

hi-fi stereo

BUYERS' GUIDE

TAPE & TAPE MACHINES

ALL YOU NEED TO KNOW ABOUT BUYING TAPE EQUIPMENT

- CASSETTE:** CHOOSING THE MACHINE THAT'S RIGHT FOR YOUR NEEDS
- TO-REEL:** HIGHLIGHTS OF TODAY'S TOPSELLERS
- SET:** A LOOK AT THE FOUR NEWCOMERS
- LINK TAPES:** OUR TEST LAB REPORTS ON HOW THEY PERFORM

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 AUBURN ME 04210



L
MIC
R
PHONES
DIN REC/PLAY

DOLBY SYSTEM

RECORD REW/REVIEW FWD FFWD/CUE STOP/EJECT PAUSE/TIMER START

COUNTER RESI
LH BIAS FINE (%)
90 100 110



BOTTOM DOLLAR BUYS: \$500 CAN STILL GET YOU HIGH FIDELITY
 Objective lab test reports on all kinds of equipment

Now the world's finest tonearm starts at less than \$135.

Complete with drive system.

You don't have to wait till someday to play your records with the world's finest tonearm. A Dual tonearm—mounted in a four-point gimbal. You can afford one right now.

We have designed into our lowest-priced turntable, the new 1237, the very same tonearm (and drive system) formerly available only on our highest-priced models.

Advantages of the four-point gimbal suspension.

If you're not familiar with the gimbal, it's understandable. Few other tonearms, at any price, have one—despite its widely acknowledged superiority.

A true four-point gimbal centers, balances and pivots the tonearm mass at the precise intersection of the vertical and horizontal axes. The tonearm maintains the perfect balance in all planes essential for optimum tracking.

Straight-line tubular design (for maximum rigidity and lowest mass) and the settings for zero balance, tracking force and anti-skating are, like the gimbal, identical in every Dual tonearm. The tonearm establishes and maintains the correct cartridge-to-groove geometry, and allows the stylus to trace the groove contours freely, precisely and with the lowest practical force. In short, flawless tracking.

Advantages of the Vario-belt drive system.

Another important inheritance is the Vario-belt drive system. It consists of a high-torque synchronous motor, a precision-machined Vario-pulley, a precision-ground belt and a machine-balanced, die-cast platter. The Vario-pulley simply expands and contracts for reliable fine-speed adjustments.

There are no complicated mechanics or electronic

circuitry, which add nothing but cost.

Versatility and reliability too.

We've just described the qualities of the new Dual fully automatic line that will make your records sound better and last longer. But there's more. For versatility, you have fully automatic and manual start and stop,

plus provision for multiple play. And cue-control damped in both directions. Plus pitch-control, rotating single-play spindle and multi-scale anti-skating.

Everything we've described applies to the 1237, which is, incredibly enough, our lowest-priced model. And where the 123 ends, the 1241 and 1245 begin. With an even higher degree of performance. And very handsome, low-profile contemporary bases.

One further point. All Dual turntables are ruggedly built. They need not be babied, by you or anyone else in your family. As any Dual owner can tell you, they are designed to last for years and years.

Now we suggest that you visit your favorite audio dealer and see first hand what Dual engineering is all about. You

may then wonder why no other manufacturer puts so much care and precision into a turntable. The answer is simply this. For more than seventy-five years, craftsmanship of the very highest order has been a way of life with the Dual people in the Black Forest. As nowhere else in the entire world.



Dual 1237: less than \$135; base and cover less than \$30 additional.
Dual 1241: less than \$200; including deluxe base and cover.
Dual 1245: less than \$230; including deluxe base and cover.
Other Duals to \$400. All with two-year limited warranty.
Actual resale prices are determined by and at the sole discretion of authorized Dual dealers.



For the life of your records

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

Circle No. 27 On Reader Service Card

THE ELECTRONIC TURNTABLE.

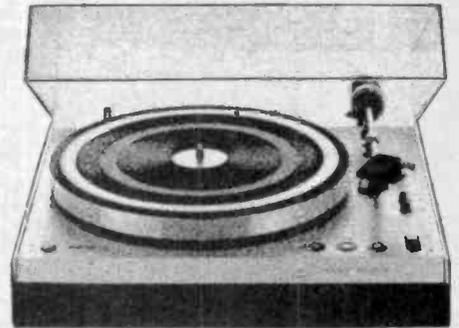
An electronic computer controls the speed; electronic circuits control everything else.

The Philips GA 312 Electronic Turntable gets its go from a low-rpm, servo-controlled d.c. motor, much the way the best (read: expensive) turntables do. But then the GA 312 goes the best one better.

Once set, the GA 312 regulates its motor with a mini-computer. The computer constantly corrects even the slightest variations in speed at the speed of light. Electronically.

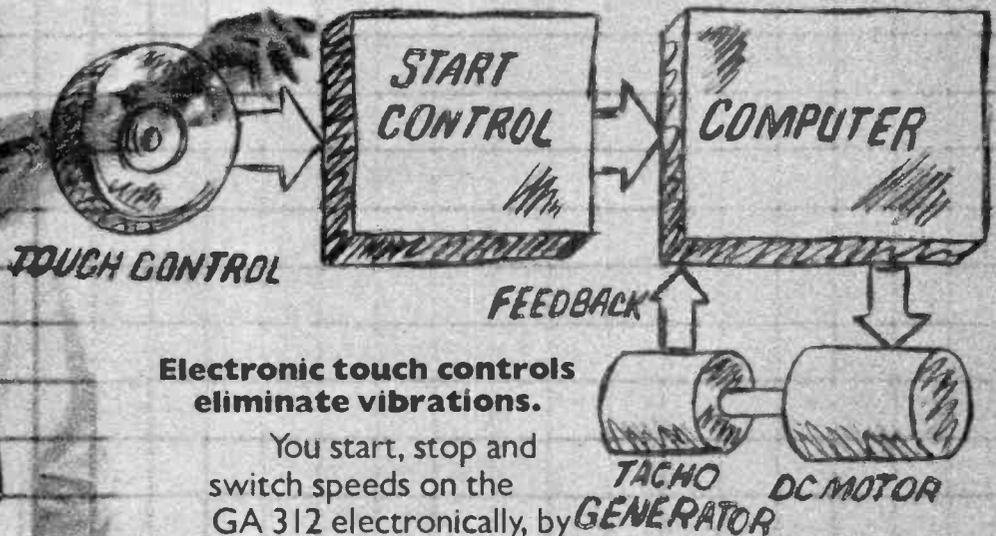
Wow, flutter and drift are so low as to be virtually undetectable; cartridge tracking forces and line-voltage fluctuations leave the GA 312's

precise speed unaffected. However, if you want to alter pitch, a strobe ring and two potentiometers put electronic control at your fingertips.



The Philips GA 312 Electronic Turntable. More than mechanical. Less than \$200*.

COMPUTER CONSTANTLY MAINTAINS SPEED



Electronic touch controls eliminate vibrations.

You start, stop and switch speeds on the GA 312 electronically, by merely touching buttons, featherlightly. You don't push, so you can't give the stylus the shakes.

To further immunize the GA 312 against mechanical and acoustic feedback, Philips engineers float the platter and tonearm on a cushioned subchassis, while rigidly mounting the motor to the main chassis. Only a shock-absorbing, precision-ground belt connects platter and motor.

Even to shut off the motor at the end of a record, Philips has replaced mechanics with electronics and optics. For the GA 312 shuts itself off—simply and silently—by interrupting a light beam with a hidden lever that parallels the tonearm.

Of course, the arm's geometry, adjustments and controls are as advanced as the motor's controls. And you know how advanced these are.

Optional with dealer.

PHILIPS

HIGH-FIDELITY LABORATORIES

For the name and address of your nearest franchised Philips dealer, call 800-243-6100, day or night, toll-free. (In Conn.: 1-800-882-6500.)

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hi-fi/sterео

BUYERS' GUIDE

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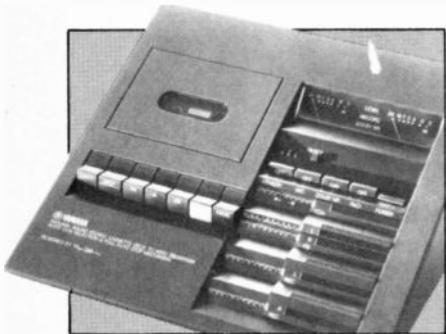
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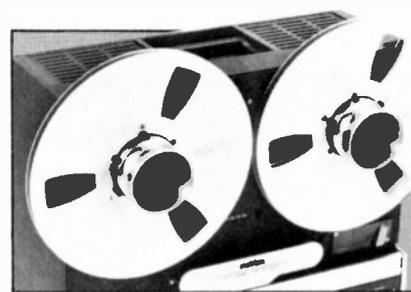
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Cover Photo by Leonard Studios

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AIWA's AD-6550 cassette deck, which has an adjustable bias feature. See the Test Report section for details (and circle Reader Service No. 102). TDK's AD-C90 cassette tape. Circle Reader Service No. 136.

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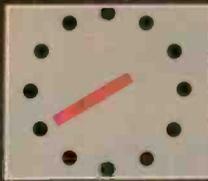




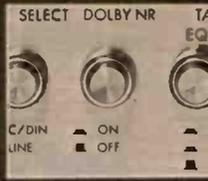
5 LED peak level indicators help eliminate distortion.



Long life Sen-Alloy head improves performance, reduces distortion.



Automatic recording when you're not there.



Dolby reduces tape hiss.



Bias and EQ switches for all types of tape.

No cassette deck can give you better performance without all these recording ingredients.



Most quality cassette decks look pretty much alike on the outside. So at first glance you might take the new JVC KD-35 for granted.

But take a second look. You'll see something no other make of cassette deck has—five peak-reading LED indicators. With a faster response than VU meters, or even peak-indicating meters, they help you avoid under-recording and they eliminate tape saturation and distortion. It's as close as you can come to goof-proof recording.

Then there's JVC's exclusive Sen-Alloy head for record and playback. Designed to give you the best of two worlds, it

combines the truly sensitive performance of permalloy with the ultra long life of ferrite.

Of course, the KD-35 has many other features like Dolby, bias and equalization switches, and automatic tape-erf stop in all modes. It's also possible to go from one operating mode to another without going through Stop. What's more, you'll never have to miss taping a favorite broadcast because you're not

there; just connect the KD-35 to a timer and switch to automatic record.

And yet, with all this built-in capability, the new JVC KD-35 is priced just above the least expensive model in JVC's new cassette deck lineup. Just imagine what our top model is like.

JVC America Company, Division of US JVC Corp., 58-75 Queens Midtown Expressway, Maspeth, New York 11378 (212) 476-8300. For nearest JVC dealer call toll-free (outside N.Y.) 800-221-7502. Canada: JVC Electronics of Canada, Ltd., Scarborough, Ont.

JVC

We build in what the others leave out

Circle No. 9 On Reader Service Card



**Before
you buy
stereo
headphones,
get
some
good
advice.**

Theirs:

Julian S. Martin
HI-FI STEREO BUYERS' GUIDE, March-April, 1976

"Superb from every viewpoint. An outstanding achievement in headphone design. One of the most comfortable."

The Len Feldman Lab Report
TAPE DECK QUARTERLY, Winter, 1975

"Response of these phones extends uniformly from 20 Hz to over 22,000 Hz with no more than ± 2 dB variation over this entire range...this is nothing short of incredible."

New Equipment Reports
HIGH FIDELITY, January, 1976

"The sound quality the AT-706 presents [to you] is exceptional: very wide range and smooth...Within this excellent operating range the sound is exceedingly clean and open...an extremely fine stereo headset."

If you asked the critics they'd tell you to listen critically to a variety of products before you buy. We agree. Because the more carefully you listen, the more you'll be impressed by the sound of Audio-Technica.

AT-706

Electret Condenser
Stereo Headset \$129.95
Our finest Personal Transducer



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Available in Canada from Superior Electronics, Inc.



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A major advance in cassette deck design. The new Sansui SC-5100.

If you're looking for a cassette deck that combines the convenience of the traditional cassette deck with the tonal excellence of open reel, you needn't look any further. Because the Sansui SC-5100 gives you both. And more.

Here's why. Performance meets the standards of today's most advanced component systems. All musical signals are reproduced cleanly and without distortion because of the wide frequency response (20-17,000Hz, chromium), excellent signal-to-noise ratio (57dB, with Dolby*) and unusually low wow and flutter (0.05% WRMS).

The SC-5100 is ultra-convenient to use. Solenoid operation permits controls that easily respond to your lightest touch. And with the electronically-controlled tape transport you get automatic play and record. The illuminated memory counter is also automatic.

For added convenience the SC-5100, when used with a timer, will record off your tuner or receive unattended. Or it will wake you gently in the morning with your favorite music.

The SC-5100 offers all the features you'd

expect in a superior cassette deck. Such as large VU meters, a peak level indicator, line input/mic mixing capability, and bias and equalization controls for every tape. We've also added something you didn't expect, Sansui's exclusive Tape Lead-In**. Just touch the control and the tape advances past the leader to the first point suitable for recording. You need never miss or spoil the start of a recording again.

Direct-O-Matic loading is another Sansui exclusive. It makes loading and unloading a snap, gives you access to the tape well for instant insertion and easy cleaning of the heads, and lets you see the direction of the tape and how much is left.

Now you have it, cassette deck convenience with open reel performance. All for less than \$600†. Hear the new SC-5100 at your Franchised Sansui dealer. We think you'll agree you've never heard anything like it.



*Trademark of Dolby Laboratories, Inc.
*Patent pending.
†Approximate nationally advertised value. Actual retail price set at the option of the individual dealers.

A whole new world of musical pleasure.



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Sansui

In the Black II



Performance, beauty, quality — three attributes that have always been the hallmarks of SAE products. SAE systems in the past have had them, this system's predecessor had them, and the new In The Black system has them and much more.

The 2900 Parametric Preamplifier offers our new flexible parametric tone control system, full dubbing and tape EQ. New phono and line circuitry results in unparalleled clarity and definition with distortion of less than 0.01% THD & IM.

The 2200 Stereo Power Amplifier with fully complementary circuitry delivers 100 Watts RMS per channel from 20-20K into 8 ohms; at less than 0.05% Total Harmonic Distortion, from 250mW to full rated power.

The 8000 Digital FM Tuner has linear phase filters, phase-lock multiplex, and of course, our famous digital readout tuning indicator system.

Combine these products together and you have a system that ensures superior performance in all areas, excellent control flexibility, and the sonic quality that is typically SAE.

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P.O. Box 60271 Terminal Annex, Los Angeles, CA 90060

Circle No. 17 On Reader Service Card

THE LATEST HI-FI COMPONENTS IN OUR... AUDIO SHOWCASE

Infinity Black Widow Air-Table

Infinity's Black Widow Air-Table platter "floats" on a cushion of air instead of resting on a conventional mechanical bearing. This system is said to eliminate a major potential source of rumble and transmitted high frequency vibration. The "air" is provided by a small, silent pump mounted in a compact, separate enclosure. The Air-Table's electronic servo drive is coupled to the platter by a new balanced belt system. The tone arm is the Infinity "Black Widow" unit which dispenses with the conventional head-shell to reduce the

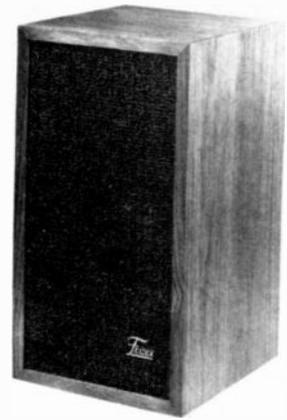


Circle No. 103 On Reader Service Card

effective mass to 3 grams, and thereby permits high-compliance cartridges to operate at full potential. The platter/arm assembly is mounted on a separate sub-chassis, suspended on pendulum springs to prevent rumble and feedback. Other features: 4 to 8.5 gram cartridge accommodation; adjustable stylus force calibrated in half-gram steps; anti-skating adjustment; 33 and 45 rpm speeds; illuminated strobe; start-up in about one revolution. Specs: rumble, better than -70 dB (DIN 'B'); wow and flutter, better than 0.025% RMS. Price: about \$400.

Frazier Monte Carlo Speaker

Frazier offers an improved Monte Carlo loudspeaker that features an "extensively" re-designed tuning slot that allows the new system to breathe better and thereby produce a fuller midrange as well as improved bass response. This two-way system contains a heavy duty 8-inch woofer and a direct-coupled Piezo-electric super horn tweeter. One watt of pink noise delivers 95 dB sound pressure at a distance of one meter on axis in an average living room. The power handling capacity is 30 watts continuous rms, and the nominal im-



Circle No. 119 On Reader Service Card

pedance is 8 ohms. Specifications: frequency response, 50 to 22,000 Hz \pm 5 dB; crossover, 4,000 Hz. The components are housed in a hand-crafted walnut veneer cabinet measuring 19 x 10½ x 12 inches and weighing 30 pounds. Suggested list price is \$124.95.

Sonab Booster Amplifier

You can double the output of your hi-fi stereo amplifier with the aid of this model A4000 dual-channel booster amplifier from Sonab. The booster can be used with any amplifier rated up to 60 watts RMS; the output of a 60-watt amplifier would be doubled to 120 watts per channel, RMS. This is strictly a stereo power amp *without* additional controls. Hence you continue to use whatever controls are on your basic amplifier. The A4000 is switched on only when needed; at other times a by-



Circle No. 111
On Reader Service Card

pass connects your regular amplifier to the speakers in the usual manner. An indicator lamp on the A4000 "winks" or shuts off when there is a fault in the system. Suggested retail price: \$400.

Altec/Lansing Speaker System

Santana II is an all-new two-way floor-standing speaker system from Altec/Lansing that replaces the 879A Santana. It employs a 12-inch bass driver and 5-inch high-frequency driver. A full LC dividing network features a high-frequency attenuator accessible from the baffle. The Santana II sports a composition slate top, and has oiled walnut finish sides and a black knit grille mounted to a removable panel. Specifications: crossover, 2500 Hz; sensitivity, 89 dB SPL, 91 dB SPL; frequency response, 40 to 20,000 Hz; dispersion, 130° at -6 dB vertical and



The world's finest audiophile recorder has become even finer

With its large professional VU meters using LED peak overload indicators, its full electronic logic control of tape motion and its precision tape cutter and splicer, the new B77 stereo tape recorder sets new standards of convenience for the discriminating recordist.

Add to this the legendary ReVox superiority in audible sound quality and you have the finest audiophile recorder in the world at a price that will pleasantly surprise you.

Willi Studer wouldn't have it any other way.

To learn more about the even finer ReVox B77, write to us for complete information and the address of your nearest demonstrating ReVox dealer.

STUDER **REVOX**

AUDIO SHOWCASE

horizontal; long term broad band maximum power, 45 watts; operation power range, 12 to 150-watts; long term

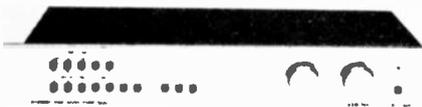


Circle No. 63 On Reader Service Card

maximum acoustic output, 107.5 dB SPL at 45 watts. Price: \$259.

A&E Preamplifier

A&E says that the SCA-2000 preamplifier, designed for the "uncompromising purist," ensures maximum waveform transmission accuracy by confin-



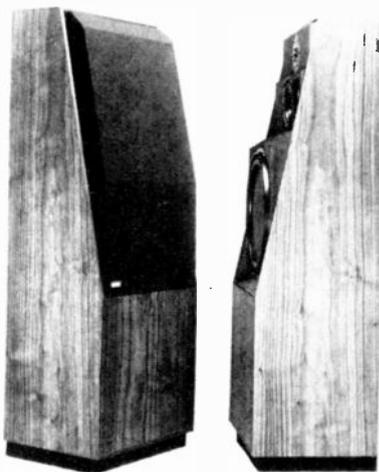
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ing phase shift to only 0-3° across the entire 20 to 20,000 Hz range. The basically DC amplifier design utilizes a low-noise dual FET differential input amp and IC computer amp in the equalizer stage, with separate negative low-frequency feedback and high-frequency RC networks to achieve an RIAA accuracy within ± 0.2 dB. Two phono inputs have switch-selectable impedances of (ohms): 100,000, 68,000, 47,000, 33,000, 1,000, 100 ohms. Sensitivity is set at 2 mV. Pushbuttons select various functions. Frequency response through the phono section is from 1 to 500,000 Hz (-3 dB), and from the aux inputs response extends down to DC. Signal-to-noise ratio is 80 dB and 90 dB for phono and aux, respectively. Total harmonic, from either input all the way through to the output, is said to be less than 0.01%; and the group time delay is only 0.7 μ sec. The maximum output level is 10V, with 75/75 ohm matching. Price: \$950.

Dynaco 80 Speaker System

Dynaco's Model 80 loudspeaker system was computer-designed to make all ele-

ments work precisely in phase. A 13-inch high-compliance woofer features a 4-layer voice coil specially treated for high power handling capability. The 4 $\frac{1}{4}$ -inch midrange has a two-layer voice coil and heavy magnet structure. The 1-inch fine filament polyester dome and

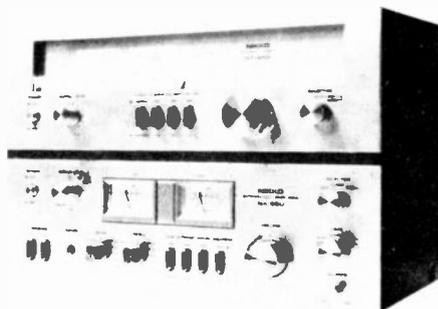


Circle No. 37 On Reader Service Card

surround tweeter has viscoelastic damping. The LCR type dividing network, with 12 dB per octave rate of slope, features low distortion, low loss components. Crossover frequencies are 800 Hz and 4,000 Hz. There's a 5-position attenuator for midrange and high frequencies. The frequency response is 30 to 22,000 Hz (DIN). Other specs: power, 100 watts maximum; music power 150 watts; sensitivity (measured at 1 meter, 1 watt input, SPL), 90 dB. Price: \$399 each.

Nikko Integrated Amp/Tuner

Nikko Audio offers a dual channel integrated amplifier that delivers 60 watts per channel, RMS, both channels driven into 8 ohms, with no more than 0.05% THD at rated power bandwidth from 20 to 20,000 Hz. Intermodulation dis-



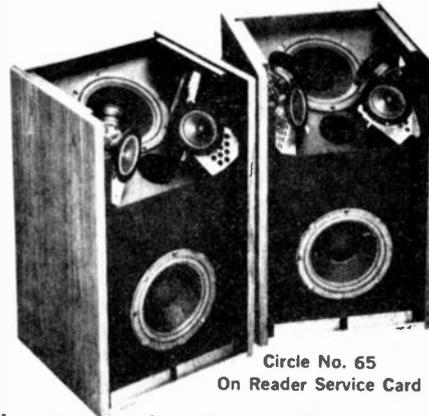
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ortion is 0.05% and the damping factor is 50. The NA-850 features bass and treble controls, loudness control, subsonic filter to eliminate turntable rumble, a -6 dB "high" filter, two VU meters, aux/tuner/phono function controls, a five-position tape control, a 41-click detent volume control, A/B

speaker switching, tone defeat switch and speaker protection circuitry. The NT-850 tuner (AM and FM/FM stereo) offers switchable IF band (normal and narrow) circuitry for increased selectivity, PLL multiplex circuitry, dual-gate MOS-FET in the RF circuit and a front panel multipath switch to aid in eliminating noise. The NA-850 amplifier is priced at \$250 and the advertised value of the NT-850 tuner is \$210.

Bose Direct/Reflecting Speaker

This Model 601 Direct/Reflecting speaker system by Bose, the fourth model in the line, is described as a high performance floor standing unit. It features six drivers in each enclosure—four tweeters, two woofers—that radiate sound through the top and front of the cabinets. By aiming the drivers in different directions, sound is beamed to different places around the speaker and to wall surfaces around the speaker. By directing a major portion of the sound energy upward, "sound is positioned above the level of sound-absorbing furniture" to facilitate



Circle No. 65
On Reader Service Card

locating speakers in any listening environment. There's also a "Symmetry Control" that alters the sound dispersion characteristics. Because the sound is "asymmetric," the two speakers of a stereo pair are mirror images. Two 8-inch woofers in each enclosure are designed for high power output capability, and their midrange response is claimed to precisely complement the response of the four extended range tweeters in the crossover region. Price: \$558.00 per pair.

Technics Stereo Integrated Amplifier

Model SU-7700 stereo integrated amplifier from Technics by Panasonic has a power output of 50 watts per channel, minimum RMS, both channels driven into 8 ohms from 20 to 20,000 Hz, with no more than 0.08% total harmonic distortion. The signal-to-noise ratio is 78 dB at 2.5% mV phono input sensitivity. Features include an equalizer subsonic filter, RIAA compensation

B-I-C VENTURI.

The art of being way ahead without being way out.

The speaker landscape is dotted with esoteric designs that produce marginal improvements at, unfortunately, very high cost.

We refer here to the not-uncommon practice of being elaborately different without being basically advanced.

At B-I-C, we believe that the finer art is being way ahead *without* being way out.

Our patented application of the venturi principle to speaker design ushered in the high-efficiency era, with many 'leaders' following our lead.

And our introduction of the System Monitor technology redefined the loudspeaker's role, giving it the ability to make the rest of a component system perform better.

Each represented a fundamental advancement in speaker design, *not* reserved for the affluent few.

This year, the addition of new Formula 3 and Formula 6 models underscores that approach. Now there are seven B-I-C VENTURI Formulas, from a 2-way bookshelf to 4-way, monitor-equipped tower.

We offer them as the best examples of the art.



Our new Formula 6 Spec II, shown here without grille, fills a size and design (and price) slot between the 5 and 7.

The patented B-I-C VENTURI coupled path. Its multiplier effect produces bass energy 140 times greater (and substantially purer) than the same signal measured directly at the woofer cone.

The brains of the system; the monitor control panel with Amplifier Clipping Indicator, Speaker Overload section and Dynamic Panel Balance Compensation (Automatic and manual).

The BICONEX® T-S-C Transducer that expands sound dispersal in treble and upper mid-range to 180 degrees. Lower mid-range and bass cones mount coaxially, achieving a large (yet compact) 4-way system.



B-I-C VENTURI SPEAKER SYSTEMS

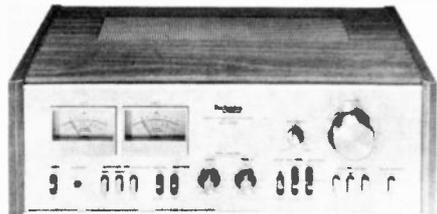
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CIRCLE NO. 7 ON READER SERVICE CARD (FOR EARLIEST RESPONSE WRITE DIRECT)

AUDIO SHOWCASE

accurate within $\pm .2$ dB, two-way dubbing, 41-step volume control, tone controls with defeat at "0" position, high



Circle No. 98 On Reader Service Card

filter which cuts out high frequency noise. Also direct reading power meters, muting circuit that eliminates power on/off switching noise, stabilized power supply, and main/remote speaker facilities. Price: \$249.95.

Visonik Turntable

Visonik's top-of-the-line turntable, model DD-8200, is a direct drive unit with a DC motor, indirect strobe, automatic shut-off functions, oil-damped cueing, anti-skate control, pitch control and front rather than top panel function



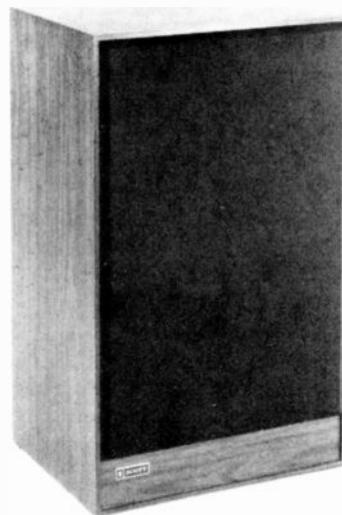
Circle No. 100 On Reader Service Card

controls. The turntable features a "low profile" platform design and incorporates a floating chassis to isolate the platter from the spindle receptacle and the arm structure from the motor chassis. A base with dustcover and "free stop" hinges is included in the retail price of \$247.

Scott Large Bookshelf Speaker

H. H. Scott says this model S-197 large bookshelf speaker system is "designed for serious listeners who want maximum efficiency, extremely low distortion levels and a broad range of power handling capability." The three-way, air-suspension system utilizes a 15-inch high compliance woofer, 4½-inch cone midrange and 1-inch dome tweeter. Specifications: impedance, 6 to 8 ohms;

frequency response, ± 4 dB from 40 to 20,000 Hz; crossover frequencies, 750 and 3,500 Hz; minimum required amplifier power, 15 watts per channel; power handling capacity, 90 watts (can

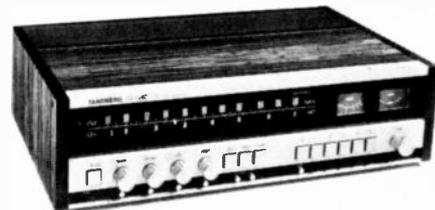


Circle No. 91 On Reader Service Card

be used safely with amplifiers rated up to 120 watts per channel RMS). Size: 27½ inches by 16½ inches by 13¼ inches. Weight: 53 lbs. Price: \$199.95.

Tandberg TR-2040 Receiver

Tandberg's TR-2040 receiver features a newly-designed circuit that automatically reduces background noise during weak signal conditions. The average continuous output power is 40 watts minimum RMS per channel, both channels driven into 8 ohms, from 20 to 20,000 Hz with no more than 0.09%



Circle No. 97 On Reader Service Card

total harmonic distortion. The FM section has a frequency response of 30 to 15,000 Hz, $+1/-2$ dB in stereo mode. Other specifications: stereo 50 dB quieting sensitivity, 40 uV/300 ohms, 37.3 dBf; signal-to-noise ratio at 65 dBf, 74 dB in stereo; distortion for stereo, 0.9% at 50 dB quieting and 0.5% at 65 dBf; adjacent channel selectivity, 10 dB at ± 200 kHz; spurious response ratio, image response ratio and IF response ratio, each greater than 100 dB; stereo separation at 100 to 10,000 Hz, greater than 40 dB. The receiver has two phono and two tape inputs. The phono section performs with a low distortion of 0.1% and a signal-to-noise ratio of -86 dB. Price of the TR-2040 is \$530.00.

(Continued on page 14)

HI-FI/STEREO BUYERS' GUIDE

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Circle No. 25 On Reader Service Card

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

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

Time

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

...and Time Again

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

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

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

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

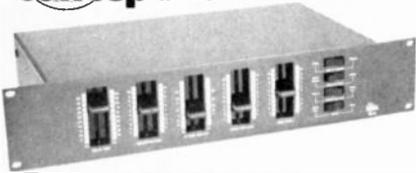


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SD550



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You could spend a lot more just exchanging stereo components for a little added range or clarity. Before you do, experience the breathtaking realism of total presence. Listen to an SD550. These people have.

"makes almost any stereo or mono program sound more real than 99% of the available quadraphonic programs." Julian Hirsh in Popular Electronics 6/76

"turns formerly flat recordings into gems while finally fulfilling the promise of 4CH sound." N.J. owner

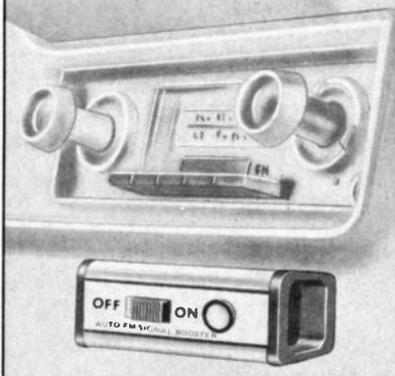
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Circle No. 6 On Reader Service Card



Curson photo courtesy of Inner City Records

Ted Curson/by Gary Giddins

□ Ted Curson was never meant, temperamentally or musically, to be a sideman. The trumpeter-composer has led a series of invigorating, freshly conceived small bands for more than 15 years against withering odds and despite neglect and occasional privation. Some of those bands were never recorded, and his leadership gifts are insufficiently recognized. Yet at a time when his contemporaries were likely to choose between the familiar formats of hard bop and the frequently chaotic derivations of the avant garde, Curson's ensembles made a separate and distinct peace between free form improvisation and the orthodoxies of the robust mainstream.

