

Audiophile

Annual Index

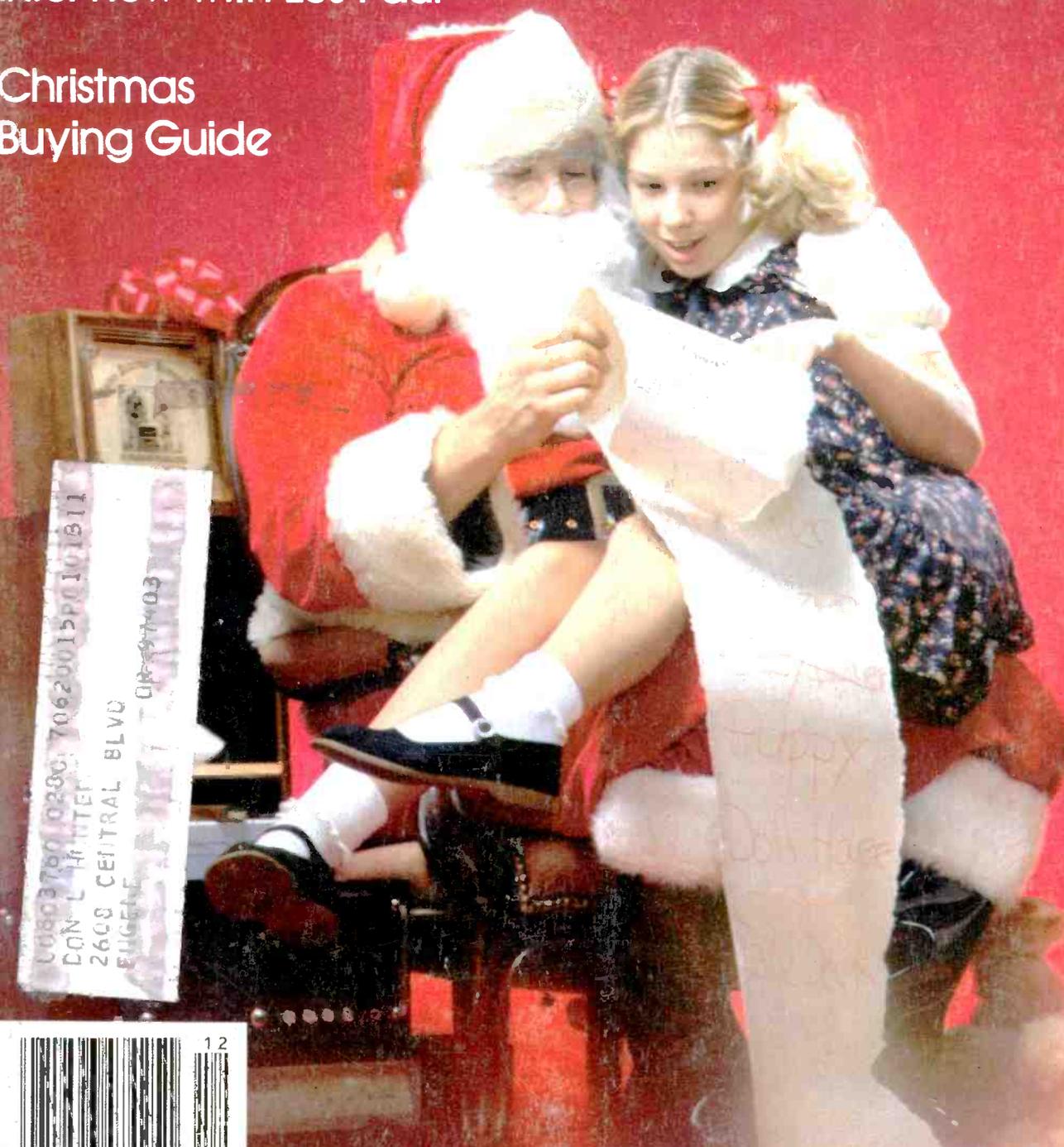
THE AUTHORITATIVE MAGAZINE ABOUT HIGH FIDELITY • DECEMBER 1978

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Interview with Les Paul

Christmas
Buying Guide



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CON L H INTER
2600 CENTRAL BLVD
EUGENE, OR 97403

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THE RIGHT WAY.



when combined with lower audible frequencies.

Most of our competitors use a standard high band filter to cancel out this signal. Unfortunately, it also cancels out some of the music.

Pioneer created a special integrated circuit that eliminates this pilot signal without affecting the music.



A pilot signal canceling circuit that lets you hear only music and nothing more.

Which means that you're assured of hearing everything the musicians had intended you to hear. Nothing more. And nothing less.

Obviously, the SX-780 is the

only receiver that gives you this feature in this price range. The others give you the noise.



An accurate picture of what you're listening to.

WATTAGE METERS THAT LET YOU SEE WHAT YOU'RE HEARING.

When a receiver has wattage meters, it lets

you see exactly how much power is going through your speakers. So that it not only helps prevent unnecessary damage due to overloading, it helps you make cleaner FM recordings.

Of course, the SX-780 has other virtues conspicuously absent from our competitors' models. Like a built-in wood grain cabinet. Which is something others give you the option of paying extra for.

But what really separates Pioneer's SX-780 from others is more than just a matter of wood cabinets, wattage meters, metal bottoms, DC power, or even price.

It's our commitment to giving you a quality hi-fi receiver, no matter how much, or how little, you plan to spend.

So if you're planning to spend less than \$400, you couldn't ask for more than the SX-780.

PIONEER®
We bring it back alive.

POWER: 45 watts per channel min. at 8 ohms from 20-20,000 hertz with no more than .05% total harmonic distortion.
FM SENSITIVITY: Stereo: 37.0 dBf

S/N RATIO: Stereo: 72 dBf
CAPTURE RATIO: 1.0 dBf
POWER METERS: 2
SPEAKERS: A, B, AB
TONE CONTROLS: Dual
TAPE MONITORS: 2

PIONEER DID IT

INTRODUCING THE SX-780.

It seems that our competitors think they've mastered the art of building a moderately priced receiver.

Unfortunately, most of them appear to be the work of cost reduction engineers, rather than high fidelity engineers. People whose jobs depend on the cost of what goes into a receiver, not the sound that comes out of it.

At Pioneer, on the other hand, we build a receiver that sells for under \$400 with the same care given to a receiver that sells for over \$1000.

A perfect example is the SX-780.

It offers the kind of features, value and sound you won't find in any other comparably priced receiver.



Metal shields our SX-780 from spurious noise.

metal. It's designed to shield the tuning section from spurious noise and keep CB interference from getting in the way of your music.

Equally important is the fact that our bottom has a special ventilating system that allows air to circulate freely around the heat sinks. This not only reduces FM drift due to overheated tuning elements, but increases the life expectancy of the circuitry.

A DC AMPLIFIER WITH THE POWER TO ELIMINATE DISTORTION.

The SX-780 features the same DC power configuration found in today's most expensive receivers.



DC power supply found on the most expensive receivers.

A STRONG CASE FOR THE METAL BOTTOM.

If you turn over our SX-780, for instance, you'll notice the bottom is made of heavy gauge

It provides cleaner sound and richer, more natural bass because it eliminates feedback and something called TIM (transient intermodulation). Transient intermodulation is a form of distortion that can keep you from hearing the subtle overtones in your music.

Which interestingly enough is why receivers with a conventional power amplifier might possibly be able to match the specs of the SX-780, but never the sound.

A PILOT SIGNAL CANCELING SYSTEM THAT'S UNHEARD OF IN THIS PRICE RANGE.

All stereo FM stations in America broadcast their music over a pilot signal of 19,000 hertz.

If not eliminated, this signal tends to create an extremely high pitched sound

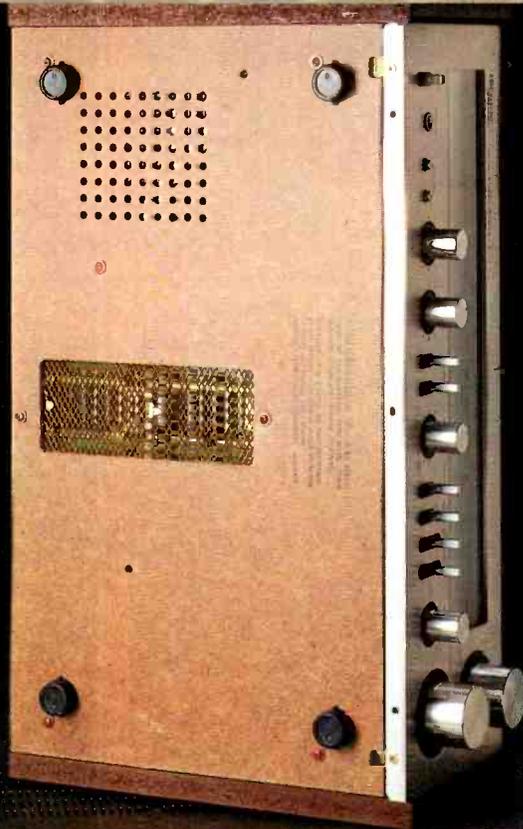


**THERE ARE A LOT
OF WAYS TO BUILD
A RECEIVER THAT SELLS
FOR UNDER \$400.**

YOU CAN
LEAVE OUT
DUAL WATTAGE
METERS LIKE
MARANTZ DID.



YOU CAN INSTALL
AN INEXPENSIVE
PRESS BOARD BOTTOM
LIKE TECHNICS DID.
INSTEAD OF
A METAL ONE.



YOU CAN USE
A CONVENTIONAL POWER
AMPLIFIER LIKE
KENWOOD DID.
INSTEAD OF
AN ADVANCED
DC AMPLIFIER.



YOU
CAN USE
STANDARD
HIGH BAND
FILTERS LIKE
YAMAHA DID.
INSTEAD OF SPECIAL
INTEGRATED CIRCUITS TO CANCEL
THE UNWANTED FM PILOT SIGNAL

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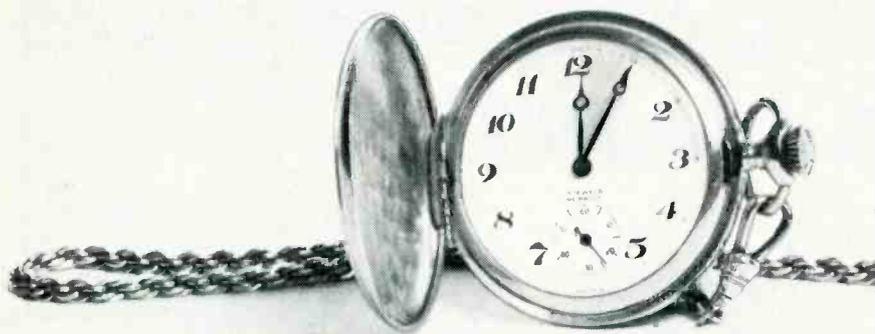
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the first 5 minutes don't count

Or even ten!
Sometimes it may take
a little while before you
know just how good a
headphone really is.

Comfort, weight, cord
convenience all are vital
factors in headphone
wearability.

With every minute of
use, any manufacturing
deficiencies in these
areas grow into
discomfort and
inconvenience.

At Beyer we know
these problems and all
our headphones are
designed to achieve the
highest possible
wearability factor (Hi-Fi
News, September '76,
page 143, Beyer
DT440 ranked 1st
out of six
comparative
tests for comfort).

Coupled with physical
comfort comes the lack of
aural fatigue. That bright
overdone sound
associated with the
'loudspeaker-on-the-ear'
concept oversold by our
competitors will often
give you a bad headache
in minutes. It takes time
to appreciate good clean
sound. And with time,
good sound doesn't tire
(Hi-Fi News, September
'76, Subjective
Headphone listening test,
Beyer DT440 ranked 1st).

So visit your Beyer
headphone dealer now
and give yourself time to
compare Beyer head-
phones against the
competition.

**But remember—
the first
5 minutes
don't count!**



Beyer Dynamic

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Enter No. 25 on Reader Service Card



No matter what system you own there's an Empire Phono Cartridge designed to attain optimum performance.

5

Detail, brilliance, depth.

This is the promise of each Empire Phono Cartridge and although there are many Empire models, each designed to meet specific turntable performance characteristics, every Empire cartridge contains the following features:

Features	Details	Benefits
Unique Fixed Unidirectional Three-Magnet Structure	Every Empire cartridge uses 3 high energy ferrite magnets in the cartridge body to provide a high level of unidirectional flux.	Higher and more linear output signal, immunity to bi-directional magnetic distortion, and improved hum and microphonic rejection.
Molded Four-Pole Magnetic Assembly	Every Empire cartridge employs a four-pole magnetic assembly that is precisely aligned and locked in place by a high pressure injection molding process... providing a uniform and orthogonal magnetic field.	Improved crosstalk and reduced distortion that is insensitive to tracking force.
Tubular moving Iron Design	By using a tubular high magnetic saturation iron armature we obtain an optimum ratio of output level to effective tip mass.	Improved tracking ability and widened frequency response.
Four Coil Hum Bucking Assembly Plus Electromagnetic Shielding	Using custom designed computer controlled machines, a precision drawn copper wire (thinner than human hair and longer than a football field) is wound onto a symmetrical 4 bobbin structure. By using 2 coils per channel a symmetrical electrical circuit is formed.	Improved rejection of hum and stray noise fields.
Aluminum Alloy Cantilever	The Empire computer designed tubular cantilever provides optimum coupling of the diamond tip to the moving magnetic system resulting in minimum effective stylus tip mass.	Superb low level tracking, reduced tracking distortion... plus enhanced wideband separation characteristics.
Precision Ground Oriented Diamond Tips	Empire diamonds are precision ground, polished and inspected in house, using sophisticated television cameras and powerful microscopes to ensure accurate angular orientation.	Reduced tracing phase distortion, together with reduced wear of both the record and the diamond tip.

For the full story on Empire cartridges we suggest you "test-listen" to one at your local Empire dealer, and for information on our full line of cartridges, write for our brochure "How to Get the Most Out of Your Records": **Empire Scientific Corp.**, Garden City, N.Y. 11530

EMPIRE

Enter No. 21 on Reader Service Card

Amid the confusion . . .

So much is stated, contradicted and re-stated, but in the end it is not a matter of opinion.

Other things being equal, 'goodness' can be expressed in simple terms.

A pick-up arm should have the lowest possible effective mass, coupled with the highest possible rigidity.

A cartridge should have the lowest possible effective tip mass, coupled with a correctly related compliance and tare (cartridge weight).

These are the rules of physics and engineering. They can be denied for various reasons but the penalty is then paid each time you play a record.

Immediately available. In case of difficulty write to Dept 1450, SME Limited, Steyning, Sussex, BN4 3GY, England
Exclusive distributors for the U.S.: Shure Brothers Incorporated, 222 Hartrey Avenue, Evanston, Illinois 60204
and in Canada: A. C. Simmonds and Sons Ltd, 975 Dillingham Road, Pickering, Ontario, L1W 3B2

SME

**Design Council
Award 1978**

The Series III precision pick-up arm and Shure V15 Type IV cartridge. Designed and built by the rules for faithful, uncoloured musical reproduction.



"Stereo Sound is Japan's principal hi-fi magazine. The Summer '78 issue carries an article compiled by seven leading critics. Of forty-three arms they recommend the SME Series III as the best and the Series II Improved as good"

Audioclinic

Joseph Giovanelli



Turntable Conversion

On occasion I play 78 rpm records on my turntable, usually for the purpose of taping and preserving them. Unfortunately very few of the present high quality manual turntables have provisions for playing 78 rpm discs. Shortly after purchasing my Philips turntable I discovered a simple modification which allowed me to play 78s with ease. By moving the drive belt from the inner (Photo 1) to the outer step of the motor pulley (Photo 2), then depressing the 33 button, the platter will rotate at 78 rpm. Minor corrections in the speed can be made

with the unit's adjustment screw. I have successfully used this arrangement for the past two years. —R.F. Kilcoyne, Mequon, Wis.

You were fortunate to have a "step" on the motor pulley that was usable in making your conversion. Unless the motor pulley has just the right diameter on some normally unused portion, this procedure would not have worked. Some motor pulleys may be readily removed. Where this is possible you have the means to machine additional pulleys which can be used for 78 and 16 $\frac{2}{3}$ rpm.

Speaker Power

Q. Would a speaker system need a low minimum power requirement and a high maximum power-handling capability to reproduce wide dynamic range material? — James W. Jones, Richmond, Va.

A. The maximum power handling capability of any loudspeaker is that power beyond which the speaker would be either overloaded or physically damaged in some way. The minimum power requirement is simply that power which is required to fill an average listening room with sound that most listeners consider to be sufficiently loud. The difference between the minimum and maximum power output, therefore, represents a power reserve for that loudspeaker, which can also account for momentary transient peaks. Assuming that the minimum power produced by your loudspeaker system is satisfactory in your listening room, then the speaker under discussion should be capable of reproducing a wide dynamic range.

Twin Antennas

Q. In my remote area there are only two sources of FM signals and I want to avoid using antenna rotators. Can two antennas be mounted on one

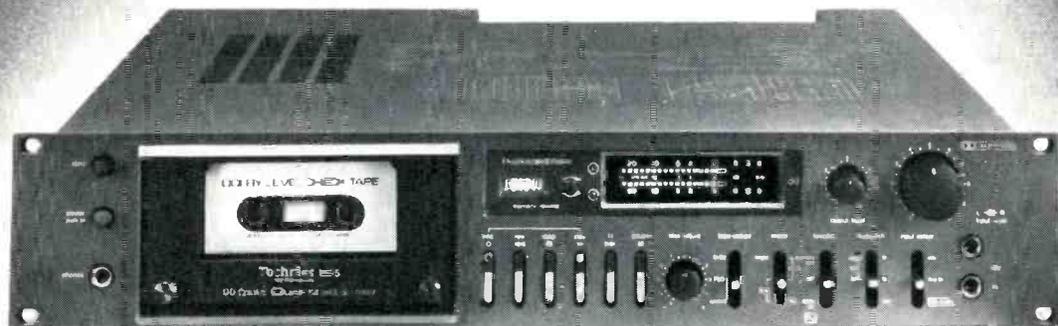
tower provided that two separate lead-ins are used? Will a switch be needed between the lead-ins or can they both be connected to the input of my equipment? — Hardy Morgan, Hico, Tex.

A. Because there are two separate sources of programming, you can use two directional antennas as you described. You must, however, keep them separated by a distance of at least six feet so they will not interact, and use two separate lead-in cables. It is possible to connect both lead cables to the input of your equipment. However, this gives rise to some multipath problems, as well as producing some signal loss. Therefore, it is best to arrange some kind of switching between the two lead-in cables.

If the lead-in cable is in the form of coaxial cable, there are special coaxial switches available for this application. If you are using a twin-lead, then a simple knife switch, DPDT, will work nicely.

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

You know what Technics quartz-locked direct drive does for records. Now listen to what it does for cassettes.



Accuracy good enough for even the most demanding professional, that's what Technics quartz-locked direct-drive turntables are all about. And that's why radio stations use them and discos abuse them.

Now you can record your records as accurately as a Technics turntable plays them. With the RS-M85, our new quartz-locked direct-drive cassette deck. Not only does it have the kind of transport accuracy that's hard to beat, it has that kind of price, too. The reason for all this accuracy: The performance of Technics direct drive combined with the precision of our quartz oscillator.

The RS-M85's servo-controlled system compares the motor rotation with the unwavering frequency of the quartz oscillator and instantly applies corrective torque if any speed deviations are detected.

To complement that accuracy, Technics RS-M85 has a Sendust head with a high-end frequency response of 18,000 Hz, low distortion and excellent dynamic range.

Since there's nothing ordinary about the RS-M85's

performance, there's nothing ordinary about its meters. The RS-M85 features Fluorescent Bar Graph meters. They're completely electronic and therefore highly accurate. Response time is a mere 5 μ s. There's also a peak-check mode plus two selectable brightness levels.

To all this sophistication, the RS-M85 adds all this: A separate, coreless DC motor for reel drive. Dolby NR* Full IC log control in all modes. A low-noise high-linearity amplifier section. And a 3-position bias/EQ selector with bias fine adjustment.

Also available is Technics RF-070. An optional full function infrared wireless remote control Technics RS-M35. Compare specifications. Compare prices.

FREQ. RESP. (CrO₂): 20-18,000 Hz. WOW AND FLUTTER: 0.035% WRMS. S/N RATIO (DOLBY): 69 dB. SPEED DEVIATION: No more than 0.3%.

Technics RS-M85. A rare combination of audio technology. A new standard of audio excellence.

*Dolby is a trademark of Dolby Laboratories, Inc.

Technics
Professional Series

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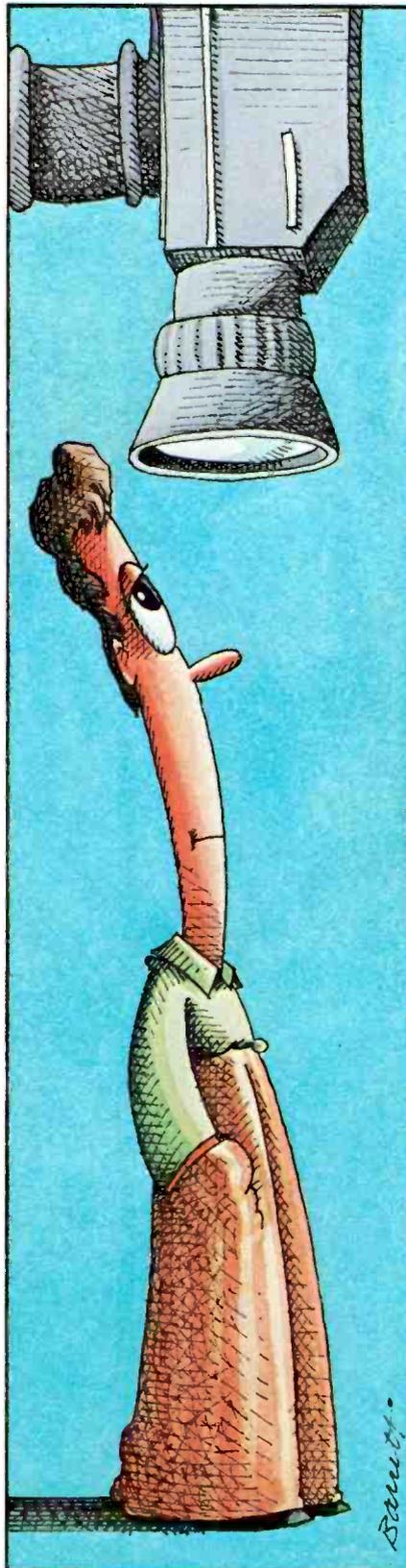
Video Scenes

You would have to be a hermit in the Himalayas not to know that the VCR . . . the video cassette recorder . . . is an idea . . . nay, a product . . . whose time has come. VCRs have been proliferating at an astonishing rate, with something on the order of 34 distinct models now on the market.

The VHS format predominates over the Betamax format, but to be fair, it must be pointed out that many of the VHS VCRs are the offspring of a few key manufacturers, and these OEM units are basically the same model with some cosmetic differences to furnish some degree of brand identification for the various units.

Sony's Betamax was the pioneering system that created the market for the VCR. With the arrival of the competing VHS VCRs on the scene, the Betamax has undergone several revisions and updatings. The new Sony SL8600 Betamax is the third generation of their VCR, and I have had the pleasure of using one of them for the past few months.

The Sony SL8600 is a considerable refinement over the early Betamax models. Gone is the clumsy "add-on" program timer, which was an extra cost option. Now there is a standard integral, electronic, digital read-out timer, with a 12-hour clock cycle synchronized with the power frequency. The SL8600 is mounted on an attractive case, finished in shades of brown, which measures $18\frac{3}{8}$ X $7\frac{3}{4}$ X $16\frac{1}{8}$ inches and weighs *in toto* a substantial 38 pounds. Operating controls on the SL8600 are of the mechanical "piano key" type, and reading from left to right there is the *Eject* button, which when depressed causes the entire cassette compartment to rise out of the center of the machine. After a standard Betamax format half-inch videocassette is inserted into the compartment, the assembly is manually pushed back into the recorder, and with a whirl and a click, the videocassette is automatically threaded into the tape path. Next button is for *Rewind*, then *Stop*, *Play*, *Record*, and *Pause*, whose functions are self-evident. However, it should be noted that unlike many VCR units, wherein the record mode is entered by simultaneously depressing a *Play* and *Record* button, on this unit the one *Record*



button does it all. Other controls on the SL8600 include separate VHF and UHF tuner channel selectors, with the VHF tuner covering the usual channels, 2-13 and the UHF channels, 14-83. The VHF output signal can be either channel 3 or 4, whichever affords the best quality. There is a tape counter and a *Memory* switch which functions in the same manner as those on an audio cassette recorder. A program selector switch is provided to activate either the TV set or the VCR. There is a VHF fine-tuning control and an AFT (automatic fine tuning) switch to be used in conjunction with it. On a selected channel, the AFT switch is defeated, and the fine-tuning knob is depressed and rotated either clockwise or counter-clockwise until the sharpest picture is obtained. Then the AFT is engaged to "lock" in the fine tuning. It is easy to use and quite effective. A tracking control on the front panel has a center detent position, which is normal for videocassettes recorded on the machine. If, when playing back tapes from other Betamax units or for prerecorded videocassettes, "snow" appears on the TV screen, adjustment of the tracking control usually corrects this condition. Of course, the tracking control is returned to the detent position when normal playback is resumed.

A remote control *Pause* function is provided on the SL8600, and the handheld control that plugs into the unit is very handy for deleting "unwanted program" in the polite language of copywriters, but otherwise known as "commercials." The electronic timer, with its luminous red digital read-out, is on the front panel so that the TV viewer can use it as a normal clock. In fact, the dust cover of the unit has a cut-out for the timer, so that the clock is not obscured. Nice touch! The timer has easy-to-set controls so that unattended recording is a simple matter.

The rear panel of the SL8600 has input jacks to accept VHF and UHF antenna inputs, via 75-ohm coaxial cable or 300-ohm twin-lead with appropriate adaptors supplied. There are VHF outputs to connect with the standard antenna input on TV sets. There are also audio input and output jacks for external audio sources. Input and output jacks are provided for video cameras,

THE JVC RECEIVER.

Every bit as revolutionary as they look, and then some.

In our case, looks are never deceiving. Because all our new DC integrated stereo receivers combine unprecedented, revolutionary styling with unique electronic design features that reflect JVC's more than 50 years' experience in audio development and innovation.

DC Power Amplifier Design

All four new JVC receivers feature DC amplifier circuitry. They offer virtually distortion-free performance (0.03% THD) throughout the entire audible spectrum. As a result, the sound you hear is clearer, cleaner and crisper. In addition, your speakers are protected with the Triple Power Protection circuit and you can monitor output wattage with dual power meters. Choose from 120, 85, 60 and 35 watts/channel.*

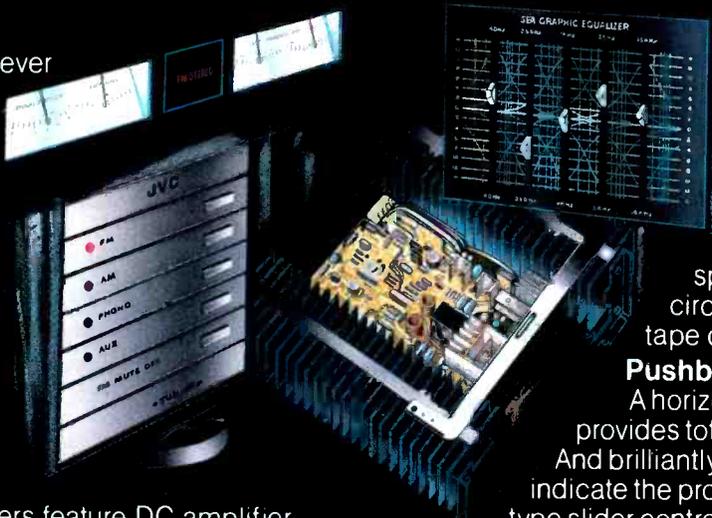
SEA all the way

All four receivers offer JVC's exclusive built-in SEA five-zone graphic equalizer for more complete control of

the music spectrum than conventional tone controls. You can attenuate or accentuate any of five separate musical bands, and as an added feature, we've incorporated a special button so that the SEA circuit can be switched to your tape deck.

