice to hear Miroslav Vitous on bass. Chick Corea's Return to Forever played five pieces from their suite *Hymn of the 7th Galaxy* which resulted in rather formless, space music in which one really couldn't hear Corea that well.

Over at Carnegie Hall was the reunion of the Cab Calloway Orchestra in which Cab jumped around leading his band for a fare-thee-well, but not for long. Instead Nellie Lutcher sang and played piano, Louis Jordan sang and played alto saxophone, followed by a seemingly endless set by vocalist Esther Phillips. However, we did get to hear Cab sing *Hi-de-Ho!*

A midnight jam session at Radio City Music Hall featured some brilliant alto work by Eric Kloss and trombone work by Bill Watrous and veterans Art Farmer and Red Rodney in *I'll Remember April.* Ralph Towner played some lovely Spanish guitar followed by a real treat from Bill Evans, Eddie Gomez, Marty Morrell, and Gary Burton after which they accompanied

Jeremy Steig on flute.

The evening continued with a set by Art Blakey, Larry Ridley, Barry Harris, Hank Mobley, Joe Farrell, Stan Getz, John Faddis, Cecil Payne, Dizzy Gillespie, and Curtis Fuller in Gillespie's *Night in Tunisia* with an extended coda by Diz. The jam session came to a close around 4:00 a.m. with Sonny Stitt, Blue Mitchell, Louis Jordan, Oliver Jackson, Milt Hinton, Tiny Grimes, Larry Coryell, Earl Hines, Al Grey, and John Mayall who, despite his youth, fitted in very nicely with the seasoned veterans.

Saturday afternoon was taken over by drummers. M'Boom with Max Roach surrounded us with a morass of percussion and a plethora of noise-makers. Art Blakey and his Jazz Messengers proved quite a contrast in a straight-forward set that featured tenor saxophonist Sonny Stitt blowing on a very fluid and light horn while Cedar Walton made multi-noted excursions on piano. Roy Haynes joined them in *Night in Tunisia*, playing a duet with Blakey that was truly remarkable.

A series of Gretsch Greats included Tony Williams, Freddie Waits, Elvin Jones, Mel Lewis who played with his mallets, treating his drums like jungle drums, and Jo Jones, who did an exhibition on sock cymbal with grace and aplomb. What style he had! Finishing off the afternoon with a propulsive beat was Randy Weston's African Rhythms.

At Carnegie Hall Saturday evening there occurred a So-Lo Piano tribute to the late Art Tatum as performed by Dave McKenna, Brooks Kerr, Jimmy Rowles, Eubie Blake, Bill Evans, Art Hodes, Ellis Larkins, Billy Taylor, George Shearing, and Earl Hines. The concert was beautifully modulated all the way from Rowles' understated and controlled *Liza* to Blake's sprightly *Rhapsody in Ragtime* to Hodes' scintillating *Grandpa's Spells*, wherein his elbow got into the action, to Hines' *Boogie-Woogie on the St. Louis Blues* which ended the festival on a celebratory note for this writer.

* * *

Robin Kenyatta: Gypsy Man

Songs: *Seems So Long; Another Freight Train; Werewolf; Reflective Silence; Gypsy Man; Melodie Chinoise; I've Got Dreams To Remember.*

Atlantic SD 1633, stereo, $5.98.

This is a mish-mash of tunes of the soul-rock ilk by Robin Kenyatta. The recording never actually seems to go anywhere or lead us anywhere and bogs down into a kind of Purgatory or Never-Never land. It's as though Kenyatta has not quite been able to commit himself to anything. He plays alto, soprano sax, and flute here and arranges all but one of the tunes, *Werewolf*, which was arranged by Robert W. McPherson.

It's almost totally Kenyatta with no other individuals getting much solo space. Most together of all and one knows at once why they named the album after it is *Gypsy Man* which features Kenyatta on vocals and soprano sax with some electric piano by Larry Willis that fits in rather nicely.

In Stevie Wonder's *Seems So Long* Kenyatta is all soul, tearing at the heart strings, but *I've Got Dreams To Remember* is a heavy-handed and burdensome accomplishment that will put you to sleep.

The sound is super-slick and electronic as Kenyatta merely skims the surface of his art.