His repertoire consists largely of lyric, deceptively simple originals—blues, ballads, riff-tunes—and more complex pieces with tempo changes, rhythmic suspensions, and multiple parts. Some of these are brittle and tough, others have the patient air of nursery tunes. A characteristic of all his groups is the use of ensemble riffing behind soloists at certain intervals—these increase the tension of a performance and make the group sound larger and tighter; they also break up the string-of-solos routine.

Not least of his talents as a leader is the ability to find unknown players and encourage them to bloom under his benign

guidance. His bands have a peculiar flexibility which permits soloists of varied persuasions to work with relative freedom in a formal situation. He has been willing to accommodate gutbucket bluesmen and energy players—anyone, in fact, who can play originally, well, and contribute overall to the band's totality. In this Curson has proven to be a true disciple of Charles Mingus, who was his demanding boss during a fruitful apprenticeship in the early 60s.

His most constant companion during the past decade is Nick Brignola, who plays a number of instruments but excels on baritone and soprano saxophones. In some ways, they're an unlikely couple. Curson's high, scrappy phrases, though played with a fuller tone than most trumpeters associated with the avant garde, reveal a modernist inclination not surprising in a musician whose early years were spent with Mingus and Cecil Taylor, while Brignola is more bop oriented, and most com-

(Continued on page 75)

Gary Giddins writes on jazz regularly for the *Village Voice* and *New York*. His criticism has appeared in a wide variety of publications, including the *New York Times*, *Hollywood Reporter*, *New Times*, and *Melody Maker*. He conducts a weekly radio show on WBAI and his first book on jazz and its makers will be published by Dial Press in 1977.

The sound and the theory.



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Introducing a speaker system with a sound so fantastic that it took a whole new theory of loudspeaker design to produce it . . . the Koss CM 1010 loudspeaker. It's the ultimate in 2 bandpass speakers, with an extended bandwidth response, high efficiency and incredibly low distortion that's unmatched by any other 2 bandpass speaker at any price.

To achieve such remarkable performance, Koss engineers set critical parameters for cabinet size, frequency response and efficiency. Then the computer-programmed Koss Theory furnished not only construction specifications for the woofer, tweeter, passive radiator and crossover network, but also the optimum position in the cabinet for each component to create maximum structural rigidity and optimum dispersion and phase coherency.

The result is an all-embracing quality of sound. The 10-inch passive radiator reinforces the lower 2 octaves

while the special 8-inch woofer also handles midrange to 3500 Hz. With the radiator's unique alignment mass in place, the CM 1010 reproduces a maximally flat response from an f_3 of 35 Hz on outward. However, for more acoustic energy in the 50 to 80 Hz range, the alignment mass can be removed to create an f_3 of 42 Hz and a low bass ripple of $1\frac{1}{4}$ dB centering on 60 Hz. The CM 1010's high-energy, 1-inch dome tweeter linked to an acoustic transformer increases the high bandpass headroom by an incredible 6 dB. With performance so superior, the CM 1010 is clearly the ultimate speaker in its price range.

For a free, color brochure of Koss CM loudspeakers, write to Fred Forbes, c/o the Koss Corporation. Or ask your Audio Dealer for a live demonstration of the Sound of Koss, and hear the Koss Theory in action. Once you've listened to the revolutionary CM 1010, you'll agree: hearing is believing.

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Circle No. 12 On Reader Service Card

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Back in 1973, E-V brought out the original Interface:A. It was the world's first vented speaker designed by computer, using the technology developed by the Australian scientist, A.N. Thiele.

This was the first vented speaker that combined the high efficiency of earlier bass reflex types with even greater bass output than the power-hungry acoustic suspension designs. And it was more accurate than either.

Now, four years later, E-V has come out with its highly refined second generation of Thiele-theory, computer designed speakers—while everyone else is bragging about their first generation.

The new Interface line—7 speakers strong—is at least four

times as efficient as a typical acoustic suspension speaker. That gives your amplifier the equivalent of four times the power, whether you have 15 watts or 60. Now you can listen to music at truly realistic levels—without audible distortion. And with greater accuracy than you have ever experienced.

And when it comes to bass, Interface speakers set new standards. Our Interface:D system is only 3 dB down at 28 Hz! That's bass you can feel as well as hear.

Fact is, our new Interface speakers really *are* a generation ahead, and we think you'll agree when you hear them yourself. For the complete story, write for our free color brochure. Then you'll be four years ahead, too.

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Clockwise from left.
Interface: 1, 2, 3, B Series II, D, C, A Series II.



Circle No. 5 On Reader Service Card

AUDIO SHOWCASE

(Continued from page 10)

Acusta Craft Speaker Kit

Acusta Craft says that if you are assembling your own speakers in order to save money, you can afford to splurge a bit by acquiring "a jewel of a component" consisting of a T-1700-H horn tweeter. This horn couples the



Circle No. 104 On Reader Service Card

voice coil diaphragm to an air column to provide greater efficiency than is obtainable by means of a direct radiator, according to the company. The unit uses a WF-1200 12-inch woofer and an M-560 cone-type midrange. The crossover frequency is 500-5,000 Hz. The minimum to maximum recommended amplifier power range, RMS watts per channel into 8 ohms, is 20 to 200 watts. Long term continuous power is put at 70 watts. Model PK-S16, which sells for \$155 brings all parts necessary to assemble the loudspeaker using ¾-inch particle board for the cabinet. Model WK-S16, priced at \$180, provides all the same components but utilizes a cabinet made from walnut veneer rather than particle board.

Ortofon Magnetic Cartridge

Ortofon's top-of-the-line M 20 FL Super cartridge was engineered to give the best possible performance in high quality tone arms of moderately high mass, which includes the majority of



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HI-FI/STEREO BUYERS' GUIDE



Harman Kardon's ultrawideband 430 and 730 receivers. Frequency response: 4-140,000Hz.

Amplifier design: true Twin Power.

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Phase linearity describes a component's ability to pass multiple frequencies without changing their

time relationships. It gives you a sound that stays open and accurate, clear on down to the bottom.

Harman Kardon feels so strongly about these benefits that, in a market full of narrowband components, with frequency response from 20 to 20,000 Hz, we make only ultrawideband components.

The twin power supplies give you a further benefit. When the music makes extreme dynamic demands on one channel, the other channel simply cannot be affected—so even the loudest passages remain clear and open. That's why you'll find this feature in the world's finest high fidelity components.

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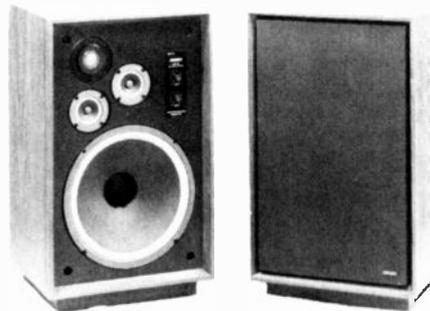
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AUDIO SHOWCASE

superior arms in use today, according to the company. To match these tone arms, the M 20 FL Super uses a medium compliance and a recommended tracking force of 1.5 grams. A "fine-line" shaped diamond is said to distribute stylus pressure over a much wider contact area than is possible with conventional tips, whether spherical or elliptical. Specifications: output voltage per channel at 1 kHz per cm/s, 0.8 mV; frequency response, 10 to 25,000 Hz; compliance, 20 $\mu\text{m}/\text{mN}$ horizontal and 10 $\mu\text{m}/\text{mN}$ vertical; tracking force range, 12.5 to 17.5 mN; weight of cartridge, 5 grams. Price: \$100.00.

Jensen Lifestyle Speaker

This model LS-6 three-way Lifestyle Speaker System by Jensen utilizes a massive 15-inch Flexair woofer to reproduce low frequencies, a 1½-inch Mylar dome tweeter for high frequencies, and two 3½-inch midranges in



Circle No. 120 On Reader Service Card

tuned isolation chambers. To "personalize" the audio output to your precise preferences, just adjust the midranges by means of one control and the tweeter with a separate control, both mounted on the front of the system. These controls are continuously variable and are calibrated in decibels attenuation. The frequency response range is 20 to 25,000 Hz, and the power rating is 10 watts minimum to 90 watts maximum—which means you can team the LS-6 with virtually any high output amplifier now on the market. Other specs: dispersion, 170°; magnet structure weight, 4½ pounds; connections, Kwik-On push-type; cabinet, genuine hardwood walnut veneers. Price: \$289.95.

AKG Studio Microphone

AKG Acoustics says the dual-diaphragm C-414 Studio Condenser Microphone has been completely re-designed and "vastly improved." All

switching controls are incorporated within the microphone. The twin-diaphragm design provides for selection of four different polar patterns: cardioid, omnidirectional, figure-eight, hypercardioid. This means that you, in effect, get four microphones in one.



Circle No. 105 On Reader Service Card

Pre-attenuation levels of 0, -10 and -20 dB are provided for close-up recordings. A base cut filter of more than 14 dB/octave slopes provides flat, 75 Hz or 150 Hz cut-off frequencies to offset extraneous vibration and/or proximity effects. An all-metal housing adds to the rejection of RF interference. The mike may be energized by 12/48V phantom powering, further minimizing the possibility of interference. A new elastic suspension and H-17 boom-mounting unit with windscreens are options. Price of the C-414: \$495.

Leak Speaker System

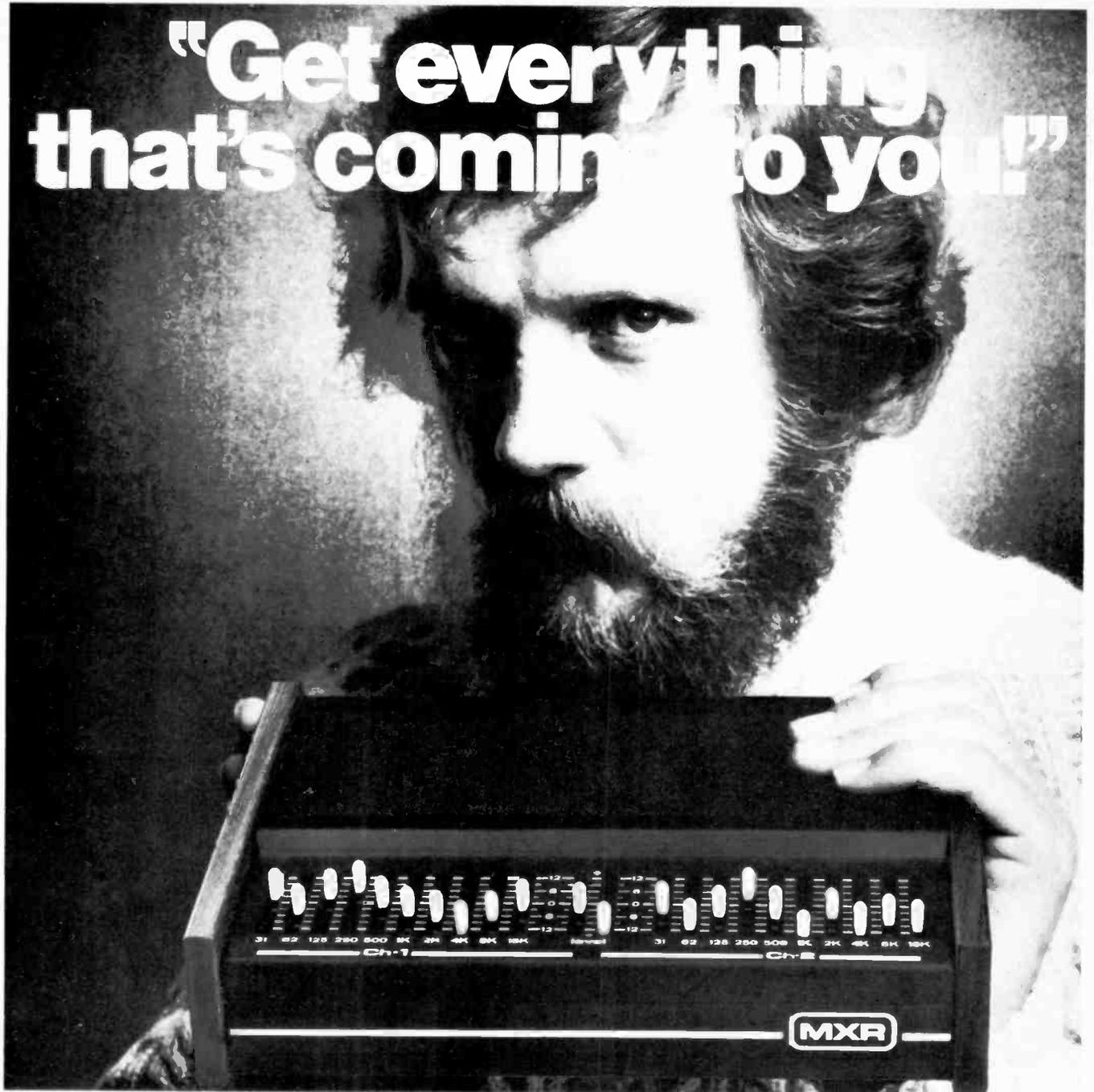
Rank Hi Fi introduces a new Leak 3050 time-delay compensated speaker system that is claimed to have the uncolored deep bass response of an acoustic suspension system, coupled with an "extraordinarily smooth," wide-dispersion dome tweeter with an "optimally-phased" output. The result is said to be an entirely phase-coherent wavefront and concomitant sonic realism.



Circle No. 113 On Reader Service Card

A dual woofer system, consisting of two 6.7-inch bass drivers in a well-damped acoustic suspension cabinet, extends the -3 dB point down to 48 Hz. There's an 11-element 10 dB/octave crossover network, whose computer-calculated phase characteristics form an integral part of the time-delay

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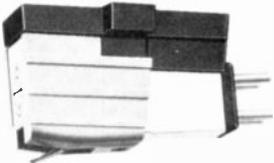
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AUDIO SHOWCASE

compensation, that feeds treble frequencies above 4000 Hz to a ¾-inch dome tweeter that extends high-end response to 22,000 Hz (-3 dB). The speaker system can handle up to 50 watts input, and recommended amplifier power is from 12 to 60 watts/channel RMS. Price: \$355 each.

Audio Technica "Compass" Cartridges

Audio-Technica's new "Compass" series stereo phono cartridges employ a "V-magnet" generating system which gives each stereo channel its own tiny mag-



net, coils and pole pieces. This design is said to result in "impressive" stereo separation, lowered distortion, extended high frequency response and longer record life. Model ATX1, recommended for lower-cost record players requiring

tracking forces from 1½ to 2½ grams, has a frequency response of 20 to 20,000 Hz, stereo separation of 21 dB minimum at 1 kHz and 16 dB minimum at 10 kHz. This model sells for \$35. Model ATX3E (\$60) offers a frequency response of 15 to 22,000 Hz and stereo separation of 23 dB minimum at 1 kHz and 17 dB minimum at 10 kHz. The recommended tracking force is 1 to 2 grams. Model ATX5E (\$75) tracks at 1 to 1½ grams and offers a frequency response of 15 to 25,000 Hz, and stereo separation of 23 dB minimum at 1 kHz and 17 dB minimum at 10 kHz. The ATX5E stylus is a .3 x .7-mil nude-mounted elliptical diamond.

Smallest AR Speaker System

Although this new AR-18 speaker system is the smallest built by Teledyne Acoustic Research, it features a liquid-cooled high-range driver which can be used by amplifiers capable of delivering 100 watts continuous power per channel (driven to clipping 10 percent of the time) on normal music source material. The drive units consist of an 8-inch acoustic suspension woofer and a ring radiator high range unit. The crossover frequency is 2,000 Hz, and the crossover network utilizes computer grade electrolytic capacitors and the acoustic output of the high-range driver



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is controlled by a switchable resistive network which includes a two-position switch. The system low-frequency response is -3 dB at 62 Hz. Dimensions of the walnut grain vinyl veneer cabinet are: 9½ inches by 16½ inches by 6¼ inches. Price per unit: \$65.

JVC "DC" Power Amplifier

JVC America's Model M-3030 stereo power amplifier provides DC amp configuration "for minimum dynamic distortion." The unit features three separate power supplies, one each for the Class B right- and left-channel power drivers, and one for the Class A pre-driver stages, plus twin mono amplifier construction to effectively suppress



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crosstalk distortion. The M-3030 delivers 100 watts per channel, minimum RMS, at 8 ohms, from 20 to 20,000 Hz, with no more than 0.05% total



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harmonic distortion. The frequency response is put at DC to 100,000 Hz, +0/-1 dB (1 watt). Other specs: input sensitivity/impedance, 1.0V/50K ohms; signal-to-noise ratio, 116 dB; damping factor, more than 75 dB (20-20,000 Hz); output impedance, 4 to 16 ohms. Notable design features include: subsonic filter; two pairs of input terminals on rear panel; separate left and right input level controls on rear panel; double differential common-mode feedback circuit for input. Price: \$699.95.

Cizek Compact Bookshelf Speaker

This Cizek Model #2 unit is a two-way acoustic suspension system featuring an 8-inch acoustic suspension woofer and 1-inch hemispherical dome tweeter. Specifications: 1,500 Hz; impedance, 4.25 ohms \pm 0.20 ohms from 100 to 15,000 Hz with controls in flat position; efficiency, average sensitivity



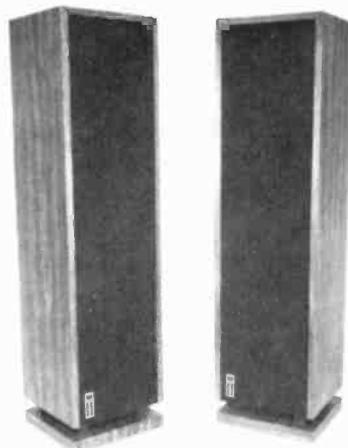
Circle No. 109 On Reader Service Card

is 88 dB at 1 meter with 1 watt input into 4.25 ohms; minimum amplifier power requirement, 15 watts RMS into 4 ohms; power handling, up to 150 watts music power per channel; in-box resonance, nominally 38 Hz; low-frequency response, -5 dB at 38 Hz or -1 dB, depending on Q adjustment. There are two controls located in the recessed panel below the woofer. A high frequency level control permits

raising and lowering of the entire tweeter response with respect to the woofer. A Q switch permits change of Q from .57 to .9. Price: \$268.00 per pair.

Epicure Microtower Speaker

Microtower 1-B by Epicure is an improved version of the company's Microtower 1 speaker system. Like its predecessor, it utilizes the "Organ Pipe Principle" to generate low bass infor-



Circle No. 110 On Reader Service Card

mation. Tuning is over a broad range of frequencies, including all bass from 200 Hz on down. A small flow of air is derived from two 4½-inch long-excitation drivers mounted back to back near the top of the 30-inch high, acoustically-damped air column. The column amplifies the bass frequencies which then emanate in a spherical pattern from a one-inch slot at the bottom of the column. Specifications: impedance, 8 ohms; power range, 5 to 50 watts; frequency range, 45 to 15,000 Hz; weight, 27 pounds. Price: \$109.95.

TEAC A-105 Cassette Deck

TEAC's model A-105 cassette tape deck features two-step bias and equalization switches and Dolby noise reduction. The deck housed in a metal case with



Circle No. 10 On Reader Service Card

brushed aluminum front. There are two permallex heads for record/playback and erase, and separate left and right record level controls and a mic or line input switch are additional features. Specifications: wow and flutter, 0.09%; frequency response, 30 to 15,000 Hz with chromium dioxide tape; signal-to-noise ratio, 53 dB (or up to 63 dB with Dolby at 5,000 Hz). Priced at less than \$200. ▲

Q. Which magazine has the widest scope of equipment test reports?

A. hi-fi stereo BUYERS' GUIDE

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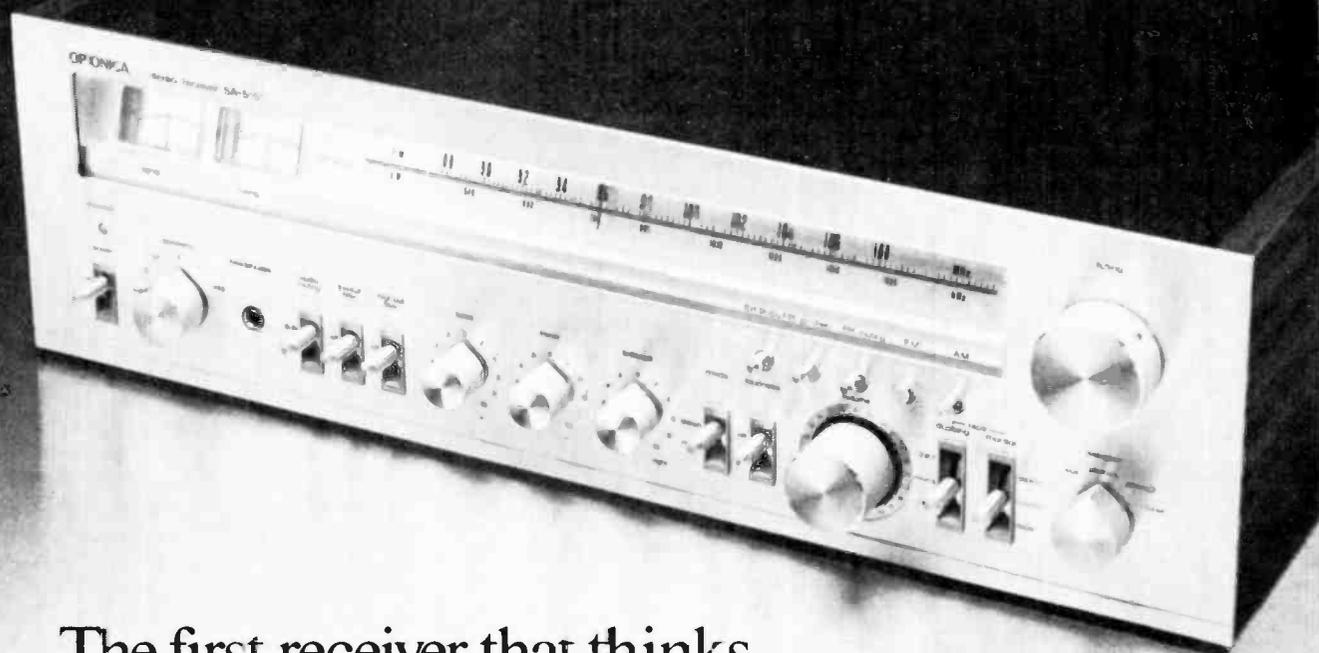
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A GUIDE TO RECENT STEREO RECORDINGS

by THOMAS D. KELLY

An avid record collector for nearly 20 years, Thomas D. Kelly has a keen ear for both live music and full-fi sound. Mr. Kelly played the records he reviews here on equipment consisting of an Empire 39 transcription system with a Shure V15 III cartridge, a C/M Labs 911 stereo amplifier, a Marantz 7T pre-amp, and two Bozak B-400 speakers.

© Beethoven: *Leonore Overture No. 3, Op. 72a; Piano Concerto No. 4 in G Major, Op. 58; Symphony No. 5 in C Minor, Op. 67.* Claudio Arrau, pianist; Bavarian Radio Symphony Orch., cond. Leonard Bernstein. Deutsche Grammophon 2721 153, two records, \$15.96.

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These performances were recorded during a live concert presented in Munich October 17, 1976 for the benefit of Amnesty International with all performers and Deutsche Grammophon donating their services for this worthy cause. The *Leonore Overture No. 3* is highly appropriate for the occasion, as is the Fifth Symphony. Both are given dynamic readings of enormous excitement, an element almost totally lacking in Arrau's leisurely view of the *Concerto No. 4*. The reproduction is exceptionally fine, and the Bavarian Radio Orchestra sounds better here than it does on many of its studio recordings. I usually enjoy recordings of live concerts, and this one has its strong merits. But for repeated hearings I'll probably turn to the unique Carlos Kleiber recording of the symphony and any one of the many superlative recordings of the concerto—Ashkenazy, Bishop, Casadesu, Fleisher or Serkin—all of which supply the vigor and scintillating pianism lacking in the Arrau live performance.

© Beethoven: *Sonata in E Flat, Op. 31 No. 3.* Schumann: *Fantasiestücke, Op. 12.* Artur Schnabel, pianist. RCA ARL1-2397, \$7.98. Both of these works were featured by the master pianist after his last tour in April 1976 when Schnabel was ninety. While his recent recording of the *Concerto No. 1* of Brahms showed some loss of technical proficiency none is evident on this new



Remarkable by any standards

Beethoven-Schumann disc. The Beethoven is beautifully paced and noble in conception, while Schumann's Fantasy Pieces are imaginatively presented. This disc, a souvenir of Schnabel's 70th anniversary tour, is remarkable by any standards, and also boasts some of the finest reproduction RCA has ever afforded the distinguished pianist.

© Beethoven: *Piano Concerto No. 5 in E Flat, Op. 73, "Emperor."* Alfred Brendel, pianist, with the London Philhar-

monic Orch., cond. Bernard Haitink. Philips 9500 243, \$7.98. Brendel is one of the supreme pianists of the day and it was inevitable that he would record his fine interpretations of the Beethoven concertos, which he recorded years ago for Vox. The present disc is the first in a series eventually to contain all five. Haitink not too long ago recorded this music with Claudio Arrau and the Concertgebouw, a thoughtful, searching series of performances, not too well recorded. Haitink and Brendel collaborate in a magisterial reading of the "Emperor," solid in its musical values yet not lacking in brilliance. The London Philharmonic recorded this music for RCA with Artur Schnabel as soloist and Daniel Barenboim conducting. It is interesting to compare the recording techniques of RCA and Philips with the same orchestra; the RCA is somewhat coarse, undefined in the bass and makes the piano bigger-than-life, while the Philips has everything in perspective, rich orchestral textures, a wide, natural dynamic range and ultra-smooth surfaces. I look forward to future releases in the Philips series. The price is premium, but you get what you pay for.

© Berlioz: *Fantastic Symphony, Op. 14.* Orchestre National de France, cond. Leonard Bernstein. Angel S 37414, \$7.98. Hardly a necessary recording! The French orchestra is on this performance not as inspired as they were on the recent Angel disc with Bernstein conducting and Rostropovich as soloist in Bloch's *Schelomo* and Schumann's *Cello Concerto* (S 37256). Here their playing is sluggish, sometimes out of tune, and the reproduction is excessively cavernous and undefined. The big blur of sound sadly lacks clarity. Bernstein's dynamic ideas on the symphony are far better represented on his Columbia disc with the New York Philharmonic. Other current recordings that are far superior to the new Angel are those by Colin Davis



Lacks clarity

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High Fidelity — Nov./1976

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*Hi-Fi Stereo
(Published in Germany)
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*The Complete Buyer's Guide
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*The Complete Buyer's Guide
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"The OHM D2 is designed to provide the identical response as

the C2, sacrificing only the ultra-wide high frequency response of the latter."

*The Complete Buyer's Guide
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Comments about the Ohm L.

"The upper mid-range and high frequencies were virtually perfect."

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Comments about the Ohm E.

"Let me assure you, it handles Chopin and pretty well anything else from accordion to zither with equal dexterity. For anyone looking for 'just an ordinary speaker' at a modest cost as Hi-Fi speakers go — this could be it."

*Canadian Stereo Guide/Winter
1974*



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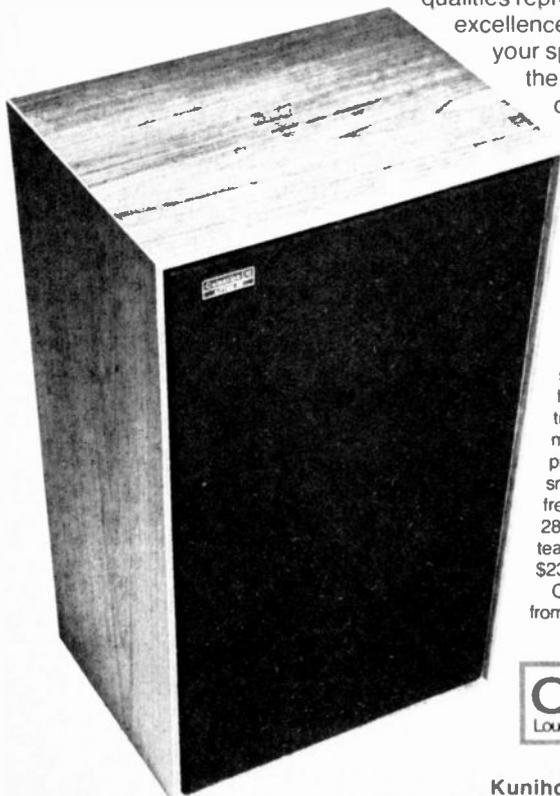
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STEREO RECORDINGS

and the Concertgebouw on Philips, Karajan's second recording with the Berlin Philharmonic on Deutsche Grammophon, Eugene Ormandy and the Philadelphia Orchestra on Columbia and Seiji Ozawa and the Boston Symphony on Deutsche Grammophon.

© Dvorak: *Piano Concerto in G Minor, Op. 33*. Sviatoslav Richter, pianist; Bavarian State Orch., cond. Carlos Kleiber. Angel S 37239, \$7.98. It is seldom that one encounters an absolutely perfect recording, but here is one, and it is incredible. Dvorak's only piano concerto is not the big virtuoso display piece that most people like to hear, hence its popularity is rather restricted with its cause carried on primarily by Rudolf Firkusny. The Czech pianist has recorded it no less than



An absolutely perfect recording

three times and plays it very well indeed. His best recording was the early Columbia mono LP with George Szell and the Cleveland Orchestra; the later stereo versions for Westminster and Vox orchestrally are only adequate. Richter's performance is equally sensitive and he has the distinct advantage of Kleiber's collaboration. Carlos Kleiber is an absolute perfectionist and achieves the highest calibre of playing from the Bavarian Orchestra. This is music-making of the highest order, with excellent reproduction from the engineers, and this disc should create many new fans for this concerto.

© Fucik: *Entry of the Gladiators*. Czech Philharmonic Orch., cond. Vaclav Neumann. Quintessence PMC 7038, \$3.98. Julius Fucik, born July 18, 1872, is to Prague what Johann Strauss is to Vienna, and every year in Prague dur-

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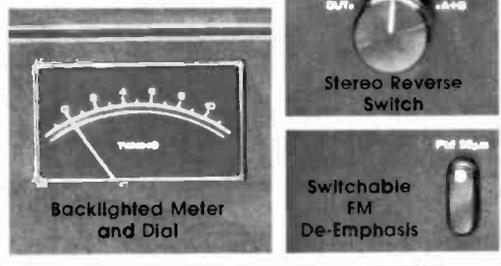
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STEREO RECORDINGS

ing Carnival time the Czech Philharmonic gives a series of pop concerts including music of their native son. Surely his most famous march, *Entry of the Gladiators*, is a knock-out and deserves its renown; the very sound of it instantly brings to mind all the best elements of a rousing circus. There have been a number of recordings of it,

with a particularly outstanding one by the Eastman Wind Ensemble on Mercury, but none is superior to this performance by the Czech Philharmonic, which has been vividly recorded. It is a delight to hear virtuoso big orchestral sound in this brief score. The record also contains the *Florentine March* plus an assortment of rarities: *The Old Bear With A Sore Head*, featuring bassoonist Jiri Formacek; *Marinarella Overture*, *Herzogewina March* and two waltzes, *Winter Storms* and *Donausagen*. The recordings originally were issued on Telefunken; this reissue lacks the dis-

tortion and overloading of the original. Highly recommended.