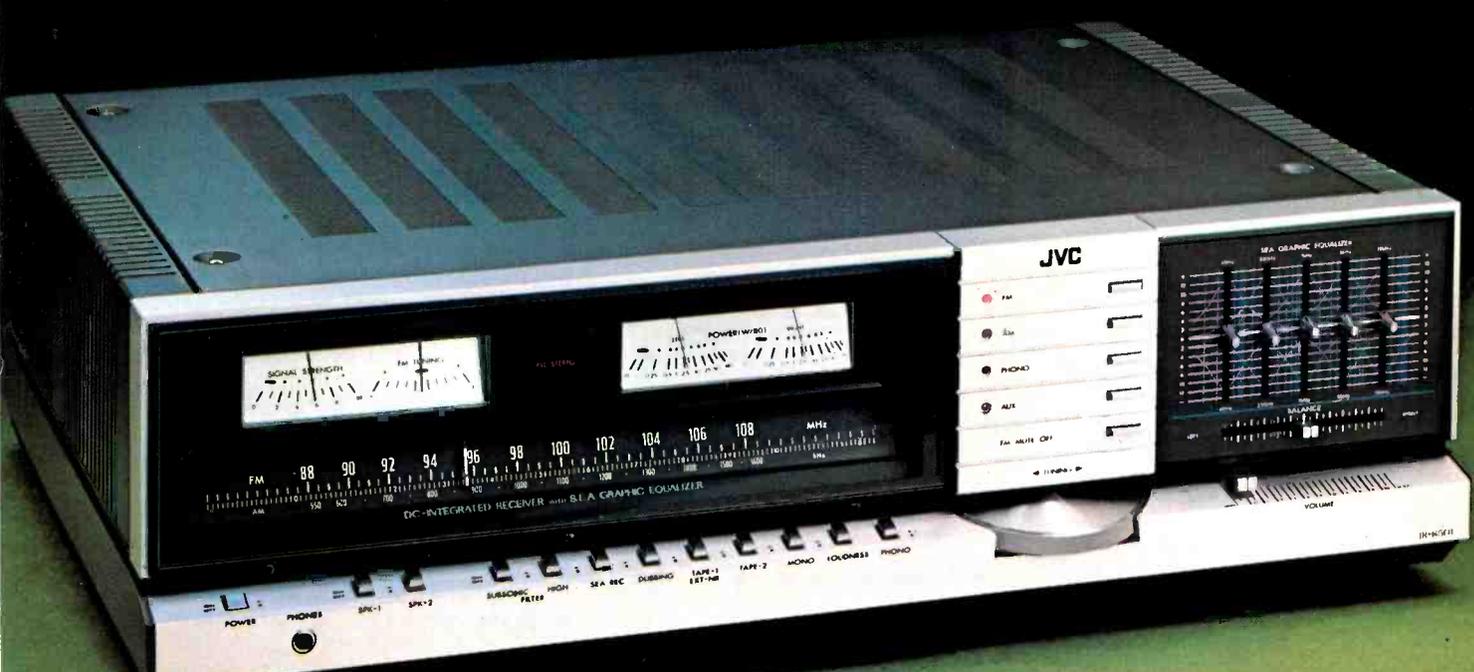
Pushbutton Source Selectors

A horizontal panel of pushbuttons provides total control over all functions. And brilliantly illuminated LEDs instantly indicate the program source. Professional-type slider controls set volume and balance. Combine all these exclusive features with high sensitivity and tuning precision, thumb control tuning wheel and accurate dual-metering and you'll see just how revolutionary the new JVC DC integrated stereo receivers are. Play one at your JVC dealer soon. JVC High Fidelity Division, US JVC Corp., 58-75 Queens Midtown Expressway, Maspeth, NY 11378. In Canada: JVC Electronics of Canada, Ltd., Ont.



JR-S 401 (top); JR-S 201 (bottom left) & JR-S 301 (bottom right).

JVC



JR-S501 * @ 8 Ohms, both channels driven from 20Hz-20 KHz, with no more than 0.03% THD.

Enter No. 30 on Reader Service Card

A new Space Program by Sansui.

Designed to send every audiophile into orbit.

Sansui has conquered space — the space in your listening room. Our engineers have created a rack to hold all your high fidelity components in one place so they're easily accessible and easy to operate. And the Sansui GX-5 rack is so elegant you will be proud to display it in your home.

The **Sansui GX-5 rack** is about the only EIA 19" standard-width rack available with casters for moving your sound system easily from room to room. It is 37-1/2 inches tall and can hold every rack-mountable component. You can also adjust the height of each unit to meet your needs.

We have filled the rack with our choice of outstanding Sansui components. And there's still plenty of room for your records. Listen to them on the **Sansui SR-838 Quartz-Servo direct-drive turntable**, about the most elegant and stable precision turntable in the world. Even when set on top of so much power, the SR-838 will perform free from all noise and feedback.

When your mood changes, listen to your favorite FM station on the **Sansui TU-717 tuner**. Reception, even of the weakest stations, is outstanding, with selectivity so high there is never a problem with adjacent channel programming.

And, of course, if you want to preserve these treasured sounds for years — as clean and pure as they were the very first time you heard them — it's all possible with the **SC-3110 cassette deck**, our rack-mountable version of the SC-3100, already well-known for its superior performance and ultraconvenience including Sansui exclusive Direct-O-Matic loading.

To match these outstanding components, Sansui offers you the **AU-717 amplifier** with the widest frequency response (from main-in) of any available **DC integrated amplifier** at any price. With astonishingly low distortion and noise, and wide overall frequency response, the signal is an ultra-faithful replica of the original. The AU-717 delivers the brilliance and all the nuance that makes music so important in your life.

Listen through a pair of **SP-L800** (or SP-L900 or 700) **dual-woofer speaker systems*** They have been designed to give you the full enjoyment of the clean and pure sound that our advanced technology components provide.

Of course, you can select other components to meet your own listening needs. You may want slightly less power; so we offer you the AU-517 DC integrated amplifier, created with the very same expertise as its bigger brother, the AU-717. If you wish to spend a little less on your cassette, you can choose the SC-1110.

And for you recordists and musicians we have something almost out of this world. The **AX-7 mixer/reverb unit** is about the finest home recording console that you can find at such a reasonable price. Versatility is the key, with up to 6 inputs for microphones, line level, electrical instruments, discs, broadcasts or tapes. You get panpots and



20dB input level attenuators on the 4 main inputs. Reverb is included, as well as circuits for 4-channel, equalization and noise reduction. Record the sounds you create on up to 3 tape decks.

We're sure you'll want to visit your local franchised Sansui dealer for a complete demonstration of Sansui's new Space Program. Just think about it. It will send you into orbit.

* Walnut veneer finish

SANSUI ELECTRONICS CORP.

Woodside, New York 11377 • Gardena, California 90247
SANSUI ELECTRIC CO., LTD., Tokyo, Japan
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In Canada: Electronic Distributors

The Sansui logo, featuring the word "Sansui" in a stylized, italicized font with a green outline, set against a solid green rectangular background.

Enter No. 52 on Reader Service Card

**A tape offer
that sounds
as good as
the tape.**



**Buy 3
and get one free.**

16

A lot of tape companies can make you an offer that sounds like this.

But not tape that sounds like this.

Because our new Maxell UD cassette should be considered among the world's finest recording tape.

You see, Maxell cassettes are built to higher standards than necessary. They're designed to give you recordings free of noise, dropouts and trouble.

So buy three Maxell UD 90's, and get a UD 60. Free.

If you think our offer sounds great, wait till you hear our tape.



*Available at participating Maxell dealers.
Offer expires December 22, 1978.

Enter No. 33 on Reader Service Card



LeKashman Dies

Larry LeKashman died after a brief illness Sunday, Sept. 24, 1978. At the time of his death, he was Vice President of Marketing and Sales at Electro-Voice, Inc. His early career started as Radio Editor for *Aero Digest*; continued through writer and consultant for Raytheon Manufacturing; Vice President and General Manager for Radio Magazines, the publisher which started *Audio Magazine*, and progressed to Manager of Advertising & Sales for RCA Victor Tube Division. First joining Electro-Voice on October 16, 1951, as V.P. Sales, LeKashman guided the company into the position of being one of the marketing leaders in the high-fidelity speaker industry. After several departures and returns, LeKashman advanced to the position of V.P. Marketing and then to President of Electro-Voice, a position which he held from 1969 to 1971. During this period, he guided several innovations in high fidelity technology, including matrixed four-channel stereo.

LeKashman's contributions to the electronics field are substantial. He had more than 100 technical articles published, was editor of two technical handbooks, and held patents and copyrights on three navigation calculators and radio direction-finding aids.

His major contributions for E-V, however, were the introduction of the first mass-produced stereo phonograph cartridge in 1958 and, on a broader scale, bringing the flair of consumer-goods marketing to the high fidelity industry. Products introduced during this period included E-V's famous Patrician, Georgian, and Aristocrat speaker systems.

Many marketing techniques that are now commonplace were LeKashman innovations. Allied Radio was one of the first companies to carry hi-fi speakers that were manufactured and private-labeled by another company — Electro-Voice. Carrying both the Electro-Voice and Knight names, this represented the first attempt by a hi-fi manufacturer to increase market penetration by offering private labeled products in the retail market. His time with Teledyne/Olson Electronics, and later with Lafayette Radio, saw many strong advances in hi-fi direct-mail marketing.

LeKashman's return to Electro-Voice in October of 1977 brought new life to the firm's high fidelity speaker business. It is regrettable that one of the founding directors of the Institute of High Fidelity could not have stayed in the business a bit longer. He is survived by his wife, Priscilla, and two daughters.

TWO SPEEDS!

B·I·C introduces the two speed cassette deck — 1 $\frac{7}{8}$ ips for compatibility, 3 $\frac{3}{4}$ ips for extraordinary performance.

Recording engineers recognize that the way to obtain more professional results is to increase the speed at which tape is moved past the heads.

Until now, all conventional cassette decks have recorded and played back at 1 $\frac{7}{8}$ inches per second only. The new B·I·C tape decks do this... superbly. When used at 1 $\frac{7}{8}$ ips, they exceed virtually every existing performance spec. At 3 $\frac{3}{4}$ ips, they establish new standards.

This faster tape speed results in dramatic improvements in frequency response, dynamic range, signal-to-noise, and wow and flutter. It also provides much quicker rewind and fast forward times, automatically at either speed.

As an example, consider the model T-3's 3 $\frac{3}{4}$ ips specs. Performance unheard of

in any other cassette deck. Guaranteed frequency response of at least 25-22,000 hz \pm 3 dB. Wow and flutter less than .035% WRMS. Total harmonic distortion below 1.5%. Signal-to-noise ratio better than 67 dB (A-weighted).

To achieve these new performance standards we used a fresh approach to the electronics. The result — a group of new circuitry concepts which we have named "Broadband Electronics." These circuitry concepts lower residual noise and distortion. They enhance frequency response and stereo imaging. And — most important, these improvements are audible at either speed on all B·I·C tape decks.

The result is sound that is cleaner and more detailed than you have ever heard from cassette tape.

There are three B·I·C cassette decks, from the "no frills" Model T-1 at under \$300, to the 3-head, dual capstan T-3... all at prices you'd expect to pay for an ordinary one speed machine.

For a free 24-page brochure, see your B·I·C dealer or write B·I·C/Avnet, Westbury, N.Y. 11590.

**Twice the speed.
Twice the versatility.
Twice the performance.**

**THE NEW B·I·C
TWO-SPEED
CASSETTE DECK.**

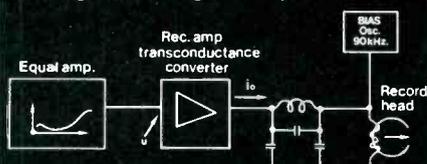


Enter No. 7 on Reader Service Card

Tandberg Presents ACTILINEAR Recording

Open reel & cassette recorders can no longer be looked upon as add-on units in today's extremely sophisticated high fidelity sound systems, but rather as components within a total system with performance capability as technically advanced as all other components of that system.

In order to achieve this, Tandberg has developed a completely new tape recording technology known as the ACTILINEAR (Patent pending) System, the only recording technology available on the market today that can fully exploit the new high coercivity metal particle recording tape being developed.



More pertinent right now is the fact that Tandberg's new ACTILINEAR System, when used with the soon-to-be-available metal particle tape, offers performance parameters approaching those of experimental PCM technology, yet is compatible for playback on all existing tape recorders.

In conventional recording systems, the summation of record & bias current in the record head is done through passive components, leading to compromise solutions which have their distinct and pronounced weaknesses.

Tandberg engineers have developed a new recording technology without compromises. In the new ACTILINEAR System, the passive components have been replaced with an active Transconductance amplifier. Among the benefits of this new approach are:

- Up to 20 dB more headroom
- Less intermodulation due to Slew Rate limitation
- Improved electrical separation and less interference between the bias oscillator and record amplifier
- No obsolescence factor — useable with any type of tape, available now or in years to come

With its unequalled 30 year tradition in tape recorder technology, Tandberg has always been recognized worldwide for its quality products. And now, with the superior performance advantages of the ACTILINEAR System in Tandberg's new TD 20 A open reel deck, as well as the TCD 340 A and TCD 340 AM cassette decks, you will for the first time be able to achieve tape recorder performance capability equal to or better than all other components in a sophisticated sound system.

Tandberg of America, Inc., Labriola Court, Armonk, N.Y. 10504

TANDBERG

Enter No. 63 on Reader Service Card

Herman Burstein

Tape guide

Readers who sent letters to Herman Burstein between the third week in July and the middle of September and haven't received a reply at the present time . . . should please write again. The U.S. Postal Service lost quite a few of these letters for Mr. Burstein and we don't, of course, know whose letters they were.

Deck Decision

Q. I'm basically interested in a tape deck that is ruggedly constructed, has superior frequency response, low noise, low wow-and-flutter, convenient features, and long playing time. I am now trying to decide between a deck which takes 10½-in. reels and one which takes 7-in. reels but has automatic reversing. — Nicholas Jones, Charleston, S.C.

A. If your aim is to have extended recordings with a minimum interruption for changing or turning over reels, your best bet is probably a deck that accommodates 10½-in. reels. Also a machine designed to operate in one direction has a somewhat better chance of giving top performance than one designed to operate in both directions.

Taping Trauma

Q. Using two microphones about 15 feet apart feeding into the low impedance inputs of my open-reel deck, I recorded a church choir with pleasant results except for some excessive tape hiss. In order to get adequate volume from the soloists I had to turn up the recording gain control about two-thirds of the way. At this point the noise level gets too audible on the quiet parts of the recording. I suspect that if I could amplify my signal a little before it gets to the recorder, I could improve my signal-to-noise ratio. If my theory is correct, I could obtain better final results by using a mixer; is this correct? — Leonard Blanchard, Clayton, N.Y.

A. Whether a mixer will improve the signal-to-noise ratio depends upon

how quiet its electronics are. If they are quieter than those of your recording amplifier you may be able to audibly improve the signal-to-noise ratio of your recordings. Another possible answer would be to use microphone step-up transformers (mounted at the tape deck end of the microphone cable) and feed these into the high-level inputs of your tape deck. Still another suggestion is to add a noise reduction unit.

You should keep in mind that when recording live material with a full dynamic range, tape system noise during the quiet passages is apt to be more evident than when recording compressed material, as from a record or FM station.

Signal Loss

Q. My problem is a gradual loss of signal level on my tapes. The signal level drops off a bit, then seems to stabilize at this lower level. Sometimes, though, the signal level is further down in some spots than in others, giving an up-and-down effect in playback. This problem occurs more in some tapes than others. — Terrell Cook, Spartanburg, S.C.

A. Magnetized heads and dirty heads, particularly the latter, can account for your problem. Dirt causes separation between the tape and the head resulting in reduced response, especially at high frequencies. Thus, to an extent, varying volume might correspond to varying frequency content of the recorded material. Magnetized heads or other magnetized parts of the tape deck contacted by the tape can cause signal loss. Therefore periodic cleaning and demagnetization are required, usually after about eight hours of use. Some tapes shed less oxide than others so they present less of a problem in the tape-to-head contact. It is possible that the tapes which give you trouble have come from an imperfect batch, so that non-uniform oxide coating is causing your volume variations.

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

AUDIO • December 1978

The best tape decks in the world are only as good as this tape.

While there's a lot of controversy over who makes the world's best tape deck, there's very little over who makes the world's best tape.

Maxell.

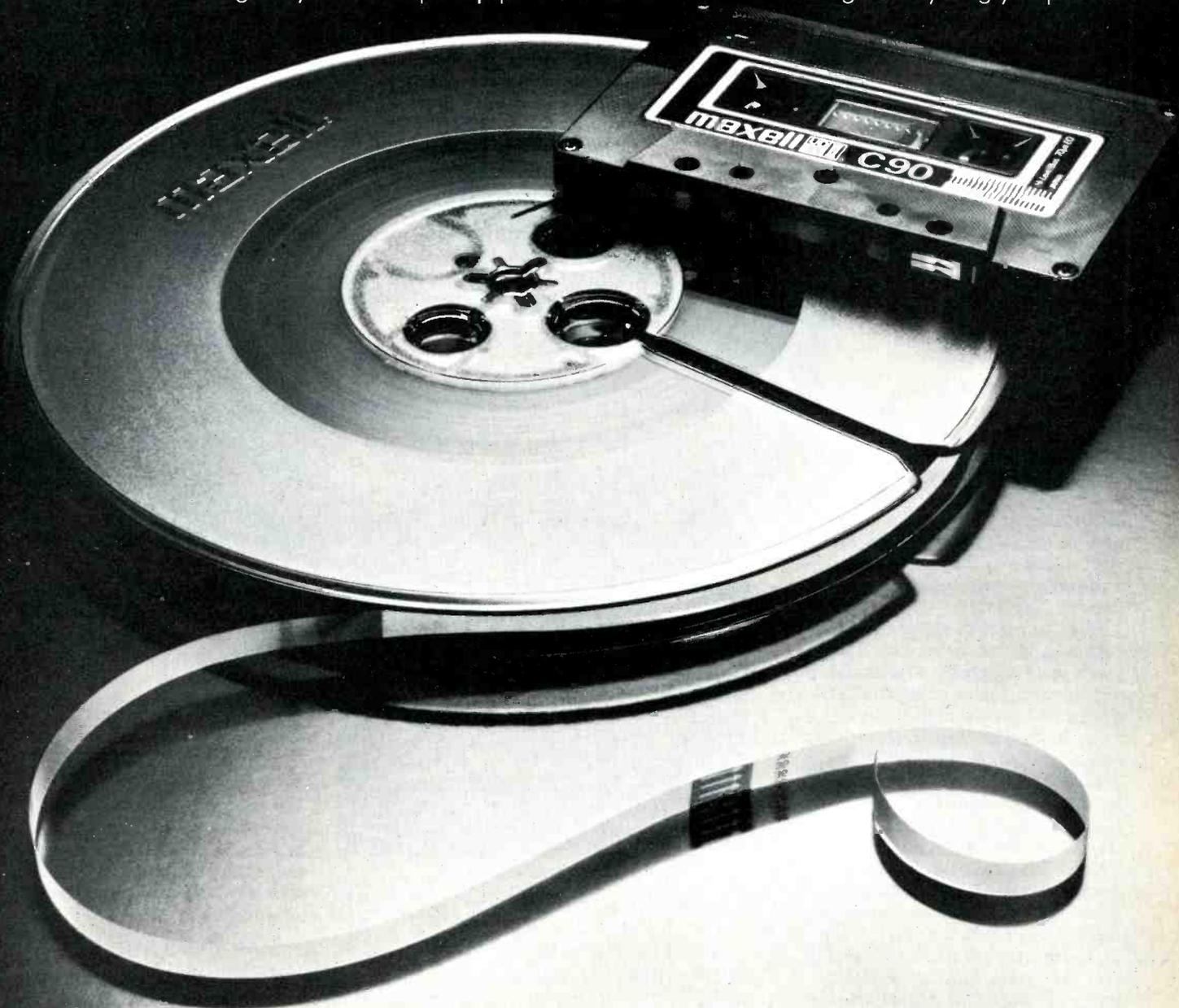
Because Maxell gives you the

widest frequency response, the highest signal-to-noise ratio and the lowest distortion of any tape you can buy. In fact, people who own the finest high-performance tape equipment use our

tape more than any other brand.

So why buy one of the world's finest tape decks and get less than the world's best sound.

When you can use Maxell and get everything you paid for.



Maxell Corporation of America, 60 Oxford Drive, Moonachie, N.J. 07074.



Enter No. 34 on Reader Service Card

See why TDK

It's the little things you can't see
that make a big difference in the way it sounds.

At first glance different brands of tape look pretty much alike. But if you look closely, you'll find there are many subtle differences. And it is these differences that make one tape stand out above all others.

Now you might not spend a lot of time looking closely at tape. But we have to—that's our business. At TDK we're committed to constantly improving our products. For years, our SA cassette has been the High bias reference standard for almost all quality cassette deck manufacturers. Yet we've incorporated improvement after improvement into SA's tape and mechanism since its introduction as the first non-chrome High bias cassette in 1975. These advances mean better quality sound for you. TDK makes this possible, by continuous attention to the little things you can't see.

The Particles

The lifeblood of recording tape is microscopic magnetic particles that can be arranged in patterns to store and reproduce sound. At best, they are as small as possible, uniform in size and shape; they are long and narrow (the greater the ratio of length to width, the better); and they are tightly, uniformly packed together, with no gaps or clumps.

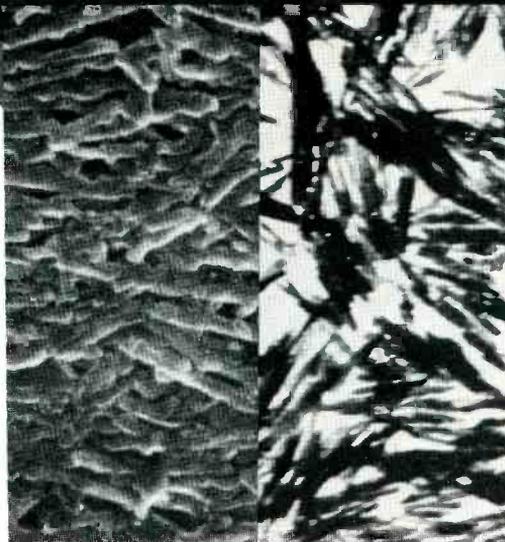
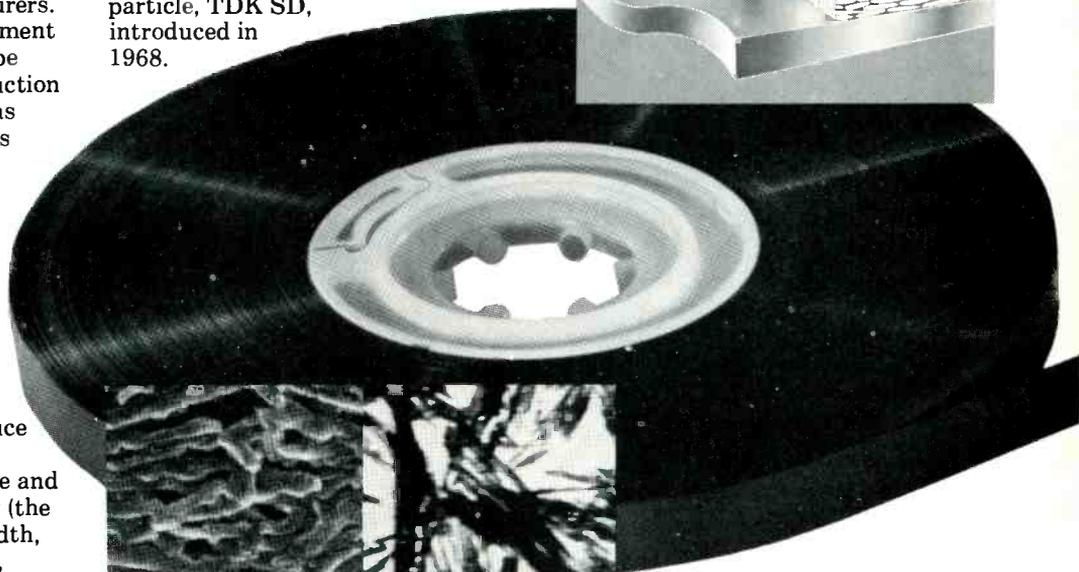
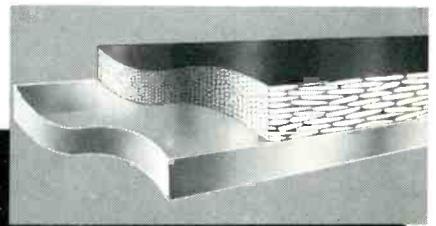
Over 40 years of experience in magnetic ferrite technology and 25 years in developing and manufacturing recording tape, bring the TDK SA and AD cassette particle formulations as close to these ideals as current technology will allow.

The TDK SA particle is a cobalt gamma ferric oxide compound made highly stable by our proprietary cobalt-ion adsorption process. The SA particle possesses one of the greatest length/width ratios of any particle used in audio cassette recording: an amazing 11:1. These little wonders are truly "state-of-the-art," and mean higher maximum output level (MOL), higher signal-to-noise and lower noise.

The particle in TDK AD is *pure gamma ferric oxide*; it has been developed specifically for use in Normal bias decks—in the home, car, in portables. With a length/width ratio of 10:1, the AD particle can deliver what most conventional cassettes lack: an extended, hot high end, to capture all the elusive highs in music, from classical crescendo to raging rock and roll. It is the logical successor to the world's first high fidelity cassette tape particle, TDK SD, introduced in 1968.

clumps nor gaps of oxide build-up. So we suspend our particles in a unique new binding, and we're fanatic about the way we do it. TDK engineers and craftsmen wear surgically clean robes and caps, and we vacuum the air to eliminate

Tape layers: coating (top); backing.



TDK SA tape surface (left) enlarged 30,000 times. TDK Super Avilyn particles (right) enlarged 20,000 times.

contaminating foreign matter and disruptive static charges. The high packing density that results means that the tape is prepared to handle high input level musical peaks gracefully, and without distortion.

The Base Film

We coat our oxides on broad rolls of supremely flexible, but nearly stretch-proof polyester film, to make sure TDK cassettes don't tangle or introduce wow and flutter.

The Polishing

After each roll is coated, it goes through a polishing process called "calendering." Any oxide is removed,

The Coating

To best attach the particles to the film used for backing, it's necessary to coat that film evenly, with neither

sounds better.

and the surface is smoothed to reduce tape head wear and oxide shedding. Reduced friction across the tape heads means lower noise.

The Edge

If you look closely at the edges of TDK's tape, you'll find that they are uniformly straight and parallel to a tolerance of one micron. That's because we slit our tape by pulling it across an array of precisely-positioned, surgically-sharp knives. That means the tape movement is unimpeded; and mis-tracking that could result in garbled stereo is eliminated.

The Hub/Clamp Assembly

TDK has met a major challenge which has always faced cassette manufacturers:

anchoring the tape to the hub without causing mechanical problems. We use a unique double clamp system we pioneered. It practically eliminates wow and flutter, distortion, drop-outs and other problems related to poor winding. Some manufacturers use plastic pins jammed into notches on the edge of the hub. This system can lead to uneven winding, which causes the edges to feather, the tape to bulk unevenly, and occasionally, to snap at the anchor.

The Cleaning

Like most leader tape, ours is designed to protect the recording surface from stress, and to provide a firm anchor to the hub. Unlike most leader tape, TDK's cleans your recorder heads as it passes by.

The Splice

Our splices are firm, with leader and tape lined up exactly. Our splicing tape is specially designed not to bleed adhesive into the cassette mechanism, which could gum up the works.

© 1978 TDK Electronics Corp.

The Inspection

Before any of our tape is loaded into cassette shells, it must pass a series of inspections to



The TDK double clamp system.



The TDK high tolerance tape/leader splice.

see if it matches up to our own rigorous standards. If it doesn't pass, it's discarded. We never compromise on quality.

The Music and the Machine

We go to more trouble than most companies do, when we manufacture our cassettes. We see to all the little details, so you can hear more of your music. Our super precision cassette mechanism delivers the tape to your heads precisely, without introducing friction, wow and flutter and other problems in the process. And we back that mechanism, and the tape within it, with high fidelity's original full lifetime warranty*, a measure of the value we have placed in our cassettes, for over 10 years.

So next time you buy cassettes, look closely at TDK, and think of all the little things you can't see that make our cassettes just that much better. TDK Electronics Corp., Garden City, NY 11530. In Canada: Superior Electronics Ind., Ltd.

*In the unlikely event that any TDK audio cassette ever fails to perform due to a defect in materials or workmanship, simply return it to your local dealer or to TDK for a free replacement.



TDK®

The machine for your machine.®

Enter No. 67 on Reader Service Card

Audio etc.

Edward Tatnall Canby

As I said last month, when you can no longer spread out your recordings luxuriously all over your living room because there are too many and you can't find anything in the mess — then, indeed, you have come to the beginning of the end. You *must* organize your home library.

I may have seemed facetious last month but was not really. I was merely being literal. As our home systems wax bigger, so do our record collections, in spite of inflation, slowly but surely, like children growing. You hardly notice the difference from day to day, but —. A mere record cabinet, a length of tasteful shelving, a box built to order, these are merely continuing symptoms of trouble, temporary substitutes for the luxury that is lost, those tables and chairs and couches piled high with the goodies, right within reach where you could find them — or so you used to think. You still can't find them. What you need is more than neatness. It is ORDER. And quick access. But please, no file cards.

Now I will admit that before you get to any such pass, there is a vast gray area, for perhaps three quarters of us, whereby our records and tapes are "filed" in a sense but in an exceedingly loose-limbed fashion, not so much by system as by feel and a vague area-memory. Show tunes at one end of a pile, Vivaldi at the other, and misc. in between. This is just fine, as long as it works for you. People do get very good at riffling through. I am writing, though, for the prognosed future, which is not good, unless you stop collecting altogether.

Why not just put the records in order — some order or other — and let 'em sit? As is. Well, you can try. But the companies have ten thousand ways to confuse you. And ruin your eyesight as well as your composure. There is nothing uniform about the info they put on the product. Covers are nice but mainly for sales. Spines? That skinny, barely visible line of information is supposed to help when you shelve your discs in close order. Half the spine copy is upside down, not to mention around the corner, on front or back, and all of them are sidewise, some to the right, some to the left; you crane your neck first one way and then the other, or stand on your head. Some are blank and more are rippled so only the tops of the letters show, unreadably. The light is always wrong and the focus fuzzy. *Not* spines.

How about a nice loose stack on the floor, or in an open box, so you can look down and riffle through, looking at the covers. It works if your records are very loosely stacked. But then, you see, they fall sidewise against each other and the considerable weight is dangerous. Warping. You're beat before you start, here too. Tighten up the stack, and you can't see the covers, or anything else. In the end, you're going to have to try something on your own, to get both order *and* visibility, which

means accessibility. So let's try home-made labels. Gummed labels, or self stick. They take only a moment to put on, and what counts is the code you put on them. It can be fun. You make it up.