Performance: C+ Sound: B-

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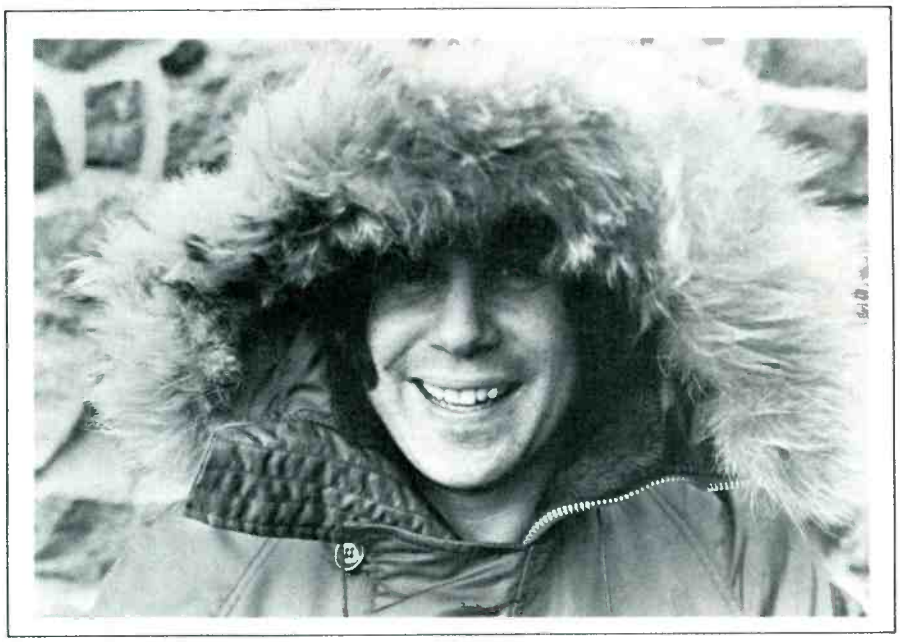
Weingarten Looks At Paul Simon

Sherwood L. Weingarten



THERE GOES RHYMIN' SIMON (Columbia, KC 32280), includes the biggest hit of the summer, *Kodachrome.* Paul Simon's chartbuster deserves that status if only because of its bounciness and first few verses: "When I think back/On all the crap I learned in high school/It's a wonder/I can think at all." Other highlights from the 11 tracks are *Tenderness,* something that seems suited to the Ink Spots or Mills Brothers and includes the thought that "I know you see through me/But there's no tenderness/Beneath your honesty." *Something So Right,* with the notation that "Some people never say those words/I love you/But like a child they're longing/To be Told," and *Was a Sunny Day,* a breezy change-of-pace, pure Simon but superimposed on a calypso rhythm. Definitely a superior album.

PARIS SESSIONS (Vanguard, VSD-79328) is folk-rock from ***Country Joe McDonald,*** who continues to lace his material with biting humor and commentary. His words are still the kind that will offend many, but if you can get over what may be an initial shock, there's plenty of meaning. Of the 10 cuts, all but one his own mental exercises, there's no standout. Your own perspective will tell you what's best, probably depending upon which of his themes (violence in reel and real life, death in life, the sexual revolution, dope paranoia on both sides of the fence) you best relate to. Joe's voice and acoustic guitar, not incidentally, were never better . . . even when he was trying to sing instead of deliver messages.

20 YEARS OF ROCK N' ROLL (Buddah, BDS 5133-2) places 30 original hits on two discs. The Dick Clark compilation is one of the best anthologies of nostalgia put on vinyl. Included are the Orioles' *Crying in the Chapel,* Curtis Mayfield's *Superfly,* the Crew Cuts' *Sh-Boom,* Jerry Lee Lewis' *Whole Lotta Shakin' Goin' On,* Joey Dee's *Peppermint Twist,* the McCoys' *Hang on, Sloopy,* Carl Perkins' *Blue Suede Shoes* and Otis Redding's *Dock of the Bay.*

—**ON STAGE** (London "Phase 4 Stereo," BP 44182/83) shows that, contrary to the adage, the more things stay the same, the more they change. Benny Goodman, who's been tooling around with his clarinet since swing was an infant, proves that the oldies *are* goodies and all they need is the slightest touch of modernization to improve them. This double-record album, recorded live in Copenhagen, puts Goodman in front of his sextet (that includes such jazz favorites as "Zoot" Sims on sax and "Bucky" Pizzarelli on guitar) for 22 superior cuts. Joys all. Among the winners are *I Want to Be Happy, Where or When, Honeysuckle Rose, My Funny Valentine, Oh Lady Be Good, Stompin' at the Savoy, The Sheik of Araby, After You've Gone* and *Moonglow.*