© Glazunov: *The Seasons*. Concert Arts Orch., cond. Robert Irving. Seraphim S 62092, \$4.98. For me *The Seasons* is one of the most delectable of all ballets. There isn't a dull moment in it and the entire score sparkles with melodic invention, culminating in the familiar bacchanal "Autumn." My first contact with the score was Antal Dorati's Dallas Symphony recording on RCA 78s, a splendid performance very well recorded for its day. Later versions on London by Albert Wolff and the Paris Conservatory Orchestra and

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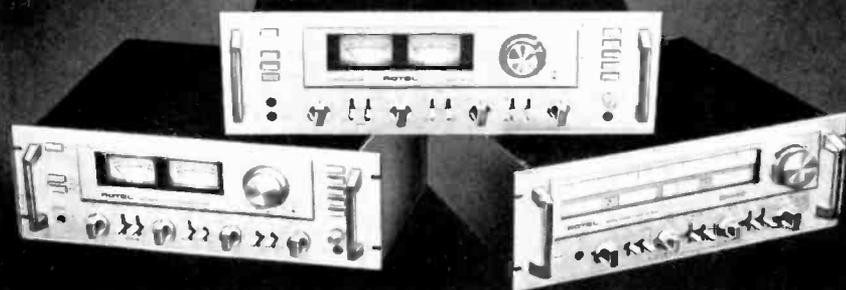
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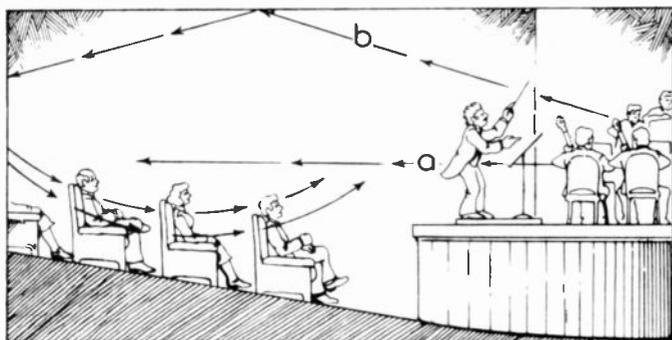
The score sparkles

Ernest Ansermet and the Suisse Romande Orchestra (both currently available, the former on Stereo Treasury and the latter on full-price London) were not nearly as vibrant as the Irving which is very well played by a studio orchestra and richly recorded as well. There is an even better more recent recording on Angel Melodiya with the Moscow Radio Symphony directed by Boris Khaikin which boasts a dynamic performance and wonderfully vivid sonics (SR 40088). But if you don't wish to spend a premium price for *The Seasons*, you couldn't go wrong with this time-tested Irving performance.

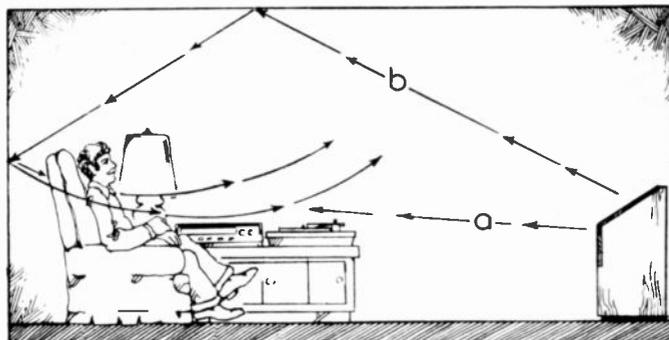
© Grainger: Piano Music. Daniel Adni, pianist. Seraphim S 60295, \$4.98. Percy Grainger was an enigma, a child prodigy who developed into one of the leading pianists and most sought-after virtuosos of his time (1882-1961), although he disliked the piano, regretted having composed for it and was terrified whenever he performed in public. Of his familiar *Country Gardens* he wrote: "The typical English country garden is not often used to grow flowers in; it is more likely to be a vegetable plot. So you can think of turnips as I play it." Much of his piano output consists of settings of folk-music, and it is surprising that, considering his

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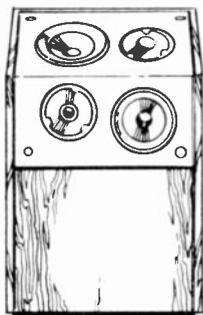


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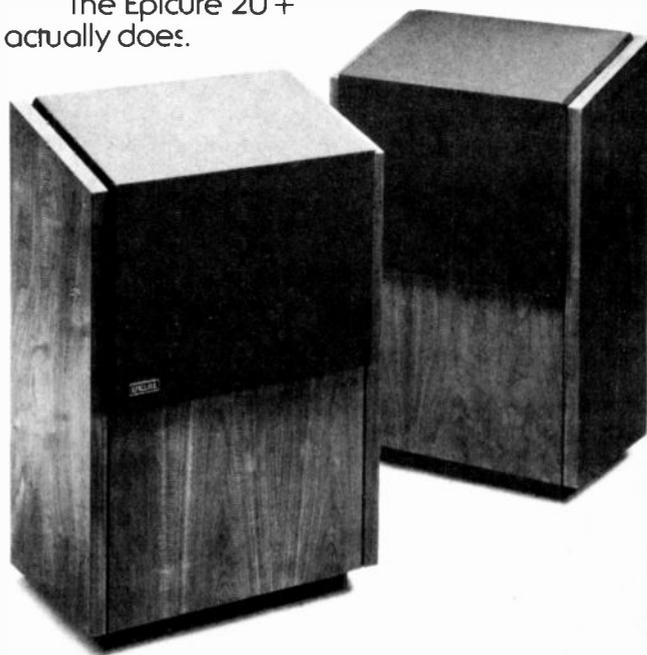
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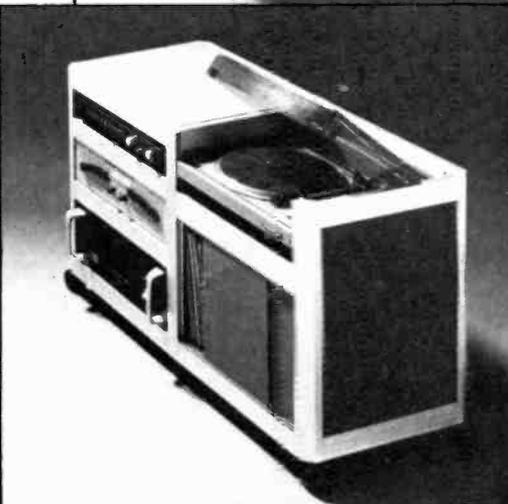
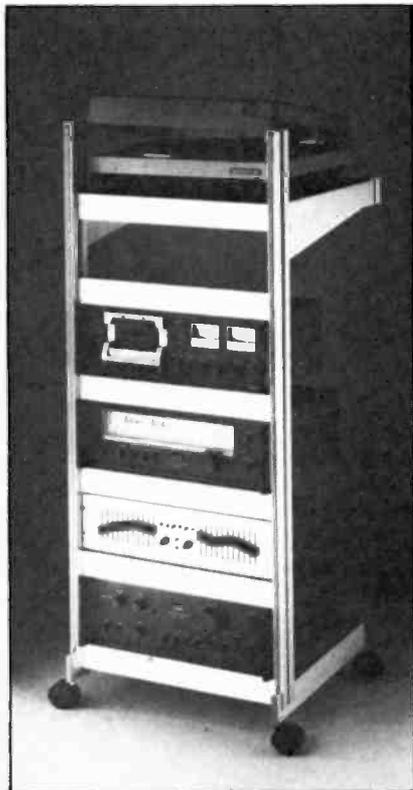
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STEREO RECORDINGS

own remarkable technical capabilities, his works for solo piano are not more exhibitionistic. This LP contains the familiar *Country Gardens*, *Irish Tune from County Derry*, *Molly on the Shore*, *Over the Hills and Far Away*, *Handel in the Strand*, *Walking Tune*, and *Shepherd's Hey*, as well as the less



A spirited performance

familiar *To a Nordic Princess*, *Lullaby*, *Knight and Shepherd's Daughter*, *Sailor's Song* and *Eastern Intermezzo*. The young Israeli pianist Daniel Adni gives spirited performance of these charming miniatures, the reproduction is fine and you'll doubtless find that this record will give you much pleasure. If you prefer your Grainger orchestrally you might investigate a fine new Mercury Golden Import (SRI 75102) offering much of this same repertory performed by the Eastman-Rochester "Pops" Orchestra conducted by Frederick Fennell.

© Grieg: *Peer Gynt Suites 1 and 2*, *Five Songs*. Elisabeth Söderstrom, soprano; New Philharmonia Orch., cond. Andrew Davis. Columbia M 34531, \$7.98. The youthful Davis continues his fine discs with this Grieg LP that features Elisabeth Söderstrom as soloist in Solveig's *Lullaby* as well as the familiar *Solveig's Song*. The five songs that fill out the record are *From Monte Pincio*, *The Swan*, *The Way of the World*, *The Princess* and the familiar *I Love You*. Orchestrally everything is fine, but some listeners might find Söderstrom's vibrato distracting. I much prefer the sound of Nilsson or Flagstad in this repertory. The jacket indicates that texts are enclosed, but my copy did not include them.

© Lanner: *Waltzes and Galops*. Johann Strauss Orchestra of Vienna, HI-FI/STEREO BUYERS' GUIDE



Handsomely played

cond. Willi Boskovsky. Angel S 37248, \$7.98. Joseph Lanner was a friend and contemporary of the elder Johann Strauss, and the two shared leadership in the explosion of Viennese dance music popularity in the early 19th century. Both formed small orchestras of 20 to 30 players and toured extensively playing their own music, but soon Strauss, whose soon later composed *The Blue Danube*, became more prominent. Lanner died of typhus in 1843 at the early age of 42. This new Angel LP contains does not contain his best know waltz, *Die Schönbrunner*, but it does offer four others, *Pest Waltz*, *The Suitors*, *Court Ball Dances* and *Marien Waltz*, as well as the unusual *Steam Waltz*, opening and closing with a musical depiction of a steam locomotive. Three sparkling galops fill out this handsomely-played and beautifully recorded disc, which is guaranteed to provide nearly an hour of pleasant listening.

© Rachmaninoff: *Symphony No. 3 in A Minor, Op. 44*. London Symphony Orch., cond. André Previn. Angel S 37260, \$7.98. Previn has always displayed a particular affinity for Rachmaninoff's music; he has to his credit two fine recordings of the *Symphony No. 2*, *The Bells*, and many other works, including an outstanding recording of the suites for two pianos. Some years ago he recorded the *Symphony No. 3* with the London Symphony for RCA, but this new version is stronger and more richly recorded. I find the *Symphony No. 3* to be a fascinating work and recommend this recording above any other currently available, including the new Stokowski-National Philharmonic set. While Previn's first recording included as a filler Rachmaninoff's orchestral fantasy *The Rock, Op. 7*, the new Angel disc offers the seldom-heard *Intermezzo* and *Women's Dance* from the opera *Aleko*, both typically Slavic in nature. Angel's reproduction is excellent in every way. ▲



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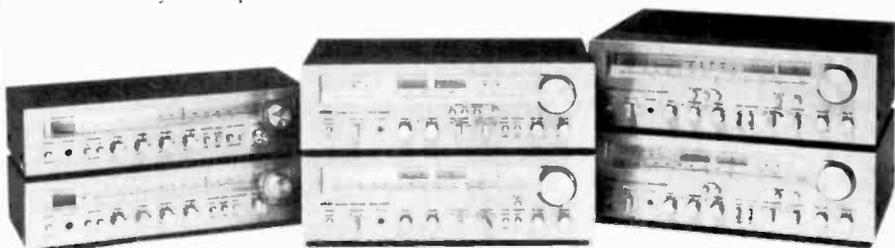
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A review of the latest popular music releases

by KEN IRSAY



Pink Floyd: "Animals". Columbia JC-34474. \$7.98.

Contrary to popular perception, you don't have to be a spaced out acid freak to appreciate Pink Floyd. The group puts out records that owners of classy hi-fi rigs like to use to show off their systems to friends. *Animals* is no exception. It sounds particularly good through stereo headphones. The album focuses on three animals: pigs, sheep and dogs as an allegory on the human condition; sort of an *Animal Farm* set to music. All of the cuts are vocals but the instrumental portions predominate. In "Dogs," for example, wailing synthesizers sweep through acoustic guitar rhythm chords with dual electric guitars in the lead. Unfortunately there's no indication on the album jacket of the instruments and electronics used. The only list of credits, other than the producers (Pink Floyd) and the engineer (Brian Humphries), is that paying tribute to the graphic artists who designed the album sleeve. Devoted followers of the group undoubtedly know who plays what. Those of you not among the cognoscenti are obliged to pick up some of Floyd's earlier opuses for the information.

John Denver: "John Denver's Greatest Hits, Vol. 2" RCA CPL 1-2195. \$7.98.

There are two kinds of albums that recording artists like best. One is the so-called "live" album, a recording of a live concert. It's no extra work for the artist who's doing his thing on stage anyway. The other is the "greatest hits" compilation, a collection of previously released work. Both types serve a useful purpose. The "live" record brings

the impact and immediacy of an in-person concert to the fan who doesn't want to go through the crowd hassle or expense of being there. The "greatest hits" collection is a perfect way to accumulate the cream of a particular artist's crop, assuming you agree with the producer's choices. John Denver fans are legion and it's hard to believe that there are any who don't already own the albums from which this group of songs is culled. Be that as it may, *J. D.'s G. H. Vol. 2* serves up everything from the syrupy sweetness of "Back Home Again" to the crashing crescendos of



Denver's tribute to Jacques Cousteau, "Calypso," with a little hillbilly throw-away, "Grandma's Feather Bed," tossed in for the goodtimey flavor. RCA would never skimp on the production of its bread and butter so the sound quality is excellent.

Dolly Parton: "New Harvest . . . First Gathering". RCA APL1-2188 \$6.98.

Already one of the shining lights in the country music world, delightful Dolly Parton has made her big move into mainstream pop music with this mixed bag of rousing rockers and wispy ballads designed to exhibit the wide dynamic range of her voice. The rhythm section in such movers as "Light of A Clear Blue Morning" is mixed way up front, but not overhearingly so; just enough to let you know that Dolly can rock with the best of them. And an ethereal rendition of Smokey Robinson's old hit, "My Girl," spotlights Dol-



ly's sensitivity at its best. Songs that tell sad stories ("Where Beauty Lives in Memory") and strongly gospel flavored pacans to heaven ("There") are Dolly's way of saying that, although she is expanding her musical balivick, she's a country girl first and foremost and she's not about to cut loose her legions of original fans. As if the pure pleasure of her voice wasn't enough, Dolly wrote eight of the ten songs on the album and produced and arranged the set. Production is clean and crisp and the arrangements imaginative. *New Harvest . . . First Gathering* is a bumper crop for old, new, and yet-to-be Dolly Parton fans.

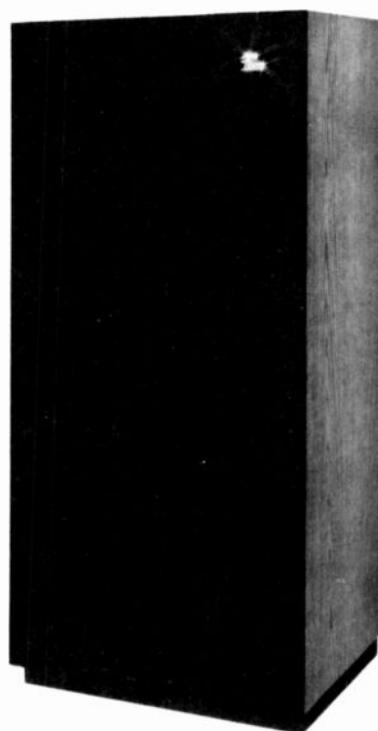
Russell Morris: "Russell Morris 2". RCA APL1-1576. \$6.98.

The clue to what goes on inside Russell Morris' head is found on the outside of Russell Morris' album. The

(Continued on page 82)



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You want quality. A record cleaner can last a lifetime. A plastic wonder can crack into oblivion—or you can purchase the hand-rubbed elegance of milled walnut befitting the rest of your audio system.

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The value of a truly fine record cleaner is justified by the cost of replacing your record collection. Fifteen dollars is a small investment in long-term protection.

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□ Decisions. Decisions. When buying an FM, it's whether it will be a tuner or a receiver. An amplifier? Integrated or separate. A tape deck? Open reel or cassette. Similar decisions, but not quite the same. Tuners and receivers, whether separate or integrated, all perform the same function. It's merely a matter of the number of packages you buy, the specs and features they offer. Basic compatibility is there; you don't need *both* a tuner *and* a receiver. But the choice between tape decks is a matter of *format*. There is good reason to have both an open reel and a cassette deck, and, if you are going to choose between them, you should have some idea of the advantages and disadvantages of each.

Cassette equipment is by far the more popular. Why? Because it's much more convenient. The tape is pre-packaged; there's no need to thread loose spaghetti through the guts of the deck. Just pop in a cassette, and you're ready to go. You can also store a lot more music in a given space; a single small cassette can hold as many minutes of program as a 7-inch reel of tape. The library of commercially recorded cassettes is much more extensive than the open reel catalog, and, with a home cassette recorder, you can prepare tapes to use "on-the-road" in your automobile deck.

But there the advantages stop. Open reel decks offer better total performance, especially with regard to high level high frequency response, noise,

and distortion. Open reel tapes are easier to edit and splice—an important consideration for the serious "live" recordist. Furthermore, the mechanical performance of an open reel deck—vis-à-vis flutter, speed stability, etc.—is, on the whole, better than that of a cassette deck. As far as *tape* reliability is concerned, it's pretty much of a toss-up. An open reel can't jam as a cassette can, but let it go haywire and spill loose tape all over the floor, and you're in a mess.

Some readers may question the statement that an open reel deck generally offers better performance than does the average cassette deck. Comparing spec sheets on frequency response and noise frequently shows little difference between the two formats, and occasionally a cassette system seems to out-spec an open reel deck. But here's a case where "specs" can be misleading. Cassette decks are measured to a different standard than are their bigger brothers. They have been given a golfing handicap so to speak.

The "standard recording level" on cassettes is 250 nWh/m; which refers to the magnetic flux level on the tape, and, suffice it to say, it's a pretty high level for the thin coated cassette tape. So high in fact that the distortion generally runs in the 1% to 3% range at the level. There is very little "headroom" above zero. The standard open reel level is 185 nWh/m, and the heavier oxide coating will withstand much greater recording levels than that—6 dB to 10 dB more on a good machine/tape combination—before 3 per cent

ALL YOU NEED TO KNOW TO CHOOSE ONE FOR YOURSELF

by WILLIAM S. GORDON

TAPE MACHINES

Harman/Kardon's HK-2000 is a two-head cassette deck which sells for \$399.95. Its features include a subsonic filter designed to eliminate unwanted signals below 20 Hz, and an MPX filter control. Reader Service No. 71.





Rotel's RD-10F is a two-head cassette deck which sells for \$230. Dolby noise reduction and locking pause control are included. Use No. 87.



AIWA's AD-6800 cassette deck features user-adjustment of the bias setting and a double-needle VU/Peak metering system. Circle No. 102.



Hitachi's \$160 D-220 two-head cassette deck includes bias and equalization settings for two types of tape. Circle Number 72 for details.



TEAC's A-303 front-loading cassette deck features a record/mute function and separate 3-position bias/equalization switches. \$350. Circle No. 10.

total harmonic distortion is reached.

Since the cassette system is so close to overload at "standard" recording level, the frequency response is specified at a much *lower* level—usually 20 dB to 30 dB below zero. The response may look good there, but it's not maintained at higher levels. Because of the peculiarities of the tape recording process, the response at higher recording levels falls off at the upper frequencies. The tape saturates. So a cassette deck with, say 15 kHz response at -20 dB may start to roll off in the 5 kHz to 10 kHz region as the recording level is raised. (That explains why high level cassette tapes sound dull.)

The frequency response of a 7½ ips open reel deck is customarily measured at -10 dB; that of a

3¾ ips at -10 dB or -20 dB. Furthermore, with a good tape, it's not uncommon to find the response holding up to beyond 15 kHz even at zero recording level and above. This means you can sock it to an open reel tape much more strongly than to a cassette and that, in turn, means quieter (as well as wider range) recordings. In short, given cassette and open reel decks with the same response and signal-to-noise specs, *in practice* the open reel deck will sound better because it will maintain that response to a higher recording level and, since you can record the signal at a higher level, the practical *signal-to-noise* ratio is much improved.

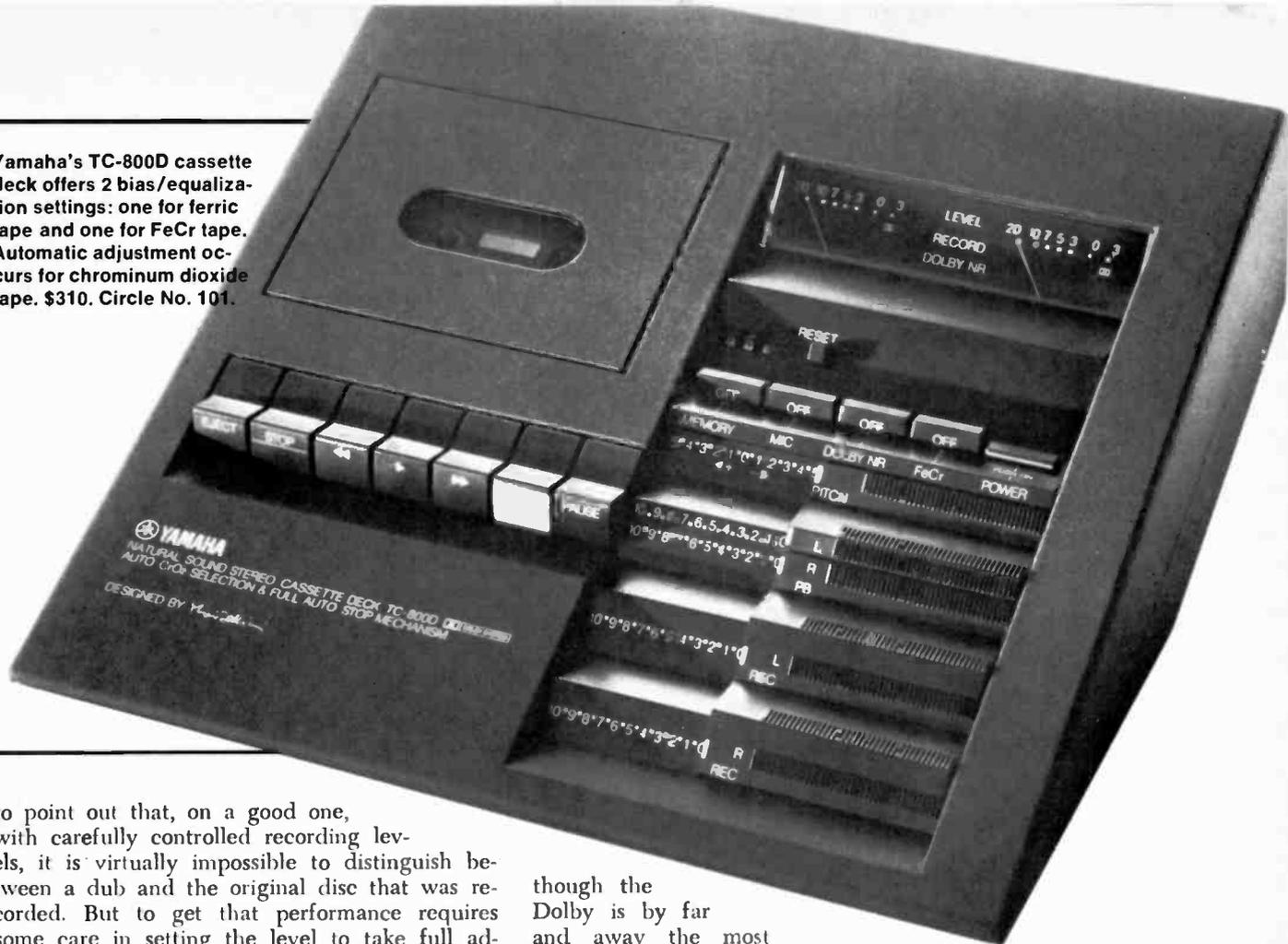
Lest you think that the cassette format is incapable of high fidelity performance, we hasten

TAPE MACHINES



Sansui's SC-3100 cassette deck is designed for easy access to the magnetic heads (which facilitates cleaning). It also has separate 3-position bias and equalization switches and Dolby noise reduction. \$430. Circle Reader Service Number 89 for details.

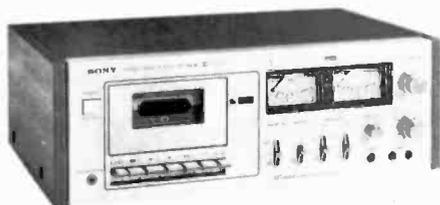
Yamaha's TC-800D cassette deck offers 2 bias/equalization settings: one for ferric tape and one for FeCr tape. Automatic adjustment occurs for chromium dioxide tape. \$310. Circle No. 101.



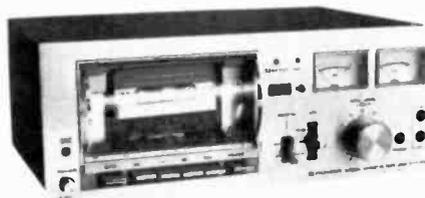
to point out that, on a good one, with carefully controlled recording levels, it is virtually impossible to distinguish between a dub and the original disc that was recorded. But to get that performance requires some care in setting the level to take full advantage of the tape; open reel decks are more forgiving. Nonetheless, today's performance of even garden-variety cassette systems far exceeds the wildest expectations of the original inventors of the format.

Cassette Noise Reducers. Much of the success of the cassette can be attributed to the Dolby-B noise reduction system, and no cassette deck can lay claim to being "high-fidelity" without a Dolby-B or some other noise reduction technique. Al-

though the Dolby is by far and away the most popular, two other systems vie with it for supremacy—the JVC ANRS (and the newer Super-ANRS) and the dbx II. The JVC systems are similar in operation to a Dolby, and tapes made on one system can be played on the other with good results. The dbx II system is totally incompatible with either of the others but offers even more noise reduction than does the competition. (However, dbx II-encoded tapes are virtually unlistenable without



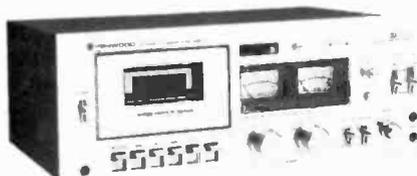
Sony's TC-206SD front-loading cassette deck includes a Dolby noise reduction system and two 3-position bias/equalization switches. Use No. 96.



U.S. Pioneer's CT-F4242 cassette deck features easy-access tape heads and a locking pause control. \$225. Circle Reader Service Number 85.



Akai's GXC-725D three-head cassette deck sells for \$425. Included are peak level meters and a 3-position tape selector. Circle R.S. Number 62.



Kenwood's KX-1030 three-head cassette deck features an adjustable bias control and a Double-Dolby noise reduction system. \$375. Use No. 74.

decoding. Dolbyized tapes can be listened to "straight" with at least acceptable results. Undoubtedly, that helps to keep it the "system-of-choice" for the pre-recorded market.)

Obviously, *your* cassette deck of choice should have some noise reduction system—probably it will have a Dolby. What other characteristics should you look for? Let's go over the typical specs and see. Of course there's frequency response—30 Hz to 13 kHz is probably par for a typical cassette deck, out to 15 kHz or 16 kHz for a good one, and to 20 kHz for a really superb deck. Open reel decks get out to 25 kHz or beyond at 7½ ips. Expect to find the response with a Dolby somewhat more truncated than without and look for a tolerance on the spec of $\pm X$ dB. The tighter the tolerance the better; no tolerance at all, and we'd raise our eyebrows.

What Features to Look For. The deck should have selectable bias and equalization for *at least* two types of tapes—usually ferric oxide and chrome—with a third, ferri-chrome position desirable for flexibility. Sometimes, the bias and equalization switches are separate so that more combinations can be established; on other decks, one switch sets both. Whether separate switches

are worth the effort depends upon whether the alternate combinations are indeed usable. We'd also try to establish specifically for which tapes the machine has been set. All ferric oxide tapes are not the same, and you'll get the best performance by using the same tape that the manufacturer uses. Your best clue comes from the tape packed with the machine. Manuals tend to claim that the deck will work with almost anything from boat rust on up—not true!

The performance you get from the deck will depend on the tape. Usually the frequency response will be a little more extended on chromium dioxide and ferrichrome than on the ferric oxides. Noise is likely to be lower too, as reflected in the S/N spec. But distortion is generally higher on chrome than on ferri-chrome or ferric oxide. Some of the more reputable manufacturers will spec their deck *separately* for each of the basic types. On ferric oxide and ferrichrome cassettes, the THD on a good deck will probably be about 1% to 1½%; double that on chromium dioxide. On open reel equipment, the THD will likely be in the range of 1% at a recording level 6 dB *above* zero—much less at zero level.

Of course, mechanical (Continued on page 78)



Optonica's RT-2050U Mk II 3-head cassette deck sells for \$299.95 and features an automatic program find system. Circle Reader Service Number 133. Tandberg's TCD-310 Mk II is a two-head cassette deck which includes an MPX filter switch and dual peak reading meters. \$530. Circle Reader Service No. 97.



JVC's KD-95 top-of-the-line two-head cassette deck sells for \$499.95. Included are a Super ANRS noise reduction system, 5 LED peak level indicators, and two 3-position bias and equalization switches. Circle No. 73.

TAPE MACHINES



□ Tape recording isn't difficult. On even a modestly priced cassette deck, there's no reason why you can't produce better recordings than you can buy from commercial duplicators. For one thing, *you* can use premium-grade cassettes—a luxury that the commercial boys simply can't (or won't) afford. Nor need that increase your cost unduly. Why, with a good C-90 going for about four or five bucks—frequently 10% less if you buy them by the dozen—you can record two record albums for less than the price of one pre-recorded cassette. Your copies are also likely to be better because you'll be recording them in real-time—1:1 rather than on the high speed 32:1 duplicators that the mass producers use.

Getting a really high quality recording isn't a matter of luck. It takes some skill, but it's skill that you can easily acquire by following a few simple rules. Then honing these skills to a fine edge is just a matter of practice. Here then are six steps to better tape recording. They fall into three basic groups: pre-

liminary work that you do prior to the recording session, the recording itself, and caring for your tapes after they've been made.

1 Select the Right Tape

Your very first task is to select the tape you are going to use. This is a matter of mating the tape with the recorder. Price alone is no guide. A premium tape *need not* perform as well as a less expensive one. This is not to say that the higher priced tape is not better in and of itself, merely that to achieve the best performance from a tape requires that the recorder have the bias and equalization characteristics that the tape demands. A proper match is of greater importance than potential (but unrealized) performance.

Cassette tapes come in three basic groups: ferric oxide types, chromium dioxide types (and their equivalents) and ferrichrome formulations. Each type requires its own specific bias and equalization settings and most quality cassette decks have switch settings for at least two, if not all three, of the formulations. But even *within* the group, there are differences among the products of various manufacturers and, for that matter, even among different products of the same manufacturer. These differences are especially pronounced among ferric oxide products which have undergone many permutations in their long life. Some are cobalt-doped, some are not; some use extremely tiny particles, others somewhat larger ones, yet each is called a ferric oxide tape. So it's important that you determine from the recorder manufacturer (or test reports, or your own experimentation) which works best on your deck (See the *Blank Cassette Tapes* article elsewhere in this issue for details on ferric oxide tapes.)

Chromium dioxide tapes are more uniform from manufacturer to manufacturer but there are exceptions here as well. The "chrome-equivalent" tapes

are quite similar to chromium dioxide in their requirements, but not *precisely* the same. Forewarned is forearmed. And, the newest tape type—the ferrichromes—differ substantially from vendor to vendor.

In general, the ferric oxides offer a lower distortion figure than do the chromium products but usually a higher residual noise level. Ferrichromes offer *both* low noise and low distortion but few decks are set to really eke out their performance potential.

When buying a cassette, you're best off sticking to a C-90 length or shorter. C-120s use very thin tape; the backing is not as strong, and the oxide coating is thinner which means a greater possibility of distortion and print-through. A screw-type cassette housing simplifies opening the cassette for repair (or for editing down to the length you want) but is not *inherently* superior to the welded housing. (However, since most audiophiles have associated the screw housing with quality, most tape manufacturers have put their best products in such housings. So the hypothesis that screw housings are superior has become self-fulfilling.) In any event, a good cassette—at least mechanically—should run freely with no screaming and screeching in the fast modes.

2 Clean the Machine Regularly

For the most uniform frequency response in both recording and playback, and for the least number of dropouts, the recording heads must be spotlessly clean. Even a dirt coating as thin as 20 *millionths* of an inch on the head can cause an audible loss in high frequency response. And if the head is

6 STEPS TO BETTER CASSETTE RECORDING

by GORDON CHRYSTIE

SELECT THE RIGHT TAPE



CLEAN THE MACHINE REGULARLY



6 STEPS

dirty when recording, the copy will be permanently lacking in highs.

Head cleaning cassettes are available from several of the tape suppliers, and some blank tape cassettes come with a short section of mildly abrasive head-cleaning tape as leader. These are all reasonably effective as regular maintenance means, but to clean a really dirty head, a liquid head cleaning solvent is your best bet. Several are available from the tape recording accessory distributors but plain isopropyl alcohol is probably as good as any. Avoid really strong solvents such as acetone, xylene and the like. They may soften any plastic around the head face (and so ruin the head) and are very likely to disintegrate the various plastic parts of the recorder. Of all the solvents, Freon is probably the gentlest, although it is less effective than alcohol.