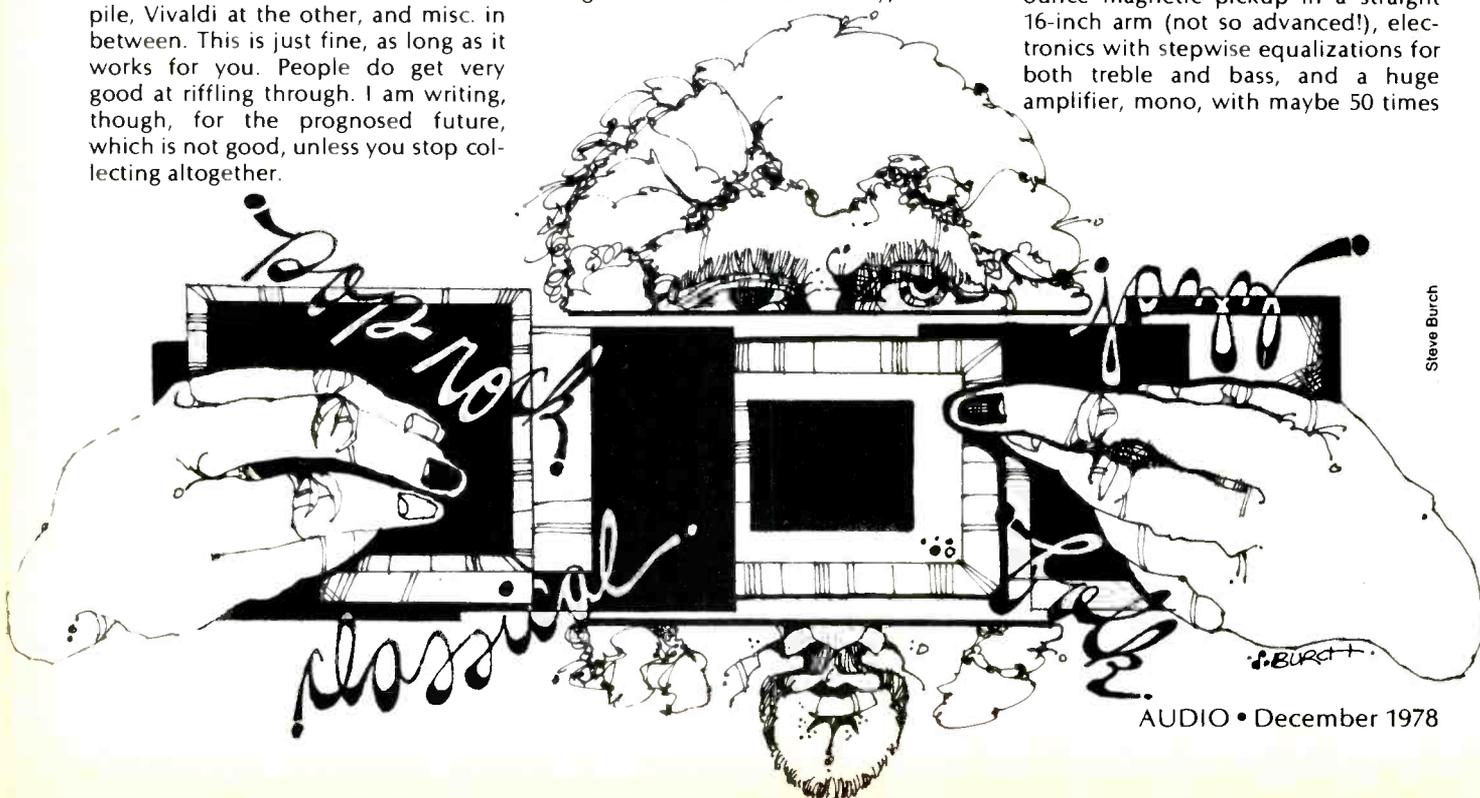
Coding The Carnegie

There's a tricky way of making a code that I learned the hard way, long ago in my very first job, as an assistant in an Ivy League college music department. This was in the Thirties. When I got there, the Music Department was just getting started, after a century of musical darkness at that distinguished institution, and we had landed a fish — we got the famed Carnegie Collection, literally thousands of 78 records, given to schools and colleges that could use them for teaching and as a loan library. Old Andrew Carnegie, you remember, more or less founded the U.S. public library system; now, for the first time, it was audio, recorded music.

That Collection was stupendous for its day. Not only all those records but also a player, a veritable Jaws of a player, the d—dest machine we'd ever seen and 30 years ahead of its time.

In 1936 it already came as components. One big box held a monster turntable, recording-lathe type, a 10-ounce magnetic pickup in a straight 16-inch arm (not so advanced!), electronics with stepwise equalizations for both treble and bass, and a huge amplifier, mono, with maybe 50 times

22



Steve Burch

AUDIO • December 1978

PHASE LINEAR SETS THE STANDARD FOR HIGH POWER.

Current loudspeaker design theory takes for granted the availability of a high power reserve. An idea once considered frivolous by many. Today it is considered essential for the best possible reproduction of recorded material.

To reproduce a musical peak, a loudspeaker requires up to 10 times the average power being delivered. If the amplifier lacks a sufficient power reserve, it will clip, producing distortion and audibly destroying sonic quality.

The Phase Linear D-500 Series Two Power Amplifier is capable of delivering 505 watts per channel from 20Hz-20kHz into 8 ohms, with no more than 0.09% Total Harmonic Distortion. That's unsurpassed power for unsurpassed realism.



CONVENTIONAL
OUTPUT
TRANSISTOR.

D-500
OUTPUT
TRANSISTOR.

The D-500 utilizes an advanced design in output devices to overcome the problems associated with amplifier clipping at realistic listening levels. As a result, the power handling capability is greatly improved. In fact, the power semiconductor complement of the D-500 features the highest power handling

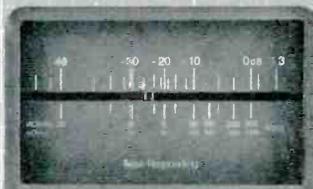
capability in the audio industry.

A massive rear mounted extruded aluminum heat sink assembly protects the 36 output devices against overheating and includes a self-contained, thermally activated forced



air cooling system. You don't have to worry about over-heating under normal operating conditions.

Instantaneous indication of output activity is easily maintained with an exclusive 32-segment LED display,



while a special 4-segment clipping indicator warns of hazardous overloads. High/Low Impedance. Operation modes are automatically,

or manually activated for increased amplifier efficiency when using low impedance speakers.



HEARING IS BELIEVING.

See your local Phase Linear dealer for the most powerful argument for the D-500: a demonstration.

SPECIFICATIONS.

OUTPUT POWER: 505 WATTS
MINIMUM RMS PER CHANNEL
20Hz-20,000Hz INTO 8 OHMS,
WITH NO MORE THAN 0.09% TOTAL
HARMONIC DISTORTION

CONTINUOUS POWER: 1000Hz per
channel, with less than 0.09% Total
Harmonic Distortion:
8 ohms - 600 watts
4 ohms - 800 watts

INTERMODULATION DISTORTION:
0.09% Max (60Hz: 7kHz = 4:1)

DAMPING FACTOR: 1000:1 Min

RESIDUAL NOISE: 120uV (IHF "A")

SIGNAL TO NOISE RATIO:
110dB (IHF "A")

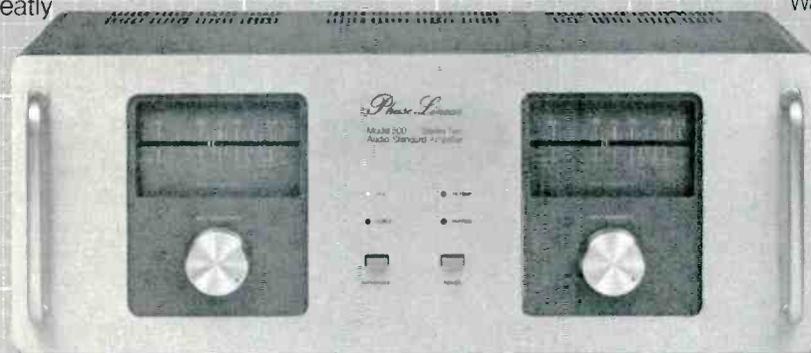
WEIGHT: 65 lbs. (32 kgs.)

DIMENSIONS: 19" x 7" x 15"
(48.3cm x 17.8cm x 38.1cm)

Optionally available in E.I.A. standard rack
mount configuration.

Optional accessories: Solid Oak or
Walnut side panels.

AGAIN.



Phase Linear Corporation
20121-48th Avenue West
Lynnwood, Washington
98036

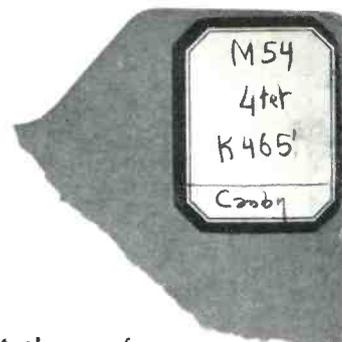
Phase Linear[®]
THE POWERFUL DIFFERENCE

the normal whomp. The speaker was mounted in its own matched box, a correctly tuned bass reflex as I remember, and it was so big it took two or three of us to move it. The woofer was 18 inch (!), and there were two tweeters, the very first I had ever seen. The woofer's electromagnet was as big as a five-gallon pail at something beyond 400 volts. This system was built by an outfit called Federal Telegraph, if memory serves. Telegraph or no, it could blow you right out of a concert hall, even in mono, and I was appointed its boss. Nobody else wanted to touch it. Right then, you see, I discov-

ered the joys of VERY LOUD music, which was some time before you did, I'll bet. Early hi-fi conditioning.

Out of the blue, I was also appointed to the job of setting up those thousands of records for practical use, in a small office at our headquarters. You can imagine it. Dozens of big cartons were delivered, every one filled with carefully interleaved and padded 78 singles, and within minutes we had them spewed all over everything, ever so carefully, in our frantic joy at this unbelievable bonanza. When calm was at last restored, I got to work.

Yes, there was some sort of cata-



Actual corner from Mozart's Quartet No. 19 in C shows Canby's "duidecimal" listing.

logue but my boss Professor didn't like catalogues and card files. He wanted to toddle right in there five minutes before he avidly gave his famous and often repeated lecture on the Schubert *Unfinished Symphony*, before 200 not-so-avid freshmen, and go right to the shelves to find the records in a hurry. Without looking up a lot of unmemorable numbers on cards. Isn't that exactly the way you feel today?

So what to do? I gave my soul to those records for months, and in the end I came up with a System which really worked, all things considered. No cards!

Just the records themselves. And labels. A gummed label was "affixed," as they say, on the upper right-hand corner of every green manila folder (equivalent to the modern LP record jacket). On the label went a code, a bold, brief, easily read code which was my big idea. With a bit of practice, you could read it right off in words, the composer, the type of music and the name of the piece. Being a classical collection, we filed under *Composer* — but the system would work out just as well in other areas with, say, the performer or the title on top. Musical shows by title. Jazz, rock/pop by performer or group or album. Take your choice.

The Long & Short of It

The necessity for any such code is that it be understandable, brief, and very visible to the roving eye. No searching, no eye strain! Thus you need uniformity, especially in the size aspect. Short composers, like Cesar Cui, or long composers, Mario Castelnuovo-Tedesco, must be equally visible. And the same for categories; make 'em brief. But quickly intelligible. That came first of all. It was a challenge.

Now somebody had told me about a thing called duidecimal or something, which was used for records at Vassar College. Innocent me, I did not know that a billion library books were, and are, filed by the ingenious Dewey decimal system, which uses decimals to

24

U.S.A. **Martin** presents the **TRANSFLEX** SYSTEM PAT. APPLIED FOR

It may be the ultimate listening machine.

Through the use of new techniques in transmission line loading, Martin engineers have developed a new series of loudspeakers with such startling bass response that enclosure patents have been applied for in seven countries. The TRANSFLEX provides extremely wide linear bandwidth, exceptional transient response and expanded polar distribution — creating a perfection in sound previously unattainable. We will be supplying audio stores with the Martin TRANSFLEX as quickly as we can craft them. Go experience the TRANSFLEX. And get yours!

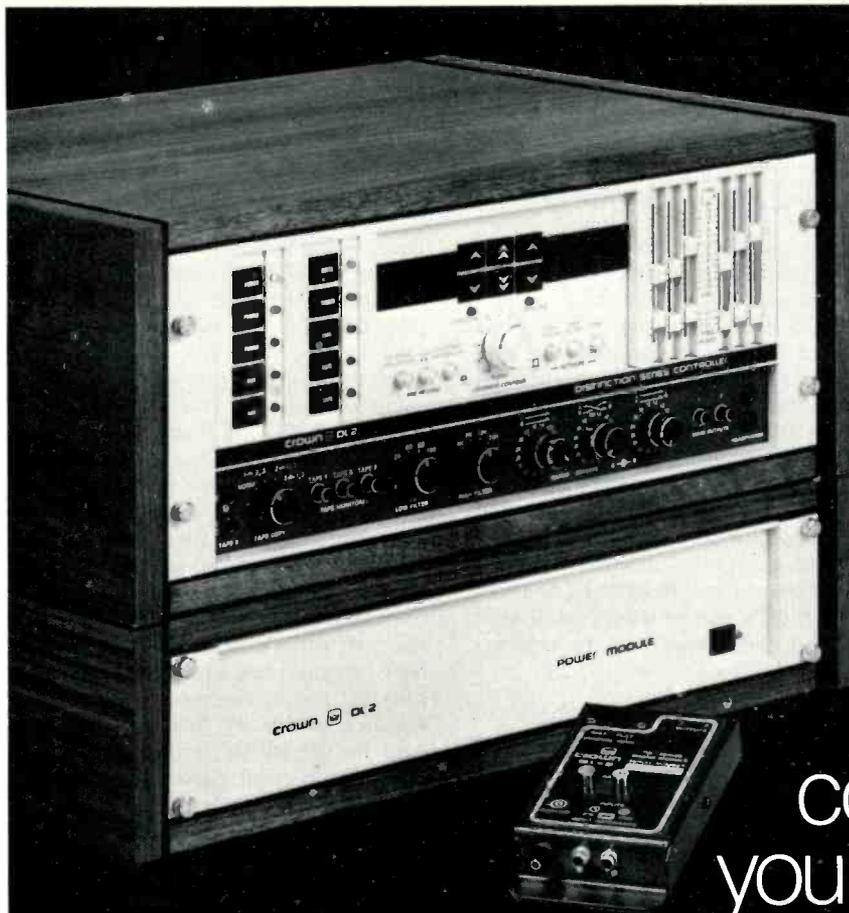
4 models • From \$450 to \$1,300 the pair.

The sound of perfection

MARTIN SPEAKER DIVISION, Eastman Sound Manufacturing Company, Inc., Mickleton, NJ 08056 • 609/423-0100

Enter No. 19 on Reader Service Card

AUDIO • December 1978



Does it make sense to buy a new audio component you can't hear?

You bet it does. Especially if you care about absolutely accurate reproduction of recorded sound.

The new Crown DL-2 Distinction Series Controller is close to being the perfect pre-amplifier. It controls the signal level but changes nothing else unless you want it to.

The DL-2's sonic excellence is impeccable. New, patent-pending circuitry and no-compromise, common-sense design have resulted in outstanding specifications. Signal-to-noise ratio is better than 97dB unweighted. Frequency response ± 0.2 dB, 3Hz to 100KHz. THD, IMD and TIM are simply not audible.

One of the reasons you can't hear the DL-2 is that it is three components.

The revolutionary phono preamp mounts next to the turntable. That eliminates most RFI problems. But it also in-

cludes wholly new circuit concepts for unmatched sonic performance, and new convenience in hook-up.

The separate power supply keeps AC line noise completely out of the signal path.

The control module sets a new standard of control freedom. Leave all controls flat for accurate reproduction of input. Or adjust the sophisticated, equalizer-type tone controls to your taste. Select one of ten built-in ISO compensation curves. Control your choice of external processor. Unbelievably accurate digital control of level and balance. A new concept in stereo imaging.

To believe the sonic excellence of the Crown Distinction DL-2 Controller, you'll have to try to hear it. At your dealer. Soon.

Write for free brochure on the DL-2. It, too, makes sense.

 **crown**

1718 W. Mishawaka Road, Elkhart, Indiana 46514

American innovation and technology...since 1951.

We build a speaker that sounds like music

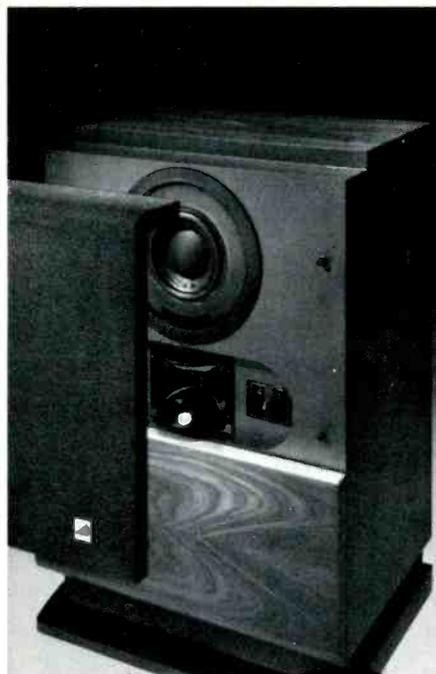
It can accurately reproduce the 120+ dB peaks that are found in some live music. That's more than just being able to play music loud. It can accurately reproduce the music bandwidth—from below 25Hz to 20kHz. And the Interface:D's vented midrange speaker reproduces midrange sounds with the clarity and purity that allows precise localization of sound sources—both lateral and front-to-back.

The Interface:D is the only commercially available speaker we know of that can meet these criteria. Audition them at your Interface dealer.



Electro-Voice®
a gulton company
600 Cecil Street
Buchanan, Michigan 49107

Interface:D™



subdivide numerical categories ad inf. Say, two books are listed as 795.1 and 795.2 and you have a third that must go in between; it's easy. 795.15. You can get into the millis and the micros if need be — 795.16483. I had a better idea, for us. Forget the numbers but borrow that decimal subdividing. And use numbers, with decimals, to indicate alphabet letter order.

What I did was to combine the idea of "instant" abbreviations, for the composers, the categories of music, and the specific titles, with the decimal thing, which I used for the composer. Not his name, but his initial, followed by a number, from 1 to 100, treated as alphabet. How's that? On the shelves, Old Johann Sebastian Bach appeared as a bold *B 15*, Beethoven as *B 55*, a sort of early zip or area code and even more easy to remember.

We gave the round numbers, so to speak, to the big guys, the famous composers, and put the others in between. The above mentioned Cui, for instance, might have been *C 96* and his long-named mate, Castelnuovo-Tedesco *C 18*. Same length. Any old number would do just so it was approximately in the right alphabetical area. In a very short time you got to remember these "zip" names and if not, there was a handy list right next to the records. If I miscalculated my numerical space, I just added decimals a' la Dewey. If J.S. Bach was *B 15*, his youngest son Johann Christian Bach might be *B 14* and if, by chance, their first cousin (?) Johann Bernard Bach suddenly turned up, he would get to be *B 13.5*. My Professor was pleased as all get-out. Just what he wanted, and no cards to bother with.

On a second line of symbols, put below the first, I placed the musical category. Much easier to read *below* than beside. Same idea, though no great need for decimals. Abbreviations, in caps, instantly interpretable. Symphony, of course, was *SYM*. Sonata was *SON*. Concerto was *C*. If you were looking for a Bach *Passacaglia*, you would find it under *PASS*. And to qualify these categories, we put a prefix in lower case, also instant-style. File accordingly. Piano Concerto came out *pf C*. Violin Sonata vi *SON*. How could you go wrong? Standard musical abbreviations, those. Even to *fag* which, in case you are unclear, refers to a bassoon (faggot). There were complications, of course. There always are. But let them pass; in general our music fitted the system neatly, and so will yours if you will make yourself a similar personal code.

Finally, the third line on the label, below the other two, was the specific title, also abbreviated to taste. Mostly a number, #1 or Op. 44, but sometimes a name. Or a combination, to be sure the piece got in the right place. Thus — the Schubert *Unfinished Symphony*, which is #7, would appear as *S 40* (top line, bold characters) *SYM* (second line) and on the bottom, #7 *Unf*. Read it right off. Only, in those days there were numerous discs for each work — so you would see #7 *Unf, 1* and #7 *Unf, 2* and #7 *Unf, 3* for the three records of the set. Mostly today it's the other way; we have two or a dozen works on a single disc, which is a problem. Get to that in a moment.

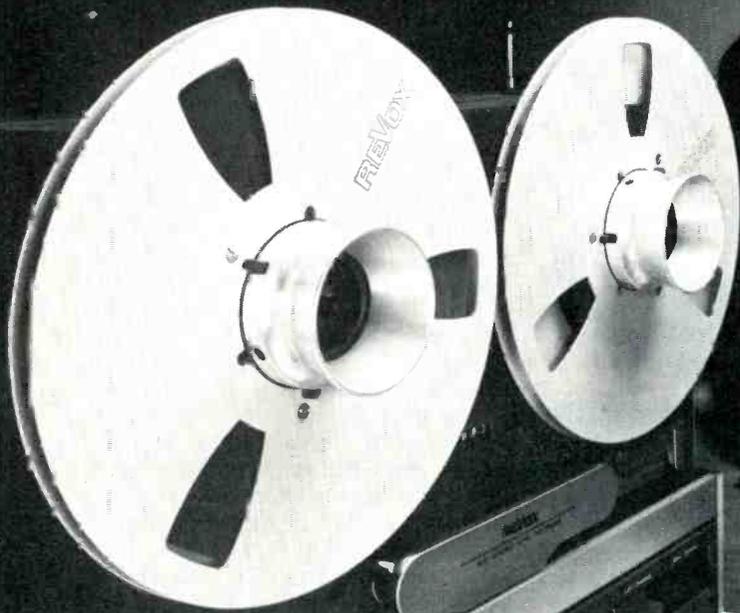
So my Professor could walk in on a Monday morning, go straight to the shelves under Schubert, which is to say *S 40*, riffle along to *SYM*, the Schubert Symphonies, and with one hand pull out the three records for the *Unfinished* under #7 *Unf*, all in a jiffy. And be off to his lecture. (Naturally, when the records came back, I had to put them away.) You can see how visible these labels were if you print out with a good felt pen that *S 40* in characters about a half-inch high, then below that the *SYM*, slightly smaller, and the #7 *Unf*, smallish but still legible at a good distance. Good for the eyes.

Dups, X-es, and Abbvs.

Hey (you say), how about duplications, different performances? Well, in the Thirties there wasn't much problem; we were lucky enough to get even one version of each major work. In that early electrical era the record companies were much too busy tackling all that music still unrecorded. Today is different, and maybe you'll want a separate symbol, to cope. By performer, perhaps, or conductor. How about *Tosc* and *BWalt* for the Toscanini and Bruno Walter versions of the same music? Awful? OK, make up your own. Fortunately, musical names tend to be shorter these days. *cDavis* and *aDavis* for the two British conductors, Colin Davis and Andrew Davis. Or use the record company, say the RCA and the London recordings. Anything that reminds you of what you own. You can even subdivide, for those determined artists who do the same piece over and over. *VonK 1* and *VonK 2* — that's Von Karajan.

Cross filing is a real problem, with more than one significant piece on a single record. In jazz it might be Bessie Smith (*BSmith*) on one side and Louis Armstrong (*LArms*) on the other; in classical, you might have the Beethoven *Fifth Symphony* on side 1 and the

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Schubert *Unfinished* on Side 2. You can't split the disc down the middle and file each in its right place. One wary answer, still without file cards, useful with extreme moderation, is the record dummy. But don't go too far.

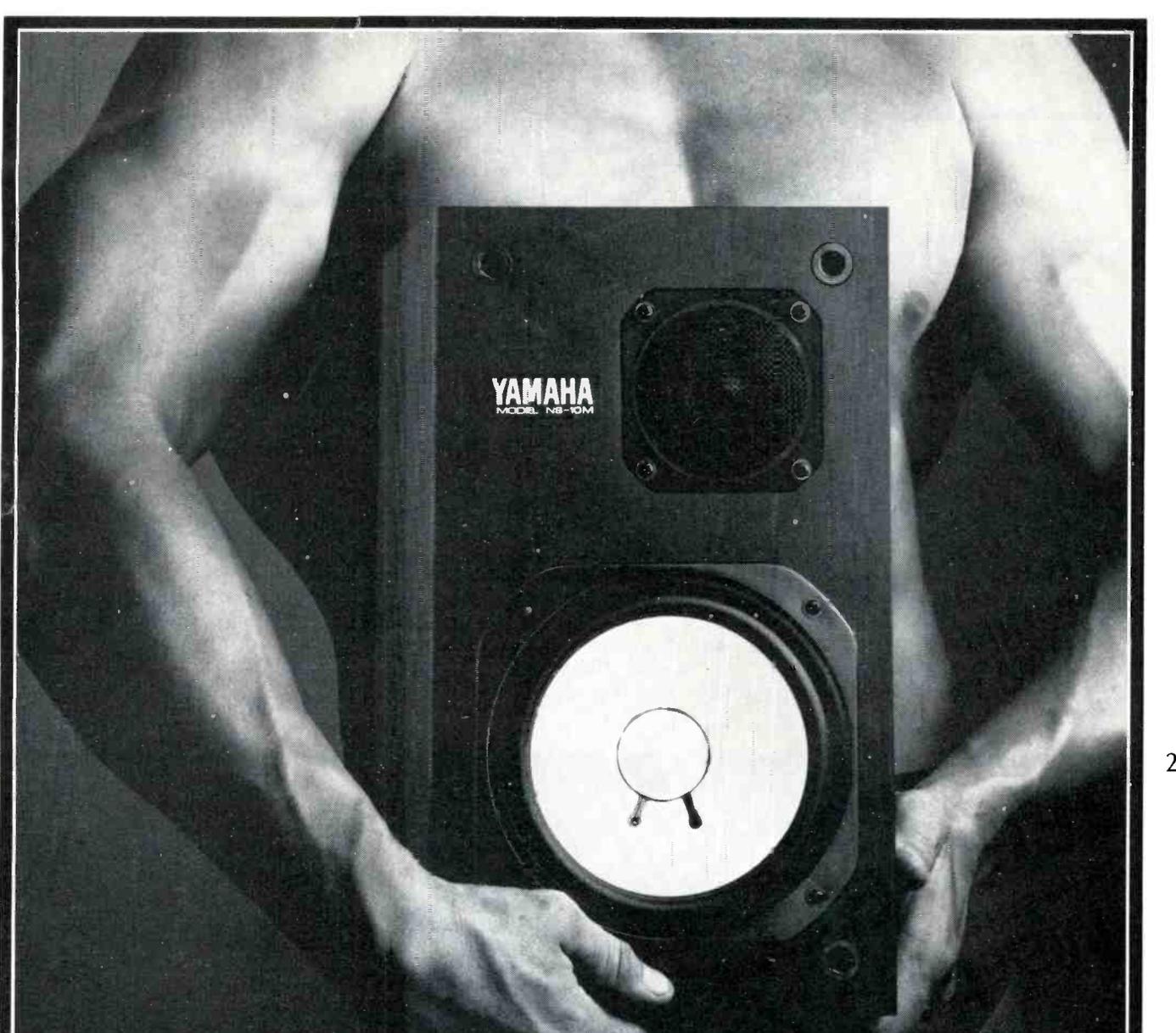
You cut cardboard squares the size of an LP (or a tape), or collect some of those rigid board squares they use for record shipping. Put your usable label on the record itself for the main item, side 1, in this case the Beethoven, *B 55 SYM 5*. Then take one of the cardboards and put a label on it, in the usual place, for the Schubert, just as though this were a real record. Now, *directly underneath* The Schubert label put another, very visible, with the Beethoven information on it, exactly like the label on the real record. Instant cross reference! File the dummy disc right among the S records, like a real record. It tells you that (a) you do own the Schubert *Unfinished* but (b) it is on the back of the Beethoven (which you might have forgotten); so go find it there.

Use dummies only for recordings you really feel are favorites. Otherwise you'll be making more dummies than you have disc or tapes — say all 16 items on an LP pop record. Quick way to go nuts.

So there it is. I am aware that this three-or four-symbol label system, devised for a very big classical collection, sounds dreadfully complicated for your modest library, which isn't that big (nor are you that ambitious). I hasten to repeat that the details are yours to invent, and you can be much less fancy and still profit. What really counts here is first — no cards. And second — a label code that is uniform, brief, and immediately readable right on the record. Not a batch of meaningless numbers that have to be looked up, before you can find anything. Short of a complete professional-type card file system, this is surely the best way for most of us to make a beginning, and it can be amusing and pleasant too. Use your abbreviational ingenuity! Go to town.

Yeah, man (Yessir), listen to those jazz greats, not only BSmith and LArms but old FatsW himself and the ever enduring BGood. You know 'em all, don't you, and you can find 'em too. And take the musical show! The old ones, like "Naughty Marietta" turn up NMar; "The Student Prince" would obviously be StudP, a stud all right. You can even get help from the P.O., which has the right idea. "Oklahoma!" OK! When they get to a musical on my state, "Connecticut!" the label will be just as brief and just as memorable—
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Behind the scenes

Recently I was visiting a friend who is an avid photography buff, and he was proudly showing me a new telephoto lens for his 35mm SLR. The lens he was showing me was merely the 14th addition to his optical armamentarium, along with countless other photographic gizmos and doohickeys that he feels are a prerequisite for the compleat photographer. The fact that he is a lousy photographer, with virtually no sense of composition and perspective, is purely coincidental.