—**HEAR & NOW** (United Artists, UA-LA018-F) is a lesson in longevity. Ferrante & Teicher, who here provide 13 cuts that lean heavily on hits, have been doing their thing on piano 100 albums' worth. They obviously must be doing something right. Actually, it's evident—for the sound is good for listening and/or background music. Backed by a lot of strings, they particularly do justice to Don McLean's *American Pie,* Neil Diamond's *Song Sung Blue* and a couple of their own compositions *Tranquillo* and *Oh to Be Young Again.* Missing is their usual adaptation of some classical themes, but the other tunes make you quickly forget that factor.

CREAM OFF THE TOP (Polydor, PD 5529) isn't the best material by one of the supergroups of the 60s, but even Cream's second best is better than most

others. These 11 re-releases, which were the forerunners of the so-called heavy metal sound, show that the ego trips the three went on were understandable. You don't have to get far into the LP to realize the artistry of Eric Clapton's guitar, or Jack Bruce's bass and vocals or Ginger Baker's drums. Best tracks are *Four Until Later*, a light blues entry; *NSU* and *Traintime*, two by Bruce, the latter featuring the composer on excellent, bluesy, gutsy harmonica; and Clapton's *Outside Woman Blues*.

360 DEGREES OF BILLY PAUL (Philadelphia International, ZQ 31793) spotlights a slick quadraphonic sound produced by Gamble-Huff. The disc, distributed by Columbia, is headed by the chartbuster *Me and Mrs. Jones*, and favored by smooth renditions of Carole King's *It's Too Late* and Elton John's *Your Song*. Paul is the kind of black singer who appeals to whites who don't like black singers.

AUTUMN TO SPRING (The Famous Charisma Label, CAS 1 0598) *almost* gets out of a rut. Keith Emerson's keyboard work causes flashes of interest as ***The Nice*** go at the business of entertaining for nine tracks.

There are, in fact, a few minutes that are actually positive listening experiences; the lion's share of the package, though, is filled with just plain noise, pretending, of course, to be creative rock.

The group sells a lot of records, so there's obviously a segment of the cash-plunking public that can accept the emphasis on gimmick effects rather than sound sound.

For those who want to hear influences of The Beatles and the Stones on one vinyl, this, as the comic intoned, must be the place. Reason? The tapes were made in '67 and '68, before the personnel shifting began.

Despite the uneven, up-and-down quality of the record, which is distributed by Buddah, the group *can* do a unique gig now and then, proven by records cut in a later time period. But this one? Mush!

WHERE ARE YOU NOW, MY SON? (A&M, SP-4390) is half entertainment, half documentary. Side one showcases the angelic voice of ***Joan Baez*** performing seven items, three self-penned and two by her sister, Mimi Farina. She also trades her guitar for piano on the lone instrumental, *Windrose*. Then, the propagandist takes over. The flip side is one cut, a ballad written about the U.S. bombing of Hanoi that covered the Yule, 1972 period. Sound quality is authentically horrible, because much of it was transferred from a hand-

recorder on the scene, and the message's impact is lost because the point-of-view is so heavy-handed.

TRUE STORIES AND OTHER DREAMS (Electra, 75053) finds ***Judy Collins*** less strident than some of her recent efforts. This time around the stress is on lyrical beauty, with more emphasis than usual on the melodies themselves. There are nine cuts, five of her own. But best are Stephen Stills' *So Begins the Task* and Tom Paston's *The Hostage.*

CALL ME (Hi-London, XSHL 32077) spotlights soul singer ***Al Green,*** who, finally, is beginning to grow on me. His arrangements are slicker now, and his voice somehow seems to better get across his meaning (without losing any of his soul). Listen, in particular, to *Call Me (Come Back Home), I'm So Lonesome I Could Cry* and *Here I Am (Come and Take Me).*

ALADDIN SANE (RCA, LSP-4852) contains nine more tunes penned and performed by ***David Bowie,*** singer and sexualist extraordinare. In addition, Bowie does a number on Mick Jagger's *Let's Spend the Night Together.* Seems to me, however, he's getting worse on vinyl all the time. Whaddya say, Ziggy? How about it, Major Tom?