When cleaning the head, use a cotton swab saturated in the cleaner and scrub both back and forth and up and down. Turn the swab as it becomes dirty and keep up the work, changing swabs as required until the last one comes away clean. Avoid excessive pressure on the head or you may upset the alignment, but some light pressure is required to get off the encrusted gunk. Take care to avoid leaving cotton fibres on the head—they're as bad as dirt as far as spacing loss is concerned.

While you're at it, clean the capstan and pinch roller. Avoid excessive solvent here so that it doesn't run down

into the bearings, but use enough to loosen the encrusted oxide. Again, alcohol is a good choice. Cleaning the capstan and pinch roller is more important than many realize to achieve the smoothest possible transport speed, i.e. freedom from flutter. In fact, if your deck seems to be acting up mechanically, try cleaning the capstan and pinch roller. The problem may be nothing more than that. After cleaning the heads, pinch roller and capstan, give the solvent a few minutes to evaporate before popping in a cassette.

How often should you clean the deck? Obviously, whenever it's dirty. Good recording practice dictates a cleaning before every session whether the deck appears to need it or not. As long as you're careful with the choice of solvent and the pressure that you apply, you're not likely to do any harm. Unfortunately, on some decks, it is very difficult to get access to the heads with a cotton swab for cleaning. Head-cleaning sticks or pencils are available that are sometimes easier to use but, when possible, we prefer the common swab.

3 Demagnetize the Heads

Any residual magnetism that builds up in the head or capstan will partially erase the highs on the recording and increase the noise level as well. The solution is to demagnetize (or "de-gauss") the head and capstan with a "head demagnetizer." This is a device that sets up a strong concentrated AC field in the jaws of an electromagnet. As it is brought close to the head or capstan, it first *increases* the magnetization, but rapidly alternates the polarity. As it is withdrawn, the field drops off gradually (constantly alternating in polarity) until it reaches zero, leaving the head or capstan neutral.

The trick in getting an effective demagnetization is to approach and depart from the head *very slowly* with the demagnetizer. A sudden withdraw-

al may leave the head "hung up" in a state of magnetization that is much worse than what you started with. *Never, never* energize or de-energize the demagnetizer while it's near the head—get it several feet away before it's turned off. And, of course, keep it well away from any tapes while it's on.

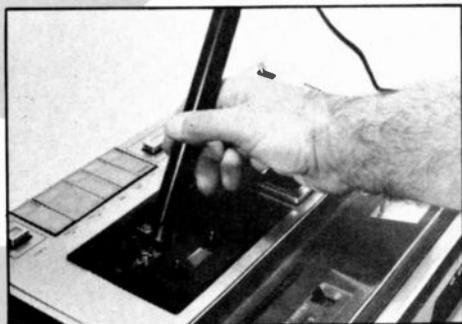
The pole pieces of the demagnetizer should be covered with a soft plastic so that the head isn't scratched. They should also be large enough (and the field strong enough) to cover the track without the need to wave the demagnetizer around excessively. Again, access to the head and capstan of a cassette deck is frequently very limited, and thus the larger, really effective demagnetizers can't be used without disassembly. (Small, pencil-shaped ones are available but have questionable field strength and distribution.)

Although many mavens recommend demagnetizing the heads every 10 to 100 hours—a practice followed by professionals on their decks on which they have ready access to the heads—this practice is questionable. A good cassette head (and capstan) need never build up excessive amounts of magnetism. Rather than take the chance of making matters worse, we'd recommend waiting until there are signs that demagnetization is necessary and then disassemble the deck far enough to use a really effective device.

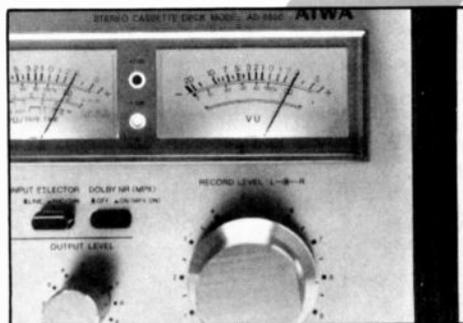
4 Check the Dolby Calibration

The majority of quality cassette decks incorporate the Dolby-B noise reduction system that has made high fidelity cassette recording a reality. When making your own tapes, some

DEMAGNETIZE THE HEADS



CHECK THE DOLBY CALIBRATION



noise reduction system should *always* be used, and, since Dolby-B is, at present, the most popular, you should know how to check its operation.

For the Dolby to function properly, a reference level—the so-called Dolby Level—must be maintained through the record/reproduce cycle. When the deck leaves the factory, the Dolby circuitry has been calibrated for a specific tape(s). Substituting one of a different sensitivity will upset the calibration. Without instrumentation, the easiest way to check if a new tape matches the calibration is to record some of the interstation hiss from your FM tuner, both with and without Dolby, and to audibly compare the results. Here's how.

First turn off the FM mute (if any) on your receiver or tuner. Tune between stations so that all you hear is the rushing hiss. Set the record level so that the meters indicate about -20. Set the tape counter to zero and turn off the Dolby. Record a few seconds of the hiss and turn on the Dolby, making a note of the tape counter reading as you do. Record another few seconds.

Now rewind to the beginning and turn the Dolby off. Play back the tape and listen to the character of the hiss. As you enter the Dolby portion of the recording (as shown on the tape counter), activate the Dolby and compare the sound of the hiss to the previous non-Dolby portion. If they're pretty much the same, you're okay. But if the Dolby portion is notably brighter or duller than the non-Dolby portion, the recorder should be recalibrated to use that tape. Some decks have user-oper-

ated calibration controls, and you can reset it yourself by following the procedure given in the manual. On others, the controls are internal and are meant to be set by a serviceman.

Note that, to check the Dolby, you should compare only the Dolby and non-Dolby portions of the tape with each other—not with the sound of the hiss coming directly from the FM. (However, comparing either of the recorded sections with the original FM hiss will tell you how well that tape mates with the machine in general. A perfect copy will seldom be achieved on any but the most expensive decks, but the relative dulling of the highs will give you an idea of how close to perfection you are.) You'll easily be able to tell when to switch on the Dolby during playback since a Dolby-encoded recording (if played back without Dolby decoding) will be noticeably brighter than the non-Dolby portion.

5 Find the Best Record Level Now, you're ready to record! The most important step in achieving a good recording comes at this point—setting the record level. If the level is set too high, the tape will be distorted and lack highs. If it's set too low, the recording will be noisy. Since the dynamic range of a cassette—the volume spread between the noise level and the overload point—is at this point limited, it's critical that none of it is wasted on an improper recording level.

Your guide to setting level, of course, is the record level meters and/or indicators. However, there is little uniformity in how they work. They vary from one to the next. Determining the foibles of *your* machine will thus require some experimentation. It's usually best to concentrate first on recording a single disc, trying to determine what sort of meter indications give the best results. Choose a disc that contains both quiet and loud passages; your best

bet is a disc with both a lot of transients (percussion sounds, cymbals, etc.) and more musical sounds (voice, strings, woodwinds, and brass). If you have a choice between peak-reading and VU modes of indication, use the peak-reading setting. It's usually a much more reliable indication of overload.

Set the level so that the meters hit zero on peaks, and record. Then record at a little higher level—say +3 dB on peaks—then at a lower setting (not more than -3 dB on peaks.) Play back the recordings, adjusting the volume between sections so that they are of equal loudness, (this is important) and compare the recordings with the original disc. See which one gives you the *best* compromise between noise and distortion. Pay careful attention to the brilliance of the highs (especially the transients) and the clarity and detail of the bass. Dull transients and a muddy bass are signs that the recording level is too high.

Once you've mastered this disc, try another of a different character, say a choral piece or a symphony. You may find that the best recording level differs from one type of music to another. Once you've built up your repertoire, so to speak, you'll know pretty well how to set the level for the particular type of music you're recording. Of course, if you change tapes, you may have to reprogram yourself to discover *its* optimal recording level.

Here are a few tricks to help you. To quickly search a disc for the loudest passages, look at its surface. Because of

(Continued on page 74)

FIND THE IDEAL RECORD LEVEL



CARE FOR YOUR TAPES



DUAL C939 CASSETTE DECK



IT'S PACKED WITH CONVENIENCE FEATURES, INCLUDING A FADE EDIT CAPABILITY

□ If Abraham Lincoln had owned a stereo showroom it's quite likely he would have noted we can please some of the people all the time, or all the people some of the time, but not everyone at the same time. Verily, he would have said something to that effect until he had a chance to try Dual's model C939 cassette deck; then he might have claimed "You can please *almost all the people almost all the time.*"

Fact is, to date the Dual C939 has pleased everyone in our test lab and listening panel for it has at least one feature each has desired in cassette decks at one time or other.

For example, we have always believed that the cassette system should have started out with peak reading meters: the C939 has that feature. Several members of our listening panel who are ex-studio engineers believe that any recording system that is consistently running against saturation should use the "running lamp" peak indicators found in film studios. Well, the C939 has that feature. There are others who would like to be able to erase the end-of-record noises after dubbing from a turntable with automatic recycle, or who would like to eliminate the gurgles of an announcer or deejay who spoils an off-the-air dub by jumping in right

as the record ends. Well, you can eliminate the mechanical and human noises after the recording is over by simply pushing a button on the C939.

If you're starting to get the idea that Dual's latest entry into the cassette marketplace is exciting and different, you're right. Except for the absence of simultaneous record/playback, the Dual C939 has almost every convenience feature anyone could want, and then something extra.

Getting the routine out of the way first, the C939 has Dolby, FM Dolby with separate right and left FM Dolby calibration controls, microphone/line input mixing, tape selectors for ferric, ferrichrome, and chromium dioxide tapes, and a headphone output.

Now for the biggies. Starting off, the C939 has automatic reversing in the play mode (manual record reverse). You can program the mechanism for a single reverse back to the beginning

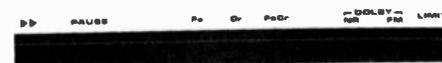
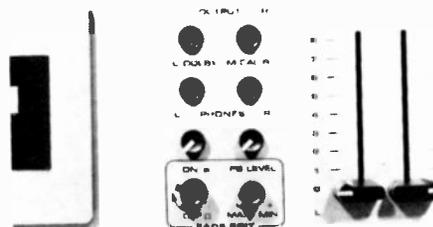
and stop, or program for continuous repeat play.

Dual's C939 cassette deck also offers a fade edit feature, otherwise known as variable erase which is done after the recording is completed. Here's how it works. Assume you have taped from an FM stereo station and before you can close down the input signal, the announcer jumps in with yet another commercial. Two controls on the C939 handle this problem. One control is the fade edit safety switch, the other is the MAX/MIN playback level control, which is actually a variable erase that can be applied during playback. As you play the end of the tape you depress the safety switch and hold it down (it does not lock). As soon as the desired program ends you rotate the playback level control from MAX (meaning *maximum playback*) to MIN (meaning *minimum playback* or complete erasure). You wipe that announcer or any other noise(s) right off the tape, leaving no cracks, snaps, or pops. If you'd like to fade out on the music you simply rotate the playback level control slowly from MAX to MIN. The program starts to fade, the highs get

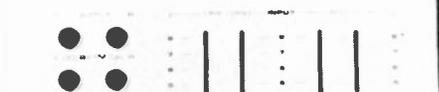
(Continued on page 80)



• It doesn't take much of a look to notice that there's something unusual about Dual's C939 cassette deck. For starters, the tape transport has more controls than usual (to handle the reverse play/record modes) and the VU meters appear to be missing (not so!).

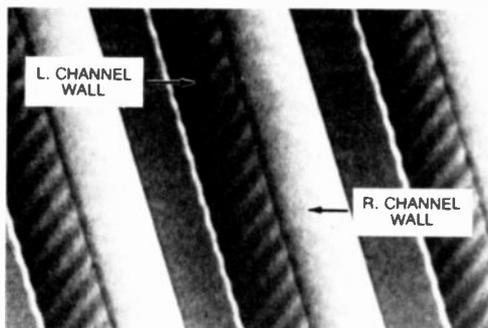


• The C939's fade edit function permits controlled erase during playback. The left-hand control is the safety switch which must be rotated and held down through the entire fade edit operation. The MAX/MIN (at right) determines the degree of erasure or fade out. Above this feature are fingertip controls for headphone level adjustments and screwdriver adjustments for left-right output level and FM Dolby calibration.

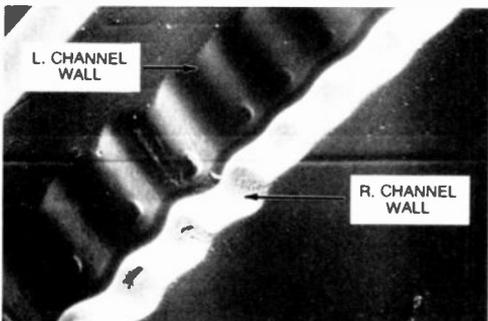


• The recording level is indicated by a light bar consisting of twelve light emitting diodes which are calibrated from -20 to +5 dB. The LED's ballistics can be set for either VU (average) reading or for peak reading by using the VU/PEAK switch centered below the meters.

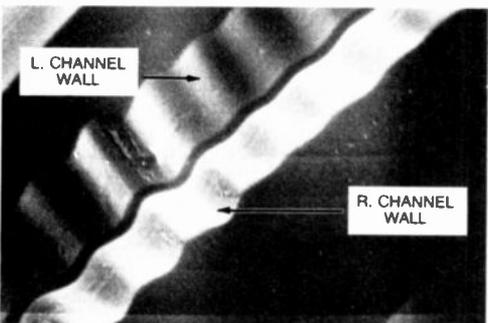
fact: one mistrack damages grooves more than 25...50...even 100 plays.



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



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



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

The Optimist's View:

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

The Terrible Truth:

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

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

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



Shure V15 Type III



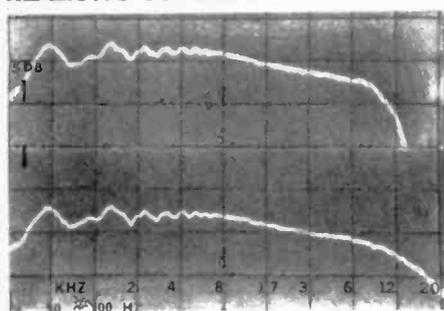
Outperforms the best of the rest

Shure Brothers Inc., 222 Hartrey Ave., Evanston, IL 60204, In Canada: A. C. Simmonds & Sons Limited
Manufacturers of high fidelity components, microphones, sound systems and related circuitry.

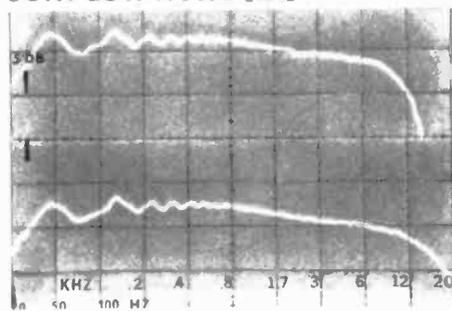
Circle No. 30 On Reader Service Card

BLANK CASSETTE TAPES

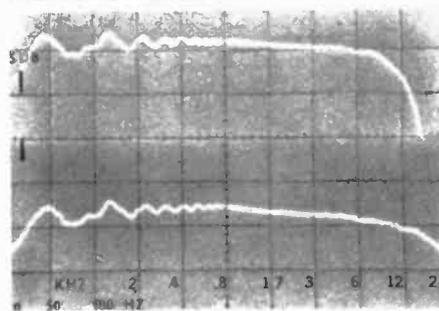
REALISTIC SUPERTAPE



SONY LOW NOISE (LN)

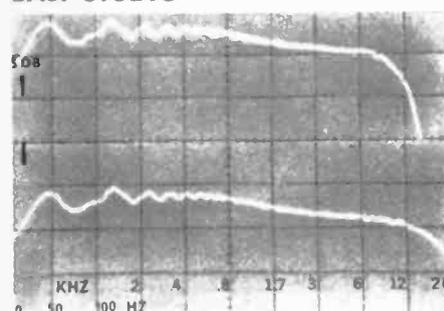


MEMOREX MRX 2

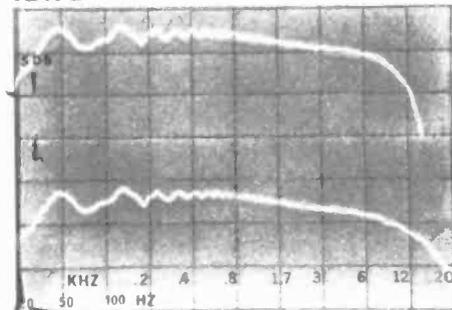


Each illustration in Group 1 and Group 2 (next page) is an oscilloscope trace of a specific tape's frequency response using a 1000 Hz test tone. The top trace was made at the 0-dB recording level and the bottom trace was made at the -20 dB level. The tapes in Group 1 represent lower-cost, better-quality tapes. Note TDK-D, a budget tape which compares well with the others in this group.

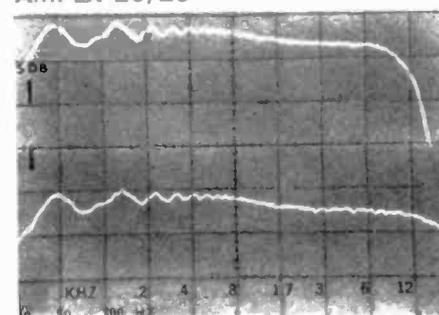
BASF STUDIO



TDK-D



AMPEX 20/20



by HERB FRIEDMAN

□ It's probably our imagination but it often appears that there's some new type of cassette supertape introduced every couple of months. Actually, it's not all that frequent, but eventually the time does come when new tape types and formulations represent a substantial proportion of the available high fidelity cassette tapes, and once again we must take time out to see how these supertapes actually perform in modern cassette recorders.

Note we say modern cassette recorders, not special test jigs, transports or decks with user-adjusted bias and/or equalization. As far as HFSBG is concerned, we are only interested in how a tape performs when used in the type of equipment owned by the typical reader of the HFSBG.

The reason we use typical cassette equipment is that because virtually any tape can be made to deliver excellent to outstanding performance by precision matching of the bias and equalization to the tape. Unfortunately, the very same tape that was optimized on a cassette test jig can turn out to be a dud when used with another deck.

For testing a currently available selection of blank cassette tapes, we decided to use one of the new three-head system machines which provides simultaneous record/play. The three-head system has considerable reader interest, as evidenced by your letters.

The cassette deck selected was the Hitachi D-800, a moderately priced machine that performed well when tested, having overall performance and features typical of what is desired by many HFSBG readers.

The tapes we tested were limited exclusively to the ferric oxide type priced in the \$2-to-\$3-each range, because once again this is the most common choice of our readers. We also did a brief comparison of the ferric oxide tapes compared to the ferrichrome and chromium dioxide formulations, which will also be discussed here.

All our illustrations show only the overload and frequency response characteristics. We do not cover distortion, signal-to-noise ratio and amplitude linearity for several reasons, the primary one being that in these areas the recorder itself influences the distortion, noise and amplitude variations. Most tapes have a better inherent signal-to-noise ratio capabilities than do the re-

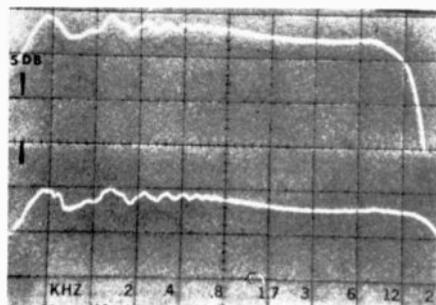
corders; the distortion is more often determined by the calibration of the record level meter (the D-800 has peak meters); and as you will see from the illustrations all tapes have essentially perfect amplitude characteristics—a change in input level of 20 dB is reproduced by all the tapes we checked as 19.5 dB. (The 0.5 dB difference is the tolerance of the test equipment, the recorder, and the tape, and that's remarkably good performance by any standard of measurement.)

Finally, when we come down to the nitty-gritty, most tape fans judge the quality of the tape they're using solely on the basis of "brilliance"—on whether the high and midband frequencies are muddy, hot, or natural. These characteristics are determined by the high frequency saturation level and the average record level (-20 dB) frequency response.

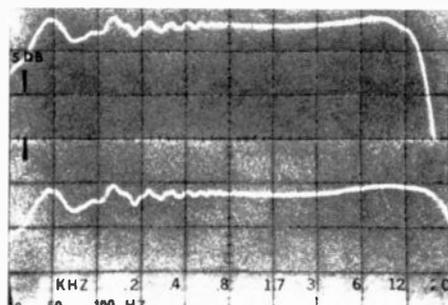
None of what we cover should be considered an absolute *comparison test* of tapes as there is no comprehensive, all-encompassing way to compare or test tapes that can and will be used on many different recorders. We can, however, make some general observations that will apply in many instances where moderate priced cassette decks

WE SHOW HOW A VARIETY OF FERRIC TAPES PERFORM IN A HIGH PERFORMANCE CASSETTE MACHINE

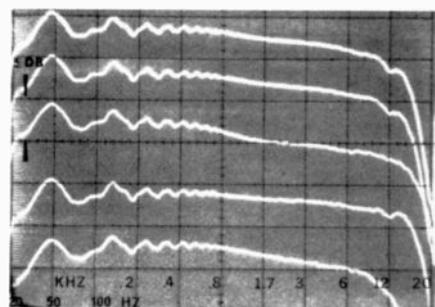
MAXELL UD/XL I



FUJI FX



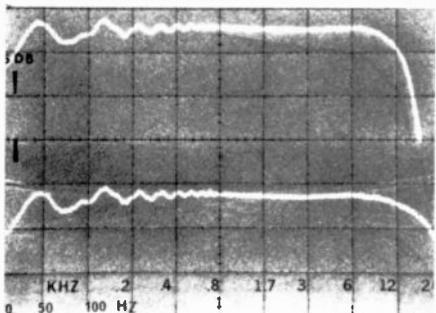
TAPE SATURATION AT 0 dB



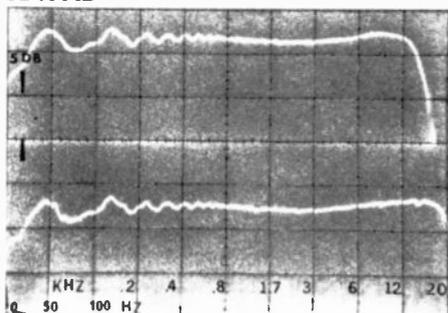
Group 2 consists of "high energy tapes." Saturation with these tapes is in the 8 to 13 kHz range, in contrast with a 6 to 10 kHz in Group 1. Note that Scotch Master I, Fuji FX and Maxell UD/XL are running neck-to-neck in terms of smooth response.

Traces in Fig. 1 show the comparative performances of different tape formulations at the 0-dB record level. Traces have been displaced for the sake of clarity—actual output levels are more similar than they appear here. From the top down the traces represent TDK-SA, Maxell UD/XL II, a ferrichrome tape, a chromium dioxide tape and a typical ferric tape. Bias and equalization were readjusted for each tape. A detailed analysis of Fig. 1 may be found in text.

SCOTCH MASTER I



TDK-AD



are involved.

In particular, it should be pointed out that the Hitachi D-800 has nominally 10 dB headroom above the 0-dB record level to 3% THD when using 1000 Hz test tone. Keep this 10 dB headroom in mind as you study the 0-dB high frequency saturation illustrations; they represent performance you will rarely attain on the average moderate priced recorder until stereo-ophiles insist on proper record level meters (the peak reading type).

A Look At the Traces. Each illustration is photographed directly from an oscilloscope. The horizontal sweep is 20 to 20,000 Hz. Each major vertical division represents 5 dB, each minor vertical division is 1 dB. The top trace was made at the 0-dB recording level. The bottom trace was made at the -20 dB recording level, the level generally used to test cassette frequency response. Only the illustration with five traces is not part of the comparisons; it is a special illustration of the performance of different tape formulations we will cover later in this article.

All illustrations were made at exactly the same recording input level, with no change in the recorder's output level control. All illustrations, there-

fore, are an accurate reflection of comparison output levels. Note that at the midband reference frequency of approximately 800 Hz there is less than 2 dB difference in output level between all the tapes.

The adage "you can't get something for nothing" holds true here. You don't get higher output without an increase in input. Thus, if you plan on spending extra money for a "higher output" tape you're wasting time, effort, and money; there is no such animal.

What the Traces Show. The tapes indicated as *Group 1* include many older formulations and are representative of the lower-cost, better-quality tapes. Some are usually offered in a special 2-for-1 deal, or some similar dollar-saving package. Most have 0-dB record level high frequency saturation in the 6 to 10 kHz range. In particular, note the TDK-D, a budget tape that holds its own with most others in Group 1. The Ampex 20/20 appears to be a new formulation and gives considerably better performance than the 20/20 we looked at last year.

The Group 2 tapes are what many call "high energy tapes", a euphemism for *hot highs*. Fact is, unless the recorder is adjusted for the highs, or has

a bias/equalization selector that includes a UD or high energy setting, the boosted high generally interfere with (to put it mildly) the Dolby tracking. The high energy tapes are at the top of the price range, often about \$1 more per 60 or 90 minute cassette than those in Group 1, though somewhat less expensive than the super-performance tapes such as ferrichrome, chromium dioxide, the UD/XL types 1 and 2, and SA.

When the recorder is factory-adjusted through a permanent or switch selected bias/equalization for the high energy tapes, we attain an essentially "flat" response with extended high frequency range at both the 0-dB and -20 dB records levels, as shown in our Group 2 illustrations. Saturation is now found in the 8 to 13 kHz range, with TDK-SA having essentially no saturation up to 12 kHz. Note that some of the Group 1 tapes closely approximate the Group 2 tapes, in particular Memorex MRX₂. We have arbitrarily placed in Group 2 those tapes whose 12 kHz saturation response is within 3 dB of the midband response when used with the D-800 machine. It happens to work out that the 12 kHz saturation limit also represents a considerable difference in price, particularly so when purchasing several tapes.

It should not be inferred that Group 2 tapes are necessarily better than Group 1 tapes for all machines. We

(Continued on page 77)

YAMAHA CR 2020 STEREO RECEIVER



CONVENIENCE FEATURES ABOUND AND PERFORMANCE IS FIRST-RATE

□ Features, features, and more features, is the best way to describe Yamaha's new high performance AM/FM stereo receiver, the model CR2020. Whether you look at the left side of the front panel, the right side, or even the center, you'll run across an operating convenience that can really make a difference in final sound quality. For example, it's possible that you have gone through the experience of wanting to try a moving coil (MC) phono pickup only to find your amp doesn't have enough input gain. With the CR2020 that's not a problem because one of the two magnetic phono inputs is designed for use with MC (moving coil) pickups. The flick of a switch activates a *head amplifier* specifically intended for MC pickups.

You may also have noticed that PLL (phase locked loop) FM circuits aren't necessarily all they're cracked up to be. When the receiver is precisely aligned PLL is quite effective; but (and it's a big *but*,) PLL is extremely critical in terms of precise tuning for minimal distortion. If the meter isn't exactly in the center of a relatively broad meter scale area indicated as "the center," often the signal is not really tuned for least distortion.

In the Yamaha CR2020, an automatic FM fine-tuning circuit, which Yamaha calls OTS for Optimum Tuning System, automatically sets the tuning for optimum reception with their PLL.

The tuning knob serves as a touch sensor for the OTS. When the knob is touched, the OTS is automatically disabled so the user can manually adjust for best tuning; when the hand is removed from the knob the OTS is automatically activated, which tweaks the electronic tuning for optimum reception. As detailed in the test report elsewhere in this issue, OTS produces *precise* FM tuning—you cannot do better manually. This is something that cannot be said for many of the FM automatic frequency control circuits.

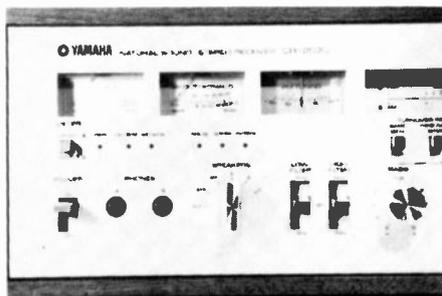
The tuning knob's electronic sensing switch also controls the signal strength meter used for AM tuning. Adjacent to the FM center-channel meter are two output power meters calibrated from 0.1 to 200 watts into 8 ohms. The right hand meter also serves as the AM/FM signal strength meter. When the hand touches the tuning knob, the right hand meter is automatically switched to serve as a signal strength meter, with maximum signal strength representing optimum tuning for AM. When the hand is removed from the knob, the meter automatically switches back to a power output indicator. If you want the meter to continuously indicate signal strength (even with your hand off the tuning knob) you simply depress a front panel switch labeled SIGNAL Q.

Another *biggie* in the convenience

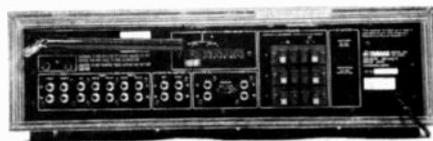
department is separate selectors for the amplifier and the tape recorder(s). These allow the taping of a signal source other than the one being monitored. For example, you can listen to FM while taping a record, or while making a dub from one recorder to another. In addition to having all signal sources on the tape recorder selector, the tape recorder(s) can be switched to PRE, meaning the pre-amplifier's output with the monitored signal source after processing by the tone, filter, and volume controls.

For signal processing the CR2020 has dual turnover frequencies for the bass and treble tone controls, and a *presence* tone control. The bass turnover frequencies are 125 and 500 Hz. The treble turnover frequencies are 2500 and 8000 Hz. The presence control's center frequency is 3000 Hz rather than the more common 1000 or 1500 Hz. It produces considerable brightening of the signal, and is one of those *effects* you like or dislike purely according to personal preference there appears to be no middle ground where you can take it or leave it. Most of our

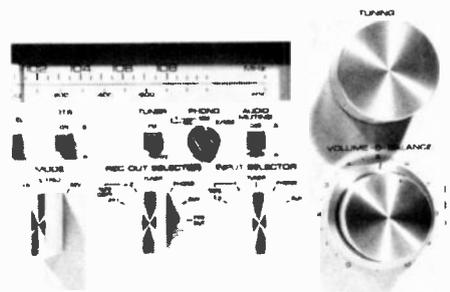
(Continued on page 75)



• The right hand power output meter also serves as an AM/FM signal strength meter. It is automatically switched to signal strength when the tuning knob is touched. It reverts to a power output indicator when released. The small switch on the extreme left provides continuous signal strength metering when set to the SIGNAL Q position.



• The rear apron connections of the CR-2020 are about as straightforward as possible, with no complications caused by the convenience features.



• The REC OUT selector is the feed to the recorders. It is totally independent of the amplifier's INPUT selector, which makes it possible to record one signal source while listening to another. Two phono input options are provided. The #1 input can be used with moving coil or standard magnetic pickups—with its use a head amplifier providing extra gain is switched into the input circuit.

HIGH BIAS.

**These cassette deck manufacturers use SA
as their reference for the High(CrO₂) bias/EQ setting:**

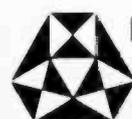
AIWA • AKAI • CENTREX • JVC
KENWOOD • MERITON • NAKAMICHI
OPTONICA • PIONEER • ROYAL SOUND
SANSUI • SHARP • TEAC • TOSHIBA
UHER • YAMAHA

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

BANG & OLUFSEN • DUAL • FISHER
HARMAN/KARDON • LAFAYETTE
SANKYO • TANDBERG
AND MANY OTHERS.



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

 **TDK**[®]

The machine for your machine.

TDK Electronics Corp., 755 Eastgate Blvd., Garden City, N.Y. 11530.

In Canada: Superior Electronics Industries, Ltd.

JANUARY/FEBRUARY 1978

Circle No. 20 On Reader Service Card

□ Despite the burgeoning of cassette tape decks, open reel recorders are still very much on the scene. While the number of companies making them has dwindled to only one third of those doing so in 1970, these companies are admirably filling the needs of audio buffs who still regard the reel recorder as the means of attaining the best possible sound quality in tape form.

A check of current directories shows that the overall pricing of reel tape decks meant for the consumer (*vis à vis* professional/broadcast) market has matched that occurring in cassette decks—a sharp movement upward. Of 46 models checked in nine brands, 16 were priced over \$1,000, with one unit tagged at a whopping \$2,495!

By the same token, the inexpensive stereo reel recorder of 1970—the \$140 seven-inch-reel model—has vanished from the scene, with one model at \$350 (Akai) and one at \$400 (Uher) representing the lowest-priced brand-name units currently being manufactured.