I was struck by the similarities between this camera buff, and many audiophiles who become so immersed in the "nuts and bolts" of audio technology that they lose sight of the original objectives for all their expenditure of time, energy, and money: To wit, to come as close as they can in creating

an illusion of reality, a simulation of the concert hall listening experience which will enhance their appreciation and enjoyment of music. I will be the first to admit to the fascinations of audio equipment, to new ideas and techniques. Quite obviously, audio technology is a major concern in my monthly column. I readily agree there is nothing quite like the thrill of anticipation when you are hooking up a new phono cartridge, amplifier, or loudspeaker, anxious to hear if the device will transport you to some audio *nirvana*. While one can appreciate the complexities of the device and admire its construction and quality, the important thing is its application and contribution to the improvement of your sound. Technology should, indeed, be the handmaiden of music.

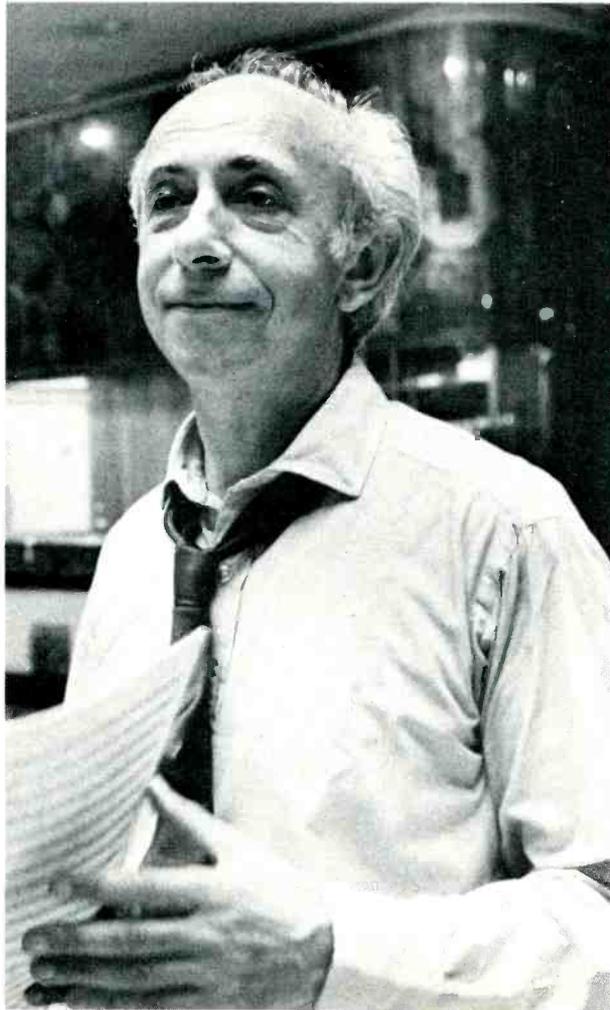
If the pursuit, or "hobby" if you will, of audio is mainly concerned with the reproduction of music, I have had the good fortune of being involved in the recording of music. Over the years, I have had the privilege of knowing and working with many famous music personalities and conductors. This association has led to some interesting situations, and life certainly hasn't been dull!

Composer Conducting

I do not have the presumption to state that I maintained a salon, nonetheless, I have entertained many people who have distinguished themselves in the arts and sciences. One of my recent guests was Morton Gould, the American composer and conductor. I had recorded his well-known *American Salute* with the Eastman-Rochester Symphonic Wind Ensemble, and he wanted to hear how it sounded. Morton, in his professional life, has heard his own and other's music through studio monitor set-ups many times. However, in my home he was exposed to an ultra high quality audio system for the first time. I played the master tape on the Ampex, and when he heard the pristinely clean woodwinds, the massive brass sonority, and the impact and weight of the percussion in this splendid orchestration, he was mightily impressed.

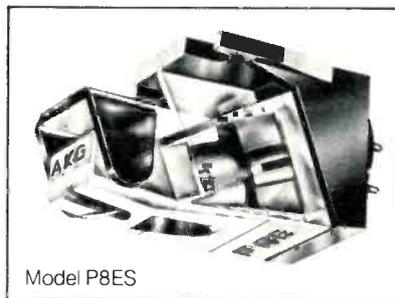
As is usual in these kinds of sessions, we talked about orchestras and conductors and music, and, of course, exchanged anecdotes and jokes about them. He liked one of my Sir Thomas Beecham jokes, which I'll pass on to you . . . Not long after the War, 1949 I believe, Sir Thomas was on an American tour with his Royal Philharmonic Orchestra, and in addition to playing in such obvious cities as New York, Chicago, etc., they had been booked into Joplin, Missouri . . . later distinguished as the home of baseball hero Mickey Mantle. This was a major social event, of course, and after the concert there was the usual reception in the Green Room (Don't ask me how it got started, but in every concert hall the world over, even if the reception room should be bright red or purple or whatever, it is always called the "Green Room.") One of the local

Morton Gould



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matrons, "dressed to the nines," came up to Sir Thomas, bubbling with enthusiasm, and said, "Oh, Sir Thomas! How did you like our Joplin audience?" In his inimitable British accent he replied, "I don't know, Madam, my back was turned!" (My apologies to the good people of Joplin for this.)

One of the things I was discussing with Morton was our forthcoming recording with the London Philharmonic Orchestra, with him conducting his famous *Spirituals for Orchestra* (which I had recorded for Everest 20 years ago with the LSO and Walter Susskind) and the first modern recording of his *Stephen Foster Gallery*.

During our conversation, I mentioned to Morton that one of my impending recording projects was to have Carlos Chavez conduct his audiophile favorite *Toccatto for Percussion* and some other of his smaller scale works. Morton said that it just so happened that he was going to Mexico the following week to conduct some of his works with the Orquesta Nacional de Mexico. Sad to relate, during his engagement there, Carlos Chavez died at the age of 74. Morton told me that he had written an *Elegy* to conclude his score for the TV special, "The Holocaust," but it was never used. When news of Carlos' death reached Morton in Mexico City, the next day at his concert he announced from the podium that he was dedicating a performance of this *Elegy* to Carlos Chavez. Carlos was a good friend of Morton Gould and Aaron Copland and a composer much admired and respected in the music world. I had the privilege of knowing him and recording him with the New York Philharmonic, playing his *Sinfonia India*, *Sinfonia Antigua*, and the world premiere recording of his *Sinfonia Romantica*. That recording took place during the summer in Manhattan Center, and with no air-conditioning the place was stifling. Carlos was a rather short, stocky man, and was obviously becoming very uncomfortable. Finally, he stopped the recording, stripped to the waist, and with his rather hirsute bull chest glistening with sweat, we continued!

Recording Retiree

I visited London recently to make arrangements for the recording of the London Philharmonic I mentioned earlier, and I had quite a talk with the genial long-time manager of the LPO, Eric Bravington, who quite rightly, has been awarded the Order of the British Empire for his services to music in Eng-

land. The LPO is a superb orchestra these days, as well they might be with Bernard Haitink as principal conductor and Sir Georg Solti as principal guest conductor. The venerable Sir Adrian Boult is President of the LPO. Now 89, Sir Adrian no longer conducts concerts but, like Stokowski in his later years, is still active in recording. In fact, I had wanted to record Sir Adrian doing Holst's *The Planets*, a work he virtually "owns," and was quite disappointed to learn that he had recorded it for EMI a few months ago. He has recently recorded the Beethoven "*Pastorale*" *Symphony*, and it has fared very well in the hands of the critics. I vividly remember my last recording session with Sir Adrian and the London Philharmonic in 1959. We were going to do the world premiere recording of Ralph Vaughan Williams, *Symphony #9*, and the composer was to have attended the recording session. That morning Sir Adrian met me in the Green Room which was (and still is) used as a control room at the Walthamstow Town Hall recording locale. He said, "Oh, Mr. Whyte! As you know, Ralph Vaughan Williams was to have been on the recording session with us today, but he died four hours ago." The orchestra did not yet know about this, and if you should run across my Everest recording of this work, you'll actually hear Sir Adrian announcing this news to the orchestra, and saying . . . "and thanks to our American friends for making it possible to record this great work."

While in London, I visited with conductor Walter Susskind in his dressing room at the Royal Albert Hall. He had just finished rehearsing the BBC Symphony Orchestra for one of the annual Sir Henry Woods "Prom" concerts. Walter is a much underrated conductor who turned the St. Louis Symphony into a first-class ensemble in his seven years as conductor and music director there. He took over as conductor of the Cincinnati Symphony this year, after the tragic death of Thomas Schippers, and will preside over the podium there next year as well. About a year ago, the New York Times carried a most laudatory article about the talents of Walter Susskind and particularly cited him as "an orchestra-builder in the tradition of Stokowski." I am to record Walter with the LPO, just before the Morton Gould sessions. Walter offered me a lift back to my hotel, and as we walked out of the Royal Albert Hotel, the sidewalks around the circumference of the Hall were jammed with several hundred young people, who had been waiting

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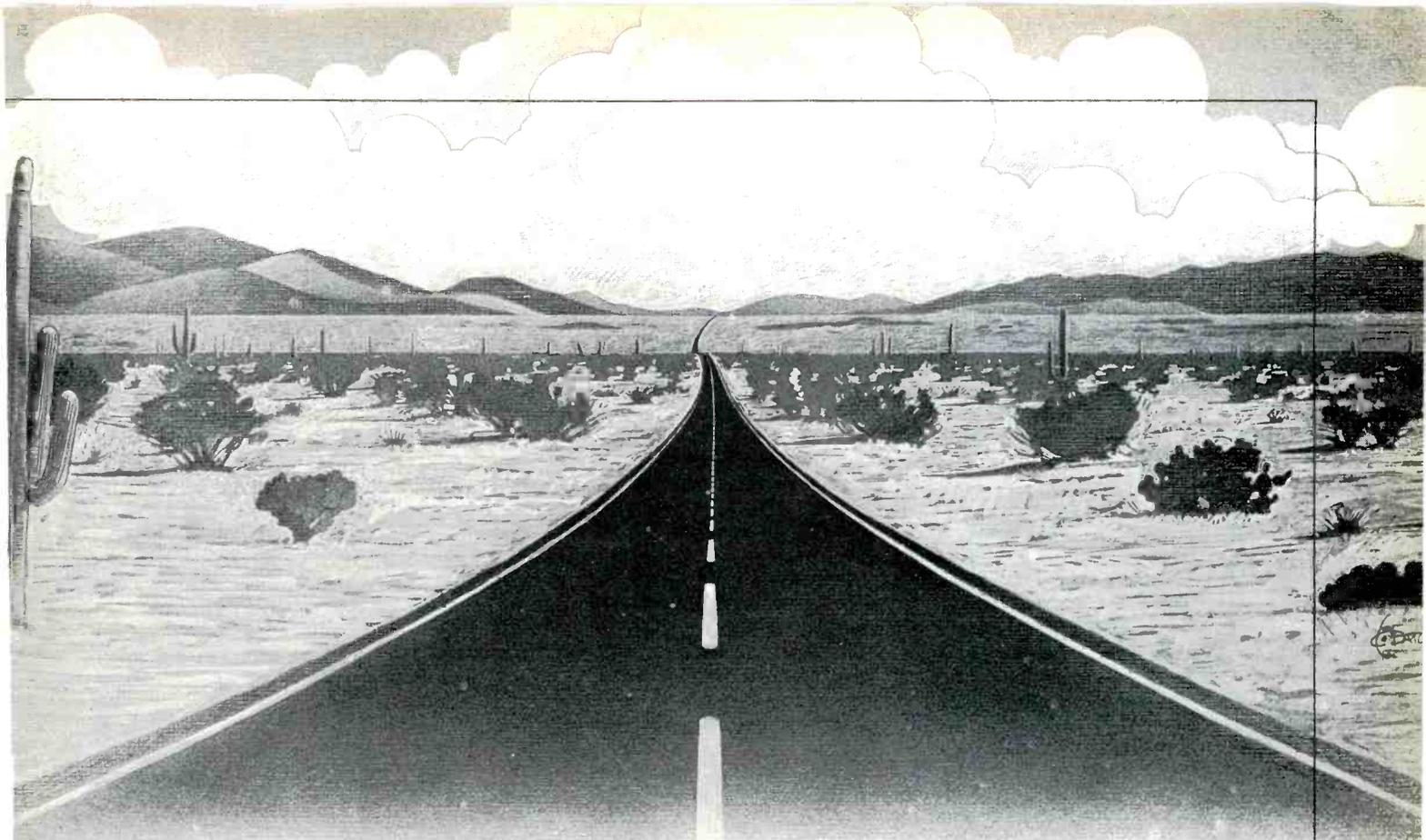
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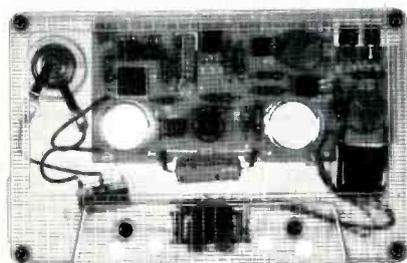
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since 8 am that morning (we left the Hall at 2 pm) for tickets to the 8 pm "Prom" concert. They take their classical music in England quite seriously!

London Line-up

The amount of recording done by the London orchestras is quite astonishing. All the "preferred" recording halls are very heavily booked. Walthamstow, where I have done considerable recording, was totally booked by RCA and Philips, through January, 1979. Watford Town Hall, which is still further out from the heart of London, was secured after considerable negotiation and finagling. Watford was much used by Bob Fine in his many Mercury recordings with the London Symphony. Watford and Walthamstow are, in essence, the equivalent of borough halls in New York City. They were never built for the purpose of recording, being general purpose halls used for various community functions. Thus, in Watford and Walthamstow, there are dances, weddings, banquets, etc. The acoustical properties of these

halls which make them so desirable for recording were discovered quite by accident around 1952. I visited Watford to check on all the various facilities and found the hall being set up for wrestling matches! With the control room up a flight of stairs, there is some back-breaking work ahead, as the Walter Susskind/Morton Gould sessions will be the first direct-to-disc recordings made "on location" in England, and getting those heavy cutting lathes up those stairs will be a Herculean task, to say nothing of the Ampex analog recorders, a digital recorder, input console, etc. Old friend Raymond Cooke, the head of the KEF speaker company, is to supply me with monitor speakers, just as he did 20 years ago when he was with Wharfedale. He'll have to wrestle his new Model 105 speakers up those stairs, as well as the special 400 watt per channel Quad amplifiers he is furnishing.

Well, there you have it . . . I thought for a change you might like a little look "behind the scenes" at the world of music and recording. A

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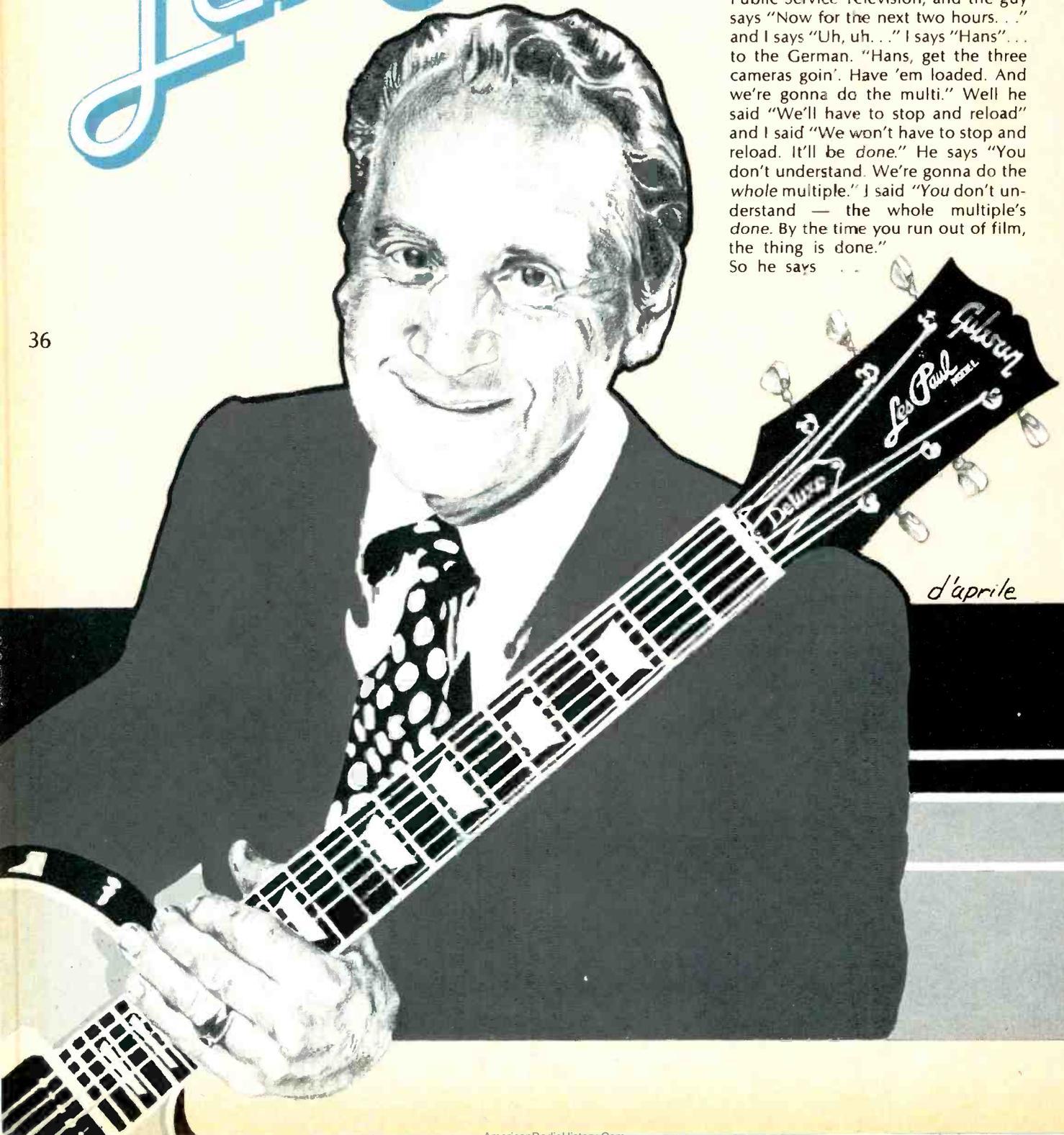
Interview with Les Paul

Paul Laurence
and Bob Rypinski

Paul Laurence: *First off, how do you approach recording?*

Les Paul: You know what? When I make a record, I don't turn any knobs. My engineer sits there and shakes his head. And I'll make a whole record and never touch a knob. No EQ, no echo, no nothin'. Then I'll go to the second part while you wind the tape, lay the second part down, then I do third part, fourth part — the whole number. In 10 minutes! Now here we got three cameras on me, from Germany. For the Armed Forces Radio and TV, and they have these cameras for Public Service Television, and the guy says "Now for the next two hours..." and I says "Uh, uh..." I says "Hans"... to the German. "Hans, get the three cameras goin'. Have 'em loaded. And we're gonna do the multi." Well he said "We'll have to stop and reload" and I said "We won't have to stop and reload. It'll be *done*." He says "You don't understand. We're gonna do the *whole multiple*." I said "You don't understand — the *whole multiple's done*. By the time you run out of film, the thing is done." So he says ...

36



"Well, let's see. Let's see." He spoke pretty good English. So they got the three cameras running . . .

First I asked them what they wanted to hear. He said "Do you know any dirty blues?" I said "I got it down, just as dirty as you wanna get a blues." I said "You want some real funky blues?" So I lay the tracks down there and he's lookin' at this tape whizzin' back and forth and . . . touchin' the button and playin' the parts and the second part and the third part and he sees the bass. . . I haven't laid the guitar down once! Right? The tracks are all filled up and I say "There you are." Then I punch the button and play it back. I don't mix — it's already mixed! No automated mixdown, no nothin', it's mixed! So it went from the 8-track to the 2-track and it's done and I say "There you are." They had a 16-track sittin' there. I didn't even use the 16, I just said "There it is." And they did it all on one take on the film. He's called me from Germany, he's called me from California. . . I guess if he had a chance to get to Alaska he'd call me from there. All he wants to do is redo that. And he says "Slow it down for God's sake. Nobody believes me! They think we chopped it out and edited and everything."

PL: "Simulated for television."

LP: Yeah, but he says "It went so fast, it's a blur." And I says "This is the way I do it." And it takes 20 minutes to make *Tennessee Waltz* or whatever the song is. Well, what are we foolin' around with? You're layin' a part down, you lay the part down, dum dum dum dum dum, it's down. Rewind the tape, dum dum dum dum dum dum next part. . . He says "You know what you're doin'?" "There it is — it's done."

And the kid today, he's got this flyin' machine, and rightfully so . . . You know, like I said, the producer over there, he's got a board that will drive anybody up a wall. Turn it wide open to get the guy with the money with that glaze in his eyes . . . Well, you know, the biggest crap table in the whole world is in the record business, right? And you get this angel with the money, and you get the Great Pretenders up there, turn 'em wide open (LAUGHTER). And sell, right? Set the clock ahead if he's not lookin'.

But in my department, it's a different world. I just say "I want to get the thing done, I know what I want to do." Then I don't listen to it back. It's on there, I'm done, I never play my records.

Bob Rypinski: *There's a question that I'm dying to ask that bears on this subject. When you started with the disc-to-disc-to-disc multitrack. . . I don't really know enough about disc recording to say, but I know that in tape recording when you go from copy to copy, you get a 3-dB degradation each time.*

LP: Well, there is modulation on the tape and there's intermodulation and there's harmonic distortion which is associated with the intermodulation . . . And there is the frequency response which is not exactly linear because of head bump, which is at the low end of the audio spectrum, and that head bump is determined by the speed. If it's at 15, you're gonna have a head bump, we'll say, at 50 cycles, and if you go at 7½, it's gonna drop down to one octave below that — 25 cycles — so that head bump has to be removed. And so at a very early age I immediately had to have linear response so that when I did my over-

dubbing, it was linear. Now this applied the same thing to disc, but with *this* machine, if I was ¼ dB off. . . Hell broke over, because I don't wanna be a quarter dB off.

BR: *But weren't you degrading each of the early tracks with each track that you added?*

LP: 'Course you degrade. But the degrading depends upon what you're degrading. You're at the Hilton Hotel, and you don't know what we're sittin' on down underneath the hotel, do ya? Okay, on my recording we don't know what's down underneath, and the parts that are the least important are the parts I put on first. One of the big secrets of sound-on-sound is that you save your goodies for the last. So if you're going to put somethin' unimportant on, let it be a little worse. Like a drum is in the background, he's just stirrin' around, he's unimportant — put him back there or rhythm guitar. So he's not important, but you get that bass, you gotta have him right up front, and you better have him just right. That lead guitar better shine, and he better be brand new. That vocal better be so clear that the four-part harmony may be off in echo and it may be half a block away. So your perspective has to be in your mind. You have to have this vision.

First of all, it is terribly important that the person sitting on this side of the room is receiving the bass because the bass is the leader of the band. Now, very few people know this, but the leader of the band is the bass. Because you gotta go "boom-ta." Now if you got "ta" and no "boom" . . . you're in trouble. So the leader of the band is the bass note. Now if you're gonna do it with your foot — today's foot player, he's a real happy guy with that foot.

And that foot may be all over the place, and he may be playin' in all kinds of figurations, okay? If he's the leader of the band, then the foot is also the leader, and the bass guitar or standup bass becomes secondary. But as a rule, the bass is the leader of the band, and the "tuck" is secondary. Your tempo is set by "bom bom bom bom" — there's your tempo. That's your tick-tock. So you start with him. So, you want him on one side, then the guy on the other side says "What the hell happened to my rhythm section?" So you put him in the center. I wouldn't think of puttin' the bass on one side, even if there were only two guys, me and a bass. And it was a stereo record with just a bass and a guitar, I would not put the bass on one side.

PL: Back in the 4-track days, when people would record the bass and drums on the same track, I would say it, more often than not, was on the side.

LP: Yeah, well, they were ping-ponging, they were doing all kinds of things, and they had some toys to work with. I was more interested in getting the sound that was pleasurable. But as far as I'm concerned, I

don't want to sit there and hear a train go by. I never was there and I'm not gonna go there. I'm there to enjoy the music. And I don't care if they get it in mono. I am not a freak that cares whether it's mono, stereo, quad — I don't flip over any of it. You just give me the message. You can play it anywhere — on a Bozo record player, and I'll get the message that he's playin' *I Can't Get Started*. And if a classic is there, I don't care if you play it with a cactus needle. It's got it. And I think a recording is the same way — a good classic recording, if it's good judgment and done well and if the bass deserves to be on the left for a very good reason, then put it on the left. Generally speaking, I'm saying "I don't want to say I want you to sit here, in one spot in a room to enjoy a record." You should sit anywhere in the room and enjoy a record. And I think it's wrong that the wife — who is the biggest obstacle within our course — says "In the house you're not gonna put those two speakers there." And eight tape machines. "Get 'em out of here," right? So you got a constant battle with the lady of the house because she's looking at it from a cosmetic

point. She wants a beautiful room and you want some machinery in it. Well, this machinery's gotta sort of blend in with the thing. When you come into the room, you're liable to plunk anywhere. It don't sound right here, so everybody's crowded over there. So it just doesn't make it. Your sound should sound good anywhere. If you go to our house, when you listen, you can sit anywhere in the control room, and say "man, that's a hit" or "It's great" or whatever's wrong, and you're in perspective, no matter where you're at. This idea that you have to sit on a pinpoint here And not that I don't measure it off with a piece of string, because I do. When I set my speakers up, I put right in the center of that speaker a piece of string, and I bring it to my ear — where I'm gonna sit — and I take a string from that second speaker, it's the same distance.

BR: You have an equilateral triangle.

LP: You better believe it. By knowing exactly where it is, because now I have to know exactly what is going on. But as far as the guy next to me is concerned, he also has to be happy. So I have my speakers aimed at the client. I want to make sure he's happy, that he's hearing whatever he wants to hear and so forth and so on. So everybody in the room, they're happy. It's the most important part about the control room. When I sell my own records, but when I think of somebody else I always think You know, the client — the angel. I call him "the angel." This is an important man in the record business.

BR: Did you emerge from being a performer to a producer after you got your own studio?

LP: No. Started out the same day. The same year. I was in electronics at the same time I was in music, and they parallel, and like I said — my mother said "You're gonna be a fireman, and it'll make up your mind what you're gonna be."

BR: You said in your bio that when Meredith Willson recruited you for the army, you played with lots of people — now you weren't producing those records?

LP: Oh, no, oh, no. If you mean later in life, I worked for Bing Crosby — I didn't produce his show, and I didn't produce in the army. I did produce my own shows in the army, yes.

BR: Well, how about that record you made — the *Grand Award* record was it?

LP: Chester and Lester?

BR: No, no. The one you made with Nat Cole . . .

LP: Oh, *Jazz at the Philharmonic*?

BR: Did you produce that?

38 Les Paul and Mary Ford in an early Capitol studio.





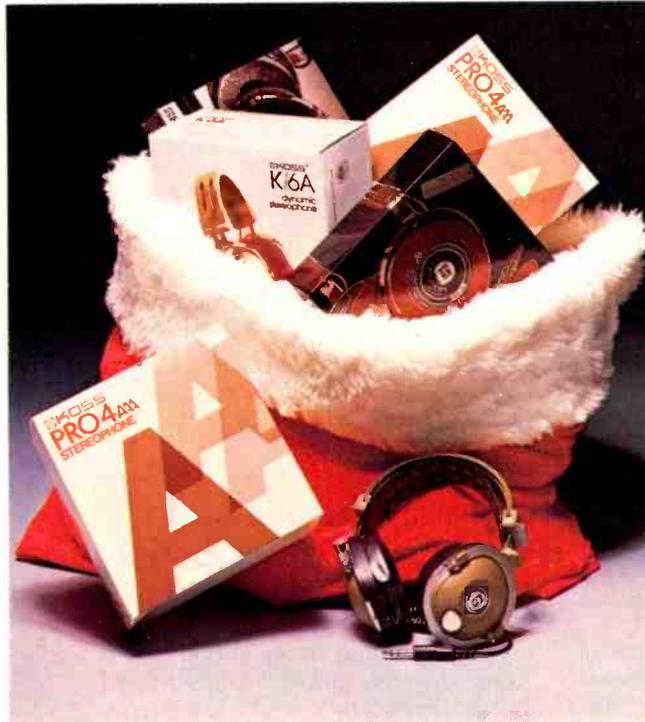
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LP: No, I didn't produce it. What I did . . . it's a funny story. Oscar Moore was playing guitar with Nat Cole. And Oscar had found a gal that he liked very much and locked himself up in the tower somewhere . . . here in Hollywood . . . and wouldn't come down — they were shovin' food under the door.

PL: *Just tortillas.*

LP: Yeah, just tortillas — flat food (*Laughter*). So Nat called me and he says "Hey, uh . . . I lost my guitar player." He says "Can you play for me?" and I says "Well, I'm in uniform. I'll have to ask my commanding officer." I says "Can I play a thing for Norman Granz? Jazz thing." Well, they weren't too enthused about jazz but he said "S'long's you wear a uniform, go ahead and do it." We went over, and I'm the only white man in the group that I remember. I don't remember any other one, but maybe there was another one. Anyway, Nat and I are old friends from back in Chicago . . . So are all the rest of 'em. Anyway, we're playing, and again, from a showman's standpoint, I'm interested

around there thinkin' "This is duck soup. We're gonna have a lot of fun and no one's gonna get hurt" — he doesn't know he's goin' to the *killing floor* (*LAUGHTER*). So, it gets tougher, and it gets tougher. And finally I let go with a run that went all the way down that guitar, and all the way up that guitar *and* that I knew God Himself ain't gonna do (*LAUGHTER*). So Nat took his hat off and threw it on the piano, and he just stood up and looked at me, and that was it — the audience went crazy, they threw *their* hats in the air, and that was the climax of that first album, **Jazz at the Philharmonic**.