ROUGH EDGES (Mercury, SRM 1-655) shows that albums *can* be well-named, for the phrase aptly describes what's inside the dustjacket. The music, by ***Doug Sahm*** with the Sir Douglas Quintet, goes back to '69 and some tapes that weren't worth releasing at the time. The dozen cuts, an amalgamation of ordinary rock, country, blues and whatnot, can't even be saved by Sahm's talent with guitar (he also sings, and fiddles, literally that is). And believe it or not, Sahm almost sounds like Louis Prima on the countrified *Colinda.* Get his later stuff instead.

BACK TO THE WORLD (Curtom, CRS 8015) is strictly soul, spotlighting the squeaky, hopeful and exciting voice of *Curtis Mayfield.* Pick any of the seven cuts on the Buddah-distributed disc and enjoy, baby, enjoy.

THE BODY AND SOUL OF TOM JONES (Parrot-London, XPAS 71060) plays up the hit *Letter to Lucille,* but Jones, still as good as any white soul singer around, is better yet on a pair of Bill Withers specials, *Ain't No Sunshine* and *Lean on Me.* And he does a creditable job on a country smash of a few years back, *Running Bear.*

WE'RE ALL TOGETHER AGAIN FOR THE FIRST TIME (Atlantic, SD 1641) merges three jazz Hall-of-Famers, ***Dave Brubeck*** and his piano, ***Gerry Mulligan*** and his baritone sax, and ***Paul Desmond*** and his alto. Backed by Alan Dawson on bass and Jack Six on drums, the superstars offer six goodies recorded live in Berlin, Paris, and Rotterdam on tour. Brubeck does one solo gig, a one-minute run-through of *Sweet Georgia Brown.*

PORTFOLIO (Stormy Forest, SFS-6013) teams up the drivin' guitar and husky voice of ***Richie Havens*** with tunes by David Blue, Marvin Gaye, Leon Russell, Jim Rado, and Havens himself. Not his best outing, not his worst.

NOW & THEN (A&M, SP-3519) spotlights straight soft rock-pop from ***Richard and Karen Carpenter.*** Included are the chartbusters *Sing* and *Yesterday Once More,* plus the revival *Jambalaya (On the Bayou).* The five cuts on the first side are newies, while the flip side contains a medley of "oldies" going all the way back to the '60s (my, ain't that prehistoric, dad). Pleasant ho-hummables.

NOWHERE ROAD (London, XPS633) finds ***Chris Youlden*** alone again, unnaturally. The singer, who fronted for Savoy Brown on four LPs over three years and then went into hibernation, comes out of hiding with 11 cuts, all self-penned. All are okay blues with a heavy dose of rock. Be glad he's back. Æ

Reviews

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synthesizer can yet quite match the healthy complexity of natural wave forms and thus when a piano or violin, or what-have-you, is made to produce noises that fall into the synthetic sound area (rather than into their conventional modes of sound production) the results are unusual, and unusually good. Beat the synthesizers at their own game.

Lazarof is an internationally trained musician, out of Europe, now transferred to America, and his work is thus without special nationalistic sounds, which is precisely what is happening today—music and the arts being, as usual, ahead of politics. Here we have "ordinary" instruments, except for one tape, and yet the sounds are typically those of the new times in which we live. exotic squeaks, bumps, scratches, rings and so on—very expertly conceived. Forget about Classical Music—just listen to them as interesting effects. You can't help but enjoy, I say! (And the message of the music, as it should, will take care of itself in due time.)

Also typically of our age, this is music entirely without regular beat, a kind of randomness in time. Which, of course, represents—in the long view—a very healthy reaction to the relentlessly "Bach-jazz" beat of much early 20th century music of all sorts. Which, in turn, was a healthy reaction to the moony swelling and dying of much late 19th century music! So it goes on this earth.

Good to welcome back the Vox label, in its excellent mid-price Candide configuration—we will be having more Vox reviews in the near future. Haven't had a Vox release sent to us for many a long moon, more's the pity. For Vox's benefit, I note that one of the first reviews I ever wrote was of a pioneer ten-inch 78 rpm album on the Vox label, just after the War, entitled *Salzburg Serenade.* It marked the very beginning of the enormous flood of new labels and new records that have come forth since then.