The accent in reel equipment today

is on “professional” attributes. The quintessence of it is 10½-inch reel capacity, three or four tape heads, three-motor transports, mixing facilities, frequency response ranges averaging 30 Hz to 22 kHz ± 3 dB, and a *lack* of Dolby noise reduction circuitry. (Dolby is generally regarded as superfluous since pro-quality reel equipment frequently offers basic high signal-to-noise ratios attainable only with the help of Dolby in cassette equipment.)

Many of the high priced reel models are being used as the nucleus of small, budget recording “studios” in the homes of audio aficionados, would-be recording engineers, and musicians seeking to perfect a type of individual “sound” (“live” or electronic) that will hopefully bring them fame as performing/recording artists. Especially popular are four-channel models that enable a recordist to easily produce basic multi-track recordings of near-professional calibre.

However, if you’re an average audio-ophile merely looking to make

first-rate recordings *simply*, without all the “bells and whistles” attendant to professional-type reel machines, you have a fair choice of equipment.

The models we’ll discuss cover various price levels and features and are generally representative of tape products in a given line. Included are recently-introduced models, bestsellers, classics, and models expected to become classics once their merits are known, or after they have established a “track record” (no pun intended) in actual, prolonged use.

Akai’s best selling reel recorder is Model 4000DS Mk2, priced at \$350. It was described by a spokesman as “A good machine that offers the features of more expensive models at a budget price.” It has three heads, two-lever tape movement control system,

REEL TO REEL
A LOOK AT WHAT'S



Technics' Isolated Loop RS-1500US open reel tape deck includes a stroboscope which serves to indicate the high degree of tape speed accuracy of which this machine is capable. \$1500. For details, circle Reader Service No. 98. Sony's TC-880-2 (\$2495) has a phase compensator circuit which is designed to correct phase distortion created while recording. Circle Reader Service Number 96 for details.

microphone/line mixing, sound-on-sound, sound-with-sound, pause control, dual monitoring, and total automatic shutoff. S/N ratio is better than 56 dB. Akai's next best seller is the GX230D, priced at \$585. It is a three-head, three-motor job for the buff who wants "more in versatility and

(Cont'd on p. 76)

MACHINES

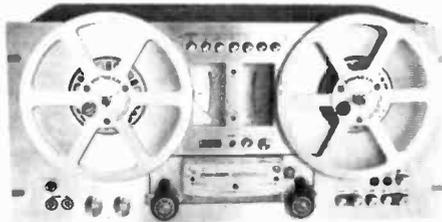
AVAILABLE FROM WHOM



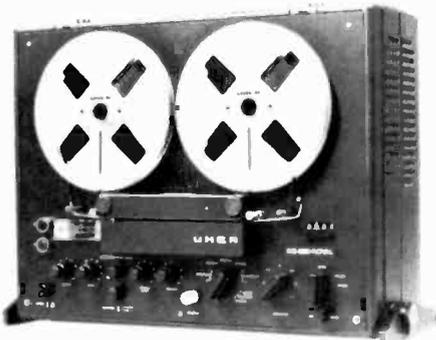
The Revox B77 accommodates both 7-inch and 10½-inch reels and is designed to provide 24 dB headroom for both record and play modes. Price: \$1195. Write Studer/ReVox, 1819 Broadway, Nashville, TN 37203 for details on this tape machine.



Philips N 4504 is a three-head, three-motor tape recorder which sells for \$450. Its signal-to-noise spec is 60 dB or better at 7½ and 3¾ ips. It accommodates 7-Inch reels. Circle Reader Service No. 84.



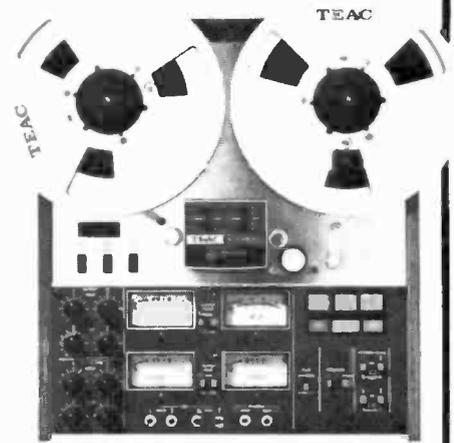
U.S. Pioneer offers this compact 7-inch-reel machine (RT-707) at a price of \$575. It operates at 7½ or 3¾ ips, includes variable pitch control of ±6% and an automatic reversing feature. Details are available; circle Reader Service No. 85.



Uher's SG 560 offers 4 operating speeds and a 10-watts-per-channel-into-4-ohms stereo amplifier section at a price of \$1020. For details, circle Number 132.



Akai's 4000DS Mk II accommodates 7-inch reels and also offers a choice of 7½ or 3¾ ips tape speed. It has a 3-head system which includes a one-micron-gap playback head. \$350. Circle Number 62.



TEAC's A3340S (\$1200) features "Simul-Sync" for multi-track recording and over-dubbing and a manual cue device. Circle Reader Service Number 10 for details.

ELCASET ELCASET ELCASET ELCASET

Four units are available
in this new format.

Technics' RS-7500US (right)
comes with three blank
tapes. Reader Service No. 98.

TEAC's AL-700 accepts an
outboard optional dbx control.
Reader Service No. 10.

Sony's EL-7 (above) is
a 3-head, 3-motor machine.
Reader Service No. 96.

JVC's LD-777 (left) has
Super ANRS noise reduc-
tion. Reader Service No. 73.

□ A relatively new cassette tape format combining the attributes of the Philips cassette and open-reel tape is beginning to attract some attention out in audioland. Called "Elcaset"—short for large cassette—the new system is a joint effort, involving Sony, TEAC, and Matsushita Electric plus JVC, a subsidiary of Matsushita. All are marketing individual versions of Elcaset machines.

Basically, Elcaset is a king-size cassette measuring about six by four inches, versus about four by two and a half inches for the Philips cassette. It is three-quarters of an inch thick; the Philips is a half-inch thick. The Elcaset runs at 3¾ ips; the Philips at 1½ ips.

In the new format the tape transport is responsible for accurate movement of the tape past the tape heads. The tape is "pulled" out of the Elcaset and moved between guides built into the transport. In the Philips system, tape movement accuracy is controlled by guides built into the cassette.

Like its predecessor, the Elcaset is stereo/mono compatible, with a stereo pair of audio tracks laid parallel on one-half of the tape in each direction. In mono operation one track would occupy one-half of the tape. In playback, a stereo tape could be played monophonically, a mono tape stereophonically.

Further, there is space running along one edge of the tape to accommodate a narrow sound track that could be used as a control channel, for program automation or slide-changing.

Both the Philips and Elcaset offer automatic accidental tape erase prevention. The Elcaset additionally offers automatic tape bias/equalization selection for three types of tape, and automatic Dolby or other noise reduction system selection.

The Philips cassette is typically available in recording times of up to 120 minutes. Elcasets come in 60 and 90-minute lengths (30 and 45 minutes per side, respectively).

Elcaset's combination of faster speed and wider tape (quarter-inch) offers a substantial potential for better sound recording and reproduction than the Philips concept. All conditions being equal, a recorded Elcaset will have a better signal-to-noise ratio, wider dynamic range, broader frequency response, and lower distortion because of greater "head room" in the recording process which lessens chances of over-saturating tapes.

All told, you can get open-reel sound quality from Elcaset at the comparable speed of 3¾ ips, but with much greater ease of handling.

Following are the current models of Elcaset you're likely to find at your local audio emporium. (Since all Elcaset machines operate in a similar fashion, we've limited descriptions to highlight details only.)

JVC's model LD-777, priced at \$800, has features which include ANRS noise reduction, two SEN-Alloy heads plus

(Continued on page 82)

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BOTTOM DOLLAR BUYS

LESS THAN \$600
AND A LITTLE
KNOW-HOW
CAN GET YOU
HIGH FIDELITY
ON A BUDGET.

by FRED PETRAS

One of the economic truisms that applies to all hi-fi purchases is that you get what you pay for. Buy cheap and you get cheap. Buy higher and you get something better. Pay top dollar and you get top quality.

But at what budget point do you get real hi-fi? Talk to a dozen people and you'll get a dozen different answers. Some buffs claim that you can get a Grade A component system (receiver/turntable/speakers) for \$300 if you shop around a bit and are in the right store at the right time. Some will tell you that \$500 is about as little as you can spend to get Grade A sound. And others will pontificate that "at \$750 you get only mid-fi; true hi-fi costs at least \$1,000."

However, "listen" to several hundred music lovers by way of warranty card returns (which is the way manufacturers get a fix on what the consumer is buying and what brands he's buying) and a pattern evolves. The majority of the returns will tell you unequivocally that it is possible to get Grade A sound from a component system that sells for \$500 to \$600.



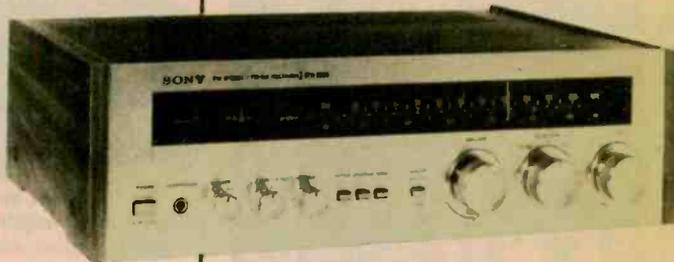
Kenwood's KR-3600 is a 22 wpc receiver with a maximum stereo signal-to-noise ratio of 68 dB. \$250. Circle No. 74.

Fisher's RS 1022 receiver puts out 22 watts per channel with less than 0.5% THD, 20 to 20,000 Hz. \$250. Circle No. 69.



Onkyo's TX-1500 is a \$200 receiver. It offers 15 wpc with less than 0.5% THD, 20 to 20,000 Hz. Circle R S No. 81.

Sony's STR-2800 receiver—offering 20 wpc, less than 0.5% THD, and up to 68 dB S/N—sells for \$215. Circle R S No. 93.



There are two basic approaches to buying a system in the \$500 to \$600 range. One is to buy a "prepackaged" system as offered by several manufacturers. The other is to pick your own.

Buying prepackaged systems is the easy way. Walk into a department store or appliance outlet and there they are, all set up waiting for you to "give a listen." You select the system best suited to your budget, listen briefly to how it sounds, and if you like what you hear, tell the clerk, "OK, I'll take this one." You'll get a legitimate stereo system for the \$500 to \$600 you've spent.

But the one thing that you won't get is a sense of identification, of involvement, a sense of "I created this system." And the package won't be tailored to your individual needs. If you have even a modicum of creativity in your makeup, a prepackaged system, no matter how great a value, how great it sounds, will always leave you feeling a bit unfulfilled, a bit dissatisfied. If that's the type of person you are, the choice is clear—you must make the selections.

Initial Decisions. Where to begin?

First off, you must determine the type of system you want and need. The traditional hi-fi rig consists of receiver, turntable, and a pair of speakers. It offers reproduction of radio broadcasts and phonograph records. But there are variations. One is a combination of a receiver only and speakers, or tuner/amplifier/speakers, which is all you need if you want to confine your listening to radio broadcasts. Another possibility is integrated amplifier/turntable (or cassette deck)/speakers, if you listen only to records (or tapes). Still another is receiver/tape deck/speakers, if you prefer radio broadcasts and tapes only.

In deciding what combination of elements would best suit your needs, one crucial thing to consider is your geographical location. If you live in a sparsely populated area where FM is a limited, local-area proposition, consider a tuner/amp combination instead of a receiver as the nucleus of your rig. In this case, the tuner could be a budget model, allowing you to come in at the \$500 level instead of \$600, or giving you leeway to buy a higher pow-

ered amplifier. In evaluating your tuner, consider this immutable fact: the FCC limits the FM spectrum to 30 Hz to 15 kHz—a range encompassed by even the least expensive of the hi-fi-rated tuners in the market place.

On the other hand, if you live in a crowded area that's packed with a wide variety of FM stations, you'd probably want to do the opposite—lay out a greater portion for the tuner to obtain top selectivity so you can pick out all the stations you want to audi-

BOTTOM DOLLAR BUYS



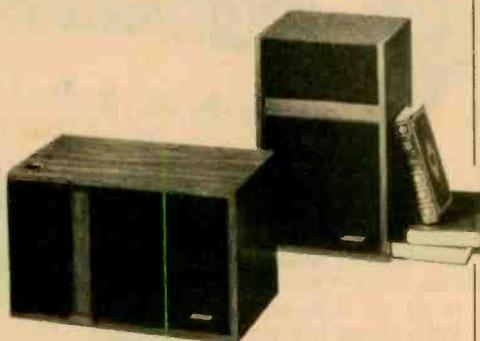
Ohm's E speaker is a two-way model with an 8-inch woofer and a 2-inch midrange. A minimum of 10 wpc is recommended to drive it. \$100 each. Circle No. 130.



Acoustic Research's AR-15 employs an 8-inch woofer and a 1-inch tweeter. Recommended minimum amplifier power is 15 wps. \$130 ea. Circle Number 60.

tion. A related spec to look for would be a low capture ratio figure, preferably under 2 dB. Many of these considerations could also be applied to decisions made regarding a receiver selection.

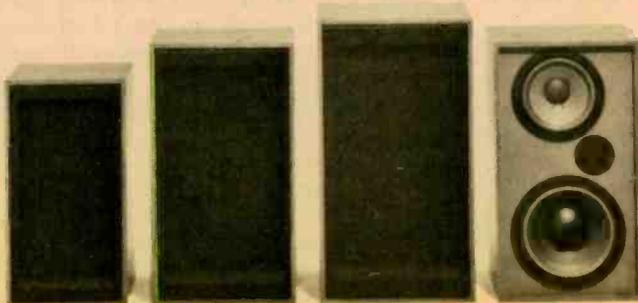
A Classic Rule Of Thumb. The type of system you choose will determine how you apportion your dollars. Assuming you will spend \$600, you might follow the classic formula of allotting about 60 percent for the combination of receiver and turntable, and 40 percent for speakers. That would suggest a receiver priced at about \$220, a turntable at about \$140, and a pair of speakers for about \$240. Using the same formula, a receiver/speakers combo would consist of a \$360 receiver and \$240 speakers. A tuner/amp/speakers combination using the same



The Bose 301 speakers sell for \$218 per pair. They require 10 watts minimum amplifier power and include three tweeter elements with crossovers at 1, 2, and 3 kHz. Circle Reader Service Number 65.



Avid's Model 80 speaker has a power handling capacity which ranges from 8 to 60 watts per channel. Its frequency response spec is 55-17,000 Hz \pm 3.5 dB. \$80 each. For details, circle Number 135.



Electro-Voice offers the Interface 1, 2, and 3 speakers at \$100, \$140, and \$170 each, respectively. All need at least 3.6 watts of power. To get details, circle No. 123.

equation would allow about \$180 each for the electronic units and the same \$240 for speakers. The breakdown of an amplifier/cassette deck/speakers trio would be along similar lines: \$180 each for the amplifier and cassette machine and \$240 for speakers.

Obviously there can be many other variations, to accommodate personal preferences and needs, as well as the vagaries of the marketplace, namely availability and pricing in your shopping area. Also, other considerations might influence your preferences in a way that will make you digress from the pat formula we've just discussed.

Experts agree that there is one element that should be favored if a precise percentage/dollar balance can't be achieved. That favored element is the speakers. Why? Specs for amps, receivers, tuners, turntables, and tape decks can be reasonably equated on a dollar-for-dollar basis; but speakers cannot—they're far too subjective a matter. In fact, some experts advise that you first spend a lot of time listening to find the speakers that sound right to you, then apportion and select the rest of the system accordingly, making sure that the receiver or amp you buy has enough power to drive the speakers to optimum listening quality/volume levels. Using this approach can surprise you. For instance, you may find the speakers you like cost twice what the classic formula suggests. On the other hand, they might cost far less, enabling you to spend more on the other ele-

ments—or saving money and buying at less than your proposed budget.

The rule for speakers is: don't skimp. Do not skimp in terms of dollar cost, and don't skimp on the amount of time spent evaluating them. Listen to as many models as possible, both *below* as well as above your budget apportionment. On the one hand, you may be surprised to find that *for your ears* certain speakers at \$180 the pair are just what you wanted. On the other hand, you may find that none under \$400 the pair turn you on. We say don't skimp, yet suggest listening below budget at the expense of sounding contradictory; unlike electronic equipment which has measurable specs that translate out to audible differences, speaker specs are far less precise and can be misleading. Right off, many specs are related to anechoic chamber reproduction measurements. Speaker systems in practical terms are used in living rooms, dens, rec rooms, etc.—all of which make speakers sound different than in an anechoic chamber. There is also the aspect of drive power and speaker efficiency and how balanced the equation is. An efficient speaker powered by a low-output amplifier can sound first-rate; with a higher output amplifier it may sound even better. A low efficiency speaker with inadequate driving power may sound distorted; with the proper amount of power it will sound first-rate. It is possible to find speakers at moderate prices that to *your ears* and under *your* listening room conditions

and with *your* particular amp/receiver sound better than models at twice the price in another listening environment with differently powered amplifiers or receivers.

Earlier, we mentioned various dollar/percentage allotments for different types of hi-fi systems. These percentages should guide you in attaining a balanced system in terms of overall quality and operating capability. For instance, you don't buy a \$350 receiver and \$300 turntable and expect hi-fi sound from them played through a \$50 pair of speakers carrying the "Far-Out Sound" label of a local entrepreneur whom you like because he is active in local community affairs.

Another word of caution: you'd do well to avoid any but nationally distributed, advertised and serviced speaker systems bearing names recognized as specialized speaker manufacturers. Many hi-fi system purchasers succumb to buying "private label" or "house" speaker systems which may sound fine during a quickie audition with selected program materials in the demo room. Many such speakers tend to show up their inadequacies during extended listening periods in your home when they're asked to handle a wide variety of music. The reason is that often house-brand speakers are made with lesser quality materials. As noted, speaker specs are hard to measure, and often the unsuspecting buyer is the victim when he feels compelled to make a hasty decision. Don't allow

anyone to convince you that heavy magnets are a sure sign of quality, or that four elements in a speaker are necessarily superior to "only three," or that the six-inch midrange is superior to "only a three-incher." And take as much time and thought as you want to take in deciding on the speaker system around which the rest of your system will be built.

Alternative Ways to Select. Keeping case of selecting a receiver/speakers this in mind, let's move to a typical combo but not sticking to the \$360/\$240 formula. You've looked around and you see two receivers, one at \$370 offering 50 watts per channel output, the other at \$280 offering 30 watts per channel. Who needs 50 watts? you ask yourself. And you may be right, you may not need them. Conditionally, set aside the \$90 differential. (You could buy 20 LPs with that!)

You check around for speakers and it's a tossup between a pair in Brand E and Brand A, the former priced at \$298 the pair and requiring a minimum of 15 watts of amplifier power, the latter at \$199 the pair and requiring 30 watts of drive power.

This could be a ticklish choice. The \$280, 30 wpc receiver and \$298 speakers would tally \$578. It would be an ideal combination, leaving a 15 wpc "reserve" for demanding, unusual program materials. The \$280 receiver and \$199 speakers combo would cost \$99 less, and on the surface, would appear to be a match, in that the power output of 30 watts matched the minimum needs of the speakers. But we'd say No to that combo. It might work well under ordinary listening conditions, but if the program material happened to be "difficult"—with lots of heavy transients, for example, you might run into noticeable distortion. Or if you moved and your new listening room was larger you'd be pushing to distortion levels in trying to fill it with sound. If you really preferred the \$199 per-pair speakers, we'd suggest that instead of trying to save \$90 you step up to the 50 wpc receiver for a total outlay of \$569 and have a tidy 20 watt per channel reserve for the times you have to reproduce tough program materials, or fill a larger room to pleasurable listening levels. And you'd still be \$31 under budget.

To give you an idea of how big a cornucopia you have to choose from, here's a run-down on availabilities by product category of equipment that could go into a \$500 or \$600 hi-fi system. Prices given are suggested list, or "national advertised value"—designations that are *usually meaningless* in



Technics' SL-2000 is a direct-drive turntable whose servo motor is controlled by one IC chip. Its features include a direct-reading anti-skate device and an illuminated stroboscope. \$149.95. Circle Reader Service No. 98.

Pioneer's PL-115D belt-drive turntable offers automatic return and an anti-skate device. The phono cartridge headshell is a plug-in type. It sells for about \$125. For details, circle Reader Service Number 85.



Rotel's RP-2300 is a belt-drive turntable whose features include automatic return and shut-off and an anti-skate device. Its price is \$130. Circle No. 87 on the Reader Service Card.



the marketplace in that dealers actually set their own prices, most often lower than list or advertised value. This information is from a major directory, listing currently available equipment in nationally advertised brands.

Receivers: At least 20 in the \$190 to \$240 range, with eight offering power outputs of 20 to 26 watts per channel, 12 offering 15 to 18 wpc. (We consider 15 wpc to be the minimum if you expect to keep distortion within hi-fi bounds.) Check the following brands: Akai, Craig, Fisher, Harman/Kardon, Hitachi, JVC, Kenwood, Nikko, Onkyo,

BOTTOM DOLLAR BUYS

Pioneer, Rotel, Sansui, Sanyo, Scott, Sherwood, Sony, Superscope, Toshiba.

Amplifiers: At least 35 in the \$120 to \$300 range. Ten under \$200 have outputs of 15 to 40 wpc; 22 between \$200 and \$289 range from 25 to 60 wpc; and three models at the \$300 level offer 55 to 60 wpc. Start your search with these lines: Akai, Dynaco, Fisher, Harman/Kardon, JVC, Kenwood, Nikko, Onkyo, Optonica, Pioneer, Rotel, Sansui, Sanyo, Scott, Sony, Toshiba.

Tuners: At least 27 in the \$100 to \$250 range, with 12 between \$100 and \$195, 11 between \$200 and \$230, and four at \$250. Consider the above-listed manufacturers for starters.

Speaker Systems: At least 135 in 68 brands in the \$80 to \$150 each price range. Audition some of these manufacturers offerings: Acoustic Research, Advent, Altec, Avid, B.I.C. Bolivar, Bose, Cervin-Vega, Electro Voice, Epicure, Frazier, Jensen, Ohm, RTR, SAS, Ultralinear, Venturi, Yamaha—all of

whom offer a pair of \$240 speakers.

Turntables: At least 23 belt-drive, single-play models priced from \$120 to \$160; check for Dual, Fisher, Hitachi, JVC, Lenco, Marantz, Micro Seiki, Rotel, Sony, among others; three direct-drive single-plays at \$150 to \$160 (in the Technics, Hitachi and Rotel brands).

Cassette Decks: At least 41 in a price span of \$150 to \$250, with nine ranging from \$150 to \$180, seven at \$200, 16 from \$219 to \$230, and nine at \$250.

When selecting equipment don't let anyone "railroad" you into buying a higher priced model by succumbing to a fast-paced delivery of *specificationese*. Listen critically to specification comparisons. Ask yourself whether there is an audible and significant difference between the two units. If there's any doubt in your mind, take the spec sheets of both units home and evaluate them carefully at your own leisure. Refer to back issues of HFSBG for advice on evaluating specs for receivers, tuners, amplifiers, or check this issue for tape equipment information and decide what unit is best suited to your needs.

A Final Note. You can often end up with more for your dollar if you don't need or want your system immediately. Take your time and study your local or regional marketplace, getting an idea of what you want, and what the prices for it are at various stores. Then sit back and wait. Invariably, within a month or two, you'll see one of the units of your proposed system go on sale at a hefty saving. Then's the time to buy it. Or, rather than putting the differential in the bank, you might opt for the model next step up the scale—an amplifier or receiver with, say, 10 more watts of power for a greater reserve, or with a better THD spec. Or a turntable with a greater degree of automation, better wow/flutter spec, etc. Sales in the audio industry are common, result of heavy competition, and the fact that the industry is always on the move technologically. A receiver may go on sale because a manufacturer has decided to redesign it cosmetically to make it stand apart from an equivalent model in a competitor's line. Or the company may have achieved one or two somewhat better specs and feels the improvement is enough to warrant a model number change and a slightly higher price. Or it may be model change time (late summer, early fall), when clearance sales abound throughout the audio industry. If you can wait for such sales, you'll be ahead, either in savings or more for your money. ▲



Optonica's ST-1515 tuner sells for \$179.95. Its features include air check / muting switch and signal strength and tuning meters. Get details with R S No. 133.



Nikko's NT-850 integrated amp offers 60-watts per channel with less than .05% THD. A/B speaker switching. \$250. Circle No. 115.



Sansui offers 3 new pieces: the TU-217 tuner (top) for \$175 (S/N: 71 dB); the AU-117 integrated amp (\$160) offering 15 wpc; and the AU-217 integrated amp with 30 wpc with less than .06% THD (\$190). #89.

Opera

For Today

Maria Callas

□ The death of Maria Callas of a heart attack in Paris on September 16 not only came as a shock to most opera lovers but it

a few stray performances here and there until her final Norma's in Paris, in 1965. 1947 to 1965 is almost a 20-year span, and



Maria Callas' scales were always faultless, and her trill was probably the most natural of any singer in recent times.

caused many of us to re-think what she has brought to opera. From a historic point of view Callas revitalized the bel canto repertory (many of the works of Rossini, Donizetti and Bellini, plus a lot of early Verdi) which had languished for decades untouched. She also re-discovered several classical works such as Cherubini's *Medea* which to a certain degree she put on the operatic gold standard and brought uniquely intense qualities to most of the standard Verdi and Puccini operas.

She did all this in one of the shortest important careers. Her international debut was at the Verona Arena in *La Gioconda* in 1947, and she last opened La Scala in 1961, singing

that gives an implication of too many years. Her great years, that is the years in which she was singing frequently in remarkable voice, were only from 1950 to 1959, and the startling fact about those years was her age: born in 1923, her career was at its height only from the age of 27 to 37. If that doesn't shock you, note that Kirsten Flagstad and Birgit Nilsson both made their Metropolitan Opera debuts (and their major rise to international stardom) when they were 42, and Joan Sutherland's burst of fame in 1960-61 came when the great Aussie was in her thirties. But brevity means little: Callas flashed like Haley's comet in the operatic sky, and there were

three areas in which she was influential. Her voice, though not as great a natural instrument as say, Miss Sutherland's, was infinitely better than one would imagine in reading most of her obituaries. She had at one time almost three usable octaves; she was a soprano "sfogato" or an unlimited soprano with a great amount of technique. Her scales were always faultless, her trill was probably the easiest and most natural of any singer in recent times, and her line and legato could give lessons to most singers. The reason her voice is often downplayed is because it was not often conventionally beautiful. There was a marked difference among the more metallic top, the soft, rich middle



Callas will also be remembered for her instinctive use of her wonderful eyes and long, shapely hands.

and ominous lower register, and Callas was never concerned with making a beautiful sound just for beauty's sake.

This brings us to the second reason for her greatness. Callas believed like Arturo Toscanini in



Maria Callas believed in the sanctity of written music; she sang every note as the composer requested it, even if it was difficult for her.

the sanctity of the music as composed, and she always sang every note. If the sound was difficult for her, if it wobbled—as her top did with increasing frequency toward the end of her career—it made no difference to her. She sang the note as the composer requested it, in the right rhythm. And even more importantly, she infused the words of each libretto with shades upon shades of meaning. In that respect she was sovereign.

Italian opera before her time, prior to perhaps 1937 or so when Rosa Ponselle's retirement marked the end of one era, had few singers who knew how to infuse the words of the recitative with all the meaning of the opera's dramatic plots. Callas took these recits and acted them vocally in such a way that suddenly Lucia or Elvira in *Puritani* or Amina in *La Sonnambula* were not silly warblers but very tragic heroines, full of definable madness. And in her concept of *Medea* and *Lady Macbeth*

(Continued on page 74)

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DECKS

73/HEADPHONES



JVC JR-400 II—\$529.95
Circle No. 73 On Reader Service Card

RECEIVERS

JVC JR-400 MK II AM/FM STEREO RECEIVER

Notably excellent sound quality even better than implied by noteworthy measurements. Unusually good sound even at very low volume levels. \$529.95 in metal finish cabinet.

Description: An AM/FM stereo receiver featuring a stereo beacon, FM center channel and AM/FM signal strength tuning meters, left and right expanded-scale power output meters calibrated 0-80 watts into 8 ohms, a five-frequency graphic-type equalizer (termed S.E.A.) with center frequencies of 40, 250, 1000, 5000 and 15,000 Hz, "flat" or S.E.A. equalized (with volume control!) output to one of two recorder connections, automatic tape dub from one recorder to another, automatic FM mono (for noise reduction) when the FM mute is disabled, a built-in "linecord" FM antenna in addition to external antenna connections, and an output hold-off that prevents power supply turn-on transients from being fed to the speakers.

There are stereo inputs for two magnetic phono, aux, and two tape. Outputs for two speaker systems, two tape, phones, and FM detector. The preamplifier outputs and main amplifier inputs are available on the rear apron.

Controls are provided for tuning, volume, balance, and the five S.E.A. equalizers. There are switches for power, speaker system 1, speaker system 2, input selection, tape monitor 1, tape monitor 2 (both tape monitors for auto-dub), FM mute/FM mono, loudness compensation, low filter, high filter, and tape output #1 equalized.

In addition to the "linecord" FM antenna there are external 75/300 antenna connections. A rod antenna and external connection are provided for AM. There are switched and unswitched AC outlets.

Overall dimensions are 22 $\frac{1}{2}$ in. wide x 6 $\frac{1}{2}$ in. high x 17 in. deep. Weight is 37.4 lbs.

Performance—FM Tuner: Full limiting was attained with 6.5 μ V. The monophonic high fidelity sensitivity (60 dB quieting) measured 8.5 μ V. The stereo high fidelity sensitivity (55 dB quieting) was 90 μ V. Full mute release of 11 μ V coincided with the automatic switching to stereo reception. (Turning off the mute automatically switches FM reception to mono, though the stereo beacon remains on to indicate the station is transmitting stereo.)

At standard test level the stereo frequency response measured +0/-1.2 dB from 40 to 15,000 Hz, down 2.2 dB at 30 Hz. Monophonic distortion measured 0.13% THD. Stereo distortion was 0.14% THD. The signal-to-noise ratio measured 77 dB. Stereo separation was 40+ dB. Selectivity was excellent.

Performance—AM Tuner: Unusually quiet. Sensitivity is considerably higher than average.

Performance—Amplifier: The power output per channel at the

Average is the rigid performance standard we require a component to pass to make it a good buy in its price range. Anything less than this rating we do not consider suitable for review purposes or for you to consider buying. An average rating is in no way derogatory, because we have deliberately kept our standards high. For example, if a \$1,000 Pilgrim receiver is rated average, this means it is equal to other average-rated receivers in the same price range, is superior to an average \$600 Minuteman receiver, and far superior to an average-rated \$200 Tory receiver. Each receiver is average within its own price range, and should be compared only with similarly priced components.

Worst case: The test results given are the "worst case" for stereo and 4-channel equipment. For example, if the frequency response of an amplifier's left channel is ± 2 dB from 20 to 20,000 Hz while the response of the right channel is ± 3 dB from 20 to 20,000 Hz, the test report shows the worst case, which is ± 3 dB. Similarly, if an FM tuner's stereo separation is 40 dB left-to-right and 32 dB right-to-left, the test report will show a separation of 32 dB. You can therefore be certain that the performance levels of all other channels are equal to or better than the indicated results.

Please note: all prices listed in the test reports section, as well as prices listed elsewhere in this issue, are approximate and subject to change. Manufacturers list prices in several ways. For example, some precede all prices with "approximately," while others list "nationally advertised value." For the purpose of simplicity and consistency, our editorial policy is to report prices as prices. It is assumed that prices vary at the discretion of individual dealers and that advertised prices may change.

clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 80.6 watts RMS. The frequency response at 80.6 watts/8 ohms measured $+0/-0.8$ dB from 20 to 20,000 Hz at a distortion no higher than 0.044% THD at any frequency.

The S.E.A. equalizers had a nominal range of ± 12 dB at all center frequencies.

The magnetic input hum and noise measured -62 dB stereo separation was 52 dB. Note: The listening panel reported an unusually clean deep bass. The power output meter calibrations are accurate to better than 5%, with a "ruler flat" frequency response from 20 to 20,000 Hz. ▲

SANSUI G-3000 AM/FM STEREO RECEIVER

Quite good performance at an almost rock-bottom price for a full-featured receiver. \$280.00 in a wood cabinet.