BR: *This was a live performance?*

LP: Yeah. Nat threw his arm around me and he says "Les," he says "that's too much." It was all a game, and the game is very simple, that is to just walk the guy out in the rings, you know, and he doesn't even know he's got his gloves on (*LAUGHTER*). And I know I can't play some of the things he can play, but I turn around and play 'em in a position so he's following me and he doesn't know it. And then I say "Well,

out that Western Electric had built theirs in something like 1925 or '26 and that I was only about three years away from *them*. The second surprise that came to me is to find out that the dog didn't invent the phonograph — it was Edison (*LAUGHTER*). I had never heard of Edison, I didn't know anything at all. I knew at a very early age I'm sittin' there lookin' at my mother's phonograph, and I says "Well, if it'll play the record back, why can't I just reverse this thing around and *make* a record?" And I did, and my father, being in the garage business, made me a lead screw, and the first thing you know I had — with my own imagination and no concept at all. I got it from a wood lathe — the whole concept. But as far as knowing what the other guy was doin', I hadn't been out of the woods. I didn't know that Edison existed. I didn't know how they made a record or anything else. I just had to do it on my own. I didn't go to a library or nothing. Made my first record, and when I heard myself come back, my brother said "Big deal." My brother, you know, when he threw a light on, he expected it to light — he didn't know why. I had to know why — I took that switch apart the first day we got electricity (*LAUGHTER*). I got knocked on my rear end but I found out damn quick it was 110. But in 1928, I was well on my way with my first machine, and I heard myself singin' *I'll Be Comin' Around the Mountain*."

PL: *Is this a lathe basically? A cutting head?*

LP: No, it was a windup phonograph — my mother gave me the handle on a Wednesday. I only got it one day a week.

PL: *Are we talking about a cylinder now?*

LP: No, it was just a flat disc. We had a Victrola, and you wind it up. Jack Mullin has one. You wind it up, and there it is. I went to Milwaukee and I bought a Western Electric playback and reproduce head, and all I did is make a steel needle for it. I put it in there, and I started cuttin' on some tinfoil. And I tried that thing, then I tried aluminum, and when I found out I could *emboss*, well, I just got a big, heavy lead weight and I put it on there, and I says "Wow, I can *hear* myself. This is great." But *then* I took the head off and played the thing backwards — the same thing. Then I went farther than *that* — I jabbed it in the top of my guitar and I had electric guitar and I says "This is the way to go, I got an electric guitar now."

PL: *What year was this?*

LP: '28. Same thing.

PL: *So you invented the electric guitar?*

"I went to Milwaukee and I bought a Western Electric playback and reproduce head, and all I did is make a steel needle for it."

in showmanship. You put a guitar in my hands, and immediately I'm gonna get . . . she's there, I'm gonna get her. And I'm gonna get the one right next to her. I'm gonna go one-by-one, but I'm gonna get 'em. And that audience was just sittin' there, and it's quite passive — it isn't really goin' crazy. So I thought "I'll do my little bit again — I'll throw a hook out." So I threw one of my cheapest runs out. I threw it at *anybody*, but Nat Cole picked it up and played it. I made it dumb enough so that *anybody* could play it, and I got Nat followin' *me*. So I threw a little tougher one at him. And Nat says "Hell, I can play that one" — you know, in his mind. So Nat climbs on my back for a second one. I said "All I gotta do is reel this cat in now (*LAUGHTER*). Got him now." So I made the next one a little tougher. Well, everybody starts gettin' in . . . You know, they're sayin' "What the hell's goin' on *here*? We got somethin' goin'!" So I see this audience lighting up and I says "Now I got 'em *all* on the hook." So Nat doesn't know he's hooked yet. See? He's swimmin'

I got three things in my pocket that I know that this guy, it'd kill him. I'm not gonna kill him until I got everybody in that audience with their eyes poppin' out, and then throw one at him and then just see what happens. If he *possibly* goes anywhere *near* it — which he did. If you listen to the record, he played something *different* than what I play. So I went back and played it *again*, and he went after it a *second* time. So the third time I give him both barrels, and he just took his hat off, threw it on the piano and he did this (*GESTURES*) and threw his arms around me and it just tore the show apart. It was showmanship. Nat was a great man — a great *piano* player, and a great singer, and a great person. I've known Nat from Chicago, and his manager was my manager, so we were closely related all through life.

PL: *One thing I'm trying to do is relate the new developments in recording to the records. And I figure you can give me a very good overview there.*

LP: Well, I built my recording machine back in the late '20s and then found

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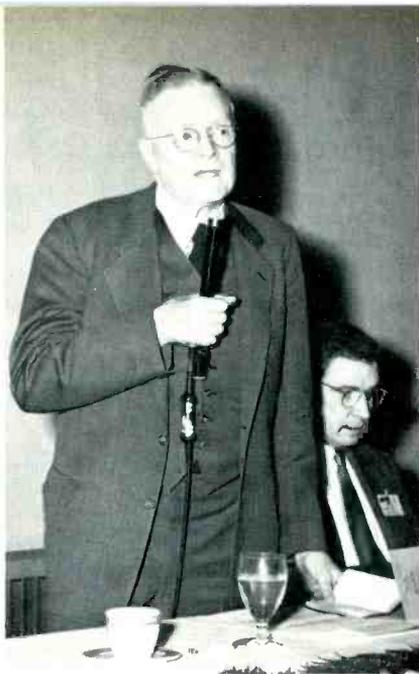
LP: Yeah. '27, '28, in the late '20s. By 1930 I was gone, in Chicago already. Here's another one for you. We used to broadcast in Wisconsin, Racine, Kenosha, Milwaukee, and the engineer sat on the floor with a little crystal set, and he'd get that and he'd say "Sounds good," ... had his earphones on and he'd point to you and you'd sing and do your songs. I'd sit on a bed! We were broadcasting from a bedroom! And the amazing part about this thing is that I didn't know any different. Two hours later I was on stage at the Capitol Theater. And I had to do a show. That's the first hook I ever found. I was out on the stage and after a few minutes of me (*MAKES WHISTLING NOISE*), I was off stage (*LAUGHTER*). Yes, sir, I learned at an early age, I better learn to be a showman. I was a dead duck. I didn't last long at all.

BR: Was it amateur night?

LP: No, it wasn't amateur night — I just was at the Capitol Theater in Racine and I got the hook. And I says "Well, I'll have to learn" so I got a wig and I started doin' comedy. And by 1930 I was well on my way to doin' burlesque shows and country shows and so forth and so on.

BR: As *Red Rhubarb*, were you a comic character?

LP: Yes. Played the harmonica and the guitar and I sang funny songs and serious songs and ... Well, I was one of the biggest in Chicago if not *the*. Well, the biggest ended up Gene Autry, but in Chicago I had a tremendous following, and in about 1933 at the World's Fair I decided to *drop* playing the guitar and become a piano player. Because by then I was a pretty good piano player. And in 1934 Art Tatum came along. And I go down to The 3 Deuces and I heard Art Tatum and I said "Well, that ends that (*LAUGHTER*). There's no sense in me even *lookin'* at a piano." So the piano went to the side, and I went back to the guitar. But *that* was my first machine. The second machine I built was in Chicago. I remember building this lathe myself and finding that the turntable had to be balanced — dynamically balanced — and so I used plaster of



Col. Dick Ranger, flanked by F. Sumner Hall, at an early meeting of the AES.

Paris underneath the table. I patched it up with plaster and I got it so that it was evenly balanced. It was a rim-drive. No overhead feed-screw, like a Green Flyer which was in there too. I had a Green Flyer for the second machine. And so I had two machines, and I was doing my multiples then. But never knowing that there were commercial machines.

PL: When did tape happen? Late '40s? 1947?

LP: The tape I heard by Col. Ranger in Newark, New Jersey, back in probably '45 or '46 — it was in that era. It was right when he came back from the war. And I happened to be workin' with Judy Garland and Paul Whiteman. And then Col. Ranger called me and asked me if I wanted to hear a



Les Paul, at age 11, in Waukesha, Wisc. Already his ability was evident.

tape machine. And I said "Is it anything like a wire machine?" He says "Yeah, but the wire is turned. This is flat paper tape and I brought it back from Germany." From Luxembourg or wherever he was. He brought it back in pieces and put it together in Newark. I went over there, and I heard it. I went back to California and I told everybody in California. I said "Man, Dick Ranger's got a thing that you won't believe." I'd known Jack Mullin, and Jack says "I got one in my garage. I haven't put it together yet but I got one in my garage." Col. Ranger was a lousy businessman ... and he worked for me, I hired him. So Col. Ranger worked for me for four years. In all our filming. Television in my home. But Col. Ranger being a bad businessman, Jack Mullin was a *good* businessman. He wasn't much better than *me*, because he gave the idea — I presume he gave the idea — to have Ampex ... He walked up to this Murdamood or whatever their name was ... up in San Carlos

BR: Alex M. Poniatoff. He was building the electric motor.

LP: That's right! Exactly! Alex is a very dear friend of mine. And he gave 'em the ...

BR: Well, I don't think Jack felt that he owned it, he just copped it from the Germans.

LP: That's right! You see, during the war, I was here stationed in California, and we had to slip-disc all this stuff. So that when we got somethin' from Hitler and we didn't want him to say what he said, we would edit him. So we had three turntables, and we had our earphones on. I worked for the Armed Forces Radio Service, and *my* job was to edit. Only two guys workin' with three turntables, while this one's running, you slip *this* to this one, *that* one you kill and you set up *that* one. So with three tables, you're there, *editing*. And, boy, you gotta drop it right down *there*, and listen and hold right *there*. And slip-disc on those things, and you make a one-generation down, and there you are with a speech. What bugged us is we could hear pops, and we could hear inside spaces — from outside to in — and then when we got

**“I went to Pop Olson, and I finally got him to make me
a pair of cutter heads . . . clean right to 12.5 kHz.
But playing it back was atrocious.”**

inside, it went from inside to *out*. On our discs. Well, we found Hitler over there givin’ speeches, and we didn’t hear any pops or anything. And that son-of-a-gun would edit Roosevelt’s tape, and he’d be on the air in five minutes with it. Or Churchill. And we’re saying “What in the devil is *he* doin’? We can’t slip *that* fast! What does *he* got goin’? Is he on wire?” If he’s on *wire*, we’d hear this fidelity



Eddie Kramer, currently a leading producer, benefitted from Paul’s innovations.

drop ‘cause that’s gonna roll. One minute you’re on the front of it, one minute you’re recording on the back of it.

So we were really befuddled with this German job, you know? When we got our hands on *that* German thing, *hell* broke loose. So in ‘48 unfortunately I tipped a *car* over, and I was in the hospital for a year and a half. And that year and a half I was at the Good Samaritan here, with my *arm* in a cast, *dying* to get my hands on a

tape machine. Because now I could see where I could *travel* — you’re not gonna travel with two *lathes* in a station wagon. Where with a tape machine, you could. And I had it all figured out on an envelope as to how you could do sound-on-sound — you can do this all on one machine. No VU, no speaker; all I had was a pair of earphones and a microphone, the guitar, and a little mixer. A little box.

PL: And so you developed sound-on-sound? And this was ‘48?

LP: Umm hmm.

PL: And how about Emery Cook and his binaural recording? Was he the first guy to do more than one track simultaneously?

LP: I think he was, it was in that era. I didn’t watch it quite that closely. Emery Cook I was very aware of, let’s put it that way.

BR: Cook was doing discs with two separate cutting heads, and then he played it with two . . . Cook’s still alive and well incidentally.

LP: He’s up in . . . where is he? Massachusetts or somewhere.

PL: Tom Dowd described him as a “wild-haired genius who fancied doing raucous things.”

LP: He was a guy I kept my eye on, and from out here we were watching him quite closely. The *problem* was nobody could get a playback arm that could reproduce what we could put on the record. Now I went to old Pop Olson who lived out on the beach, went fishin’ all the time. And I finally got him to make me a pair of heads. And I said “I want these cutter heads to go to 12.5 kHz — clean. Right to 12.5. Well, he said “Mine only go to 8,” and I said “Well, I’d like to get ‘em to 12.5,” and he said “Well, if you’ve got the patience to wait, I’ll work on it until I get it. I have to get a different kind of rubber for the damping and so forth” and I said “All right.” So he did. And he got the things out there to *almost* 12.5 and then we found that if we *rewound* ‘em, then we could get ‘em out there. Now we got the heads there, and we got the light pattern, and we’re *lookin’* at the thing, and it’s on the record. With an oscillator. So we know that we’re goin’ out there at 12.5, and we know the music is clean. But playin’ it *back* was with a 9A cutter and a playback arm, it was *atrocious*.

Later on you get the 7,000 cycles, and we took a nosedive and it was bad news. So in about 1945, ‘46 — somewhere in that era — along came a friend of mine. He said his brother worked in Schenectady or wherever it was for G.E. And he pulled out of a bag six pickups. And he handed ‘em to me, “They’re no good to me. You want ‘em?” And I says “What are they?” He says “They’re pickups of some kind.” So we *try* the pickup. And the pickup was a high-impedance pickup, and we said “Gee, if we run it . . . Let’s try rewinding this thing down 250 ohms and see what we got.” And we got that kid to go all the way out to 15,000 cycles.

BR: Were these the ones with the double stylus that you push the button in the top and turn it around?

LP: No, before that, before that. I got the original tomato cans home. So these two — we call ‘em “tomato cans” — we got a pair of those goin’, and the first thing you had to do was remove the four bolts that hold the turntable down because they were magnetic. Can’t have any magnetic bolts or anything around it or it’ll go “tuck tuck tuck tuck” you know. So, we got the tomato cans to go, and we got a flat response to 15 k and we got the cutter to 12½ k so we had *that* goin’. And that’s when Fairchild came into the picture, and *he* actually built a replica of the garage on Curson and Sunset. He come out here with his crew — flew the whole crew out — they measured the garage off, and *copied* it. Then they went to the guy that built the *head*, copied that, and they copied the *amplifier*. But they made some fatal mistake. First of all, they didn’t get the original head. They got the head that was the *old* head, with the big bumpers on the side. Olson wouldn’t sell ‘em the new heads, he sold ‘em the *old* head, the one he’d tossed out. Just one. The *second* mistake that Fairchild made is he went to the 807s because he could get more power out of the heavier amplifier, and use four of ‘em push-pull. Instead of my little ding-a-ling job. And probably many other mistakes that he made that I don’t know about. I’m sure in his drive mechanisms he copied my disc machine. The disc machine was made with Wally Heider. Where his studio was, was a hobby shop, and for \$10, I

**“Consumer’s Research wanted to know if
‘high fidelity’ would be offensive in their first record review.
They wanted to use *Lover* to check their equipment.”**

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rented that hobby shop. We could go in there after 10:00 at night and stay there all night and work. And we built this machine, little by little. Another friend of mine, who died, Lloyd, and I built this thing with the lathes. We cut out all this stuff, and we made the turntables and the feed screw and everything else, and as we built this thing, we had to put it somewhere, so we put it in the window. So the engineers for Arcturus Engineering happened to be walkin’ by this window, saw this machine in there, walked in, and said “What is that?” “I don’t know — two kids rentin’ this place at night are building somethin’. I don’t know what they’re building” So they got my phone number and they called me; they said “What is that?” and I says “That’s gonna be a recording lathe.” And he says “Well . . . what percentage would you want for it?” “Do you have it copyrighted?” And I says “Nah, we just built this thing.” “Tell you what — if you build us one First one you build, give to us” “It’s yours. Take it.” So they copied. Like I say, there’s 1500 of ‘em out here. You’ll see ‘em at KHJ, you’ll see ‘em at Radio Recorders You’ll probably see ‘em everywhere.

BR: Does Bill Robinson have one?

LP: Probably Bill has one. It’s a well-known cheapie tape machine that we built up. It worked perfect. With those dental belts, I was doctor to White because during the war you couldn’t get dental belts. So I just said “Dr. Paul” to S.S. White, and says “My belts are shot and I need some new belts” and, being a doctor, I got the things right away (LAUGHTER). So I got these things and some beeswax . . . Here is a funny story — very short, but very funny. We got down to fixin’ the speed. And I says “I want three speeds; 33, 78, and one right in the middle ‘cause I want to vary the speed and do these multiples at different speeds.” Happened to be 45. Damdest accident ever happened in my life! Happened to be in between and it happened to be 45. No reason — could have been 40. So we look in the phonebook — in the Yellow Pages — and I’m wondering if the guy is in there yet. So we run our finger down there and we see “cutting lathes” for doing this work that we wanted done . . . cutting the

pulleys. Goodspeed, it was. I said “That’s our man.” And he’s in Glendale. So we go there and the guy says “What do you want?” and we brought the whole lathe in this Model A Ford to him. Laid it down there on this floor and he says “What do you want?” and we say “One between 78 and 33. We got a strobe here, we can show you.” We wanted something in between there — halfway in between there. And the guy says “Well, can you guys go to a movie or somethin’ and come back in an hour? I’ll have it done.” So my friend says to me “That’ll be the day.” Come back, it was dead on when they put the strobe on it . . . He didn’t even use a strobe. He said “Take the strobe with you. I don’t need it.” He figured it out, you know? He says “What kind of groove — you want a round groove, you want a V-groove, what kind of groove do you want?” “I want a V-groove.” “You got it.”

Goodspeed was the man that put the lathe on speed, but the dynamically balanced flywheel, that’s Cadillac Flywheels. I started that thing and I says “You know, that’s gonna be one hell of a job to get this thing perfectly balanced.” Here’s how it happened: The guy’s name was King. And this fellow trained the dog for “The Thin Man.” And he said “My dog can talk. And I want to record him” (LAUGHTER). A talking dog! A talking dog is all I need now! I’ve had Pat O’Brien, the Andrews Sisters, you know, W.C. Fields — I’ve had everybody in my backyard. Art Tatum, Andre Previn . . . and a talking dog, man. So this little guy comes in here, Mr. King, and he sees me building this machine. I had taken two 16-inch discs, and cut a piece of plywood 16 inches and glued ‘em together. That was my turntable. Well, that was a pretty crummy turntable, I want to tell you, but I still got it. So he says to me “You know, you need something more rugged than that, something that when it gets up to speed . . . you may want to put a governor on that thing — you know, that wig-wags underneath there. With the springs on ‘em” and I says “Jeez, that’s complicated, and I don’t want to go that way.” So he says “Well, there’s somethin’ dynamically about” He says “What about a flywheel?” Well, we were out the door so fast, we were

down to the junkyard in a minute, asking “What do you want for a flywheel?” Only wanted a buck or whatever. Come back and you can’t beat that, those guys spent years to get that correct, right? There you are! It was that simple. Happened in ‘42.

Then in 1949, sound on sound happened, and once when Bing Crosby was in our backyard, I went to Bing and I said “Bing, you’re close to Ampex. I gotta have a tape machine. We’re doing a show every Friday night on KFI — on NBC — and it was ‘Les Paul and Mary Ford at Home’.” And I said “This show, I gotta do travelling. I may be in Terre Haute, but I gotta do this show. And I gotta have a way. If I can get a hold of this tape machine” So the idea one day came to me, the idea would be to add a fourth head to the thing. That would solve the problem.

PL: We’re talking about Sel-Sync?

LP: No, we’re talking sound-on-sound. Sel-Sync didn’t come in until ‘52. That’s when you’re listening off the record head when you’re in the record mode.

PL: But who was the first person to be involved with more than one track on a tape machine? Was that you, and when was that?

LP: That was me, ‘52. That was the first of what we call Sel-Sync, where you can overdub — you’re into that status. There probably was such things as stereo and so forth on the horizon. Stereo is nothing new, it just wasn’t accepted or ready.

BR: Western Electric developed stereo in the early ‘30s. They had 3-channel stereo that was better than the later stereo.

LP: Oh, it was here. In ‘52, no one ever said the word “stereo.” It was 1948 and I got a call from Mt. Vernon. “Consumer’s Report” — “Consumer’s Research” it was called at that time. And they wanted to know if the word “high fidelity” would be offensive to use in the first record review. And they wanted to use *Lover* as the standard of the industry, to check their equipment. And if *Lover* sounded right on their equipment, then it was cool.

PL: So you’d place overdubbing and Sel-Sync and multitrack — multitrack meaning more than one track — all in 1952.

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Tom Dowd, another producer who benefitted from Paul's ideas.

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LP: Right. 1952, and it was 1956 before we'd completely wedded the console which was built way ahead of the 8-track . . . there was Rein Narma, who was vice president or president of General Instrument Company now. Preceding that he was vice president of Ampex, preceding that he was vice president of Fairchild, but preceding that, he worked for me. The other man was Bob Flint, who is now the chief engineer of Black Company, ahead of that Addressograph I believe is the name of it. He was chief engineer of Ampex, ahead of that he was at Fairchild and ahead of that he worked for me.

The engineers that have come out of my little company — my little haven back there — are outrageous. If you look at "The Hindenburg Disaster," if you look at "Earthquake," if you look at "The Towering Inferno," if you look at "Kojak," that's all an engineer that grew up and learned engineering from me. That's John Mack. He's at Universal, and he was my engineer. Col. Ranger worked for me. Now if you want to go further than that, Rein Narma worked for me, Harry Mearns, chief engineer, RCA, no, maintenance engineer — chief of the maintenance department. Ah, if you want to take my brother-in-law Wally Kaman for 10 years did nothin' but edit for Bill Putnam — he was *the man* at Western

and United Records. Did you know Wally?

BR: I know his name.

LP: Wally Kaman? I handed him a piece of tape and told him to edit it and I think he drank a half a bottle of bourbon — just scared him to death! You see, the great part about the early days was we had no fear because we didn't know *what* to fear. We didn't know what it was all about. So we just went in there and *did* it. There wasn't anybody to say "can't do it" because they didn't know what they were talkin' about and we didn't know *either*. You know, who thought of a patch bay? — you just solder it on, that's all. I had a lump of solder big as a golf ball on there! (LAUGHTER)

PL: And how long was it till stereo filtered down to the public?

LP: We were designed for stereo unknowingly. We had everything for stereo, there has never been a thing changed on my board from 1954 till now. It's exactly as it was, and it has all the provisions that you have now. Not as many knobs as you've got now. I had a choice of slider faders or knobs and I picked knobs. It was just a matter of choice. I says "Spread 'em out, I got big hands." I says "I'm in no hurry. And I only want eight tracks." There's four on the low-level mixer — on the side — and eight across, and I got all the equalizers under the sun. Which I

never use, but they're there. And I only do that when I rescue some guy that got in trouble (LAUGHTER). If I do a date, I don't go into the 8-track — I go right to the 2-track. But the machine was built with a left and a right. And a center.

PL: I understand 3-track and 4-track came in pretty simultaneously.

LP: They come in right on top of that 8-track. Well, the 8-track, when it came out, say '56, the 8-track took out. It was a sleepin' dog, and so was the 4-track . . . and the 3-track. Three-track came out faster, because it was used in filming. So 3-track was an idea that came from filming, so that came about, and that was a dog, and had a lot of things that had to be redone. So that's when I called Poniatoff and told him that when he goes to work he's gonna find a pigeon sittin' on the Ampex on his front lawn. He said "You wouldn't do that to me." I says "I already did it. That son-of-a-gun is on your front lawn." He says "Did you put a lemon on it?" I says "No, I did everything *but*. You got that darn thing until you fix it. It's full of garbage." And he laughed. He says "Well, we'll fix it, we'll get the best engineers on it." I met one of the engineers the other night who said "they sat up all night workin' on it until they got the noise out of it.

But that didn't come in until the later years. The 3-track came in first, then the 4-track came in, and I guess the guys that really got their hands on it was The Beatles. The Beatles did all their stuff on 4-track I understand, and did an excellent job with **Sgt. Pepper**. That was a hell of an album.

I think it was more 3s than 4s when it started. Our Ampex, that we got — we had to ship it back three times, that 8-track, because the first time they sent it at 30/60. Instead of 15/30. If we stood near it, we could get killed! (LAUGHTER) Then the EQ was wrong, then they didn't have a master bias oscillator and, naturally being in the experimental stage, there was no head lifters and there was a lot of things that were wrong with it. The signal-to-noise was high, and there were many things . . . crosstalk and so forth and so on. That's where Col. Ranger came into the picture, and Rein Narma. I'm amazed that so many people . . . have kind of forgotten Narma, because he's in the marketing department at General Instruments — probably one of the most brilliant men that I've ever had the pleasure of working with. He was captured by the Russians, he was captured by the Germans, captured by the Americans (LAUGHTER), and he's from Estonia. He's a man that says

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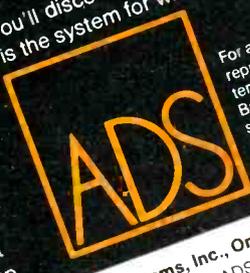
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Paul with son Robert on drums.

"What's your problem?" and when you tell him the problem, he says "Well, I know of three answers right off." He never looked negative, he was a guy that always left his suitcase, his rubbers, or his kid at my house (LAUGHTER) and went home and then would call me and say "Have you seen a kid runnin' around there? It's mine." He was a real scientist — x-minded professor. The guy would walk in and I would say "I want so-and-so" and he'd write it out on a piece of paper and give it to one of my engineers and say "Go build it." And it was dead on. We'd make bets — four engineers would stand there makin' bets. John Mack, who did "The Hindenburg Disaster," "The Towering Inferno," and all that made a bet with a couple three other engineers of mine, and Johnny Hilliard was there too. We all made a bet that Rein would blow it — he couldn't be that close. And Rein said he'd be within an eighth of a dB.

BR: Is Dick Stumpf part of your circle, out at Universal?

LP: No, no. No, just John Mack — I got John Mack out here. He was with Rank over in England and came to America, I was short an engineer and I said "Anybody in here got an ear for music?" John Mack raised his hand and says (ENGLISH ACCENT) "I'd like to try. If you give me a chance." And I said "I'll give ya a chance. Come on in here" and when we were done makin' our films, around 1959, he said "Les, do you know anybody out in California?" I said "I'll getcha a job on me. I

know everybody in California. He came out here, he worked his way from the bottom all the way to the top, and he's extremely happy. I'm very proud of him, and he's one of my many... They're like *children* to me.

My son is a head at Atlantic — you go down to MCI and say "Gene Paul" and they say "That's your son? He's the *king!* The king." I'm very proud, very proud of my son.

He came to me one time, and he said "I got a problem at Atlantic. A *tough* problem." I says "There's no problem, kid." He says "Well, they're only gonna have seven fiddles and they want to make it into a whole string section. What should I do?" I says "Well, you set up the chairs for the whole bunch. And you put the *mikes* up for the whole bunch. And turn all the mikes on. And put the guys in the first row and have 'em play, and then have 'em move back to the second row and play there, and then move back to the third row and play there, and play all the way back, and you got yourself... (LAUGHTER)." Then he walked out of there, and I walked up to Atlantic one day, and Tom Dowd come to me and he says "That kid of yours is a genius! (LAUGHTER)." I says "He sure is. That's the sharpest kid you'll ever find."

I'll tell you the one that really threw Gene though. I walked up to Atlantic one day and Ertegun was in there, everybody was in there, and they're doin' whoever it was they were doin',

a big date in there. I walked in and I wasn't there two seconds and I says "You got that piano out of phase for any reason?" And everybody jumped up like they were standing at attention for the general. And my son says "Is it out of phase?" I says "Yep" and turned around and walked out. And a guy walked out with me, he says "You sure shook hell out of your son. What a joke." I says "It was no joke; it was out of phase." He said "It was?" I says "Yeah." So my son come out in a few minutes, and he says "You know what, Pop? It was out of phase." I says "I know it was out of phase."

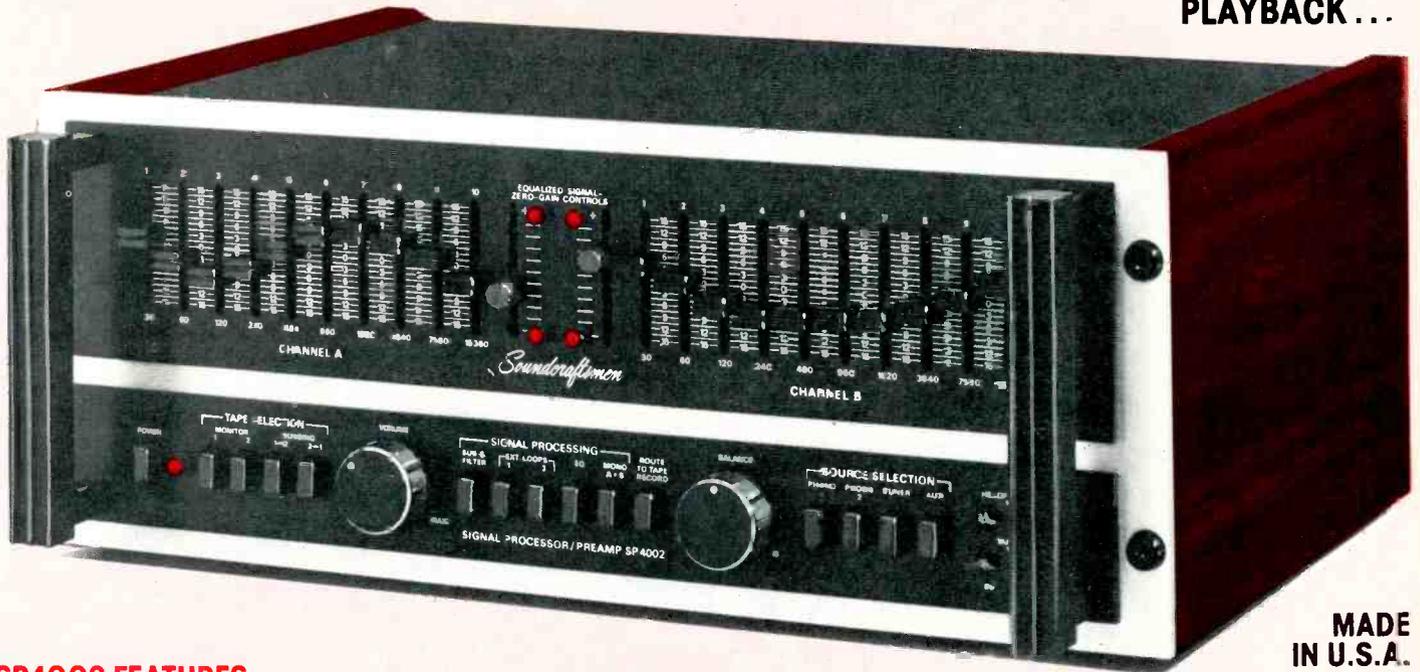
PL: What did you hear?