Performances: A Sound: A–

Bruno Walter conducts Schumann. (Symphonies No. 3 "Rhenish," No. 4 in D Minor.) Parnassus 8 (*P.O. Box 281, Phoenicia, N.Y. 12464*).

I can remember the hierarchy of conductors back before the war, when these two recordings were first made. Stokowski was, then as now, the man for flare; Koussevitsky brought flamboyant Russo-French Romanticism to Boston and Toscanini went all-out Italian temperamental in New York, the fiery Maestro. Bruno Walter was the good gray classicist, gently European, a true German soul, whose many recordings were treasured for their sane, beautifully balanced musicality. In his eighties, Walter still preserved that image and that ability, on into the stereo age.

The "Rhenish" symphony is here played by the New York Philharmonic in 1941, in the famed and tattered Liederkrantz Hall before it was converted to TV use. The D minor comes from London in 1938 with London Symphony. Musically, both are just superb—there is no other word for it. I wouldn't hesitate to say that these are definitive performances—so *right*, so marvelously easy and natural, so

wonderfully phrased and shaped, so light and airy and yet so impressive and earnest in the louder parts. If you want to know Schumann, forget about the fi and get to know these versions *first!*

The 1941 New York recording is excellent, with the large Liederkrantz liveness of fond memory, the playing extremely accurate and well rehearsed. The 1938 London disc is less good, with that curious closed, ringing sound familiar in many orchestra recordings of the time from Europe. And the London Symphony is less accurate than the New York Philharmonic. But the *music* is there, even so. (If you have oldie LPs you may own Columbia ML 4040, the "Rhenish" transferred to LP format around 1948, at the beginning. It must have been recorded on 16-inch transcriptions, as were many in the pre-tape era at Columbia.)

Performances: A Sound: C-

JOEL GREY/LIVE
Columbia KC32252, stereo.

There's no Peppermint Room crooning in Joel Grey's style. Whether he's belting out a medley from *George M.*, the Broadway show that brought him to notice and eventually to *Cabaret*, or easing his and our way through *What Kind of Fool Am I?* or *Love Is Here To Stay*, he's got an almost primal simplicity. This freshness—one might almost say "vocal innocence"—must have nothing to do with his youthful appearance and boyish good looks. I've never seen him perform in person, but his engaging personality filled my living room easily from this record. *Joel Grey/Live* is a pressing of his Waldorf-Astoria show last year, and in it he depended on a stylish delivery that had an astonishing spontaneity to it.

Who'd ever think the Empire Room could itself take on the atmosphere of intimate cabaret? Joel Grey does it: in his light humor, which never tries too hard, his immediate establishment of rapport with his audience . . . this is one of those few discs that have a visual sense built right into them. You can almost see the Cheshire Cat grin breaking across his face.

Lean on Me has a poignance that stops mercifully short of the maudlin. *Happiness Is Just a Thing Called Joe* is sung, he tells us, to his wife Jo, and we believe the tenderness in his voice not in spite of but because of his casual attitude. He has to convince no one; he is secure in his devotion. He can also be secure in his talent.

I also like very much his brief delivery of *For All We Know*, which he performs as a coda and which is a lesson in the difference between sentiment and sentimentality. May others take notice.

Grey's *Wilkommen* is the best in the *Cabaret* medley. I doubt it can ever identify anyone else.

Occasionally the brass gets in his way. And the live audience reaction has been generally toned down in the final mixing. Incidentally, is it only American nightclub audiences who applaud when they like a joke? And who interrupts the start of a good song to show their recognition? I'd be grateful for explanations of these curious national traits.

Donald M. Spoto

Performance: A Sound: B+

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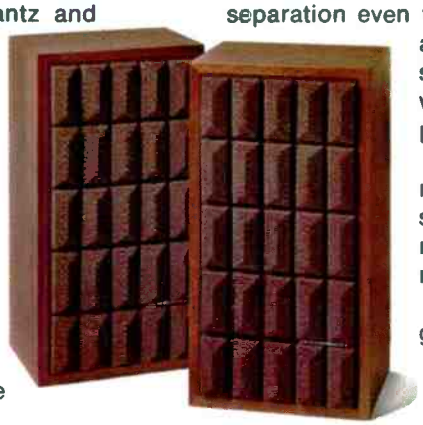

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