Description: An AM/FM stereo receiver featuring a stereo beacon, FM center channel and AM/FM signal strength tuning meters, and a front panel monophonic microphone input that can be mixed with other signal sources.

There are stereo inputs for magnetic phono, aux, and tape. Outputs for two speaker systems, tape, and phones.

Controls are provided for tuning, volume, balance, ganged bass, ganged treble, microphone mixing level, input selection, and power/speaker selection. There are switches for loudness compen-



JVC JR-400 II—\$529.95
Circle No. 73 On Reader Service Card



Sansui G-3000 — \$280.00
Circle No. 89 On Reader Service Card

TEST REPORTS / RECEIVERS



Sansui G-3000 — \$280.00
Circle No. 89 On Reader Service Card

sation, FM muting, stereo/mono, and tape monitor.

The FM antenna input is 75/300 ohms. An internal antenna and external connection are provided for AM. Switched and unswitched AC outlets are provided.

Overall dimensions are 17-1/16 in. wide x 6-1/16 in. high x 13 3/4 in. deep. Weight is 17.6 lbs.

Performance—FM Tuner: Full limiting was attained with 2.5 μ V. The monophonic high fidelity sensitivity (60 dB quieting) measured 8.5 μ V. The stereo high fidelity sensitivity (55 dB quieting) was 70 μ V. Full mute release was attained with 2 μ V.

At standard test level the stereo frequency response measured +0/-1.5 dB from 20 to 15,000 Hz. Monophonic distortion measured 0.09% THD. Stereo distortion measured 0.5% THD. The signal to noise ratio was 68 dB. Stereo separation was 40+ dB. Selectivity was good.

Performance—AM Tuner: The built in antenna's orientation is fixed by the position of the receiver and a desired station might lie off the end(s) of the antenna, resulting in weak (noisy) reception. Essentially average reception can usually be attained by attaching a few feet of wire to the AM antenna terminal.

Performance—Amplifier: The power output per channel at the clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 25.6 watts RMS. The frequency response at 25.6 watts/8 ohms measured ± 0.2 dB from 20 to 20,000 Hz at a distortion no higher than 0.045% THD at any frequency.

The tone control range measured +10/-12 dB at 50 Hz; ± 10 dB at 10,000 Hz.

The magnetic input hum and noise measured -75 dB; separation was 62 dB. ▲

SONY STR-7800SD AM/FM STEREO RECEIVER

Lovely sound and features. Notably excellent overload recovery. You must at least try and listen to this one before purchasing any receiver. \$700.00 in wood trimmed metal cabinet.



Sony STR-7800SD—\$700.00
Circle No. 93 On Reader Service Card

Description: An AM/FM stereo receiver FTC-rated for 8 ohms at 125 watts per channel into 8 ohms with no more than 0.07% THD from 20 to 20,000 Hz. Features include: built-in FM Dolby decoder with automatic switching to 25 μ Sec FM de-emphasis; a stereo beacon; FM center-channel meter; combination AM/FM signal strength and FM multipath meter; switch-selected acoustic compensation providing standard loudness compensation, low frequency boost, or presence boost (midband); front panel switched connections for an external sound processing adapter, automatic dubbing to or from either of two recorders, dual cutoff-frequency low (25, 50 Hz) and high (5,000, 10,000 Hz) filters, and an output hold-off that prevents power supply turn-on transients from being fed to the speakers.

Inputs are provided for two magnetic phono, aux, two tape, and external adapter. Outputs for three speaker systems, two tape, external adapter, phones, and the FM detector.

There are controls for tuning, volume, balance, concentric-clutched left and right bass, concentric-clutched left and right treble, input selection, speaker selection, and acoustic/loudness compensation. Switches for power, low filter frequency, low filter on-off, high filter frequency, high filter on-off, FM mute, FM Dolby,

FM multipath meter mode, mono/stereo, external adapter, 20 dB audio mute, tape copy (dub) selector, and tape monitor selector.

The FM antenna input is 75/300 ohms. A rod antenna and external connection are provided for AM. Three unswitched AC outlets are provided.

Overall dimensions are 19¼ in. wide x 6-9/16 in. high x 20-5/16 in. deep. Weight is 50.12 lbs.

Performance—FM Tuner: Full limiting was attained with 3.4 μ V. The monophonic high fidelity sensitivity (60 dB quieting) measured 8.5 μ V. The stereo high fidelity sensitivity (55 dB quieting) was 80 μ V. Full mute release was attained with 6 μ V.

At standard test level the non-Dolby stereo frequency response measured +0/-1 dB from 30 to 15,000 Hz, down 2 dB at 20 Hz. With the Dolby active, which automatically switches the de-emphasis to 25 μ Sec, the stereo frequency response was +0/-1.1 dB from 30 to 15,000 Hz, down 2 dB at 20 Hz. Monophonic distortion measured 0.13% THD. Stereo distortion was 0.2% THD. The signal-to-noise ratio measured 74 dB. Stereo separation was 40+ dB. Selectivity was very good.

Note: The tuning range is relatively broad for minimal distortion. Exact adjustment for the meter-indicated center channel is not necessary for low distortion. Actually, slight detuning off the meter-indicated center channel produced even lower distortion values. The reception has an unusually clean quality.)

Performance—AM Tuner: Background noise was slightly higher than average.

Performance—Amplifier: The power output per channel at the clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 127 watts RMS. The frequency response at 127 watts 8 ohms was +0/-0.6 dB from 20 to 20,000 Hz at a distortion no higher than 0.09% THD at any frequency. Note: Overload recovery was exceptional. The sound quality is good even when a transient drives the amplifier into deep saturation.

The tone control range measured \pm 13 dB at 50 Hz; +9/-10 dB at 10,000 Hz.

The magnetic input hum and noise measured -68 dB; separation was 57 dB.

The acoustic compensation control provides for standard loudness compensation, essentially the same bass compensation without the high end compensation (the low setting), and a broad midrange boost of about 2 dB centered at 2700 Hz in the presence mode.

The listening panel unanimously liked the mild presence equalization and the overall sound quality, all commenting on the excellent overload recovery characteristics. ▲

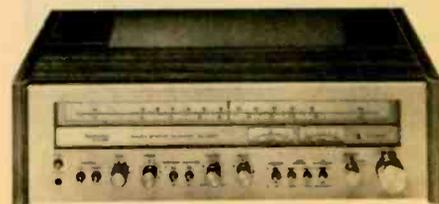
TECHNICS SA-5370 AM/FM STEREO RECEIVER

A moderate power receiver that will actually fit a standard wall or free-standing shelf. \$329.95 in wood cabinet.

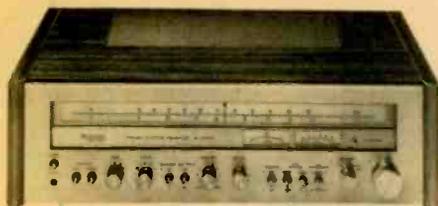
Description: An AM/FM stereo receiver FTC-rated at 48 watts per channel into 8 ohms with no more than 0.1% THD from 20 to 20,000 Hz. Features include a stereo beacon, tuning meters for FM center channel and AM/FM signal strength, automatic dub from one tape to another, and an output hold-off that prevents power supply turn-on transients from being fed to the speakers.



Sony STR-7800SD—\$700.00
Circle No. 93 On Reader Service Card



Technics SA-5370—\$329.95
Circle No. 98 On Reader Service Card



Technics SA-5370—\$329.95
 Circle No. 98 On Reader Service Card

There are inputs for magnetic phono, aux, and two tape. Outputs for two speaker systems, two tape, and phones.

Controls are provided for tuning, volume, balance, ganged bass, ganged treble, and input selection. Switches for power, main speakers, remote speakers, low filter, high filter, loudness compensation, tape monitor #1/dub, tape monitor #2, and FM mute (reception is mono-only when mute is off).

The FM antenna input is 75/300 ohms. An internal antenna and external connection are provided for AM. There are switched and unswitched AC outlets.

Overall dimensions are 19-5/32 in. wide x 5-25/32 in. high x 13 in. deep. Weight is 25.1 lbs.

Performance—FM Tuner: Full limiting was attained with 3.2 μV . The monophonic high fidelity sensitivity (60 dB quieting) measured 7 μV . The stereo high fidelity sensitivity (55 dB quieting) was 170 μV . Full mute release was attained with 3 μV .

At standard test level the stereo frequency response measured +0/-1 dB from 20 to 15,000 Hz. Monophonic distortion was 0.18% THD. Stereo distortion was 0.4% THD. The signal-to-noise ratio measured 74 dB. Stereo separation was 40+ dB. Selectivity was good.

Performance—AM Tuner: Sensitivity was below average. Background noise was higher than average.

Performance—Amplifier: The power output per channel at the clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 47.5 watts RMS. The frequency response at 47.5 watts/8 ohms measured +0/-0.2 dB from 20 to 20,000 Hz at a distortion no higher than 0.03% THD at any frequency.

The tone control range was +13/-11 dB at 50 Hz; ± 10 dB at 10,000 Hz. The magnetic input hum and noise measured -73 dB; separation was 59 dB. ▲

YAMAHA CR2020 AM/FM STEREO RECEIVER

Jam-packed with performance and features, must be seen and used to be fully appreciated. \$750.00 in wood cabinet.



Yamaha CR2020—\$750.00
 Circle No. 101 On Reader Service Card

Description: An AM/FM stereo receiver FTC-rated at 100 watts per channel into 8 ohms with no more than 0.05% THD from 20 to 20,000 Hz. Features include a stereo beacon; FM center channel tuning meter; automatic FM fine tuning which is applied when the hand is removed from the tuning knob (called OTS for "optimum tuning system"); left and right power output meters calibrated from 0.1 to 200 watts into 8 ohms, with the right meter also serving as an AM/FM signal strength/tuning meter (automatically switched to signal strength when the hand is on the tuning knob); a head amplifier for a moving coil (MC) pickup; dual range FM mute (3 and 30 μV); dual range bass (125, 500 Hz) and treble (2,500, 8,000 Hz) tone control turnover frequencies; a presence (midband) tone control; dual range low (70, 15 Hz) and high (8,000, 12,000 Hz) filters; FM Dolby adaptor connections switched from the front panel; automatic dub to and from either of two recorders; separate input/tape monitor and recorder input selectors (allowing taping of one source while listening to another); continuously variable loudness compensation, an output hold-off that prevents power supply turn-on transients from being fed to the speakers; and an output cut-off that temporarily disables the amplifier if an

attempt is made to drive the output into overload.

There are inputs for MC/MM (magnetic) phono, MM phono, aux, two tape, and FM Dolby adaptor. Outputs for three speaker systems, two tape, FM Dolby adaptor, and two phones. The preamplifier outputs and main amplifier inputs are available on the rear apron.

Controls are provided for tuning (also serves as a touch-switch for the FM fine tuning and power/signal strength meter), concentric volume/balance, ganged bass, ganged treble, ganged presence (midband), input selection/tape monitor, tape input selector/tape copy, speaker selection, and MC/MM phono selection for the #1 phono input. There are switches for power, right meter power/signal strength function, low filter selector, high filter selector, bass turnover frequency, treble turnover frequency, tone control defeat, FM Dolby adaptor on-off, FM blend (MPX noise filter), FM mute on-off (automatic mono when mute is off), FM mute level, OTS (FM fine tuning) on-off, AM/FM tuner selector, and 20 dB audio mute. The preamplifier/main amplifier separation switch is on the rear.

The FM antenna input is 75/300 ohms. A rod antenna and external connection are provided for AM. There are two switched and one unswitched AC outlets.

Overall dimensions are 21¼ in. wide x 6-9/16 in. high x 16-15/16 in. deep. Weight is 42 lbs. 7 oz.

Performance—FM Tuner: Full limiting was attained with 3.5 μ V. The monophonic high fidelity sensitivity (60 dB quieting) measured 8.5 μ V. The stereo high fidelity sensitivity (55 dB quieting) was 65 μ V. Full mute release was attained at 4 or 30 μ V depending on the setting of the mute range switch.

At standard test level the stereo frequency response measured $+0/-0.5$ dB from 20 to 15,000 Hz. (The FM Dolby selector appears to have "standard" 75 μ Sec de-emphasis.) Monophonic distortion was 0.06% THD. Stereo distortion was 0.1% THD. The signal-to-noise ratio measured 76 dB. Stereo separation was 40+ dB. Selectivity was very good.

The FM fine tuning is magnificent, providing a precise lock-up at minimum distortion. One of the best fine tuning systems we have tested to date. Has none of the fine tuning problems presently common to PLL.

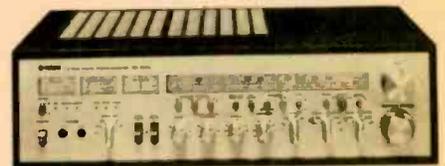
Performance—AM Tuner: Very good. Sensitivity and reduced background noise considerably better than average. The automatic power/signal strength meter serves as the AM tuning indicator.

Performance—Amplifier: The power output per channel at the clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 121 watts RMS. The frequency response at 121 watts/8 ohms measured $+0/-0.3$ dB from 20 to 20,000 Hz at a distortion no higher than .028% THD at any frequency. With the 15 Hz subsonic filter switched in, the frequency response is down only 1 dB at 20 Hz.

The tone control range depends on the setting of the turnover switches. At 50 Hz: with a 500 Hz turnover the range was ± 15 dB; with a 125 Hz turnover the range was ± 8 dB. At 10,000 Hz: with a 2,500 Hz turnover the range was ± 10 dB; with an 8,000 Hz turnover the range was ± 4 dB. The presence control has a center frequency of 3000 Hz with a range of ± 6 dB.

The magnetic input hum and noise measured -70 dB; stereo separation was into the noise.

The moving coil phono input selector switches in a head ampli-



Yamaha CR2020—\$750.00
Circle No. 101 On Reader Service Card

fier having 5 dB gain into the #1 phono input channel. When the head amplifier is switched out, the #1 input serves as a standard magnetic phono (MM) input.

The power output meters have a nominal accuracy of 10% across the entire scale from 100 to 20,000 Hz. At 20 Hz the meter readings are 50% of the actual power output (3 dB down). ▲

TUNERS

HARMAN-KARDON CITATION 18 FM STEREO TUNER

Measured stereo performance far outclasses the specifications. An excellent tuner with high level headphone outputs (actually a small power amp). \$595.00 in metal cabinet.

Description: An FM stereo tuner featuring a built-in headphone amplifier FTC-rated at 2 watts per channel into 8 ohms with no more than 0.1% THD from 20 to 20,000 Hz. Other features include a stereo beacon, a *quieting* tuning meter (optimum meter tuning provides highest noise quieting), an *in tune* panel lamp indicator, 75 uSec and 25 uSec de-emphasis, front-panel switched connections for an FM Dolby processor, user-adjustable stereo threshold, user adjustable FM muting level, and wide/narrow FM mute sensitivity. (In the *wide* mode the FM mute will release when any signal is stronger than the user-set threshold level; it releases when the tuning crosses into a station's sideband(s). In the *narrow* mode the mute releases only when the received signal is above the threshold level and is properly tuned, as indicated by the *in tune* panel lamp; the mute won't release on sidebands and stations appear to literally "pop" out of a dead quiet background.)

There are outputs for variable line level, and two headphones or small speaker systems. Input/output connections are provided for a Dolby processor.

There are controls for tuning, mono/stereo modes, and headphone/speaker monitor output level. Switches for power, MPX noise filter, 75/25 uSec de-emphasis, and external processor on-off. Controls for the FM stereo and mute threshold levels are on the rear apron, as is the output level adjustment.

The antenna input is 75/300 ohms or a 75 ohm coaxial jack.

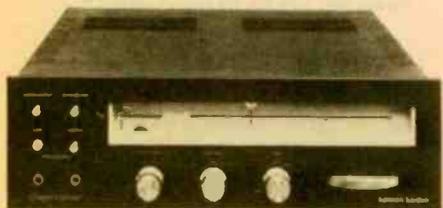
Overall dimensions are 16 in. wide x 4¾ in. high x 13½ in. deep. Weight is 23 lbs.

Performance: Full limiting was attained with 3.5 uV. The monophonic high fidelity sensitivity (60 dB quieting) was 7.5 uV. The stereo high fidelity sensitivity was 62 uV. Full mute release can be user-set for a range from full off to 300 V.

At standard test level the stereo frequency response with 75 uSec de-emphasis measured +0/-0.5 dB from 20 to 15,000 Hz. With 25 uSec de-emphasis the frequency response measured +1/-0.7 dB from 20 to 15,000 Hz. Monophonic distortion measured 0.1% THD. Stereo distortion measured 0.08% THD (yes, less than mono THD). The signal-to-noise ratio was 68 dB. Stereo separation was 40+ dB. Selectivity was very good.

The output level range corresponding to 100% modulation of the transmitter was 0.42 to 2.4 volts.

The *in tune* lamp will illuminate over a relatively broad tuning adjustment when receiving a strong signal. Best tuning in terms



Harman/Kardon Citation 18 — \$595.00
Circle No. 71 On Reader Service Card

of sound quality is attained by tuning for maximum quieting as indicated on the meter.

The monitor amplifier was right on specs. It can produce a sound level almost at the threshold of pain with many standard hi-fi phones. It's a nice feature if you like to do some FM listening late at night. With a couple of small speakers it makes for a nice bedside system (if you don't mind not having tone controls). ▲

PHILIPS AH673/44 AM/FM TUNER

Here's some real AM high fidelity. \$599.95 in metal cabinet.

Description: An AM/FM stereo tuner with high fidelity AM reception from stations which actually transmit a hi-fi AM signal. Features include an FM stereo beacon, combination center channel tuning meter for both AM and FM, an AM/FM signal strength meter, multipath indication on the center channel tuning meter, ASNC (automatic stereo noise cancelling)—an mpx filter that automatically senses when the noise level is high enough to require filtering, a continuously variable FM mute, both standard and wideband (to at least 10 kHz) AM reception, a 10 kHz AM whistle filter for suppression of 10 kHz "beat note" interference from two AM stations on adjacent channels, and capacitance-type touch-to-operate control switches.

There are fixed and continuously variable line level outputs. Also outputs for the FM detector and an oscilloscope. Controls are provided for tuning, AM output level, FM output level, and AM/FM mode. There are switches for power, multipath meter switching, ASNC, FM mute, and 10 kHz filter. The master power switch for the capacitance switches is on the rear.

The FM antenna input is 75/300 ohms or a 75 ohms coaxial jack. A rod antenna and external input are provided for AM. There is one unswitched AC outlet.

Overall dimensions are 5½ in. high x 18 in. wide x 13½ in. deep.

Performance—FM Tuner: Full limiting was attained with 2.5 μ V. The monophonic high fidelity sensitivity (60 dB quieting) measured 5.5 μ V. The stereo high fidelity sensitivity (55 dB quieting) was 48 μ V. Full mute release was attained over the range of 0 to 30 μ V (value is user-set).

At standard test level the stereo frequency response measured +0/−2.5 dB from 20 to 15,000 Hz. Monophonic distortion was 0.21% THD. Stereo distortion was 0.13% THD (Note: stereo distortion measured less than the mono distortion which is unusual). The signal-to-noise ratio measured 71 dB. Stereo separation was 40+ dB. Selectivity was excellent. The fixed output level, and also the maximum variable output level, equal to 100% modulation of the FM transmitter measured 1.2 volts.

Performance—AM Tuner: Excellent. Sensitivity and suppression of background noise is much better than average. In the "fidelity" mode the response does extend to at least 10 kHz and if the AM station is transmitting hi-fi it is actually heard, proving that AM hi-fi is really possible. The 10 kHz whistle filter is extremely effective and removed all traces of the interstation "beat note" always heard when receiving stations on adjacent channels. In the normal mode (standard) the AM performance is somewhat better than average with regard to sensitivity and background noise. ▲



Philips AH673—\$599.95
Circle No. 84 On Reader Service Card

SANSUI TU-717 AM/FM STEREO TUNER

This tuner features a wideband FM selectivity for lower than usual distortion when reception conditions permit interference-free wideband reception. \$320.00 in metal cabinet. (Optional user-installed instrument-type "crash handles" are supplied.)

Description: An AM/FM stereo tuner featuring a stereo beacon, FM center channel and AM/FM signal strength tuning meters, user-selected narrow and wide FM selectivity, a built-in calibration oscillator whose output level is equal to 3 dB below 100% FM modulation (recorders are adjusted so their VU meters indicate -3 dB on the oscillator signal), and an FM mute.

Two sets of outputs at line level are provided.

There are controls for tuning and output level. Switches for power, AM, FM (auto stereo/mono), FM mono, noise canceller (mpx filter), calibration level, and FM mute.

The FM antenna input is 75/300 ohms. A rod antenna and external connection are provided for AM.

Overall dimensions are 17 in. wide x 6½ in. high x 18½ in. deep. Weight is 20.3 lbs.

Performance—FM Tuner: Full limiting was attained with 5.5 uV. The monophonic high fidelity sensitivity (60 dB quieting) measured 9 uV. The stereo high fidelity sensitivity (55 dB quieting) was 75 uV. Full mute release was attained with 6 uV.

At standard test level the stereo frequency response measured +0.1/-1.2 dB from 20 to 15,000 Hz. In the wideband mode, monophonic distortion measured 0.1% THD; stereo distortion measured 0.12% THD. In the narrowband mode mono distortion was 0.18% THD; stereo distortion was 0.15% THD (correct, the stereo distortion was less than the mono distortion). The signal-to-noise ratio measured 75 dB. Stereo separation was 40+ dB. Selectivity in the wideband mode was fair; in the narrowband mode selectivity was very good. The maximum output level corresponding to 100% FM station modulation was 1.1 volts.

The built-in calibrator is very convenient when setting up for taping of FM programs. Its level is precisely 3 dB below 100% modulation when the tuner is in the FM Auto mode. When using the calibrator use FM Auto even for mono stations.

Performance—AM Tuner: Considerably better than average. Background noise is unusually low and sensitivity is much higher than average. ▲

TECHNICS ST-7300 AM/FM STEREO TUNER

Features an unusually noise-free AM tuner. \$179.95 in wood cabinet.

Description: An AM/FM stereo tuner featuring a stereo beacon, tuning meters for FM center channel and AM/FM signal strength, and a constant level 440 Hz oscillator used for presetting tape recorder adjustments for FM recordings.

There are fixed line level outputs.

There is a control for tuning. Switches are provided for power, AM/FM, FM mute (automatic mono-only reception when mute is off), and the record level check (440 Hz oscillator).



Sansui TU-717—\$320.00
Circle No. 89 On Reader Service Card



Technics ST-7300—\$179.95
Circle No. 98 On Reader Service Card

The FM antenna input is 75/300 ohms. An internal antenna and external connection are provided for AM.

Overall dimensions are 17-5/16 in. wide x 5 3/4 in. high x 12-15/32 in. deep. Weight is 13.9 lbs.

Performance—FM Tuner: Full limiting was attained with 3.5 μ V. The monophonic high fidelity sensitivity (60 dB quieting) measured 9 μ V. The stereo high fidelity sensitivity (55 dB quieting) was 90 μ V. Full mute release was attained with 3.5 μ V.

At standard test level the stereo frequency response measured +0.1/-0.5 dB from 20 to 15,000 Hz. Monophonic distortion was 0.15% THD. Stereo distortion was 0.5% THD. (Note: these minimum distortion values were attained with the tuning off the meter-indicated center channel. At center indication both distortions were approximately 0.8% THD.) The signal-to-noise ratio measured 73 dB. Stereo separation was 40+ dB. Selectivity was good.

The output level corresponding to 100% modulation of the transmitter was 0.42 volts for automatic stereo-mono operation. With the tuner switched for mono-only (FM mute off) the output level was 0.23 volts.

The output level from the built-in oscillator was 0.24 volts.

Performance—AM Tuner: An unusually quiet tuner. Interstation and background noise is below that of many high performance tuners at no reduction in overall sensitivity. Essentially, the AM reception is much higher than average for the price range. ▲

PREAMPLIFIERS

AUDIONICS BT-2 STEREO PREAMPLIFIER

A basic preamplifier with 500 ohm outputs for interfacing with audiophile or professional equipment. \$379.00 in metal cabinet. (Optional wood cabinet is available.)

Description: A basic stereo preamplifier (no tone controls or equalizers) with a standard 19-inch rack front panel. There are inputs for magnetic phono, tuner, aux, and tape. Outputs at 500-600 ohms line level for the left and right channels with a summed mono output at 10,000 ohms for mono center fill, and a tape output.

Features include a 15 Hz rumble filter and an output level on-off switch with indicator lamp. The main power is always on for thermal stabilization—the manufacturer suggests a 12-hour warm-up before the initial listening evaluation.

Controls are provided for volume, balance, and input selection. There are switches for output on-off, stereo/mono, tape monitor, and rumble filter defeat (the rumble filter is operative only for the phono input). One unswitched AC outlet is provided.

Overall dimensions measure 19 in. wide x 3 1/2 in. high x 7 1/2 in. deep. Weight is 10 lbs.

Performance: Note: Though the output level is specified to 3 volts into 500 ohms, tests were conducted at the more common audiophile level of 1 volt.

The frequency response measured +0/-0.4 dB from 20 to 20,000 Hz at a distortion no higher than 0.02% THD at any frequency. The output clipping level measured 7.6 volts, with the



Technics ST-7300—\$179.95
Circle No. 98 On Reader Service Card



Audionics BT-2—\$379.00
Circle No. 131 On Reader Service Card

TEST REPORTS / POWER AMPLIFIERS



Audionics PZ3 Series II—\$449.00
Circle No. 131 On Reader Service Card

distortion at clipping level no higher than 0.04% THD at any frequency.

With the rumble filter switched in, the frequency response was down 2 dB at 20 Hz, 1 dB at 30 Hz.

With a 3 mV phono input level and a 1 volt output the magnetic input hum and noise measured -68 dB; separation was into the noise level.

The preamplifier draws approximately 6 watts (0.05 ampere) on a continuous basis (as there is no power switch). ▲

POWER AMPLIFIERS

AUDIONICS PZ3 SERIES II STEREO AMPLIFIER

Designed for professional and commercial applications, this amplifier is supplied on a 19-inch rack panel. \$449.

Description: A basic stereo power amplifier FTC-rated at 100 watts per channel into 8 ohms with no more than 0.03% THD from 20 to 20,000 Hz.

One stereo set of line level inputs and speaker outputs are provided for each channel. The speaker outputs are on 5-way binding posts. The only control is a front panel power switch.

Overall dimensions measure 19 in. wide x 6 in. high x 15 in. deep. Weight is 29 lbs.

Performance: The power output per channel at the clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 105 watts RMS. The frequency response at 105 watts/8 ohms measured +0/-0.7 dB from 20 to 20,000 Hz at a distortion no higher than 0.053% THD at any frequency.

1 volt input was required for 100 watts/8 ohms output.

The signal-to-noise ratio referenced to 1 volt input/100 watts output measured 94 dB.

Note: There is no power supply turn-on output hold-off. Small transients were measured on the speaker output connections when the amplifier was turned on. ▲

PHILIPS AH578 STEREO AMPLIFIER

Features notably low distortion at all power levels. \$699.95 in metal cabinet.

Description: A high power stereo amplifier FTC rated 210 wpc/20-20 k Hz/0.08% THD/8 ohms featuring left and right output power meters calibrated 0-400 watts and 0-4 watts into 8 ohms loads. Meters also have dB calibrations, with 0 dB representing 200 watts or 2 watts depending on the selected range. An output hold-off prevents power supply turn-on transients from being fed to the speakers.

There is one set of line level inputs. Outputs for two speaker systems.

Controls are provided for left level, right level, and speaker selection. There are capacitance-type touch-to-operate switches for power, -20 dB meter range ($\times .01$ watts), 0 dB meter range ($\times 1$ watt), and subsonic filter. The master power switch that controls the power for the capacitance switches is on the rear.



Philips AH-578—\$699.95
Circle No. 84 On Reader Service Card

One switched and two unswitched AC outlets are provided.

Overall dimensions are 18 in. wide x 8 in. high x 15 in. deep. Weight is 63 lbs.

Performance: The power output per channel at the clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 219 watts RMS. The frequency response at 219 watts/8 ohms was +0/-0.2 dB from 20 to 20,000 Hz at a distortion no higher than 0.05% THD at any frequency. With the subsonic filter switched in the response was down only 1.8 dB at 20 Hz.

A 1 volt input produced a 200 watt/channel output. The signal-to-noise ratio referenced to 200 watts output was 94 dB.

The output meter readings are within 10% accuracy including estimates of the meter pointer's position. The meters' frequency response measured +0/-2 dB from 20 to 20,000 Hz. ▲

INTEGRATED AMPLIFIERS

PIONEER SA-6500 II STEREO AMPLIFIER

A no-frills, good-sounding moderate-price, moderate-power package. \$175.00 including metal cabinet.

Description: An integrated stereo amplifier featuring a tone control defeat and automatic dubbing from one tape to another.

There are inputs for magnetic phono, tuner, aux, and two tape. Outputs for two speaker systems, two tape, and phones.

Controls are provided for volume, balance, ganged bass, ganged treble, input selection, and speaker selection. There are switches for power, tone control defeat, loudness compensation, tape monitor 1/dub, and tape monitor 2.

Two switched and two unswitched AC outlets are provided.

Overall dimensions are 15 in. wide x 5½ in. high x 12¼ in. deep. Weight is 16¼ lbs.

Performance: The power output per channel at the clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 30.4 watts RMS. The frequency response at 30.4 watts/8 ohms measured +0/-0.4 dB from 20 to 20,000 Hz at a distortion no higher than 0.06% THD.

The tone control range measured ±10 dB at 50 Hz; +7/-6 dB at 10,000 Hz.

The magnetic input hum and noise measured -61 dB; separation was 56 dB.

The listening panel reported a good overall sound quality with an unusually clean deep bass for a moderate power amplifier. ▲

KENWOOD KA-7100 STEREO INTEGRATED AMPLIFIER

Full power distortion at values normally associated with preamplifiers. \$300.00 in metal cabinet.

Description: An integrated stereo amplifier FTC-rated at 60 watts per channel into 8 ohms with no more than 0.02% THD from 20 to 20,000 Hz. Features include two loudness compensation contours, tone control defeat, subsonic filter (6 dB per octave below 20 Hz), automatic dub between two recorders, and an output



Pioneer SA-6500 II—\$175.00
Circle No. 85 On Reader Service Card



Kenwood KA-7100—\$300.00
Circle No. 74 On Reader Service Card

TEST REPORTS / CASSETTE DECKS



Kenwood KA-7100 — \$300.00
Circle No. 74 On Reader Service Card

hold-off that prevents power supply turn-on transients from being fed to the speakers.

There are inputs for magnetic phono, tuner, aux, and two tape. Outputs for two speaker systems, two tape, and phones.

Controls are provided for volume, balance, ganged bass, ganged treble, input selection, tape monitor/tape dub selection, loudness contour selection, mono/stereo modes, and speaker selection. There are switches for power, tone control defeat, subsonic filter, high filter, and 20 dB audio mute.

Two switched and an unswitched AC outlet are provided.

Overall dimensions measured 16-15/16 in. wide x 5 7/8 in. high x 14-15/16 in. wide. Weight is 25.4 lbs.

Performance: The power output per channel at the clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 62.7 watts RMS. The frequency response at 62.7 watts/8 ohms was +0/-0.5 dB from 20 to 20,000 Hz at a distortion no higher than 0.02% THD at any frequency.

The tone control range measured ± 8 dB at 50 Hz; ± 7 dB at 10,000 Hz.

With the subsonic filter switched in, the frequency response is down 3 dB at 20 Hz; 1.6 dB at 30 Hz.

The magnetic input hum and noise measured -75 dB; separation was into the noise level. (A very quiet phono input.) ▲

CASSETTE DECKS

AIWA AD-6550 STEREO CASSETTE DECK

Allows optimizing of bias for any ferric tape through a front panel bias adjustment. Also features an electronic remaining time indicator. \$450.00 in metal cabinet with wood trim.

Description: A front-loading Dolby cassette deck featuring a front panel user bias adjustment for ferric tapes, bias and equalization selectors for ferric, ferrichrome and chromium dioxide tapes, an electronic remaining tape-time indicator which utilizes the dual-function left record VU meter, peak record level indicator lamps calibrated at +3 dB and +7 dB above 0-VU record level, automatic end-of-tape stop/disengage, a preset for timer controlled recordings, a memory reset counter, and a control jack for connection to an associated record player that starts the recorder (when preset to record) when the tonearm is lowered to the record. The cover to the tape transport can be removed to expose the entire tape path for cleaning.