LP: Oh, I hear it, I hear it. Once I went to the Mayo Clinic for these ear operations, and they rebuilt me an ear. Mayo Clinic said "We're gonna put a hole in your ear that's so small water won't go through it but we can get this high-powered microscope and see if there's any granulation or any liquid behind it." And I says "Okay." After a couple of days, I went back there, and the doctor says "Uh, how's your hearing?" I says "Lousy." And he says "Well, what's it like?" and I says "Well, its down 40 dB at 125 cycles." He says "It's *what?* That's *impossible.*" And I says "I can tell, just right like that." Guy called in the other doctors. There's all these doctors comin' through and they get ready to run another test and put it right over the top of the other test, in another pencil, red pencil. So I says "Well, fore we make this test, what is the bet?" and he says

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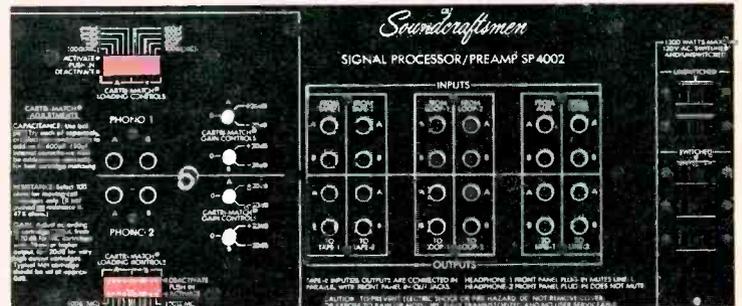


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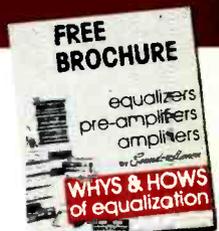
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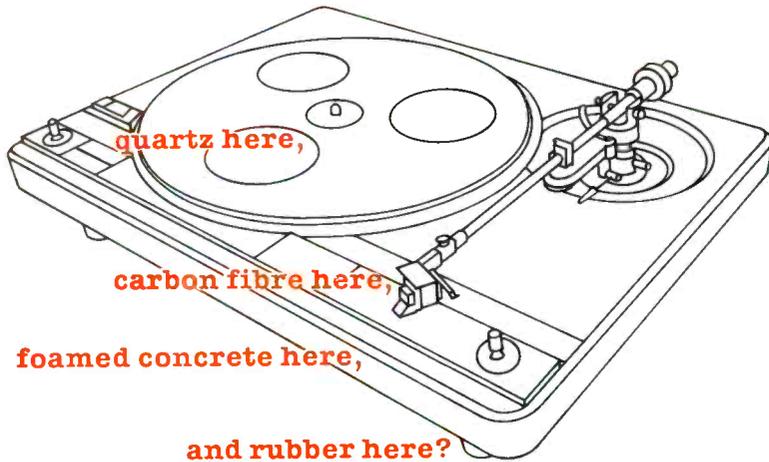


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"Well, you got the Mayo Clinic free if you win. If you lose you pay for it (LAUGHTER)." I says to myself, "I can't lose on that deal." And if I go up there now and if I announce my name, I'm the next one in. I mean I don't get no bills. And they said "Can we put it in a medical journal?" I said "You can put it anywhere you want." He says "We must have been gettin' up and drivin' a hayrack!" I said "I know what you're gettin' but my ear is so tuned to what I'm hearing, that I know if it's 6 dB, 8 dB, 4 dB, and at what frequency I'm hearing what" And I was on the operating table, and during the middle of an operation the guy takes a tuning fork and hits it and asks me what key it's in. Right? So I named it and the guy says "You're right." I says "This is the damndest thing I ever heard. Here you're choppin' my head up, and you want to know what key I hear!"

BR: I was waiting for the story you said you were gonna tell about Jazzbo Collins . . . and his ball of string.

LP: Oh, the ball of string! Well, I'm goin' overseas, and I'm over Alaska in

saves string." He says, "So? What's so bad about that?" I says "I didn't mind it when it was a little ball. But when it got so big that I had to cut a hole in the apartment . . . 'cause the ball got so big . . . (LAUGHTER)." When you pack a lunch every Sunday and take a flashlight to check the knots! I'm living with a ball of string in my house and "this string is gettin' out of hand — every time she sees a piece of string she picks it up and adds it on to this ball (LAUGHTER), and I can't take it anymore." And he says "Well, when she comes out, can I talk to her?" I said "Sure (LAUGHTER)." And when she comes out, they're tryin' to talk her out of this ball of string, and she's lookin' at 'em dumbfounded (LAUGHTER). And another guy's talkin' to me saying "Look, a ball of string isn't the end of the world. You can always put the ball of string in a separate room (LAUGHTER)." And this went on all the way to Japan And I guess about the second and third place I played, I walked out on that stage and they says "Here he is, Les Paul!" and I walked out and right in the front row

PL: Les, do you remember the first record you were ever on that was commercially available? Was it a single?

LP: It was a hit. It was called *Just Because*. Made in 1930, for Montgomery Ward.

BR: Was this the one that goes "Just because you're a da da da . . .?"

LP: No. "Just because you think your hair is so curly / Just because you think you're so hot / Just because you think you've got something / That nobody else has got." Oh, it was a big hit.

PL: So you were the artist — as "Les Paul"?

LP: "Rhubarb Red." I made \$20 (LAUGHTER). And it took about four, five years for it to be a hit.

PL: And what was the label there, do you remember?

LP: Champion, I believe. I think it was Champion. I do not have that record, but it was made on gravity feed. A gravity-feed recorder.

PL: I don't know what that means.

LP: Well, you just write down "gravity feed" and there'll be a lot of questions asked. But that means it's got a weight, and it goes toward the ground at the speed of gravity and that's what makes your turntable go at 78 rpm. And that's a beaut. And then you crank it up and start all over when it hits the floor. It's a counterweight. It's non-electric. You crank it up to lift the weight up but that's it. And the VU meters. . . I'll never forget the early VU meters. You say "Hello" and that needle'll start to move (LAUGHTER), and about two minutes later it says "Hello." It goes like that (DEMONSTRATES), that meter. The damping on that meter was unbelievable — guy says "Watch the meter." I says "You gotta be jokin'. I'll be half done with the number by the time that meter moves!"

PL: You sang and played guitar on this record?

LP: Yes, and harmonica. The other side of that was *Deep Elm Blues*, and that was a hit too.

PL: Les, you mentioned some non-standard-speed recording, as double-speed guitar, say? When did you first do that?

LP: Well, that came about in '46.

PL: And so were you the first to do that — to playback. . .

LP: Yes. As far as I know.

PL: How about backwards recording?

LP: Oh, sure. Meredith Wilson was the one that brought it to my attention. That didn't happen until maybe 1947, when I made the records for Capitol I found out that you better make 'em backwards because of the transient response, and when you start goin' up there double-speed, and you're laying

"I'll never forget the early VU meters. You say 'Hello' and about two minutes later, it says 'Hello.' The damping was unbelievable."

the lounge and this guy comes up to me and he says "You know, I'm an engineer with so-and-so." He don't know who I am, I don't know who he is. I'm listening to him talk and he asked me what business I was in. I had to think of a business, so I said "I'm in the garment business." And I don't know where I picked that up. Just then a woman wanted to get in the bathroom. So I ask her if she had a dime, and she digs in her pocket lookin' for a dime and I said "I was only kiddin'. You can get in for nothin' here." The guy says "Hey, that's a good-lookin' chick." And I says "Watch it, that's my wife." I never seen that gal before. "Oh," he says, "I'm sorry." I said, "Don't feel sorry about it because we're breakin' up. This is our final trip to get over it — gonna try and cement it up but "we'll never make it." He says "That's a shame. Look, you're a perfect matched pair here, you know (LAUGHTER). I says, "Never make it." She's too far out for me." He says "What's the matter with her?" and I says "Well, she saves string. (LAUGHTER)." "She does what?" "She

is this guy (LAUGHTER). And he says "Have I been had! Boy" he says, "did I get sucked in on that story."

You know I tell these stories like now and there was one where I went to Brazil and we didn't want to be known. We were there early and I said "I want to see Brazil without being bugged with a lot of things and people." I said "I'd like to go in there with a pair of Levis, walk down the street and see what Brazil's all about." So I registered in as Lester Polefuss. Come down in the lobby and the guy said "You Lester Polefuss?" I says "Yeah." He says "Can I speak to Mary Fordus? (LAUGHTER)"

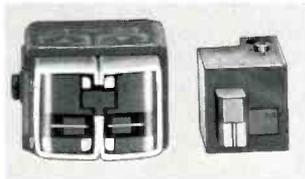
I went to get the Grammy award and I registered in as Lester Polefuss and I'm there a week before the Grammys. One day this lady said "I'm dyin' to tell you who you are (LAUGHTER)." She just says to me "Mr. Polefuss, I'm dyin' to tell you who you are." Then she starts hummin' *How High the Moon* and I'm thinkin' "I don't believe it." One of the funniest lines — "I'm dyin' to tell you who you are." I couldn't believe it!

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that's crazy. You're gonna break the mike." I says "I haven't broken a mike yet. Everything is fine." "Well, you're gonna pop the Ps," they said. I says "Then let 'em say B instead of P." And it wasn't long before I had to put two mikes up and told 'em to sing in that mike and I recorded on the close mike. So this guy is singin' like mad right into this distant one and the one right next to him is the one that I'm really getting him with. So I would get him, I would fool this guy. We'd put a pencil right across the center of that microphone so he wouldn't pop his Ps.

PL: What was the close mike for in this case?

LP: The close miking essentially was because there was noise in my amplifier, because I was a low-level mixer. That's what I had, a low-level mixer. A low level means that you are controlling with a T-pad before, from the microphone looking into the preamp. In every console you look at today, your volume is controlled after the preamplifier. So you've already cremated the amplifier. You're going to go like that (*CLAPS HANDS*), and you've killed it.

PL: We're talking about distortion?

LP: We're talkin' about distortion. We're talkin' about you *cannot* overload anything that's got a pot hangin' right in front of the microphone, right there before it ever gets to the preamp. So I had the cleanest records that ever came out. So when the piano player went up and hit one of the big chords . . . Like I played last night, you're hearing these tremendous sounds come off an acetate, where everybody says "My God, what in the world is happening? Why?" And it was a very simple thing — I had to close-mike. Because if I backed the guy that far away, you got so much noise, you couldn't believe it. So I had to bring the guy right up tight in here, when I brought him tight in, a *second* thing happened. You should never put a resistive load across a microphone. If you do, you change the response. But nobody found out that the response is to your advantage. That it took the bass out of the 44. So, with the 44, as you moved in, the bass built up. But when you put a resistor across it, it took the bass out. So by accident, I found out that by leaving the T-pad in there, you move the guy right into the microphone and you have the same thing as you did if it wasn't in there and you're *three* feet away.

PL: But weren't the vocals always recorded fairly close? Even in the *Big Band Era*?

LP: In the *Big Band Era*, they may have got that close (*DEMONSTRATES*), but you never walked right up to the mike.

You never got right where you had lip-stick on the mike, no.

PL: So you were the first to close-mike instruments, anyway.

LP: Yes. When you get a violin, and the bow is just runnin' right straight across that microphone, when, you get a trombone with the microphone *in* the bell, with a Saltshaker — or a whatever — you say, "This is ridiculous." And I've had many a guy from MGM say "I won't record in that room. I just came from Republic Sound Stage, and if you think I'm goin' in that dumb garage and play one inch from a microphone, you're crazy." So I'd say to the musician "Would you mind playin' a couple of notes, come in and hear it yourself and *then* make up your decision whether you'll record in my studio or not?" One guy was hired on a date, and he says "I don't care how much you pay me. A microphone should be that far away." Now that's the way he was brought up. So the microphone'll be over there where those *lamps* are; this is the way he's used to recording a string quartet, and he just doesn't. . . . And this was the industry — the standards of the industry. It was *not* to chuck a mike down your throat. *Bing Crosby* was the first one to say "I never heard sound like this in my life. The guy swallowed the mike." He says "This is . . . ridiculous. It's the greatest sound I ever heard in my life. That guy, you can hear him breathe. You hear every sound in his voice." You see, this is because you're capturing everything you want to capture. If you don't want to capture it, don't.

PL: So when was it that you first close miked the instruments? What year?

LP: I close miked right from the beginning. So that goes back to '42. Starts right from the time that I built the mixer and the whole thing. . . .

BR: This overpowered the noise in your amplifier.

LP: That was the basic idea, 'cause without it I was in trouble (*LAUGHTER*). More accidents happened in my lifetime that turned out to be . . . some of the greatest things that ever happened in my life were just necessities. In fact, all of 'em were necessities.

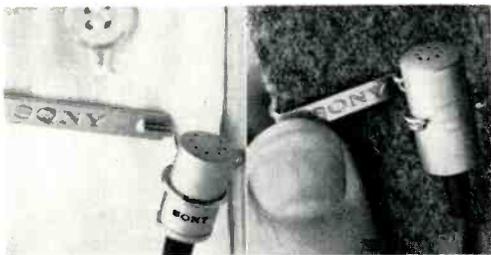
BR: How do you feel about playing through an amplifier into a microphone versus playing from a pickup right into the board?

LP: Well, now there's a good question. Now you may find that going direct into the board is a direct sound, an intimate sound. It's as close as you can get; you can't get no closer than direct. Direct, I happen to prefer because it's so pleasant, and you can do so much with it. But many times I'll place a microphone as much as across the room.

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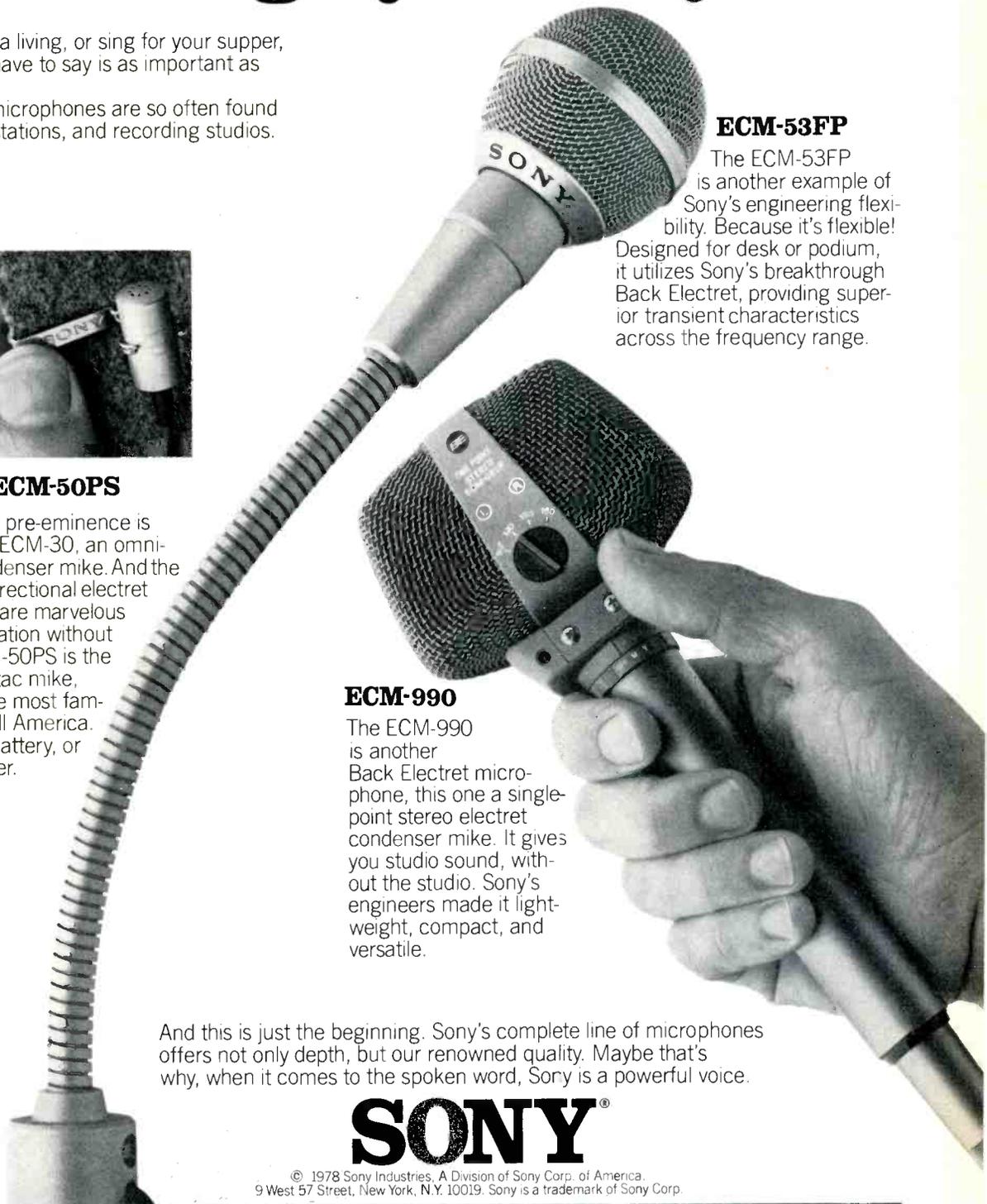
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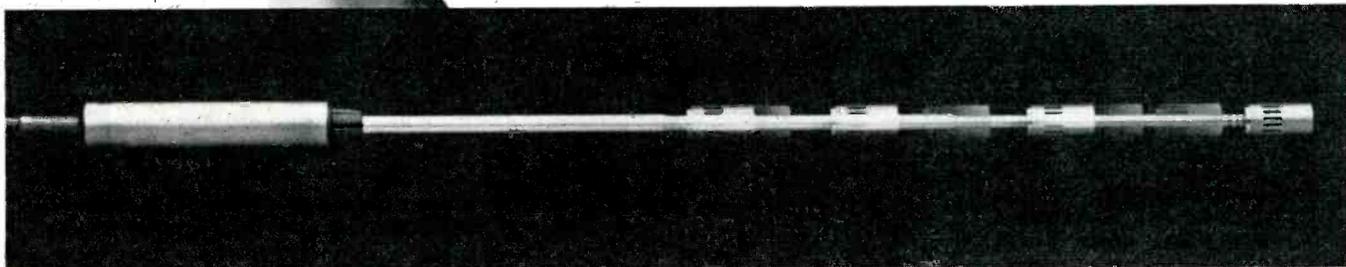
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And pick up a speaker. And multi that kid. I won't do it with their funny boxes. I have a lot of funny boxes, but I don't do it that way. I do it the correct way, where you take a multi off the preamp, feed it out there, feed it into a speaker, take that speaker and put that microphone over there at a distance. Jimi Hendrix called me one day and asked me, how he would do it? How he *should* do it? And I said "That's the way I would do it."

PL: *It was direct and distant miked?*

LP: Direct and distant miked. And now the distance of the miking is up to him because there is a certain sound that you get out of this non-linear string, non-linear pickup, non-linear guitar — okay? — coming out of a non-linear speaker, out of the wrong box, out of a wrong guitar, but they sound great, so that these two wrongs make a right. And this sound that he gets out of this dumb speaker and this dumb guitar turn out to be great. And he *wants* that sound.

PL: *Well, Eddie Kramer used direct and distant and close miked all the time.*

LP: Eddie Kramer did it, was working for Jimi Hendrix — that was at the Electric Lady, that's where it happened. He was the guy who'd asked me. This is where it came about. So when you're saying Eddie Kramer, you're talking about Eddie Kramer worked for the Electric Lady and Electric Lady was owned by Jimi Hendrix and Jimi Hendrix was the guy that called me. And he says "Hey, I wanna get that real raunchy fuzzy dirty down ... you know, that."

PL: *Probably "big" sound.*

LP: Yeah, that *real* big sound. You know, the Led Zeppelin came in there later on with ... doin' a similar thing to that, with Jimmy Page and the bunch of guys there, you know.

PL: *More guitar effects-oriented here. How about tremolo? When did that first start happening?*

LP: Well, tremolo ... Where did the tremolo come from?

PL: *Was it on an amp, first of all, or was it a separate unit?*

LP: Yes, it was on an amp. No, it was not on an amp. The first tremolo was mercury, in a little tube, and it used to jiggle with the motor. You turn the motor on, and it would jiggle and would change the amplitude. And it was strictly amplitude and not vibrato — vibrolo. It was a change in amplitude, and it was on a motor. This was just before ... it was back in the '40s somewhere.

PL: *How about phasing?*

LP: Oh, phasing came in, and it came from a guy out here in California. My

phasing came about by puttin' two discs on at the same time and getting 'em out of phase.

PL: *Are we talking about a shift now or just ...?*

LP: It's shifting, it's shifting in and out. I was in the army and I was listening to Tokyo Rose. She was on every day and that's how I used to hear my records — in the Armed Forces Radio Service. And the station would go in and out of phase, because, you know, overseas. So you'd have this shifting ...

BR: *Just from the fading pattern.*

LP: From the pattern. And my little son, who is now the #1 engineer at Atlantic — and his brother — they used to come in and say "Can I change the radio, daddy?" and I'd say "Okay." And I'd become fascinated to see what stations they'd pick. And they didn't pick a station with music — they picked the station that was out of phase. And this intrigued 'em. I looked at the kids and I says "You know, it must be commercial (LAUGHTER). It must be commercial." So I says "How am I gonna do this?" You know what I'm gonna do? I'm gonna put two records on ... just let two records go — get 'em right together — and see if they would cancel each other out. And they *would* cancel each other out, and I put on a Variac. I just put a Variac on it — I'd bring it in and I'd bring it out, and I started to get this shifting back and forth.

PL: *And about when was this?*

LP: Oh, that was somewhere in '46, maybe '45, or somethin' like that.

PL: *And did you use this for selected instruments on your records?*

LP: Oh, sure. Used it with Mary a lot, and I used it because there'd be a lot of voices goin' here and there and we'd use it on the guitars.

PL: *When did people start limiting? Limiting and compressing?*

LP: The limiting came about in Atlantic City, when Jim Conklin at Columbia Records says to me "You have turned the world upside down. Columbia Records is goin' crazy. We had a meeting the other day and your ears must have been burning." Columbia had their convention at the same time Mary and I were playin' Atlantic City. And he says "Les, what you're doing on a phonograph record, we've got to do with Frankie Laine, with other people. And we can't do it, because they got one note at zero on the meter and the next that don't move it at all." He says "Everything you play, that needle stands still." I says "It's simple for me because I'm my own limiter." I didn't know the word "limiter" then — but I says "I do my own balancing, controlling by



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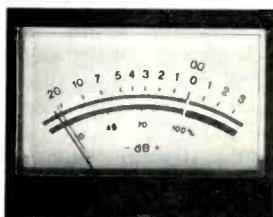
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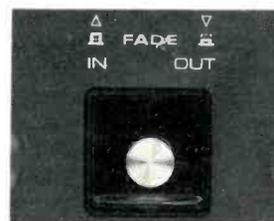
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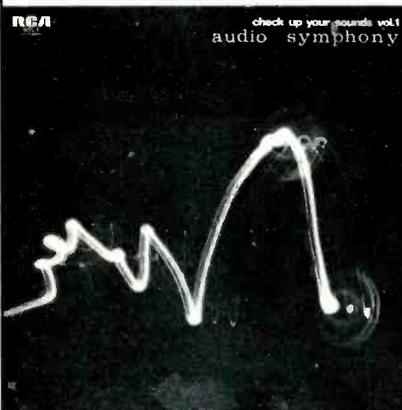
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playing the guitar. I'm looking' right at a meter. And when Mary sings she's lookin' at the meter. I'm watching that meter all the time so that I don't overshoot or undershoot — that I keep the level up. I pick softer, I pick louder." So the limiter came about in the '50s — late '50s, 'bout '58 — something like that.

PL: Can you restate here one aspect of your philosophy on recording — the feeling over technical perfection?

LP: Well, I think that they're getting to a point of demanding more and more and more . . . I'm judging this from my sons as engineers, and others that are engineers close to me that grew up same age as my son — all of the people surrounding me. The longer they're in the business, they have a tendency to simplify. They find there's no reason just because that knob is there to use it.

BR: Well, I think that Paul is referring to is something you said earlier, when you said if you have a choice between technical excellence and feeling, go for feeling every time.

LP: Every time. If that's what you mean, yes, yes. The feeling is so much more important than it is to be an excellent . . . Perfection is a disease, and it's something that . . . Be aware if you happen to be of my nature. Anybody that happens to be a person that wants something as close to perfect as you can get — and that is dealing with frequency response and distortion and so on, tape machine, and slowing down the tempo and so forth and so on — you gotta be careful, 'cause you can lose your perspective quickly with one glass of beer. You can go out and come back an hour later and say "I can't believe what I just thought was good." And you've only had a dinner, a couple beers and come back. And you know when I see 'em doing all this automation . . . I say "They're gonna hate themselves in the morning. Tomorrow's another day."

I'll be darned, I can't help but think of my son — he made *Killing Me Softly*. And he brought a test over to my house. And listened to it and I says "Well, you blew it there" and he says "Yeah, well, I'll correct that tomorrow. And I says "Well, that . . . that over there" . . . you should have done that" and he says "Yeah, you're right — that's not too slick there." He got back the next morning, they were *pressing* it already! (LAUGHTER). And he won the Grammy on it! He won the Grammy! Did Tommy Dowd tell you that?

PL: No, but I know that sort of thing does go on — you'd better watch your mixes or . . . they'll make a record out of it.

LP: The feeling was there. You see. Now, you get guys that are doin' all this stuff. . . and I pull back. They say "What's the matter, Pop, aren't you with it?" And it's hard to screw my head onto their body. Very difficult. And they may be right, I may be right. . . Lot of times they'll say "Well, now you gotta look into what's happening now." Like I jokingly said "If you oversleep one hour, you're out of the ballgame." Because today is moving so fast. If you oversleep one hour, you are now out of the business. You are out of track with the whole field and it's a lost game. So when you look at just that new automated board down there. . . that's the top of the board. To run the top of that board is one man. Now, there has to be a man that can go underneath that board — that's another man. There has to be another man that built that board. Or men. The three of 'em. Now there's a producer sittin' over there, and there's an arranger sittin' next to him. Then there's the performer. And then there's the angel — the guy that says it ain't commercial. And usually that cat is sittin' there like the sultan, and he's listening to this thing and he's saying "Get rid of it. It won't sell."

So there's a lot of facets to this thing. The top of that board is fantastic all by itself. And it's not like the old days where if it doesn't run right, you lift up, you go inside, and you fix it yourself. As I told my kids many years ago, I said "If I ever catch you kids with your hands in that board, I'll kill you. Stay out of it. You're an audio engineer and remember don't go under that board. Because it's frightening what's under there." It's another world. There's few. . . Tommy Dowd is one of 'em that can go under the board and on top of the board . . . I would venture to say that Bill Robinson's not very anxious to go on top of today's board. And me, I can't cancel out many years of goin' on top of that board except for my own study. So when I go on top of that board, it's very simple. If I do Benny Goodman tomorrow, it's gonna be very simple. I do Crosby. . . Crosby actually said "How're you gonna make the next record?" I said "Simple. With no mixer. No nothin'. I'm gettin' an AG-440 and I bring the guys up. We do it in your living room. I take the tape under my arm and kiss you goodbye. That's it." "Hey," he says, "that's something. But I said "Nothing. Nothing! Don't need no engineers, don't need nothing. Just four mikes, four tracks, four people. The guitar player and bass plug in, go. That's it, that's the end. Bing sings, we talk, we do our thing, gone." A

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Equipment Directory Addenda

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The new Uher distributor for the Eastern United States is Saul Mineroff Electronics, 946 Downing Rd., Valley Stream, NY 11580. The West Coast distributor remains Walter Odemer Co.

The Advent/2 loudspeaker weighs 18.5 lbs. and the price is \$81.00.

The proper models for the Chartwell speakers should have been: LS3/5A, PM-100, PM-200, PM-400, and PM-450.

The proper model numbers for the Sansui speakers were: SP-X 9000, SP-X 8000, SP-X 7000, SP-X 6000, SP-A 3100, SP-A 2100, and SP-A 1100. The cross-

over frequencies for the SP-X 9000 and the SP-X 8000 are: 1k, 6k, and 10k.

The price of the Sansui SC-2100 cassette deck is \$400.00, and there are no mike mixing inputs on this unit.