There are inputs for microphones and line. Outputs are provided for line and phones.

Controls are provided for concentric-clutched left and right record level, ganged output level, and ferric bias level (with detent at the "high energy" setting). There are switches for power, bias, equalization, meter function (left meter as VU meter or remaining time indicator), input selection, Dolby (with automatic MPX filter when Dolby is selected), and counter memory on-off.

The tape mechanism has lever controls for the record interlock, REW/review (monitored fast reverse), FWD, FF/cue (monitored fast forward), stop/eject, and pause/timer preset.



AIWA AD-6550—\$450.00
Circle No. 102 On Reader Service Card

Overall dimensions are 16 $\frac{1}{2}$ in. wide x 5 $\frac{1}{2}$ in. high x 13 in. deep. Weight is 16.5 lbs.

Performance: The playback frequency response from a standard test tape with a 50 to 10,000 Hz response measured +3/-2 dB, (+3 dB at 50 Hz).

The ferric bias could be adjusted for excellent performance with virtually all commonly available ferric tapes. A calibration for the control, and recommended settings are provided in the manual. The following results attained with Maxell UD/XL tape are typical of results attained with common high energy tapes.

Using Maxell UD/XL tape: without Dolby, the record/play frequency response measured +1/-0.3 dB from 30 to 15,000 Hz, down 5 dB at 20 Hz. Distortion at the meter-indicated 0-VU record level measured 0.8% THD with 5 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 51 dB. With the Dolby active the frequency response measured +1.4/-0.3 dB from 30 to 15,000 Hz (notably excellent Dolby tracking). Distortion and headroom remained the same. The signal-to-noise ratio measured 55 dB wideband; 61 dB narrowband.

Using Sony ferrichrome tape: with Dolby, the record/play frequency response measured +0/-0.5 dB from 30 to 15,000 Hz. Distortion at the meter-indicated 0-VU record level measured 2% THD with 2 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 55 dB wideband; 62 dB narrowband.

Using BASF chromium dioxide tape: with Dolby, the record/play frequency response measured +0/-1 dB from 30 to 15,000 Hz. Distortion at the meter-indicated 0-VU record level was 2.7% THD with 1 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 55 dB wideband; 62 dB narrowband.

The maximum output level corresponding to a 0-VU record level was nominally 0.9 volts.

Both the +3 dB and +7 dB peak record level indicator lamps were calibrated right "on the mark."

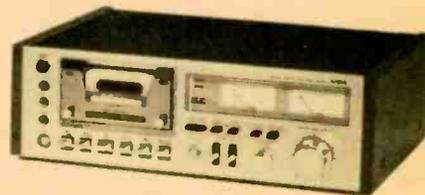
Wow and flutter measured a rock-steady 0.06% (an unusually low and steady value for a moderate-priced deck).

The ferric bias adjustment is extremely effective and will probably become a standard feature this year on many of the high performance recorders. It actually does optimize response from a wide variety of ferric tape types—from low-cost "normal" tapes to the latest in high energy cassettes. The calibration chart supplied in the instruction manual proved unusually accurate; the user can essentially preset the correct bias for any ferric tape; it doesn't take experimentation to get it right. ▲

AKAI GXC-709D DOLBY CASSETTE DECK

Features separate bias adjustment for standard and high energy standard tapes in addition to ferrichrome and chromium dioxide. \$350.00 in wood cabinet.

Description: A front-loading stereo Dolby cassette deck featuring a tape-type selector for low noise (standard), high output low noise (also standard), ferrichrome, and chromium dioxide tapes, with TDK-SA and Maxwell UD/XL-II tapes specifically recommended for



AIWA AD-6550—\$450.00
Circle No. 102 On Reader Service Card



Akai GXC-709D—\$350.00
Circle No. 62 On Reader Service Card



Akai GXC-709D—\$350.00
Circle No. 62 On Reader Service Card

the chromium dioxide bias-equalization. Other features include microphone/line input mixing, Dolby MPX filter, record level limiter, two calibrated VU meters, peak record level indicators calibrated at +3 dB and +7 dB, automatic end of tape stop/disengage, and a memory reset counter.

There are inputs for microphones and line. Outputs for line and phones.

Controls are provided for concentric-clutched left and right microphone level, concentric-clutched left and right line level, and ganged output level. There are switches for power, tape-type, MPX filter, Dolby on-off, record limiter on-off, and counter memory on-off.

The tape mechanism has lever controls for the record interlock, REW, play, FF, pause, and stop/eject.

Overall dimensions are 17.3 in. wide x 6.5 in. high x 11.2 in. deep. Weight is 14.4 lbs.

Performance: The playback frequency response from a standard test tape with a 50 to 10,000 Hz range measured +1.4/−1.2 dB.

Using TDK-D tape: without Dolby, the record/play frequency response measured ± 2 dB from 40 to 12,000 Hz, down 3 dB at 35 and 13,000 Hz. Distortion at the meter-indicated 0-VU record level measured 1.5% THD with 6 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 48 dB.

With the Dolby active, the record/play frequency response measured +2.8/−2 dB from 40 to 11,000 Hz (−1 dB at 11,000 Hz), down 3 dB at 35 and 12,000 Hz. Distortion and headroom remained the same. The signal-to-noise ratio measured 53 dB wideband, 56 dB narrowband.

Using Sony ferrichrome tape: with Dolby, the record/play frequency response measured +0.8/−3 dB from 35 to 13,000 Hz. Distortion at the meter-indicated 0-VU record level was 1.9% THD with 4 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 52 dB wideband, 58 dB narrowband.

Using TDK-SA tape: the record/play frequency response using Dolby was +2.8/−2.2 dB from 40 to 14,000 Hz (−0.1 dB at 14,000 Hz), down 3 dB at 35 and 14,500 Hz. The distortion referenced to 0-VU record level was 1.7% THD with 3 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU measured 53 dB wideband, 57 dB narrowband.

The maximum output level corresponding to a 0-VU record level was 0.44 volts.

Note: The tape type control setting for low noise and high output low noise tapes don't quite match the chart supplied with the machine. Try both positions with ferric tape to determine which gives the best results with a specific brand of tape. For example, TDK-D gave best results with the high energy setting, rather than the specified low noise setting.

The calibrations of the +3 dB and +7 dB peak record level indicators were essentially exact, and the instructions supplied for their use are excellent—they lead to a low distortion cassette recording.

The record level limiter cuts in fast at +2 dB above 0-VU and has a relatively slow release. Low level sounds following operation of the limiter tend to sound even lower; but the limiter is effective at protecting against sudden overload caused by peak signals.

Wow and flutter measured 0.2% steady. ▲

DUAL C939 CASSETTE DECK

A beautiful system. Can produce an outstandingly clean cassette recording if you use the right tape. Excellent tape handling. Under \$550.00 mounted on a wooden base.

Description: A Dolby cassette deck with automatic reverse, automatic stop, continuous play, separate FM Dolby calibration controls, headphone level controls, left and right 2-step L.E.D. record "meters" calibrated from -20 to +5 dB with switching for VU or peak indicating ballistics, a record level limiter, microphone/line input mixing, fade-edit (controlled erasure performed after a tape is recorded—during playback), selectors for Fe, FeCr, and Cr tapes, and a memory reset counter.

There are inputs for microphones and line. Outputs for line and phones.

Controls are provided for left microphone level, right microphone level, left line level, right line level, and screwdriver-adjust controls are provided for left and right output level and left and right FM Dolby calibrate level. Fingertip adjust controls are provided for left and right headphone volume. There are switches for tape type, Dolby in-out, FM Dolby on-off, record level limiter, fade-edit on-off, VU-peak meter indication, and memory counter on-off.

The tape mechanism has piano key controls for stop, continuous play, record interlock, left drive, right drive, high speed rewind, high speed forward, and pause. There is a pushbar for tape eject.

Overall dimensions are 17 $\frac{3}{8}$ in. wide x 4 $\frac{3}{4}$ in. high x 11 $\frac{1}{8}$ in. deep.

Performance: (Note: Maxell UD/XL tape was supplied with the machine so we assume the adjustments are specifically for this tape.)

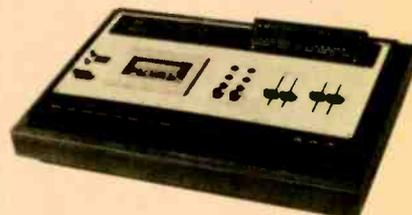
The playback frequency response from a standard test tape with a 50 to 10,000 Hz range measured +0/-3 dB from 70 to 10,000 Hz.

Using Maxell UD/XL tape: without Dolby, the frequency response measured +0.8/-3 dB from 50 to 13,500 Hz. Distortion at the meter-indicated 0-VU record level was 0.5% THD. (mixed with noise at this level) with 12 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 47 dB.

With the Dolby turned on, the frequency response measured +0.8/-3 dB from 50 to 12,000 Hz. Distortion and headroom remained the same. The signal-to-noise ratio measured 48 dB wideband; 59 dB narrowband.

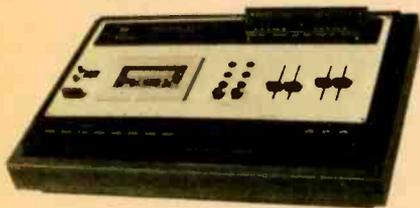
Using Sony Ferrichrome tape: without Dolby, the frequency response measured +0/-3 dB from 50 to 11,000 Hz. Distortion at the meter-indicated 0-VU record level was 1.1% THD with 8 dB headroom to 3% THD. The signal-to-noise ratio measured 48 dB. The Dolby tracking was completely off any acceptable standards for this particular tape, and thus we cannot recommend using this tape on this machine.

Using TDK-SA tape in preference to chromium dioxide: with Dolby, the frequency response measured +0/-3 dB from 40 to 13,200 Hz. Distortion at the meter-indicated 0-VU record level was 1.2% THD with 5 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 50 dB wideband; 61 dB narrowband.



Dual C939 — \$550.00
Circle No. 27 On Reader Service Card

TEST REPORTS / CASSETTE DECKS



Dual C939 — \$550.00
Circle No. 27 On Reader Service Card

The record level limiter has a fast attack and release and cuts in precisely at 0-VU. If your recording situation calls for a limiter, this one is excellent.

The peak reading function of the LED "meters" is extremely fast (similar to the type used in movie studios) and allows the record level to be pushed right up to the headroom limit without fear of overload. Used with the Maxell tape, which has unnecessarily high headroom on this machine, notably clean high level recordings are possible. We suggest only the peak mode be used; there is no reason to use the VU mode.

The wow and flutter in the forward tape direction (standard) measured 0.07% steady—more steady than most reel-to-reel machines. In the reverse drive mode the wow and flutter measured 0.09% with peaks to 0.12%, which is exceptionally good for cassettes (steady wow and flutter indicates an excellent drive system). The optically controlled automatic stop/reverse system worked as well as could be asked for. Overall, the tape handling is excellent, if not outstanding.

The fade-edit feature allows erasure of end-of-record clicks and pops, or radio announcements after the recording is made. It is done by fading in a partial erasure. While playing the tape the user holds down the safety with one hand and fades out the sound with a special fade-edit control. The tape is left click-pop-and-announcer-free. Works just great. Will probably become a standard feature on many high performance machines in the months to come. ▲

HITACHI D-800 STEREO CASSETTE DECK

Peak reading meters combined with high headroom results in unusually clean recordings. \$399.95 in metal cabinet.

Description: A front-loading Dolby cassette deck featuring a three-head system with simultaneous record/playback even when Dolby processed. Other features include separate FM Dolby calibration controls, a tone generator for Dolby calibration, Dolby mpx filter (for recording FM programs), left and right recording meters with switch-selected VU or peak reading ballistics, a selector for "normal", Ferrichrome and chromium dioxide tapes, automatic end of tape stop, and a reset counter.

There are inputs for microphone and line. Outputs for line and phones.

Controls are provided for concentric-clutched left and right record level, and concentric-clutched left and right output level. There are front panel screwdriver/coin-edge adjust controls for Dolby calibration, and controls on the rear apron for FM Dolby calibration (using the calibration tone transmitted by FM Dolby stations). Switches for power, tape/source monitor, tape type, Dolby, FM Dolby, mpx filter, test oscillator on-off, microphone/line input selection, and peak/VU meter ballistics.

The tape mechanism has lever key controls for the record interlock, play, REW, FF, stop/eject, and pause.

Overall dimensions are 17.1 in. wide x 5.7 in. high x 11.8 in. deep. Weight is 14.3 lbs.

Performance: The playback frequency response from a standard test tape with a 50 to 10,000 Hz range measured +2.2/-1 dB.

Using Maxell UD tape; without Dolby, the record/play frequency response measured +2.2/-0.6 dB from 40 to 15,000 Hz,



Hitachi D-800—\$399.95
Circle No. 72 On Reader Service Card

down 3 dB at 31 Hz. Distortion at 0-VU/dB record level was masked by internal noise equivalent to about 0.3% THD. There was 11 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 42 dB.

With Dolby, the record/play frequency response was +1/-0.6 dB from 40 to 15,000 Hz. Distortion and headroom remained the same. The signal-to-noise ratio measured 54 dB wideband, 59 dB narrowband.

Using Sony Ferrichrome tape: with Dolby, the record/play frequency response measured +2/-3 dB from 30 to 15,000 Hz. Distortion at the 0-VU/dB record level was 1.5% THD with 10 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level measured 42 dB wideband, 54 dB narrowband.

Using Memorex chromium dioxide tape: with Dolby, the frequency response measured +1.5/-2 dB from 40 to 15,000 Hz, down 3 dB at 30 Hz. Distortion at the 0-VU/dB record level was 2% THD with 3 dB headroom to 3% THD. The signal-to-noise ratio was 52 dB wideband, 60 dB narrowband.

The peak reading meter mode has a very fast attack and slow decay, and indicates peaks approximately 6 dB to 10 dB above the VU meter readings. Recordings made with the meters in the peak mode are unusually clean—because the tape is not overloaded—and the record level can be crowded right up against the +3 dB meter calibration (to increase signal-to-noise ratio with essentially no effect on distortion). We suggest the peak mode always be used; there is no justification in the cassette system for the more common VU type of metering.

The maximum output level corresponding to a 0-VU/dB record level was nominally 0.3 volts.

Because there is only one set of Dolby calibration adjustments, optimum frequency response is obtained for one particular type of tape at a time. Because the unnecessarily high headroom for the Maxell UD tape results in unusually clean recordings we suggest the Maxell tape for this machine, with the Dolby specifically adjusted for the tape.

Wow and flutter measured 0.12% steady. ▲

HEADPHONES

BEYER DT-22 STEREO HEADPHONES

Excellent definition. Very efficient. \$59.95.

Weight: 10 oz. Cord: 9 feet long. Cushioned headband, pressure phone cushions. Very light, with easy pressure on the ears. Sound quality is slightly bright with excellent definition. The DT-220's are very efficient, requiring little power for high sound levels. You have to drive them to the point of pain before the signal breaks

KOSS K/145 STEREO HEADPHONES

Response and definition about average for the price range. \$45.00.

Weight: 13 oz. Cord: 8 feet long, coil type. The K/145's come with a cushioned headband and circumaural phone cushions, as well as built-in volume controls. They fit snugly, but comfortably. Response and definition fall within our standards to be expected for headphones within this price category. ▲



Hitachi D-800—\$399.95

Circle No. 72 On Reader Service Card



Beyer DT-220 — \$59.95

Circle No. 134 On Reader Service Card



Koss K/145 — \$45.00

Circle No. 76 On Reader Service Card

the variable-pitch cutting techniques now in use, the loudest portions of the disc will have a duller, grayish cast. The quietest sections will be blacker and shinier. Then, you can quickly sample the loudest sections and set the recording level accordingly.

When recording a disc, switch in the subsonic filter on your preamp if it occurs in the circuitry before the tape out jacks. (This is not always the case.) The filter will help to prevent tape overload on subsonic wrap signals. If you see the meter kick up on the lead-in grooves of a warped record, and the subsonic filter does no good, it is probably *after* the tape out jacks. You may need to buy an outrigger filter to interpose between the preamp and the recording inputs of the deck to prevent overload.

When recording off-the-air, you have no chance to preview and set the best level. Here's where your past experience with discs is invaluable. But there are some tricks still available to you. If there is a station in your area that broadcasts using Dolby-encoding, it *should* transmit a Dolby calibration tone periodically. (You may have to call the station to find out when.) That tone will be precisely at a 50% modulation level, and you can count on the

station's limiters to insure that the peak level transmitted will be no more than 6 dB higher than the tone. Again because of the differences among meters and tapes, you may have to experiment to find just what meter indication (on the tone) will do the best job with music. Start off with a -3 dB reading and go from there. Once you've found the best setting, mark the position of the record level controls. You can now just set to that level and forget it as far as FM is concerned. Not only the Dolby station, but all others should come in on the money providing you don't switch tuners or tapes. Some tuners have a built-in test tone to aid you in setting the recording level. If you have such a feature on your tuner, by all means, use it.

The ultimate in recording sophistication is required when taping a live concert. Not only do you seldom have a chance to preview, but the dynamic range is likely to be much wider than that of compressed and limited discs and broadcasts. To go at live recording with a will, you should have your own compressor and/or limiter—and a better one than that usually found on most cassette decks. Here's where the 100 dB dynamic range of the dbx II noise reduction system shows its mettle

over a Dolby-B. With that sort of range available to you, you can set the recording level low enough to avoid overloading on peaks and still get a quiet copy.

6 Care for Your Tapes

With all the effort you've put into getting a good tape, it would be a shame to see it wasted by sloppy housekeeping. Store your tapes where they won't be subjected to excessive heat or very high or low humidity. If you'd be comfortable where the tapes are, they're likely to be too. But no one likes to roast in the sun for a few years!

Keep the tapes out of magnetic fields—both the AC type that surrounds transformers and motors, and the DC type from permanent magnets. Usually if the cassettes are kept at least a couple of feet away from problem areas, they'll be alright.

If they're not used frequently, occasionally rewind each cassette to keep the tape packs loose and to minimize print-through. And keep your deck in good mechanical condition to reduce the chances of tangles when you play the cassette. Now that you've got a really good recording on it, that cassette is more valuable than ever. ▲

OPERA FOR TODAY: MARIA CALLAS

(Continued from page 55)

she introduced pure, unvarnished hatred into the sound of her voice on-stage. It was not always pretty—indeed it should not have been—but when one heard either of these roles with her the effect was incendiary.

And finally—and this was not her most significant characteristic although often the one most praised—she acted with passion, dignity, and feeling. It is interesting that she was always described as a great actress, but so much of her dramatic art was what she did vocally, which was correctly perceived as acting but incorrectly attached to her stage movement. It is very true that after her Violetta in *La Traviata* with Luchino Visconti in 1955 and her work with Franco Zeffirelli, she became a formidable tragedienne. It is also true that the Metropolitan Opera *Tosca*'s in 1965 were the most theatrically effective anyone can remember, but that was after the vocal career had largely passed. What was clear about Callas from the beginning was an instinctive use of her wonderful eyes and her long, shapely hands.

On records the story is good, al-

though not ideal, on commercially produced recordings. On pirated recordings, *The Callas Legacy* (the title of an excellent recent book on all her recordings by John Ardoin) is clear for anyone to hear. The great performances are detailed there—concert arias, and all the bel canto heroines. The soprano, however, fortunately recorded 24 operas in all for EMI (Angel in America) and 20 of them are still available. Though it is clear that she really gave her absolute best only before a live audience, there are many wonderful recordings. First of all is the first *Tosca*, conducted by Victor de Sabata, with Giuseppe di Stefano and Tito Gobbi (Angel 3508). This is one of the great recordings in the history of the phonograph. Though Callas in her career often found the high C-sharp less easy than higher notes such as the E flat, she had all nine of *Tosca*'s C-sharp's on this recording, plus every other note. Added to this was a wealth of interpretation, a reading that brings the whole character of the Roman prima donna to life, and she is seconded everywhere by her three co-stars.

No recording enthusiast can be without this *Tosca*.

Of almost the same calibre is the amazing first *Lucia di Lammermoor*, again with Di Stefano and Gobbi, but this time conducted by Tullio Serafin (Serafin 6032). Here the high notes and ornaments work perfectly, and one can feel the depth and weight of Lucia's character. In 1977, however, it is impossible for any listener to relive the feeling that I had in a small record store on first hearing this *Lucia*—because then it was the very first time anyone had ever heard the seriousness and pathos of the role. All the Lucia's who have followed have been influenced by her reading, and this first recording is the standard from which most of them learned.

Another bel canto role that was unique with Callas was also early, Bellini's *I Puritani* (Angel 3502). Though there are some high notes that are a bit raw, the variety between madness and joy in Elvira has never been more accurately suggested.

Turning to verismo, Callas recorded Santuzza in *Cavalleria Rusticana* (An-

HFSBG UPDATE

In the September/October 1977 issue, in an article on receivers and tuners, we discussed a new digital synthesis tuner at length, erroneously giving credit to Harman/Kardon for manufacturing it. Harman/Kardon does not presently have a digital tuner in its line. The tuner we were discussing is, in fact, the Sherwood Micro/CPU 100. It sells for \$2,000. You may obtain further details by circling Number 92 on the Reader Service Card.

gel 3528) though she never sang it in her adult career. Audiences were the losers, for the interpretation is one of the most exciting on records. Blazing from first to last the recording practically comes alive as she creates a Santuzza wronged and excommunicated, desperate for love, but finally vengeful.

Of all her recorded operas except *Tosca* her most famous was *Norma*, and again it is Serafin who is found in the pit with Ebe Stignani as Adalgisa (Seraphim 6037). This is the classic Druidess, a character in which Callas could convey the variegated splendor of her emotional palette. *Norma* is a mother, lover, betrayed mistress and priestess. She shows pas-

sion, maternal love, patriotism, rage, jealousy and practically any other emotion one can name. Though there are better pirated performances of this role, the Seraphim *Norma* is one to own.

With all the tears shed at the soprano's early, sudden death, there is much that remains. She gave the world a huge legacy of recordings that capture her art; she burned deep into the memory of those that saw her; and in the end she will always be remembered as the most influential soprano of the third quarter of this century. She was unique and all of us are the richer from having lived when she did. ▲

Photo credits: (left) Christian Steiner/Angel Records, (ctr. & right) Photo Pic, Paris/Angel/EMI Records.

SPOTLIGHT ON: YAMAHA

(Continued from page 44)

listening panel prefers a midband control in the 1000-1500 Hz range.

The filters also are dual range. The low filter provides for cut-off frequencies of 15 and 70 Hz. The 15 Hz filter is actually a subsonic filter having essentially no effect on the low frequency response of the amplifier (it is only 1 dB down at 20 Hz), and we therefore suggest the 15 Hz filter always be used if there is no need for the 70 Hz filter. The high filter has cut-off frequencies of 8000 and 12,000 Hz.

Another extra in signal processing is continuously variable loudness compensation. With the CR2020 you are not limited to one or two fixed levels of loudness compensation. Instead, you have a control that permits the user to establish the *no compensation* (threshold) level. With the loudness control set "flat" the main volume control and tone controls are adjusted for desired sound quality at *maximum volume*. If the *loudness control* is then used to adjust for lower volumes the compen-

sation for lower volumes is applied from the user's maximum volume, rather than an arbitrary level selected by the manufacturer.

While the foregoing are the highlights of the operating features of the CR2020 there are a couple of other operating features which might be of specific value for you. First of all, front panel switching is provided for FM Dolby adaptor connections. When a front panel switch labeled DOLBY FM ADAPTOR is pressed, the FM tuner's signal is routed to jacks for connection to a Dolby decoder. The return jacks from the decoder are connected into the FM source circuit. (If there is no adaptor connected, the FM signal is disabled when the ADAPTOR switch is on.) For some unknown reason the FM Dolby adaptor switch does not change the FM de-emphasis to 25 uSec. You can, however, install one of the commercial 75-to-25 uSec adaptors between the receiver and the Dolby decoder. The adaptors sell for a few

dollars and are available in most of the better hi-fi shops.

The second extra feature is dual range FM muting: switch selected at 3 or 30 uV. There is no off. Three microvolts represents the full limiting level, so only signals which fall below a bearable noise level will be muted (the 3 uV setting). Thirty microvolts is slightly below the IHF quieting rating (40 uV) for this receiver, so only stereo signals considerably above the noise level will pass the mute. It's a nice convenience feature if you don't care to have interstation noise, or weak signal-distortion blasting from the speakers as you tune the FM band.

As for the overall electrical performance, as indicated by the test report elsewhere in this issue, it's strictly first-rate from the FM tuner section to the amplifier's output. The operating features simply gild the lily.

For additional information on the Yamaha CR2020 (\$750), circle number 101 on the reader's service card. ▲

JAZZ

(Continued from page 12)

portable when charging through a battalion of chord changes. In Curson's unpredictable solos, melodies and many-noted lick passages are joined by odd intervallic leaps; Brignola is a steadier, but no less impassioned player who can always find a new twist or an unexpected turn of phrase no matter how familiar the chords. They both like to play fast, and they complement each other with telepathic assurance.

During the 60s, Curson and Brignola regularly toured Europe, playing only intermittently in this country. For a while they were the front line in an excellent Curson quartet with bassist Reggie Johnson and drummer Dick

Berk; sadly, it was never recorded. Since 1975, Curson has been struggling to reestablish himself in the United States. (In Europe, he is a familiar artist on television, radio, records, and at all the festivals.) Usually he's led a septet with Brignola, a fiercely blues-oriented altoist named Chris Woods, bass virtuoso David Friesen, pianist Jim McNeeley, a drummer (the extraordinary Steve McCall was with him for several months, then Bob Merigliano), and, on congas, Sam Jacobs.

Curson's career has been marked by obstacles, and the septet's debut was no exception. It was booked to play

the Five Spot just before the club went out of business. So Curson took the band into a nearby room, the Tin Palace, paying the musicians partly from his own pocket. Almost immediately, he attracted an enthusiastic following. The band was both polished and raw; its music was aggressive, hot, and full of a spirit that seemed to hark back to the best jazz bands of the 20s. Yet it was indisputably modern, replete with strange tempos, infectious polyrhythms, and curious variations of familiar structures, i.e. Curson's memorable but difficult blues originals "Searching for the Blues" and "Reava's Waltz." (Continued on page 76)

During a typical set, Curson would play three uptempo pieces, mostly originals though he might throw in Kenny Dorham's "Blue Bossa" or a Thelonious Monk number, and one of his own ballads, notably "Marjo" and "Song of the Lonely." On slow numbers, he plays flugelhorn with a warm, open-hearted sound. He also occasionally plays the ancient four-valve piccolo trumpet, which gives him a more playful sound and a battery of half-cooked effects. In addition to the trumpets, he is likely to kick off the latin pieces by pounding a rhythm on cowbell—no jazz musician is as effective on cowbell as Curson. Thus far the group has made one record, *Jubilant Power* (Inner City 1017). At this writing, Curson plans to slim the band down to a quintet, with just Brignola and a rhythm section.

Curson was born in Philadelphia in 1935 and raised in a community that produced several noted musicians, including the Heath Brothers, Bobby Timmons, and Jimmy Garrison. It isn't generally known that he tutored the great trumpeter Lee Morgan; Morgan became famous at so tender an age that it is often assumed the influence

went in the other direction. At the age of 12, Curson started playing carnivals. After studying at Mastbaum and the Granof Music Conservatory, he landed his first "name" gig with Charlie Ventura. Miles Davis heard the group and arranged for Curson to play New York's Birdland with Red Garland. By 1959, he was working with the epochal Cecil Taylor group; a year later, he became part of one of Charles Mingus's finest bands, a quartet with Eric Dolphy. He can be heard with Taylor on *In Transition* (Blue Note) and with Mingus on *The Candid Recordings*, *Charles Mingus Presents the Charles Mingus Quartet* (both reissued on Barnaby and presently unavailable), and *Mingus Revisited* (Trip), where he appears only briefly.

In 1961, he made his first album, with Dolphy, for the new defunct Old Town label. Three years later, he made his first tour of Europe which started a regular pattern that has continued to this day. He made numerous records abroad with a variety of bands and, on at least one occasion, a large orchestra. In America, there were albums for Prestige, Atlantic, and Audiofidelity (a

wonderful session with the Barron Brothers called *Now Hear This*). He also appeared on records with Bill Barron (Savoy) and Archie Shepp (Savoy and Impulse). In recent years, two albums made in Europe have been rereleased on Arista/Freedom: *Tears for Dolphy* is a quartet date and *Flip Top* features both the quartet and the Zagreb Radio Orchestra. Barron is present on both albums and does some of his finest playing. Sessions with Booker Ervin (*Urge on Fontana*) and a quartet of Scandinavians (*Ted Curson & Co.* on EMI) have never been released in this country, but they are among his most satisfying records. A recent album for Atlantic, *Quicksand*, is (as of late 1977) only available in Japan, where it's become a genuine hit. His music is also heard on the soundtrack of Pasolini's *Teorama*. The records are difficult, sometimes impossible to find, but worth every effort. Still, in order to best appreciate the visceral energy of the man, you must hear his band in concert. However little mass attention it has attracted, it is one of the most volatile and valuable jazz groups of the 70s. ▲

REEL-TO-REEL

(Continued from page 47)

professional operation." Key features include expanded VU meters, timer connection, automatic or manual reverse stereo playback, dual monitoring, and mic/line mixing. Both the above have seven-inch reel capacity.

Philips High Fidelity Laboratories recently entered the American tape recorder market with two toteable vertical models in polystyrene cabinets with built-in carrying notches. The black-finished units in European or "Continental" styling are both three-head, three-motor models with four-digit tape counters, illuminated peak-reading meters, dynamic noise limiter switch that reduces playback noise by better than 10 dB, playback with or without pressure pads, A/B monitor switch, three-speed operation, and seven-inch reel capacity. Signal-to-noise ratios for both models are 60 dB or better at 7½ and 3¾ ips. Model N4504 sells for \$450. Model N4506, which additionally offers a built-in preamp section and optional on-off remote control, is priced at \$650.

U.S. Pioneer Electronics recently did an about-face; instead of adding new units to its line of full-size 10½-inch reel decks, it created two compact decks featuring a narrow profile—9-1/16th inches high to be exact—and seven-inch reel capacity. These two models can be rack-mounted if desired or placed

alongside, atop or beneath other components in a hi-fi system. The two three-motor units—the RT-701 at \$525, and the RT-707 at \$575—are the same, except the higher priced model additionally offers automatic reverse playback. Features include solenoid drive, direct-switchable function buttons and preset function buttons for timer recording and playback, mic/line mixing, 7½ and 3¾ ips operation, variable pitch control in playback of plus/minus six per cent, pause indicator lamp, and bias and equalization selection. Signal-to-noise ratios are more than 58 dB.

ReVox is continuing to produce its classic Model A77, a 10½-inch reel model priced at \$899 that has been on the scene for ten years. But it is also giving consumers who need more than the A77's basic features a chance to have them, in the new ReVox B77, priced at \$1,195. In addition to all the features of the A77, the B77 has an LED overload indicator for more positive recording results, built-in precision tape cutter and splicing block, pause control, complete electronic logic control, space for a fourth head, and larger, easier to read VU meters. The B77 is a 3¾ and 7½ ips machine with quarter track or half-track head configuration, and offers 24 dB headroom for both record and play for a wider overload margin.

While the best seller for Superscope is reportedly the Sony Model TC-377, a seven-inch-reel model priced at \$450, the firm is creating a lot of excitement among superbuffers with its Sony Model TC-880-2, priced at \$2,495. Described as a "professional quality tape deck" in Superscope's advertising, it offers 10½-inch reel capacity, 7½ and 15 ips speeds, peak reading VU meters, half-track stereo record/playback and quarter-track playback, three motors, four heads and closed loop dual capstan tape drive. A "phase compensator circuit" compensates for phase distortion caused by the recording process; its use is claimed to result in sound quality virtually identical to the original source. Another feature called "Symphase" prevents phase shift. It is ideal for recording of matrixed four-channel program materials since it retains the exact positioning of the original signals. For buffers who do a lot of discrete four-channel recording, Superscope offers the Sony Model TC-788-4, priced at \$1,595. The unit is also ideal for other forms of multi-track recording.

Tandberg of America, mindful of audio buffers' needs, recently added the Model 1041X, as a successor to its highly acclaimed 1041XD. The latter is a Dolbyized 10½-inch reel model priced at \$1,399. The 1041X is similar in all respects except it is without the Dolby

feature, which brings the price down to \$1,099. The 1041X and 1041XD feature 15, 7½ and 3¾ ips operation, three motors, three heads, plus separable bias head, electronic speed regulation (servo system with tachometer), mixing facilities, echo, sound-on-sound, peak reading meters, and edit/cue for easy tape search. Optional accessories include a remote control, variable pitch control, and rack mount kit.

Technics by Panasonic recently made big waves in tape recorder technology by debuting a deluxe reel recorder—at \$1,500—with an “isolated loop” drive mechanism. This feature represents an advance in closed-loop systems, completely isolating the loop from all outside influences such as take-up and back tensions exerted by the reels. A giant capstan—possibly the largest currently used in tape equipment—provides a greater pressure area in contact with two pinch rollers, thus minimizing tape slip and assuring absolute accuracy in tape travel. Among other features of the Model RS-1500US are: three-speed operation, 10½-inch reel capacity, timer start switch, meter scale selector, three-way equalization/bias selectors, cue/edit lever, four heads,

two-track stereo record/play, four-track stereo play, pitch control, real time tape counter, and a stroboscope—said to be possibly the first ever incorporated in a tape recorder. The unit is also unique in that it can operate from a 24-volt external storage battery or optional dry cell adaptor.

Best seller in the TEAC reel line is the Model A2300SX, priced at \$650. It was described by TEAC's New York sales representative as “a workhorse machine,” designed for “recreators” who record largely from non-live sources. It features three motors, three heads, seven-inch reel capacity, 7½ and 3¾ ips operation, mic/line mixing, four-digit tape counter, dual-position bias and equalization selectors, and large VU-type level averaging meters. A Dolby version, Model A2300SD is priced at \$750. To “creative” recordists, TEAC's A3340S at \$1,200 is designed especially for them. “It's for the specialist who likes to lay down a lot of tracks, who is out to create special affects, who likes to work with ‘live’ sound, who is a professional recordist at heart.” The four-channel stereo unit, operating at 7½ and 15 ips, features “Simul-Sync” for multi-track

recording and overdubbing, manual cue for fast search, cueing and editing, and four large VU-type level averaging meters, among a host of other facilities. A smaller version with seven-inch reel capacity and 7½ and 3¾ ips operation is available as Model A2340SX at \$800.

Uher Corp. is capturing the attention of recordists who need a wide range of speed capabilities with its Model SC560, priced at \$1,020. This seven-inch reel model in black Continental/European styling is unusual in that it provides 15/16 ips operation as well as the three other popular speeds—1½, 3¾ and 7½ ips. It is also unusual in that it can function as a “sound center” via a 10 wpc amplifier driving a pair of built-in speakers, or be used as a deck in a hi-fi system. Among its many features are: interchangeable head mounts for optional two-track stereo operation, four-digit counter, four heads, A/B monitor switch, sound-on-sound, trick effects control, and tape head azimuth adjustment control. Uher also has a lower-priced, lower-powered, four-speed self-contained double-duty unit, Model SC520 at \$685, with many of the features of the SC560.

Happy choosing!

BLANK CASSETTE TAPES

(Continued from page 43)

have tested some recorders giving best performance with TDK-D tape, a true budget-priced tape. These same recorders produced screaming highs when used with a Group 2 tape. Our illustrations are useful in highlighting tape characteristics which might affect the performance attained from your own recording equipment. Use our findings as a guide to finding a tape that is optimally compatible with your machine.

One comparison that can be made with a degree of accuracy regardless of machine, bias, or equalization, is the uniformity of coating as represented by the smoothness of the -20 dB trace between 1000 Hz and the highest frequency. This year we find quite an improvement in coatings: the ripples in our oscilloscope graphs—which indicate dropouts—are sharply reduced from what we found in previous years. Note in particular the absolutely smooth traces of the Scotch Master I and Fuji FX tapes, a shade smoother than the Maxell UD/XL I which has been the leader in smooth response in previous years (though this is comparing *outstanding* with *outstanding*).

Also note, however, the TDK-D—our budget tape. The smoothness of trace compares favorably with Scotch and Fuji, leading us to suppose there has been a considerable improvement in

tape technology which will become increasingly apparent in budget tapes.

What Difference Does Tape Formulation Make? Now look at the traces in Fig. 1, made at 0-dB level on different tape formulations.

For clarity the traces have been displaced; the oscilloscope's graticule calibration of 5 dB per major division applies only to a specific trace. The actual output level from each tape-type is similar—not as close as the Ferric-only tapes in Groups 1 and 2, but similar.

From the top down, the traces represent types TDK SA, Maxell UD/XL Type II, a ferrichrome, a chromium dioxide, and a typical ferric tape. We used the proper bias for each type of tape as specified by the tape manufacturer; for example, SA, UD/XL Type II and chromium dioxide tapes were recorded using chromium dioxide bias and equalization.

Note the overall response and saturation of the SA, UD/XL II, and chromium dioxide tapes—traces 1, 2, and 4—are very similar. Trace 3, ferrichrome, has a slightly different high frequency response and overload than traces 1, 2 and 4. Now compare the low frequencies, especially the peak near 50 Hz. Ferrichrome low frequencies have a slightly greater output in relation to the midband than the other tapes. We

have found this “improved” low frequency response to be true of ferrichrome when used on other recorders; it is a characteristic not restricted to only the D-800 machine.

Finally, we come to the number 5 trace which is one of the better ferric tapes. Note the high frequency saturation in relation to the premium tapes, traces 1 through 4.

On the surface it would appear the premium tapes are always at an advantage over the standard ferric type. In terms of high frequency response this is a correct assumption. However, the *chrome type tapes* (referring to all tapes which have chromium dioxide in their formulation, including ferrichrome tapes) generally have considerably higher 0-dB record level distortion and substantially less midband headroom compared to standard ferric tapes when the *chrome* tapes are recorded on a moderate priced machine. (As we said, any machine can be optimized for any tape. Moderately priced machines are usually optimized for “standard ferric” or “high energy” ferric tape.) The SA and UD/XL II tapes usually have less distortion and much greater headroom than ordinary ferric tape, but at a premium price. Whether the price difference is worth the extra midband and high frequency headroom

is your decision to make.

Summing Up. While we don't like to fall back on the old cliché "The best tape is the one that sounds best on your cassette deck," it is nevertheless true that it's the only way to determine which tape will perform best on budget through upper-moderate priced cassette decks. Just a glance at the tape-tables usually provided with the machine which attempts to specify bias and equalization switch adjustments for two or more tape-types tells you something is wrong, for no table can be

correct that shows the same bias/equalization for TDK-D and Maxell UD/XL. There is just no one single adjustment that can be a reasonable compromise for these two tapes. Similarly, no table is correct that shows the same bias/equalization for ferrichrome and chromium dioxide tapes.

The manufacturer of the recorder does the best he can do to create the illusion that any readily available tape can be used on his machine. If you're willing to put up with anything from good to miserable sound his tape charts

and tables will at least put you somewhere in the ballpark. If you want the best sound your recorder can deliver for your available hi-fi dollar, decide how much you're willing to pay for a cassette tape (not everyone is willing to splurge \$4 or more for 90 minutes of time), then purchase every available type of tape within that range and try them all. The one that sounds the best to you is the best for your machine, regardless of what any person, test report, or advertising brochure claims to the contrary. ▲

TAPE MACHINES

(Continued from page 36)

performance is important too, so check the wow/flutter and speed accuracy. Of the two, wow and flutter is by far the more important. But watch the standard used. Some manufacturers use the DIN peak weighted flutter method—it *should* appear as $\pm X\%$ (DIN peak weighted). Others opt for a "weighted RMS" measurement to either NAB or JIS standards. The DIN technique relates to the audibility of the flutter much more closely than do either the NAB or JIS measurements and so is a better guide. But the DIN flutter is likely to be worse than the alternate specs, so many manufacturers opt for JIS or NAB. Just be aware of the differences so you don't downgrade a DIN-rated deck because the number is worse; the deck may very well be better.

Flutter specs of the order of 0.1% to 0.2% are common with cassette equipment. Speed accuracy is generally within a percent or two—plenty good enough unless you have perfect pitch hearing. (If you do, you're probably best off with a deck that has a variable pitch control. They're available.) Fast forward and rewind times are more a matter of convenience than anything else—not really indicative of quality. Be sure that those times refer to the same length cassette (or open reel tape.) Most manufacturers spec the time for a C-60 since it's obviously less than that for a C-90.

Potential Extra Options. Some decks offer a slew of mechanical convenience features—auto-reverse, memory rewind, auto-stop, remote control, timer control, and a footage counter. In large measure, you must decide how important these are to you. The really important ones—auto-stop, pause and a footage counter—are included on practically every deck. The auto-stop will disengage the pinch roller (and usually turn off the deck as well) when the end of tape is reached (or if the tape breaks on an open reel deck.) That's import-

ant to prevent flat spots from appearing on the pinch roller and later cause flutter.

The pause control momentarily stops the tape motion, leaving the deck on and in whatever mode it had been. Some are more effective than others, but you'll have to try it in the showroom to find out. The tape should stop and start practically instantaneously without pitch variation, and there shouldn't be any clicks or pops recorded when it does start up.

The tape footage counter on most cassette decks merely keeps track of the number of revolutions that one of the reels has made, and it's not usually precise in measuring tape length. Too much depends on just how tightly the tape is wound. On some open reel decks, an idler in the tape path accurately measures the number of feet of tape that have passed. Nonetheless, some indication of relative position is handy even if it's not right on the money.

On an auto-reversing deck, the tape will reverse at the end of one side and automatically switch over to play the alternate pair of tracks. (If it does this stunt in both directions, it's sometimes called "continuous-play".) With memory-rewind, you can rewind to a pre-established position (zero on the footage counter), and the deck will automatically stop (and perhaps automatically go into the play mode.) A remote control is handy in controlling the deck from your listening (or recording) position, and a timer control will let you preset the deck to record an FM broadcast in your absence. All these features cost money, and that money is better spent on improved basic performance if you don't intend to use the features.

Two-Head vs. Three-Head. Most cassette decks use a combination record/play head which, with a separate erase head, constitutes a "two-head" configuration. With such a setup, you can record or play but not both simul-

taneously. Thus, you can't monitor what you've just recorded. Three-head decks—that includes most open reel machines and a few cassette units—use *separate* record and play heads. This is much more convenient for recording, since you can play the tape back as it is being recorded, compare it to the original, and make minor adjustments in level on-the-fly. To boot, by using separate heads, each can be optimally designed for its job, and so the performance is generally better. Beware, however, of the so-called three-head cassette decks in which the "third head" is merely a low grade playback head used *only* for monitoring. It won't give you an accurate idea of what's *really* on the tape but merely indicate that something is there. A true three-head deck uses the *same* play head all the time, and it's a quality one.

Heads themselves come in a variety of constructions—ferrite, hard permalloy, sendust, etc. Each manufacturer claims that his is best. That, in itself, is the subject of an article. Suffice it to say here that good performance can be achieved from any of the types. As usual, it comes down to a trade-off—electrical performance vs. long life vs. cost. Each designer pays his money and takes his choice.

Input/Output Flexibility. Check the input and output flexibility of the deck. Some decks have built-in mike/line mixers with separate recording level controls for each; with others, it's an either/or arrangement with the same amplifier and controls used to handle both inputs. On the output end of things, some decks offer an output level control (and perhaps a separate headphone level control); others don't. The line output control will let you match the deck to your other sources so that, when you switch between them on the preamp, there are no gross level changes. That also makes it easier to A/B compare on a three-head deck. And a separate headphone volume con-

LITERATURE LIBRARY

201. There are over 400 kits described in the new *Heathkit* catalog for virtually every do-it-yourself interest—amateur radio, hi-fi components, color TV, test instruments, digital clocks and weather instruments, radio control equipment, marine, aircraft and auto accessories, and many more.

202. *Electro-Voice* will send complete information on Thiele-Small parameter speakers and systems which combine flat, wide response, high efficiency, and small size (to half size of sealed systems) including Interface and Sentry systems. There's also information on new separate component speakers.

203. *Crown* offers a new four-color brochure illustrating and describing the company's complete line of hi-fi amplifiers, preamplifiers, speaker systems, control centers and tape recorders.

204. *Sony's* "High Fidelity Components" has a glossary defining major specification, control and convenience feature terminology, which complements the reference chart of specifications for components.

205. The new 20-page, full-color stereo-phone catalog from *Koss* features lively photography and art to show 15 of the company's dynamic and electrostatic stereophones and listening accessories. There is a specification comparison chart and prices.

206. *Kenwood's* wide range of receivers, amplifiers, tuners, tape decks, stereo compacts, and speakers is described in a new brochure.

207. The full range of *Magnavox* audio products from the tuner/amplifiers to combination stereo FM/AM radio phonographs and 8-track tape player/recorders are featured in this new 60-page four-color audio catalog.

209. *JBL's* brochure describes the Decade "family" of loudspeakers: the L26, the L16 and the L36. Each system features styling, hand-craftsmanship, and sound quality, yet is priced for the budget-minded. Their enclosures are finished in natural oak.

210. *Klipsch* loudspeaker systems are attractively presented, including explanation of the Klipschorn corner horn and corner mirror effect. Available for a few dollars are reprints covering design, stereo re-creation, etc.

211. "Hearing Is Believing," a booklet from *ESS, Inc.*, has a serious theme and a constructive purpose. Fundamentals of loud-speaking technology are examined. How to develop a superior loudspeaker is spelled out.

213. *Pickering* has attractive specification sheets on stereo headphones. Also offered is a colorful brochure on cartridges in the UV-15, XV-15 series, as well as the V-15 Micro IV series.

216. For tips from leading sound engineers, send for "The Music-Maker's Manual of Microphone Mastery" from *Shure*. It describes how to match voices and instruments.

220. This full-color booklet by *Dynaco* is subtitled "High Fidelity Components for the Audio Perfectionist." There are two intro-

ductory articles to help you choose your component stereo system. Following is detailed information on the components.

221. A new series of product literature is now available from *Jensen Sound Laboratories*. The new catalogs feature four-color photographs and graphic illustrations of the high fidelity line.

222. *TDK* has a new booklet, "SA... a new state of the cassette art," in which they claim great things: much lower noise levels, greatest dynamic range, unexcelled frequency response, high precision, among others. So send for the booklet to see if you agree.

223. *Technics-Panasonic* has a complete condensed catalog of its line of stereo and 4-channel receivers, separate amplifiers, turntables, tape decks, speakers, separate tuners, microphones, headphones, integrated amplifiers, and CD-4 4-channel demodulators.

224. Before you purchase your hi-fi equipment, read "The *Garrard* Guide," what every hi-fi shopper should know about *Garrard* automatic turntables. There are 11 pages of information and pictures.

225. As part of a broad educational campaign, *Sansui* is making available a booklet, "A Non-Technical Guide to QS 4-Channel Sound," for the consumer. It describes the various forms of 4-channel, their advantages, disadvantages and availability of material.

227. *Tandberg* has an attractive color booklet displaying its tape decks, cassette deck, receivers, speakers and accessories.

228. *Pioneer* value-packed receivers are gracing more and more living rooms as audiophiles turn on, and tune into, the quality sounds of *Pioneer*. Circle the number 228 and let *Pioneer* do the rest.

230. Make your own evaluation of why *Acoustic Research* (AR) components, designed basically for home use, are often selected for critical professional and scientific applications.

231. *JVC* offers three catalogs—"Tape-it-Live" is in English, French and German and features portable stereo cassette deck and accessories. "Listening for the Future" is all about the *JVC* FM/AM-stereo receiver series. The "JVC High Fidelity Catalogue" is a 36-page full-color delight.

232. *Sherwood Electronics Laboratories* has literature available on its full line of receivers, amplifiers, and tuners. Included are specifications and independent reviews.

233. In "Meet the Creator," *TEAC* invites you to explore the realm of musical creativity with the *TEAC* 3340 4-Channel Simul-Sync Tape Deck. The booklet introduces some of the basic effects that can be produced, using ample diagrams.

236. *Jennings Research* has a full-color brochure describing the *Contrara* Group loud-speaker line: two bookshelf models and a floorstanding, pedestal loudspeaker. Also available is a full-color brochure on the *Vector One*, a phased-array 8-inch bookshelf speaker.

237. The 32-page *Pioneer* booklet, "How I Install Car Stereo," by a 26-year-old expert who has installed nearly 5000 car stereo systems, shows in detail how to mount, wire, troubleshoot and maintain hi-fi in your automobile.

238. *Fuji* has just made available a new booklet on their tapes—"Cassette Tape and How to Make It Work for You." It is written on a non-technical level and contains practical information on the selection and use of cassette recorders/players.

239. *3A's* 24-page color catalog gives detailed information on many subjects, among them the principles of acoustic pressure feedback and infinite acoustic loading.

240. A new 6-page color brochure has just been released by *B&K-Precision*. It describes their complete line of discrete semiconductor test instruments for laboratory, industry, maintenance, and service.

241. *Allison* loudspeaker systems claim to be unique in producing in real-room environments. This booklet on their models One through Four explains in quite some detail how they work. Each system is pictured alongside its specifications.

242. A new four-color brochure from *VOR* describes in detail the inner workings of the patented automatic "dry" vacuum record cleaner—the *Vac-O-Rec*. It cleans by lifting dust and dirt with mohair brushes, and a fan blows them away.

243. A new 12-page catalog from *Quam-Nichols* lists 127 loudspeakers, covering virtually any application and providing a tool for selection. It includes listings for new mobile 2-way radio replacement speakers—CB and land mobile business.

244. *Beyer Dynamic's* full-color brochure presents their large assortment of dynamic microphones and headphones. They claim to have the right headphone for every job—monaural, binaural, 2- or 4-channel listening, hi-fi equipment, receivers, televisions and dictating machines.

245. *Celestion* speaker systems are created in England, but are now being made available throughout the world. Send for this brochure to see why they claim such excellence in the speakers they conceive, design and produce.

246. *B&F Enterprises' Truckload Sale* catalog features 10% off their already low prices. All merchandise is high-grade military or industrial surplus: speaker kits, TV games, computer terminals, tools, TV components, lenses, transformers, semiconductors, and more.

HI-FI STEREO BUYERS' GUIDE, Dept. LL-20
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January/February 1978

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245	246									

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trol is obviously desirable if you do a lot of on-site live recording and will be using earphones to monitor what's going on.

In any event, you should ascertain that the mike preamp is sufficiently sensitive to work with the microphone you are using, and that it won't overload on loud sounds. (Many of them will.) Similarly, line input sensitivity and line output level should be compatible with your preamp, but that's not usually a problem.

Dolby Calibration. Some cassette decks offer user-operated Dolby calibration controls but many do not. We think they're desirable to match the Dolby circuitry to different tapes and so get the best performance from each. Of course, if you misuse the calibration controls, matters get worse instead of better—that's the reason Dolby doesn't encourage their inclusion in garden-variety equipment. Suffice it to say that, if you're a really serious audiophile, you'll probably want access to the control yourself.

Recording level indicators come in a wide variety of types ranging from the truly useful to the practically useless. A sine qua non is that the meters should be large enough to read—not always the case. The ballistics of the meter are important too. If they are underdamped, they will bounce around

like whirling dervishes—quite useless in setting level. If they're overdamped, they just won't respond in time (or accurately) to brief musical transients, and you'll overload the tape. To our way of thinking, the best recording level meter is the peak-indicating type; one that will respond quickly and accurately to brief transients and hold that peak reading long enough for you to see what's going on. A peak-indicating light or LED is also frequently helpful in alerting you to a dangerous overload.

Music frequently has a very wide dynamic range. Meters that are calibrated from -20 to +3 (as most of them are) just can't indicate the wide range that is prevalent especially in symphonic music. During quiet passages, the needle doesn't get off the stop, and you can't tell if you should turn up the recording level or not. Next thing you know, you're bashed into the red. That's why we prefer meters with a 40 dB or greater indication range. They make the setting of levels infinitely easier, and that's the clue to good recordings—especially on the unforgiving cassette. (Some decks include a recording "limiter" to prevent overload when recording live. They are helpful in a pinch, but, since you can usually hear them squash down the level, you shouldn't rely on them to do your work

for you. Consider them as a safety valve only and set the recording level so that they rarely, if ever, trigger.)

As is true with most high fidelity equipment, the choice of a tape deck is a matter of balancing features and performance. Whether you should choose an open reel deck or a cassette system depends on what you want to do with it. The serious live recordist will probably prefer the open reel format for its obvious convenience in that mode. Most others will probably opt for a cassette deck. If you've noticed, we haven't even mentioned eight-track. It simply hasn't kept up in the high fidelity area. But a newcomer, the Elcaset, shows promise. It combines many of the editing and performance features of the open reel system with the convenience of a cassette. Whether it makes it in the real world, only time will tell. Many tape formats have come and gone. But, if it succeeds, it may solve the cassette/open reel dilemma. ▲

SPOTLIGHT ON: DUAL

(Continued from page 40)

attenuated as more erasure is applied, and finally the signal fades out. An absolutely lovely feature that works perfectly. Best of all, you cannot accidentally apply the erase; you must hold down the safety throughout the entire procedure. (Works great when preparing sound tracks for slide shows because you don't have to worry about start and stop noises—you just get rid of them after the sound track is finished without affecting the overall timing.)

Moving along to an even more important feature for many tape fans, the left and right record level meters are actually a series of twelve light emitting diodes (L.E.D.'s) color-coded green and red, like the safe/overload scales of a standard VU meter. Each L.E.D. meter is calibrated from -20 to +5 dB.

As the record signal passes through the recorder the series of L.E.D.'s forms an everchanging bar of light whose maximum value represents the recording level. A VU/peak switch converts the L.E.D. "meters" to the slower average type of VU indication, or instantaneous peak level. Actually, there's really no reason for the VU characteristics, since best recordings are attained

using the peak indication, which permits you to work right up against the saturation level of some tape types without worry as to whether "unseen" peaks not usually indicated by a VU meter are driving into the high distortion of tape saturation. It takes about 15-minutes to get used to the "bar lights," after that you'll never want to go back to VU metering. (When using a high performance tape such as the Maxell UD used for the test report elsewhere in this issue, the machine has so much headroom you can run the complete "bar" at full brilliance and still turn out an outstanding recording.)

Next on the list of outstanding features is a record level limiter. There are limiters, and there are *limiters*. The one on the C939 works like a professional limiter with a very fast attack and release. It cuts in with full limiting at precisely 0 dB meter reading and releases quickly, avoiding a fade-up of background noise or a sudden drop in the volume of the signal following the peak if it is not at approximately the same level as the signal that caused the limiter to activate.

A feature of less importance to most
(Continued on page 82)

STATEMENT OF OWNERSHIP

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(signed) V. C. Stabile

Vice President and Treasurer

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hi-fi stereo BUYERS' GUIDE

MARCH/APRIL 1978

ON YOUR NEWSSTAND:
February 28, 1978

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tape fans, but still desired by many, is continuously variable headphone volume through separate left and right headphone volume controls.

Finally, coming full circle, we get back to the reversing tape mechanism. If you've ever fussed and fumed while trying to attach sensing foil to the end of a tape, you can forget about it on this recorder—the reversing mechanism is photo-optically tripped. You can use an *unmodified* standard cassette and still get auto-reverse operation. Note that because the photo-optical system works on the leader portion of the tape the automatic system is inoperative during recording because there would be a *drop out* during the time the leader was over the record/play head. During recording the mechanism is manually

switched to reverse tape drive.

Because the tape mechanism uses a twin capstan system so that the tape is always pulled (rather than pushed) past the heads regardless of direction, the wow and flutter figures were typical of better cassette equipment for both forward and reverse drive.

Additional information on features and performance will be found in the test report elsewhere in this issue.

Overall, the Dual C939 cassette deck at \$550 is best described as "beautiful." It performs well, is notably easy to use (you can trust it in the hands of young children), and it has features most of us thought were impossible to get in cassette equipment. For additional information circle number 27 on the Reader's Service Card. ▲

ELCASET

(Continued from page 48)

a third ferrite head, memory rewind for rapid tape indexing, and provision for accessory timer for delayed recording. A special feature is a combination of six LED indicators for multi-point peak level indication, to prevent accidental tape saturation.

Sony offers models EL-5 at a tentative price of \$630, and EL-7 at a tentative price of \$880. EL-5 has two Ferrite and Ferrite heads, Dolby and Dolby FM noise reduction system, end-of-tape shutoff, independent multiplex filter, optional external timer, memory rewind, and remote control connection. The EL-7 has three Ferrite and Ferrite heads for separate erase, record and playback functions, closed-loop dual capstan drive, three-motor drive and detented master volume control.

TEAC's Model AL-700, priced at \$1,100, utilizes Dolby noise reduction circuitry and is equipped to accept op-

tional dbx control (RX10) and a remote control. It uses three heads and has a three-motor transport with closed-loop, double-capstan drive system, with a wow-flutter spec of 0.04 per cent wrms, and a timer connection.

Technics by Panasonic offers the RS-7500US, priced at \$650 with three blank tapes. Features include three heads, mic/line mixing, memory rewind, tape monitor switch, timer connection, separate recording and playback amplifiers, and illuminated "remaining tape" check window. Its wow/flutter is 0.06 per cent wrms.

NOTE: At press time we learned that at least one other company will be entering the Elcaset field. It is Marantz, reported to be developing a series of Elcasets in a wide price range, and with different combinations of features, to accommodate a wide variety of needs. ▲

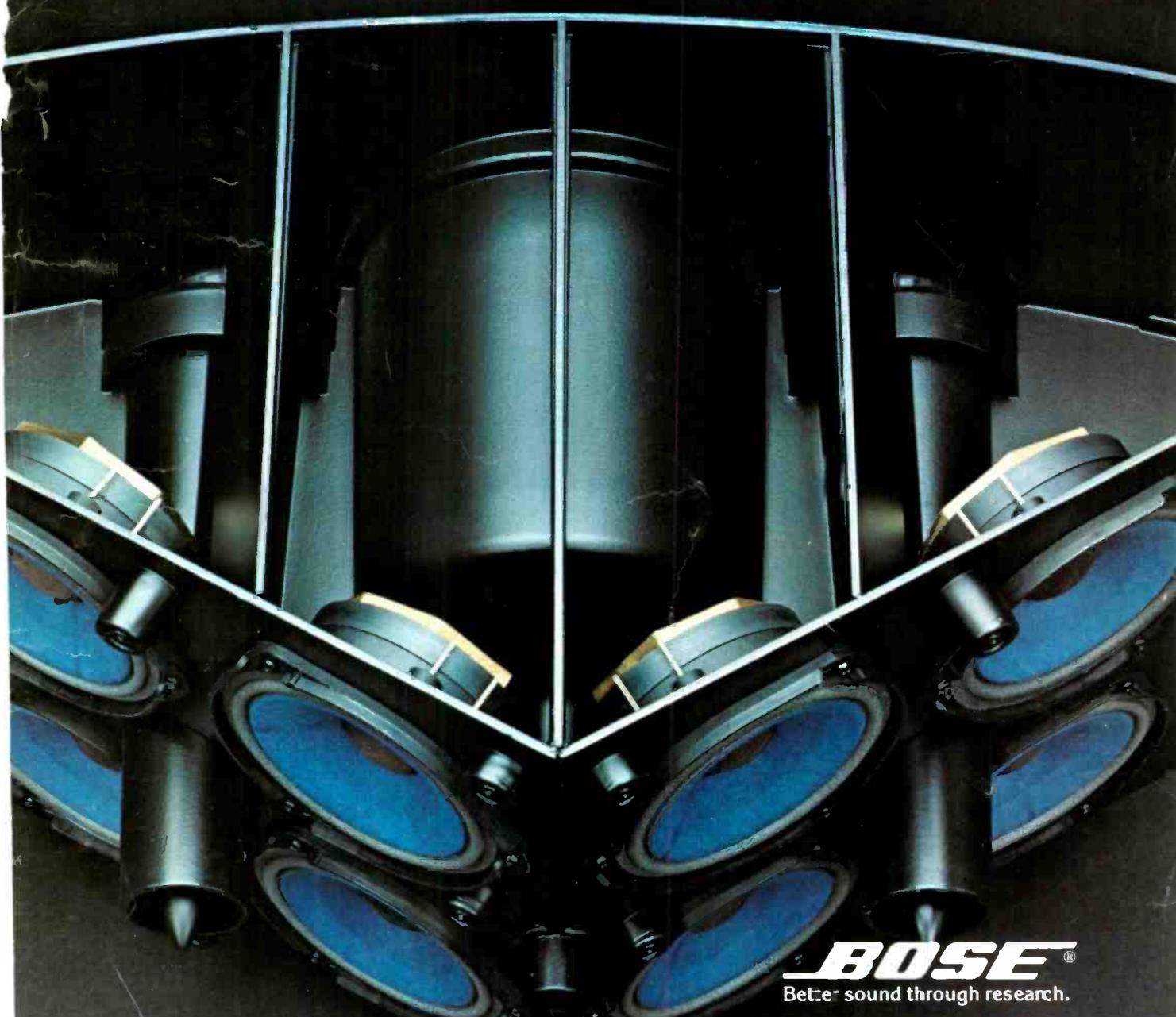
POP DISCS

(Continued from page 30)

front cover has a close-up picture of a spigot with a rubber hose attached to the spout. The hose loops around to the back cover, where we find the other end attached to another spout. Now you psychiatrists out there pay attention. I figure that this picture means either that the music inside is whimsical and funny, or that it comments on the frustrations and pressures that people suffer. It seems that I'm right in both cases. Russell Morris has the gift of being able to make a perceptive comment on the trials and tribulations of our times, but in a good natured rather than a morose way. For example, "Broken Egg Shells" is about the many actors that try but never make it to

stardom. What an imaginative metaphor for an actor's ego—an egg shell. "Superman" bemoans the plight of the personality having to put up with uninvited and unwelcome hangers-on and droppers-in. But all is not sadness and frustration. When the pressure valve is opened, the joy of such songs as "Two-Wheeled Flyer," describing the feeling of a fast motorcycle ride, provides a balance for the more negative cuts. And here's the surprising thing—all of the songs are backed by some of the best, most commercially hooked rock and roll riffs of recent vintage. The messages in this album are good for you, but the taste is like cherry cough syrup, not castor oil. ▲

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



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In one page we cannot begin to describe the 901 Series III and the technology behind it. So we've put together a comprehensive literature package that includes a detailed 16-page color brochure, a 20-page owner's manual, and a copy of Dr. Amar Bose's paper on "Sound Recording and Reproduction," reprinted from Technology Review. To receive this literature, send \$1.00 to Bose, Dept. A10, The Mountain, Framingham, Mass. 01701. Patents issued and pending. Cabinets are walnut veneer.

Circle No. 23 On Reader Service Card

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The engineering in the SU-9070 DC pre-amp is similarly unique. There's a built-in moving coil pre-amp with -157 dBV noise voltage. A moving magnet pre-amp with an extremely high S/N of 100 dB (0 mV input). Direct-coupled circuitry to keep distortion at a minimum of 0.003% (rated THD). What's more, the SU-9070 has inputs for three tape decks.

Finally there's Technics SE-9060 amp. It's DC like our pre-amp. Has a frequency response of 0-100 kHz (+0, -1 dB). And a "strapped" circuit for more than double the power in a multi-amp system.

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ST-9030 THD (stereo, 1 kHz): Wide—0.08%. Narrow—0.3%. S/N (stereo): 73 dB. FREQUENCY RESPONSE: 20 Hz—18 kHz \pm 0.1, -0.5 dB. SELECTIVITY: Narrow—90 dB. CAPTURE RATIO: Wide—0.8 dB. IF, IMAGE and SPURIOUS RESPONSE REJECTIONS (98 kHz): 135 dB. STEREO SEPARATION (1 kHz): Wide—50 dB.

SU-9070 PHONO MAX. INPUT VOLTAGE (1 kHz RMS): MM—380 mV. MC—9 mV. S/N (IHF A): MM—100 dB (10 mV input). MC—72 dB (60 μ V). FREQUENCY RESPONSE Phono 20 Hz—20 kHz (RIAA \pm 0.2 dB).

SE-9060 POWER OUTPUT: 70 watts per channel (stereo), 180 watts (mono) min. RMS into 8 ohms from 20 Hz to 20 kHz with no more than 0.02% total harmonic distortion. S/N: 120 dB (IHF A).

SUGGESTED RETAIL PRICES: \$399.95* each.

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*Technics recommended price. But actual retail price will be set by dealers.

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