There were several updates for the listings under Shure. The SME 3009 Series III tonearm is 11¼ in. long and can handle a cartridge weight up to 12 grams. The SME 3009/S2 and SME 3009 Series II tonearms both measure 11¼ in. and have a cartridge weight range from 4 to 9 grams. The SR116B and SR112B loudspeakers both have an SPL

sensitivity of 97 dB. The new prices for Shure phono cartridges and the replacement styli are V15 Type III, \$95.00, \$34.00; M24H, \$88.50, \$33.80; M95ED, \$77.50, \$31.50; M95EJ, \$61.95, \$25.95; M91ED, \$66.95, \$28.50; M75ED, \$66.95, \$28.50, and M93E, \$51.50, \$21.80. The new prices for equalizers are M610, \$164.50, and SR107, \$275.00.

The correct address for R. Allen Waech is 2614 N. 68th St., Milwaukee, WI 53213.

Directory of Manufacturers

Audio Technology

1169 Tower Road
Schaumburg, IL 60195

BGW Systems, Inc.

13130 S. Yukon Ave.
Hawthorne, CA 90250

Harold Beveridge, Inc.

505 E. Montecito St.
Santa Barbara, CA 93103

R.T. Bozak

P.O. Box 1166
Darien, CT 06820

Burhoe Acoustics

78 Stone Place
Melrose, MA 02176

Concertaudio

80 George St.
Paterson, NJ 07503

DFS

12729 N.E. Whitaker Way

Portland, OR 97230

Dennesen Electrostatic

P.O. Box 51
Beverly, MA 01915

EMT

See: Gotham Audio
Electro Research Marketing
20727 Dearborn St.
Chatsworth, CA 91311

Essence

5500 Old Cheney Rd.
Lincoln, NE 68506

General Sound

2334 N. 32nd St.
Phoenix, AZ 85010

Gotham Audio

741 Washington St.
New York, NY 10014

H and H International

354 State St.

Rochester, NY 14608

Neumann

See: Gotham Audio
Norlin Music

7373 N. Cicero Ave.
Lincolnwood, IL 60646

PSU

2535 Durango Drive
Colorado Springs, CO 80910

Pearl

See: Norlin Music
Quantum Electronics

300 Audubon Pkwy., No. 80
Syracuse, NY 13224

Ram Audio Systems

17 Jansen St.
Danbury, CT 06810

Sansui Electronics

55-11 Queens Blvd.
Woodside, NY 11377

Shure Bros.

222 Hartrey Ave.
Evanston, IL 60204

Signet Div.

A.T.U.S., Inc.
33 Shiawassee Ave.
Fairlawn, OH 44313

SpeakerKit

P.O. Box 12
Menomonie, WI 54751

Willie Studer America

1819 Broadway
Nashville, TN 37203

Synergistic Sound Systems

1608 S. Douglas Ave.
Loveland, CO 80537

Systems Magnetic

2837 Coronado St.
Anaheim, CA 92806

Phono Cartridges



Signet Mk112E

MANUFACTURER	Model	Frequency response, Hz to kHz, ±dB		Channel separ., 1kHz, dB		Channel separ., 10kHz, dB		mV output, 1 kHz, 5 cm/Sec. rms lateral Velocity	Recommended tracking force range, gms.	Recommended load impedance, ohms	Recommended load capacitance, pF	Stylus type—use code	Stylus radius (radial), mils	Is stylus user or factory replaced?	Weight, gms.	Price	Replacement stylus price	Notes
		Hz to kHz	±dB	1kHz, dB	10kHz, dB													
EMT (see Gotham)	XSD-15		25		0.75	2.5	800		C	0.6	Fact.	21	435.00	150.00			Repair/exchange units avail.	
FIDELITY RESEARCH	FR-1Mk3F	10-40k	26	24	0.14	2.0			E		Fact.	10	230.00	115.00			All units moving coil. FRT-3, FRT-4 x-formers opt. † Comes w/headshell.	
	FR-1Mk7	10-45k	28	20	0.2	2.5			E		Fact.	† 30	660.00	400.00				
	FR-1Mk2	20-20k, ±1	25	20	0.1	1½-2.1			E	0.2 x 0.8	Fact.	10	150.00	75.00				
RAM AUDIO SYSTEMS	Ram 9210SG	20-20, ±1	20	17		2	50k		E	0.08 x 0.75	User	3.8	299.00	35.00				
SIGNET	TK5E	10-30	25	20	4.2	¾-1¾	47k	200	E	0.2 x 0.7	User	6.8	85.00	50.00			Moving-coil type. † inc. integrated headshell. Moving coil type.	
	TK7E	5-30	30	22	2.7	¾-1¾	47k	200	E	0.2 x 0.7	User	6.8	150.00	75.00				
	TK7SU	5-45	30	23	2.7	¾-1¾	47k	200	Q	0.2 x 0.7	User	6.8	175.00	100.00				
	MK111E	5-50	30	20	0.4	1-2			E	0.2 x 0.7	Fact.	4.8	275.00	110.00				
	MK112E	5-50	30	20	0.4	1-2			E	0.2 x 0.7	Fact.	15 †	300.00	120.00				
SUPEX (SUMIKO)	SD-900E+ Super	10-50, ±3	30	27	0.2	1.2-1.7			E	0.3x0.8	Fact.	8	200.00	100.00			Moving-coil type, needs transformer. SDT-722.	
	SD-901E+ Super	10-35, ±3	30	27	2.0	1.2-1.7	47k		E	0.3x0.8	Fact.	9	175.00	87.50			Hi-output moving coil, needs no transformer.	



BGW 203

Preamplifiers

MANUFACTURER	Model	Type or Unit — KT-4K, Wired w/ Tube T; Phono Stage Only 2-Mono M	Frequency Response, Hz to kHz		Maximum Output, V	% THD	% HF IM Distortion	S/N, :1 w/d. phono re: 5 mV input, dB	Phono Sensitivity, mV	Phono Overload, mV	Phono Input Impedance, ohms	High Level Sensitivity, V	Tone Control	Dimensions, to nearest quarter inch, W x D x H	Weight, Lbs.	Price	Notes
			Hz to kHz	± dB													
AUDIO TECHNOLOGY	440	P	20-20k +0,-0.2	14	0.005	0.005	85	0.1-2.0†	140	100-100k ††	No		7½ x 5½ x 1¾	2	189.00	† User adj. gain, 6 steps; †† user adj. resis. & cap. loading, 10 steps. Pre-preamp & RIAA for MC/MM carts. W. clip. LED, subsonic filter.	
BGW	103		20-20k ±0.25	8	0.01	0.01	82	2.0	100	47k	0.20	Yes	19 x 10½ x 3½	13½	399.00	Variable cartridge loading.	
	203		20-20k ±0.2	8	0.01	0.01	82	1.5	100	47k	0.20	Yes	19 x 11¼ x 5¼	18½	649.00		
BOZAK	909		20-20k +0.25		0.1	0.1	85	2.5	120		0.26		17¾ x 5½ x 6½	21	450.00	EQ tape out; 2 phono inputs	
	912		20-20k +0.25		0.1	0.1	82	2.0	120		0.08		17¾ x 7 x 10¼	28	800.00	Mixable inputs; 3-band EQ w. var. turnover; indep. cue circuit; slide controls.	
QUANTUM ELECTRONICS	CP-1		1-225 -1 +1	15	0.01	0.01 †	76	0.45	150	50k	0.05	No	14½ x 3½ x 7¼	15	895.00	† SMPTE method. w. CP-1PS power supply.	
	MCP-1		2.5-100 +0-1	1.5	0.01 ††	0.01 ††	87 ††	0.078 ††	250	20k		No	7¼ x 3½ x 7¼	3		†† When used with CP-1. Moving coil pre-preamplifier. Requires CP-1PS power supply or phantom power off CP-1.	
RAM AUDIO SYSTEMS	Ram-200		5-30 ±0.1	10	0.02	0.02	80	0.25/14	300	†	0.25	No	17 x 3½ x 14	25	1050.00	† Selectable, 6-78k.	
	Ram-203		20-20 ±0.2	8	0.01	0.01	70	2.5/25	300	†	0.25	Yes	15 x 3½ x 8	15	290.00	† 47k or 68k.	
	Dep-233		5-35 ±0.1	15	0.02	0.02	85	0.25/14	300	†	0.25	No	15 x 3½ x 12	20	597.00	† Selectable, 6-10k, Dual mono, Passive RIAA EQ.	

Open-Reel Tape Decks

MANUFACTURER	Model	Speeds — See letter code	Maximum reel size, inches	Number of heads	Number of tracks	Number of channels	Number of motors	Drive motor type	Drive to capstan	Freq. resp. Hz-KHz	S/N, db	Wow & Flutter, DIN 45-507, %	Output level at 0 VU, mV	Dolby N/P included	Mike mixing	Mike input Z, ohms	Record level indicator(s), Type and quantity	Dimensions, inches, W x H x D	Weight, lbs.	Price, \$	Notes																			
																						Letter Code For Speeds																		
																					A	B	C	D	E	F	G	H												
																					15					x	x	x												
																					7 1/2	x	x	x	x	x	x	x												
																					3 3/4	x	x	x	x	x	x	x												
																					1 1/2	x	x	x	x	x	x	x												
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REVOX (STUDER)	B77	B	10 1/2	3	2, 4	2	3	Asyn.		30-20 +2, -3	0.08	66	†	yes	50-600	2 mtrs.	17 1/2 x 18 1/4 x 8 1/4	37 1/2	1499.00	† Dolby optional.																				
	A77	B	10 1/2	3	2, 4	2	3	Asyn.		30-20 +2, -3	0.08	66	†	yes	50-600	2 mtrs.	18 1/2 x 14 1/4 x 7 1/4	34	1249.00																					
	A700	E	10 1/2	3	2, 4	2	3	Asyn.		30-22 +2, -3	0.06	65	No	yes	50-600	2 mtrs.	19 x 18 1/4 x 7	53	2999.00																					

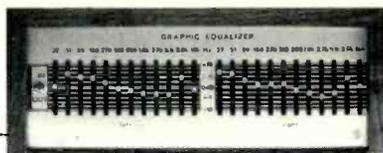


Shure SM81

Microphones

MANUFACTURER	Model	Directional Pattern	Operating Principle	Case Material	Response tailored For	Impedance, ohms	Frequency Range, Hz to kHz	EIA Sensitivity, dBm	Mike Connection	Cable length, feet	Cable plug type	Dimensions, inches, length x diameter	Weight, ounces	Mounting Method	Price, \$	Notes	
NEUMANN (GOTHAM)	KM-84	Cardioid	Cond.	Metal		200	40-20	-137	XLR 3			1 x 4 1/2	3	3/8 x 27	298.00		
	U-87	Omni. Card., Fig. 8	Cond.	Metal		150/250	40-16	-137	XLR 3	25	XLR 3	8 x 2 1/4	20	3/8 x 27	890.00		
	U-47 fet	Cardioid	Cond.	Metal		250/200	40-16	-137	XLR 3	25	XLR 3	6 1/4 x 2 1/4	24 1/2	3/8 x 27	833.00		
	KM-86	Omni. Card., Fig. 8	Cond.	Metal		200	40-20	-140	XLR 3	25	XLR 3	7 1/4 x 1 3/4	7 1/4	3/8 x 27	871.00		
	SM-69 fet	Omni. Card., Fig. 8	Cond.	Metal		200	40-16	-140	Tuchel	33	XLR 3	10 x 2	16	3/8 x 27	2229.00		
	OM-69	†	Cond.	Metal		200	40-16	-140	Tuchel	33	XLR 3	11 1/2 x 1 1/2 x 2	16	3/8 x 27	2303.00	† Quadraphonic, four-pattern mike.	
	KM-88	Omni. Card., Fig. 8	Cond.	Metal		200	40-16	-138	XLR 3	25	XLR 3	6 x 1	3 1/2	3/8 x 27	871.00		
	KM-83	Omni	Cond.	Metal		200	40-20	-137	XLR 3				4 1/4 x 1	3	3/8 x 27	298.00	
	KM-85	Cardioid	Cond.	Metal		200	40-20	-137	XLR 3				4 1/4 x 1	3	3/8 x 27	298.00	
	KMS-84	Cardioid	Cond.	Metal		200	40-16	-137	XLR 3	25	XLR 3	8 1/4 x 1 1/2	10 1/2	3/8 x 27	811.00		
KMA	Omni	Cond.	Metal		200	40-16	-137	attach				1 1/4 x 3/4	2	clip	348.00		
KU-801	†	Cond.	Metal		200	40-16	-137	Tuchel			XLR 3	1 1/4 x 3/4	2	clip	2440.00	† Rubber "human" head w/mikes at ears for binaural recording.	
SHURE	516EO	Cardioid	Dynamic	Zinc		150	50-15	-153	Swcft. A3F	15	Phone	6 1/4 x 1 1/2	9 1/2	3/8 x 27	91.80	\$165.00 per pair.	
	545SD	Cardioid	Dynamic	Zinc	Vocal	150/45k	50-15	-149	Swcft. A3F	15	Not Furn.	6 1/4 x 1 1/4	9	3/8 x 27	87.60	On-off switch.	
	565SD	Cardioid	Dynamic	Zinc	Vocal	150/45k	50-15	-148	Swcft. A3F	15	Not Furn.	6 1/4 x 2	10 1/2	3/8 x 27	97.20	On-off switch.	
	589S	Cardioid	Dynamic	Zinc	Vocal	150/30k	90-13	-155	Swcft. A3F	15	Not Furn.	7 x 1 1/2	12	3/8 x 27	66.60	On-off switch.	
	SM57	Cardioid	Dynamic	Zinc	Instr. & Vocal	38/150	40-15	-148	Swcft. A3F	20	Not Furn.	6 1/4 x 1 1/4	10	3/8 x 27	108.00		
	SM58	Cardioid	Dynamic	Zinc/Alum	Instr. & Vocal	38/150	50-15	-148	Swcft. A3F	20	Not Furn.	6 1/4 x 2	15	3/8 x 27	138.00		
	SM59	Cardioid	Dynamic	Alum	Instr. & Vocal	150	50-15	-155	Swcft. A3F	20	Swcft. A3M	7 3/4 x 1 3/4	7.6	3/8 x 27	144.00	Hum-bucking coil. w. shock mount.	
	SM81	Cardioid	Elect. Cond.	Steel	Vocal Prof. Rec.	150	20-20	-136	Swcft. A3F	25	Swcft. A3M	8 1/2 x 1	8	3/8 x 27	225.00	Two-position roll-off.	
PEARL (NORLIN)	CM 1000	Uni	Cond.	Metal		600	50-14	-68		16 1/2	phone	7 1/2 x 1 1/4	5		45.95		
	CM 2000	Uni	Cond.	Metal	strings	600	40-15	-68	Cannon	16 1/2	phone	7 1/4 x 1	4		65.95		
	CM 3000	Uni	Cond.	Metal	strings	600	30-16	-68	Cannon	20	phone	8 x 1 3/4	5		71.95		
	CM 4000	Uni	Cond.	Metal	strings	600	30-16	-68	Cannon	20	Cannon	6 1/4 x 2	10		81.95		
	CM 5000	Uni	Cond.	Metal	strings	600	30-16	-68	Cannon	20	Cannon	7 1/2 x 2	8		86.95		
	DM 7000	Uni	Dynamic	Metal	vocal	200	50-16	-73	Cannon	20	Cannon	6 1/2 x 2	9		105.95		
	DM 7500	Uni	Dynamic	Metal	Vocal, Bass	200	50-16	-73	Cannon	20	Cannon	7 1/2 x 2	7		119.95		
	DM 9000	Uni	Dynamic	Metal	Vocal, Bass	200	15-16	-73	Cannon	20	Cannon	7 1/2 x 1 1/2	7		139.95		
SANSUI	DM-11	Cardioid	Dynamic	Alum		600	100-15	-154	5P	20	phone	6 1/2 x 2	9.9	3/8 x 27	110.00		
	EM-1	Cardioid	Elect.	Alum.		600	50-15	-149	Integ.	20	phone	7 3/4 x 1 1/4	3.6	3/8 x 27	80.00	W. 3 windscreens.	

Equalizers



Synergistic EQ-1

MANUFACTURER	Model	No. of Channels	No. of Bands	Bandwidth, octaves	Bowl/Cut Range, ± dB	Rated Output, rms V	% THD at rated output	dB S/N at rated output	Dimensions, inches	Weight, lbs.	Price, \$	Notes
SYNERGISTIC SOUND SYSTEMS	EQ1	2	12	0.8	10	2	0.02	92	8 1/2 x 3 1/2 x 4 1/4	3	90.00	Kit

Tuners

MANUFACTURER	Model	Type of Unit, Use Letter Key	Mono IIF Sensitivity, μV / dB	Stereo IIF Sensitivity, μV / dB	Capture Ratio, dB	Aft. Chan. Select., dB	Mono Signal Strength for 50 dB Quieting, μV / dB	Stereo Signal Strength for 50 dB Quieting, μV / dB	Separation, dB, 1 kHz	Separation, dB, 10 kHz	THD mono/stereo, 1 kHz, 100% modulation	S/N, max., dB, Mono/stereo	Switchable De-emphasis	Dimensions, inches WxHxD to nearest 1/4 inch	Net Weight, lbs.	Price, \$
RAM AUDIO SYSTEMS	Ram-102	F	1.6/9.5	6.0/21	1.5	70/	2.2/12.2	34.5/36	46	35	0.08/0.08	75/71	Yes	17x3 1/2 x 14	20	639.00
REVOX (Studer)	B760		2.0	20	0.9	80					0.15	75		17 1/4 x 13 1/4 x 6		1649.00

Amplifiers



BGW 410

Letter Key: K = kit; W = wired; T = tube; P = phone stage only; M = mono.

MANUFACTURER	Model	Type of Unit — Integrated I; Basic B; Kit K; Tube T	Cont. Ave. Watts per Chan. into 8 ohms	Freq. Resp. at rated power, Hz to kHz	Rated THD, percent	Rated IIF (M), percent	S/N, "A" wtd., p. Phono	Phono Sensitivity, mv	Maximum Phono Input, mv	Moving Coil Phono Input	High Level Sensitivity, V	Class of Output Operation	Dynamic Headroom, dB	Dimensions to nearest quarter inch, W x D x H	Weight, lbs.	Price, \$	Notes
BGW	250D	B	100	1-90k +0.3	0.1	0.02				1.4	AB †		19 x 11 1/4 x 5 1/4	30	599.00	† Plus B full comp. For pro use, w. relay spkr. protect, clip. LED. As above.	
	750B	B	225	1-90k +0.3	0.1	0.02				2.1	AB †		19 x 12 x 7	57	1099.00	As above.	
	750C	B	225	1-90k +0.3	0.1	0.02				2.1	AB †		19 x 12 x 7	57	999.00	As above.	
	210	B	100	1-90k +0.3	0.1	0.02				1.4	AB †		19 x 11 1/4 x 5 1/4	30	599.00	LED metering, relay spkr. protection.	
	410	B	200	1-90k +0.3	0.1	0.02				2.0	AB †		19 x 11 1/4 x 5 1/4	35	799.00	For pro use, w. dual 4-segment LED metering.	
	100B	B	50	1-90 +0.3	0.1	0.02				1.0	AB †		19 x 12 1/4 x 1 1/4	20	399.00		
BOZAK	929	B	150	20-20k	0.2	0.2	100 †			1.0	AB		17 1/2 x 12 x 7	46	925.00	† Unweighted. Model 929V, \$825.00 w/o meters.	
	939	B	70	20-20k	0.2	0.2	100 †			0.7	AB		17 1/2 x 10 1/4 x 5 1/4	35	525.00		
ESSENCE	75 ab	B	75	d.c.-2M	0.03	0.03										900.00	
RAM AUDIO SYSTEMS	Ram-508	B	80	20-20k	0.08	0.1	100			1.25	AB	2	15 x 8 x 3 1/2	25	399.00		
	Ram-520	B	200	20-20k	0.09	0.1	100			1.7	AB	2	19 x 14 x 5 1/4	48	999.00		
	DEA-511	B	110	20-20k	0.05	0.1	100			1.27	AB	2	7 x 12 x 5	25	379.00	No overall closed-loop feedback.	
SANSUI	AU-919	I	100	5-20	0.008	0.008	96	2.5	350	Yes	0.15	B		19 x 17 1/4 x 6 1/4	46.2	800.00	Slew rate 200 V/μs. Rise time 0.5 μs.
	AU-717	I	85	10-20	0.015	0.01	86	2.5	350		0.15	B		19 x 16 1/2 x 6 1/4	39.2	550.00	Slew rate 60 V/μs, rise time 1.4 μs.
	AU-517	I	65	10-20	0.015	0.01	86	2.5	320		0.15	B		19 x 16 1/2 x 6 1/4	36.4	450.00	Slew rate 50 V/μs, rise time 1.4 μs.
	AU-317	I	50	20-20	0.03	0.03	83	2.5	200		0.15	B		19 x 13 1/4 x 4 1/2	21.4	350.00	Slew rate 40 V/μs; rise time 1.4 μs.
	AU-217	I	30	20-20	0.06	0.06	82	2.5	180		0.15	B		19 x 13 1/4 x 4 1/2	19.0	230.00	
	AU-117	I	15	20-20	0.17	0.17	82	2.5	150		0.15	B		19 x 13 1/4 x 4 1/2	14.6	190.00	

Tonearms

MANUFACTURER	Model	Overall Length, inches	Pivot-Stylus Distance, inches	Cueing	Damped Cueing	Maximum Tracking Error, degrees/inch	Anti-Skating Adjustment	Tracking Force Range, gms.	Total Cable Capacitance, pF.	Cartridge Weight Range, gms.	Vertical Bearing Type	Lateral Bearing Type	Price	Notes
FIDELITY RESEARCH	FR-12	11.5	9.1	Yes	Yes	2.0	Yes	0-3	80	4-12	Ball	Ball	400.00	
	FR-14	12.5	9.6	Yes	Yes	2.0	Yes	0-3	80	4-12	Ball	Ball	400.00	
	FR-64a	12.7	9.6	Yes	Yes	1.0	Yes	0-5	80	0-24	Ball	Ball	600.00	
	FR-66a	15.1	12.1	Yes	Yes	1.0	Yes	0-5	80	0-18.7	Ball	Ball	1250.00	

Headphones

Signet TK33



MANUFACTURER	Model	Operating principle (dynamic, electrostatic, etc.)	Frequency Range, HZ to kHz	Impedance, ohms	Sensitivity, dB SPL for 1 mV input	Maximum input, mV	Cord Length, feet	% THD at 95 dB SPL	Cord Style Flat — F Coiled — C	Weight, ounces	Price	Notes
SIGNET	TK22	DYN	20-20	4-16	96	250	12	0.4	F	9.2	80.00	FXD Magneta Bi-polar Design † 100 dB at 1 V.
	TK33	Elect.	10-22.5	4-16	†	10,000	8.2	0.1	F	10	250.00	

Loudspeakers

MANUFACTURER	Model	Enclosure type	Woofer dia., inches	Midrange dia., inches	Midrange type	Tweeter dia., inches	Tweeter Type	Level controls, W = woofer M = midrange, T = tweeter, ST = super tweeter	Anechoic freq. response, Hz to kHz, ± dB	Recommended min. amp. power	Crossover frequencies, Hz.	Impedance, ohms: Nominal/minimum	Dimensions, inches	Finish	Grille Material Color	Weight, lbs.	Price \$ (Noted if per pair.)	Notes	
ADVENT	Advent/3	Ac. Sus.	8½			1½	Cone		85	10	1.5k	8/6	9½ x 6½ x 15½	vin. wal.	cloth	10.8	57.00		
BEVERIDGE	2SW-1	Line Source	12		E.S.		E.S.		25-18 ±2		90		24 x 15 x 78	oil. wal.	foam blk.	360	7000.00	W/biamp, elec. x-over, & subwoofer.	
	Bev. Jr.	Line Source	10		E.S.		E.S.		35-18 ±2		50	200	8	17 dia. x 72	oil. wal.	foam blk.	140	2000.00	
BOZAK	CS-310B/CS-410	Inf. baf.	(4) 12	(2) 6	Cone	(8) 2	Cone		28-20		60	400,	8	36 x 19 x 52	oil. wal.	cloth wh.	225	1375.00	
	CS-4000/CS-4005	Inf. baf.	(2) 12	6	Cone	(8) 2	Cone		35-20		50	400,	8	27 x 16 x 44	oil. wal.	cloth brn/wh	190	860.00	CS-4005 LoBoy.
	CS-501	Inf. baf.	12	6	Cone	(3) 2	Cone	M	40-20		15	400,	8	20 x 16 x 32	oil. wal.	cloth brn	90	450.00	
	LS-400	Inf. baf.	12	6	Cone	(2) 2	Cone	T	40-20		20	800,	8	18 x 13 x 25	oil. wal.	cloth brn.	65	300.00	
	LS-300	Vented	8	4	Cone	2	Cone		32-18 ±3		15	325,	4	17 x 12½ x 6½	†	cloth blk	66	250.00	† Wal, teak, or ebony.
	LS-250	Sealed	12	4	Cone	2	Cone	T	45-20		20	800,	8	15 x 12 x 23	vin. wal.	cloth brn	48	195.00	
	LS-200	Vented	6			2	Cone		45-20		20	2k	8	12 x 11 x 20	vin. wal.	cloth brn	34	110.00	
	B-1002	Inf. baf.	8			2	Cone		50-20		12	2k	8	16 x 21 x 12	white	gold mesh	25	159.00	Weather-proof. Rear spkr for time delay.
DS-1207	Inf. baf.	12		(2) 2		Cone	T	45-20		20	2k	8	15 x 15 x 30	oil. wal.	cloth brn.	60	215.00	As above.	
DS-1800	Vented	8						44-12		15		8	13 x 13 x 21	vin. wal.	cloth brn.	40	110.00		
BURHOE ACOUSTICS	Crimson	Tuned Port	4			1	Dome			89	3k	8	13 x 8½ x 7½	vin.	foam blk.	12½			
	Green	Tuned Port	8			1½	Dome			93	2k	8	22 x 13½ x 10	vin.	foam blk.	25			
	White	Tuned Port	8			1	Dome			90	1.5k	8	13½ x 22 x 10	wal.	foam blk.	34			

Loudspeakers

MANUFACTURER	Model	Enclosure type	Woofer dia., inches	Midrange dia., inches	Midrange type	Tweeter dia., inches	Tweeter Type	Level controls: W=woofer, M=midrange, L= Tweeter, ST=super-tweeter	Anechoic freq. response Hz to kHz, ± dB	dB SPL (watt/meter)	Recommended min. amp. power	Crossover frequencies, Hz	Impedance Ohms Nominal/minimum	Dimensions, inches	Finish	Grille Material Color	Weight, lbs.	Price \$ (Noted if per pair.)	Notes
BURHOE ACOUSTICS (continued)	Light Blue	Tuned Port	10			1½	Dome		94	1.5k	8	24¼ x 14¼ x 10¼	vin.	foam blk.	40				
	Blue	Tuned Port	10	1½	Dome	1	Dome		92	1&2k	8	24¼ x 14¼ x 10¼	wal.	foam blk.	42				
	Silver	Tuned Port	10	1½	Dome	1	Dome		93	1&2k	8	31½ x 23 x 10½	wal.	cloth blk.	65				
CONCERTAUDIO	Generation I	Inf. baf	(2) 15			1½			40-16.5	100	800, 5k	8/3	36 x 20 x 24	Wood	cloth blk.	200	1599.00		
	Generation IV	Inf. baf	(2) 15			1½			40-13.5	100	3k	8/4	36 x 20 x 24	Wood	cloth blk.	175	1199.00		
DFS	JJ	Ac. Sus.	8			2½	Cone		62-18 ±5	5	2k	8/5.8	16 x 11 x 8	Ven. wal.	cloth blk.		80.00		
	J1	Ac. Sus.	8			2½	Cone		55-18 ±5	15	2k	8/5.8	20 x 12 x 10	ven. wal.	cloth blk.		115.00		
	J-2a	Ac. Sus.	10			2½	Cone		50-18 ±5	15	2k	8/4.9	24 x 13 x 12	ven. wal.	cloth blk.		137.00		
	J-3	Ac. Sus.	(2) 8			(3) 2½	Cone		45-18 ±5	15	2k	4/3	27 x 14 x 12	ven. wal.	cloth blk.		200.00		
	T-4	Ac. Sus.	(2) 8	5	Cone	(2) 2½	Cone		40-18 ±5	20	1.5, 5k	4/3	36 x 13 x 12	ven. wal.	cloth blk.		225.00		
	T-5	Ac. Sus.	8&10	5	Cone	(2) 2½	Cone		38-18 ±4	25	100, 1&5k	4/3	37 x 14 x 12	ven. wal.	cloth blk.		312.50		
	T-6	Tuned	12	4	Cone	1½	Dome	M,T	17-22	40	500, 3&7k	8/4.3	40 x 15 x 14	ven. wal.	cloth blk.		525.00		
DENNESEN	ESL-2					(8)	E.S.				3.5 or 4.5		11 x 16 x 6		foam		120.00	Add-on tweeter.	
	ESL-180		8				E.S.				1.5k		21½ x 13½ x 9½		foam		220.00		
	ESL-360		10	2	Dome		E.S.						28 x 16 x 16	vin. wal.	foam		450.00		
GENERAL SOUND	Micron 630	Ac. Sus.	6	2	cone	1	dome			12		8/6	7½ x 7 x 11¼	oil. wal.	Cloth, var.	16	200.00	W/"Time Align." inc. crossover for satellites.	
	Micron 1011	Tun. Port	10							40	100	8/6	20 x 20 x 19	oil. wal.	Cloth, brn.		300.00		
	Micron 420	Ac. Sus.	4			1	dome					8/6	5 x 5 x 7½	oil. wal.	Cloth, var.	8	125.00	W/"Time Align." As above.	
	Micron 520	Ac. Sus.	5¼			1	dome					6/4	6 x 6 x 9	oil. wal.	Cloth, var.	10	150.00		
JR (HAND H INTERNATIONAL)	JR 149	Ac. Sus.	5¼			¾	Dome		55-20 ±4	30	3k	8/5	9-in. dia x 14½	Var.	foam brn.	12	475.00 pair		
SPEAKERKIT	Model One	Ac. Sus.	5			1	Dome		70-22 ±3	91	10	2.5k	8	10½ x 7 x 5¼	Opt	Cloth, Brown	7	39.00	
	Model Two	Ac. Sus.	8			1¼	Dome	T	55-22 ±3	91	10	2.5k	8	18 x 11¼ x 10	Opt	Cloth, Brown	30	49.00	
	Model Three	Ac. Sus.	10			1¼	Dome	T	40-22 ±3	91	10	2.5k	8	23½ x 15¼ x 12½	Opt	Cloth, Brown	49	60.00	
	Model Four	Ac. Sus.	10	1½	Dome	1	Dome	M,T	40-22 ±3	91	10	850, 4k	8	23½ x 15¼ x 12½	Opt	Cloth, Brown	52	88.00	
	Model Five	Ac. Sus.	12	1½	Dome	1	Dome	M,T	32-22 ±3	91	15	850, 4k	8	28 x 16¼ x 12½	Opt	Cloth, Brown	65	99.00	
	Model Six	Pas. Rad.	12	5 1½	Cone Dome	1	Dome	M,T	28-22 ±3	91	15	400, 1.3k, 4k	8	43¼ x 16¼ x 12½	Opt	Cloth, Brown			Optional Ultra tweeter \$20.00.
	Model Seven	Ac. Sus.	(2) 10						30-125	91	10	125	8	22 x 24 x 12½	Opt	Cloth, Brown	73	73.00	Infra-woofer use with Model One
	Model Eight	Trans. Line	10	5 1½	Cone Dome	1	Dome	M,T	30-22 ±3	91	10	400, 1.3k, 4k	8	35 x 18 x 15½	Opt	Cloth, Brown	92	115.00	Optional Ultra tweeter \$20.00.
	Model Nine	Ac. Sus.	12	1½	Dome	1	Horn	M,T	32-15 ±3	91	15	850, 4k	8	28 x 16¼ x 12½	Opt	Cloth, Brown	65	124.00	
	Model Ten	Ac. Sus.	12	2	Horn	1	Horn	M,T	32-15 ±3	91	15	850, 4k	8	28 x 16¼ x 12½	Opt	Cloth, Brown	69	181.00	
	Model Eleven	Pas. Rad.	12	2	Horn	1	Horn	M,T	28-15 ±3	91	15	850, 4k	8	43½ x 16¼ x 18	Opt	Cloth, Brown	89	193.00	
	Model Twelve	Tuned Port	15	2	Horn	1	Horn	M,T	34-15 ±6	103	5	850, 4k	8	57 x 36 x 18	Opt	Cloth, Brown	110	265.00	
SYSTEMS MAGNETIC	SMC-15	Ported	15						30-16	104		800	8	32½ x 26¼ x 19¼	oil. wal.	cloth blk.	125	675.00	
	SMC-10-2	Ported	10						40-16	100		800	8	33½ x 21 x 13½	oil. wal.	cloth blk.	86¼	645.00	
	SMC-10	Ported	10						45-16	97		800	8	21 x 21 x 15	oil. wal.	cloth blk.	58	525.00	

CAR STEREO ADDENDA

Manufacturers

ADS
One Progress Way
Wilmington, MA 01887

Acoustic Fiber Sound Systems
P.O. Box 50829
Indianapolis, IN 46250

Audioanalyst
P.O. Box 262
Brookfield, CT 06804

Audiotex
400 S. Wyman St.
Rockford, IL 61101

Avanti
See: Audiotex

BP Electronics
855 Conklin Rd.
Farmingdale, NY 11735

Draco Labs
1005 Washington St.
Grafton, WI 53024

Jensen Sound Labs
4136 N. United Pkwy
Schiller Park, IL 60176

Matrecs
See: Audiotex

Motorola
1299 E. Algonquin Rd.
Schaumburg, IL 60196

Nakamichi
220 Westbury Ave.
Carle Place, NY 11514

Pyramid Industries
12970-7N Branford St.
Arleta, CA 91311

Road Sounds
See: Suntron

Sanyo Electric
P.O. Box 5177
Compton, CA 90220

Suntron, Inc.
425 7th St., N.W.
Washington, D.C. 20004

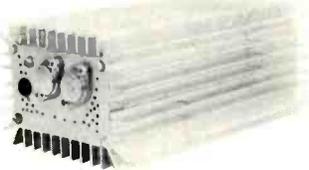
An error crept into the July, 1978, test of the Sanyo FT-1490A AM/FM cassette player. It seems that a phantom ground showed up on the Sound Technology 1200A test panel, whereas the speaker connections of the Sanyo unit must be totally isolated from ground, as they would be in a normal car installation using two leads to each speaker. As a result, we reported a

power output of only 2.03 watts per channel across 4-ohm loads. Sanyo's engineers contacted us and assured us that we were "doing something wrong," and so Len Feldman rechecked his results. Made aware of the grounding problem, he isolated the unit under test from the test panel and used a completely separate load and voltmeter. Sure enough, the unit now

produced 10 volts across an 8-ohm load (per channel), or approximately 12.6 volts per channel for a nominal 5 per cent THD. We offer our sincere apologies to Sanyo and our readers for this goof.

The new address for Fosgate Electronics is 2925 N. 33rd Ave., Phoenix, AZ 85017.

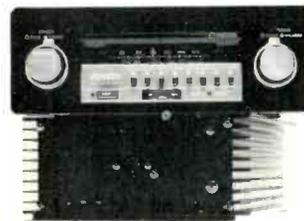
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Draco db-90



Sanyo FT-1679



Jensen R430



Nakamichi 250

Car Radio/Tape Players

MANUFACTURER	Model	Price	Stereo (S), Mono (M), or 4-channels (C)	FM Sensitivity, uV (for 3-dB quieting)	Selectivity	Average Watts/channel 52-10 kHz. at 100% Distortion	% Distortion @ rated watts	Local/Distance Switch	Pyrophotons (Yes)	Number AM, Member FM	Bass Control	Treble Control	Cassette	8-Track	Auto Reverse	Fast Forward	Tape Rewind	In-Dash (I) or Under-Dash (U)	Control Shift Spacing, inches	Dimensions, inches, H x W x D
DRACO	db-30	\$59.95	S		15															5 3/4 x 5 3/4 x 1 3/4
	db-90	169.95	S		45	0.25														9 x 5 1/4 x 4
JENSEN	R430	489.95	S	75	26	0.4	Yes		Yes	Yes	Yes	Yes	No	No	Yes	Yes	I	Adj.	2.7x7x6	
	R420	389.95	S	75	10	1.0	Yes		Yes	Yes	Yes	Yes	No	No	Yes	Yes	I	Adj.	2.7x7x6	
	R410	299.95	S	75	4	1.0	Yes		Yes	Yes	Yes	Yes	No	No	Yes	Yes	I	Adj.	2.7x7x6	
	R330	489.95	S	75	26	0.4	Yes		Yes	Yes	No	Yes	No	No	Yes	No	I	Adj.	2.7x7x6	
	R320	389.95	S	75	10	1.0	Yes		Yes	Yes	No	Yes	No	Yes	No	I	Adj.	2.7x7x6		
	R310	299.95	S	75	4	1.0	Yes		Yes	Yes	No	Yes	No	No	Yes	No	I	Adj.	2.7x7x6	
MOTOROLA	TF850AX	\$99.95	S		4		yes		no	no	no	no	yes	no	no	no	I	Adj.		
	TM428S	\$99.95	S		12		no		no	yes	yes	no	yes	no	no	no	U			
	TM228S	\$69.95	S		4		no		no	yes	yes	no	yes	no	no	no	U			
	TM125S	\$49.95	S		4		no		no	no	no	no	yes	no	no	no	U			
	TC881AX	\$139.95	S		4		yes		no	no	no	yes	no	no	yes	yes	I	adj.		
	TC879AX	\$99.95	S		4		yes		no	no	yes	no	no	yes	yes	I	adj.			
	TF882AX	\$189.95	S		12		yes		5 AM, 5 FM	yes	yes	no	yes	no	no	I	adj.			
	TF880AX	\$149.95	S		4		yes		5 AM, 5 FM	no	no	no	yes	no	no	I	adj.			
Continued	TC888AX	\$219.95	S		4		yes		5 AM, 5 FM			yes		no	yes	I	adj.			

Car Radio/Tape Players

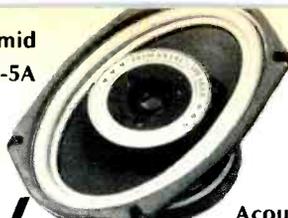
MANUFACTURER	Model	Price		Stereo (S), Mono (M), or 2-Channel (C) FM Separability (S)	Selectivity (for 3-DB sideband)	Average Watts (channel, 50% DUTY at rated Discontinuation @ rated)	Local/Distance Switch	Pushbuttons (If Yes, Number AM, Number FM)	Bass Control	Treble Control	Cassette	B-Track	Auto Reverse	Fast Forward	Tape Rewind	In-Dash (I) or Under-Dash (U)	Control Shaft Spacing, inches	Dimensions, inches, H x W x D	
MOTOROLA (Continued)	TC887AX	\$229.95	S			4	yes	5 AM, 5 FM	no	no	yes	no	yes	yes	yes	I	adj.		
	TC885AX	\$179.95	S			4	yes	5 AM, 5 FM	no	no	yes	no	yes	yes	yes	I	adj.		
	TC883AX	\$169.95	S			4	yes	5 AM, 5 FM	no	no	yes	no	yes	yes	yes	I	adj.		
NAKAMICHI	250	310.00	S															3 1/2 x 7 1/4 x 9 1/2	
	350	440.00	S						No	No	Yes	No	No	Yes	Yes	U		3 1/2 x 7 1/4 x 9 1/2	
PYRAMID	PMA40	55.00	S			20	1.0												
	PMA80	99.00	S			40	1.0												
	PME-100	89.00	S																
	X-700VL	159.00	S			22	0.5												
	X-1000VL	199.00	S			25	0.5												
SANYO	FT 488R	\$159.95	S	1.5	55	4	3	Yes	No	No	Yes	No	Yes	Yes	Yes	I	Adj.	2 x 7 x 6	
	FT 418	\$159.95	S	1.5	55	4	3	Yes	5 AM or FM	No	Yes	No	No	Yes	Yes	I	Adj.	2 x 7 x 6	
	FT 484R	\$139.95	S	1.5	55	4	3	Yes	No	No	Yes	No	No	Yes	Yes	I	Adj.	2 x 7 x 6	
	FT 117	\$139.95	S	1.5	55	4	3	Yes	5 AM or FM	No	Yes	No	No	Yes	No	I	Adj.	2 x 7 x 6	
	FT 1495	\$219.95	S	1.0	60	14	3	No	5 AM or FM		Yes	No	Yes	Yes	Yes	I	Adj.	3 x 7 x 6	
	FT 1490A	\$199.95	S	1.0	60	14	3	Yes	No	No	Yes	No	Yes	Yes	Yes	I	Adj.	3 x 7 x 6	
	FT 489	\$179.95	S	1.0	60	4	3	Yes	5 AM or FM	No	No	Yes	No	Yes	Yes	I	Adj.	2 x 7 x 6	
	FT 415	\$159.95	S	2.0	60	3.5	3	No	5 AM or FM	No	No	Yes	No	No	Yes	I	Adj.	2 x 7 x 5 1/2	
	FT 874	\$149.95	S	1.5	55	4	3	Yes	5 AM or FM	Yes	Yes	No	Yes	Yes	Yes	I	Adj.	3 x 7 x 6	
	FT 950	\$129.95	S	1.5	55	4	3	Yes	No	Yes	Yes	No	Yes	Yes	Yes	I	Adj.	2 x 7 x 5	
	FT 870	\$109.95	S	2.5	55	4	3	Yes	No	No	No	Yes	No	Yes	Yes	I	Adj.	2 1/4 x 7 x 6	
	FT 869	\$89.95	S	2.5	55	4	3	Yes	No	No	No	Yes	No	Yes	Yes	I	Adj.	2 x 6 1/4 x 5	
	FT 481	\$109.95	S	2.5	55	4	3	Yes	No	No	No	Yes	No	Yes	Yes	I	Adj.	2 x 7 x 6	
	FT 479	\$109.95	S	2.5	55	4	3	Yes	No	No	No	Yes	No	Yes	No	I	Adj.	2 x 7 x 6	
	FT 478	\$89.95	S	2.5	55	4	3	Yes	No	No	No	Yes	No	Yes	No	I	Adj.	1 1/2 x 6 1/4 x 4 3/4	
	FT 1877	\$199.55	S	1.0	60	12	3	Yes	5AM or FM	Yes	Yes	No	Yes	No	Yes	I	Adj.	3 x 7 x 6	
	FT 8705/A	\$89.95	S	2.5	55	3.5		Yes	5 AM or FM	No	No	No	No			I	Adj.	2 x 7 x 4 1/4	
	FT 8706	\$79.95	S	2.5	55	3		Yes	5 AM, 5 FM	No	No	No	No			I	Adj.	1 1/2 x 6 1/4 x 4 1/4	
	FT 1679	\$369.95	S	1.0	60	4	3	Yes	5 AM, 5 FM	Yes	Yes	Yes	No	No	Yes	Yes	I	Adj.	3 x 7 x 6
	FT 690	\$299.95	S	1.0	60	4	3	Yes	5AM, 5 FM	No	No	Yes	No	No	Yes	Yes	I	Adj.	3x7x6
	FT 8701A	\$99.95	S	2.0	60	4	3	Yes	5 AM, 5 FM	No	No	No	No	No	No	I	Adj.	2 x 7 1/4 x 6	
	FT 823R	\$54.95	S			4		No	No	No	No	Yes	No	Yes	No	U		2 3/4 x 4 1/4 x 6 1/2	
	FT 817	\$44.95	S			2.5		No	No	No	No	Yes	No	No	No	U		2 3/4 x 4 1/4 x 6 1/2	
	FT 1405	\$139.95	S	1.5	55	12	3	No	No	Yes	Yes	Yes	Yes	Yes	Yes	U		2 1/4 x 6 1/4 x 6 1/2	
	FT 1400	\$119.95	S			12	3	No	No	Yes	Yes	Yes	Yes	Yes	Yes	U		2 1/4 x 7 x 7	
	FT 407	\$109.95	S	2.5	55	4	3	Yes	No	No	No	Yes	No	Yes	Yes	U		2 1/4 x 7 1/4 x 6 1/4	
	FT 406	\$89.95	S			4	3	No	No	No	No	Yes	Yes	Yes	Yes	U		2 x 6 1/2 x 6 1/4	
FT 402R	\$64.95	S			3.5		No	No	No	No	Yes	No	Yes	Yes	U		1 3/4 x 6 1/4 x 5 3/4		
FT 601	\$44.95	S			3		No	No	No	No	Yes	No	Yes	Yes	U		2 x 4 3/4 x 5		
FT 1004	\$139.95	S	1.5	55	12	3	Yes	No	Yes	Yes	No	Yes	Yes	No	U		2 1/4 x 6 1/4 x 6 1/2		
FT 1003	\$119.95	S	2.0	60	8	3	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	U		2 3/4 x 7 1/4 x 8		
FT 1002	\$119.95	S			12	3	No	No	Yes	Yes	No	Yes	Yes	No	U		2 1/2 x 7 x 7		
FT 1001A	\$89.95	S			8	3	No	No	Yes	Yes	No	Yes	Yes	No	U		2 3/4 x 7 1/4 x 8		

Car Speakers

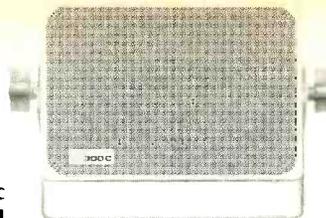
MANUFACTURER	Model	Price, \$ (if sold individually)	Price, \$ (if sold in pairs)	Recommended Power, Watts	Driver Size, inches	Magnet Size, Oz.	Impedance, Ohms	Frequency Response, Hz to kHz, ± dB	Two-way (2) or Three-way (3)	Flush Mount (F) or Surface Mount (S)	Overall Dimensions	Notes
ADS	200C/II	117.50		10	†	4/3.6	55-22k ±5	2	S††	4 1/2 x 4 1/4 x 7		†4-in. woofer & 1-in. dome. ††Flush w/klt.
	300C/II	150.00		10	†	4/3.6	40-22k ±5	2	S	8 1/2 x 6 x 5 1/4		†5 1/4-in. woofer & 1-in. dome.
	2001/II	589.95			†	47k	50-22k ±5	2	S††	4 1/2 x 4 1/4 x 7		†4-in. woofer & 1-in. dome. ††Flush w/klt.
	2002/II	449.95			†	43k, 350k	55-22k ±5	2	S††	4 1/2 x 4 1/4 x 7		160 W rms bi-amplified. †4-in. woofer & 1-in. dome ††As above. 80 W rms bi-amplified.



Pyramid
PMS-5A



Acoustic
Fiber 8974



ADS 300C/II



Matrecs MA-0069-20TP

Car Speakers

MANUFACTURER	Model	Price \$ (if sold individually)	Price \$ (if sold in pairs)	Recommended Power, Watts	Driver Size, Inches	Magnet Size, Oz.	Impedance, Ohms	Frequency Response, Hz to kHz, ± dB	Two-way (2) or Three-way (3)	Fluid Mount (F) or Surface Mount (S)	Overall Dimensions	Notes	
ACOUSTIC FIBER SOUND SYSTEMS	1020	13.95											
	1080	13.95											
	2031	17.50											
	2032	24.60											
	2731	17.95	25	4x10	10	8	55-16k	2	F		7x8x12	CB console w/storage Stereo console w/storage	
	2732	24.60	25	4x10	10	8	55-18k	2	F		7x8x12		
	2821	14.60	25	5x7	10	8	60-16k	2	F		10x4 1/2 x 2 1/4		
	2831	19.40	25	5x7	10	8	60-18k	2	F		10x4 1/2 x 2 1/4		
	3025	12.95	18	8	5	8	85-15k	2	F		7 1/4 x 5 x 2 1/2		
	3035	17.95	30	8	10	8	50-15k	2	F		8x3		
	3045	21.95	5	3 1/2	3	8	200-8k	2	S		8x3		
	3055	24.95	5	3 1/2	3	8	150-10k	2	S		4x5x4 1/4		
	3065	16.95	5	3 1/2	3	8	150-10k	2	S		4 1/4 x 5 1/4 x 4 1/4		
	3085	29.95	5	3 1/2	3	8	150-10k	2	S		7x5x5		
	4060		17.95										
	6049	39.95	25	5 1/2	10	4/8	60-15k	2	S/F		5 1/2 x 5 1/4 x 4 1/2		
	6059	49.95	25	5 1/2	10	4/8	60-20k	2	S/F		6x5 1/2 x 3 1/2		
	6069	44.95	36	6x9	10	4/8	50-15k	2	S/F		6 1/2 x 8 x 12		
	6079	54.95	36	6x9	10	4/8	50-18k	2	S/F				
	7311	22.95	10	3 1/2	3	4/8	80-16k	2	F				
	8231	44.95	12	5 1/4	10	8	55-15k	2	F				
	8232	64.95	12	5 1/4	10	8	55-17.5k	2	F				
	8531	44.95	10	5	10	8	65-15k	2	F				
	8931	49.95	18	6x9	10	8	45-15k	2	F				
8932	69.95	18	6x9	10	8	45-18k	2	F					
8971	59.95	30	6x9	20	4/8	40-15k	2	F					
8972	79.95	30	6x9	20	8	40-18k	2	F					
8974	109.95	50	6x9	20	4/8	40-20k	2	F					
AUDIOANALYST (Phase Matrix)	M2	139.00		10	†	4	46-20 ±4	2			9 3/4 x 6 x 7	†5-in. woofer & 1-in. tweeter.	
AUDIOTEX (GC Electronics)	30-2654	\$82.45	45	6x9	25	4-8	40-18K	2	F		6x9x4		
	30-2656	\$87.65	30	6x9	20	4-8	40-20K	3	F		6x9x4		
	30-3058	\$19.35	20	6x9	10	4-8	50-16K		F		6x9x4		
	30-2650	\$42.60	20	6x9	10	4-8	50-16K		F		6x9x4		
	30-2651	\$48.90	25	6x9	20	4-8	40-16K		F		6x9x4		
	30-2652	\$62.45	20	6x9	10	4-8	50-18,700	2	F		6x9x4		
	30-2653	\$69.00	25	6x9	20	4-8	45-18K	2	F		6x9x4		
	30-2640	\$34.20	16	5 1/4	5.5	4-8	60-15K		F		5 1/4 x 5 1/4 x 4		
	30-2641	\$38.45	20	5 1/4	10	4-8	55-15K		F		5 1/4 x 5 1/4 x 4		
	30-2642	\$45.40	25	5 1/4	20	4-8	50-16K		F		5 1/4 x 5 1/4 x 4		
30-2644	\$69.90	25	5 1/4	20	4-8	50-20K	2	F		5 1/4 x 5 1/4 x 4			
BP ELECTRONICS	BP-2000 69-ORD	89.95	30	6x9	20	8	50-20	4					
MATRECS	MA-0525-00SP	\$26.00	16	5 1/4	5.5	4-8	60-15K		F		5 1/4 x 5 1/4 x 4		
	MA-0525-010P	\$30.00	20	5 1/4	10	4-8	55-15K		F		5 1/4 x 5 1/4 x 4		
	MA-0069-010P	\$31.00	20	6x9	10	4-8	50-16K		F		6x9x4		
	MA-0069-020P	\$37.00	25	6x9	20	4-8	40-16K		F		6x9x4		
	MA-0410-0010	\$12.00	15	4x10	10	4-8	60-14K		F		4x10x4		
	MA-0069-25CP	\$64.00	35	6x9	25	4-8	40-18K	2	F		6x9x4		
	MA-0069-20TP	\$68.00	30	6x9	20	4-8	40-20K	3	F		6x9x4		
	MA-0069-10DV	\$14.00	20	6x9	10	4-8	50-14K		F		6x9x4		
	MA-0057-0010	\$11.00	15	5x7	10	4-8	50-14K		F		5x7x4		
	MA-0525-020P	\$35.00	25	5 1/4	20	4-8	50-16K		F		5 1/4 x 5 1/4 x 4		
	MA-0525-20CP	\$53.00	25	5 1/4	20	4-8	50-20K		F		5 1/4 x 5 1/4 x 5 1/4		
	MA-0069-10CP	\$47.00	20	6x9	10	4-8	50-18K	2	F		6x9x4		
MA-0069-20CP	\$52.00	25	6x9	20	4-8	45-18K	2	F		6x9x4			
MOTOROLA	D5-10C	\$69.95	20	5.25	10	4		2	F				
	D5-20C	\$77.95	25	5.25	20	4		2	F				
	D69-20C	\$79.95	25	6x9	20	4		2	F				
	D69-20T	\$119.95	25	6x9	20	4		3	F				
PSB	PSB Alpha	220.00	15	†	4	90-20k ±3	2	S			9x4 1/2 x 5	†4-in. woofer & 1-in. tweeter.	
PYRAMID	PMS-5A		20				25-22k	3					
ROAD SOUNDS (Suntron)	RS543	\$39.99	25	5 1/4"	20	8		3	F		5 1/4" rd.		
	RS692	\$39.99	25	6x9	20	8		2	F		6x9		
	RS693	\$49.99	25	6x9	20	8		3	F		6x9		
	RS694	\$59.99	30	6x9	20	8		4	F		6x9		
	RS2000	\$89.99	50	6x4	10	4		2	S		6x4		
	RS3000	\$79.99	25	5 1/4	20	8		3	S		6x9		
	Series 5000	\$69.99	25	6 1/2	40	8		2	S		9x36		
	RS3001	\$89.99	25	5 1/4	20	8		3	S		6x9		
SANYO ELECTRIC	SP795	\$129.95	30	6x9	10	4-8	100-20	2	S				
	SP777	\$129.95	30	6x9	20	4-8	60-20	3	F				
	SP 780	\$104.95	33.5	6x9	20	4-8	60-20	2	F				
	SP 770	\$99.95	28	6x9	20	4-8	45-20	3	F				
	SP 768	\$64.95	28	6x9	20	4-8	60-20	2	F or S				
	SP 757	\$49.95	18	5x7	15.3	4-8	70-15	2	F or S				
	SP 730	\$39.95	21	6	20	4-8	80-15	2	F				
	SP 720	\$34.95	14	4 x 4	6.7	4-8	80-12	2	F				

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CASSETTE TEST addenda

Howard A. Roberson

This article presents the results of evaluating cassettes that were received too late to be included in the survey in the September issue. Some facts of the first article deserve more attention, and those points will be covered first. Some confusion and a little discontent arose because of the author's use of the word "average." For each category of tape, from low-bias ferrics to high-bias non-CrO₂ tapes, the results for each test were added and divided by the number of cassettes in the category. The figure obtained, of course, is the mathematical average. Unfortunately, it appeared that some concluded that a rating of "average" for one of a group of high-performing tapes was little different from a rating of "average" for a tape in a lower-performance group. The listing of averages was for the purposes of comparison within a category and from one general category to another. If you're looking for particular results in performance, you have to look at the actual figures for the cassette under consideration.

It may turn out, however, that the best test for *your* needs did not have the widest frequency response, the highest maximum record levels, etc. The results presented in these two evaluation articles are indicative of maximum inherent tape capabilities, primarily because bias and EQ adjustments were made to show each formulation at its best. In the practical world of tape usage, the recordist may

very well find that a tape with an average rating gives him the best results. Here we must examine machine-tape inter-relationships more carefully.

The playback responses of all cassette decks are to the same standards, one for 120-microsecond EQ and one for 70-microsecond EQ. The output responses will be flat with good design and the appropriate flux levels on the tape. The flux patterns placed on the tape during recording are affected by such design elements as record equalization, record-head construction, and bias. The particular choices made by the designer, such as the peaking frequency for EQ and how much boost to use, include factors that will affect the measured performance of the *tape*. It is obvious that there has to be interaction among manufacturers so that the machine-tape combination can be improved. The end point of such a process can be when the deck manufacturer selects a particular formulation or two for use in machine set-up on the production line. Perhaps the best-known example is that of TDK SA, where the high-bias 70-microsecond combination is designed "SA" by JVC and others, rather than just "CrO₂" as has been common practice in the past. If the maker of your deck gives such specific recommendations on tapes to use, that certainly is a very good place to start. You may want to try other cassettes with similar bias requirements if there is any question about the results with your particular

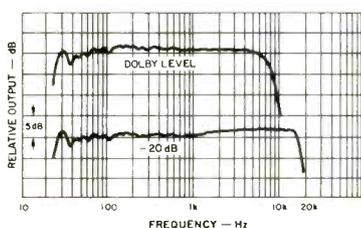
unit. If the list in the owner's manual is lengthy and unqualified, it is of limited value, and you should benefit from testing with the articles to aid you.

It would be nice, of course, if bias and EQ could always be adjusted to get good results whatever the tape being used. In the setting of bias and EQ for best frequency response at -20 dB, what do you have to lose? There are two major factors that cannot be ignored. First of all, reducing bias to extend the high end could increase the level of distortion. In the second place, extra peaking of EQ for good response at -20 dB can lead to much poorer response at 0 dB. For example, one of the tapes used in the survey had HDL₃=2.2 percent at 6 dB above Dolby level with a 400-Hz signal. Not bad at all, but the -20 dB frequency response was 2 dB down at 10 kHz. With the bias reduced to get the 10-kHz response up to the same level as 1 kHz, the distortion increased to 3 percent for the +6 dB record level. If you *do* vary bias and/or EQ for better tape matching, use the controls judiciously. Be especially careful about trying to make too great a compensation, causing an increase in distortion or more loss in highs at elevated record levels.

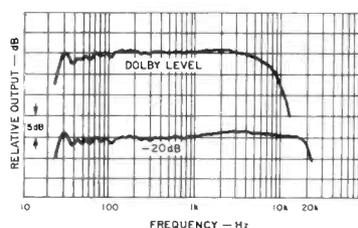
Use of another formulation could be a better choice, and this is certainly more easily accomplished. Remember that performance in Dolby mode will be affected by frequency-response variations and by errors in record-sensitivity calibration. Also keep in mind

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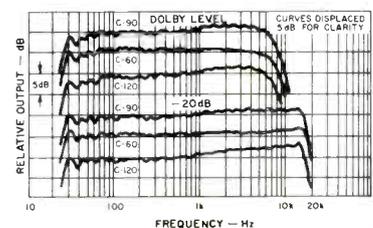
Denon DX3



Denon DX5



SDS HE



MANUFACTURER'S SPECIFICATIONS

BRAND OR MANUFACTURER	TAPE DESIGNATION	TAPE TYPE	COER Oer	RET Gau	REM Max	SQU RAT	SENS dB	BIAS dB	PRICE C-90
Denon	DX3	Fe							
Denon	DX5	FeCo							
Maxell	LN	Fe	330	1200		0.82	0	0	
Maxell	UD	Fe	360	1450		0.87	+1	0	
SDS	HE	Fe	300	1400	0.19				\$4.49

that a multiplex filter sets a high-frequency limit regardless of the tape being used. A final example from a tape clinic: a lower priced deck was given a very poor rating by its new owner as it sounded so dull, particularly with Dolby, using Maxell UD XL-II. With such a good tape, how could the deck sound so bad? Checks with the pink-noise/RTA system showed that the CrO₂-position response was terrible with any high-bias tape. In short order, it was determined, that the Reg record/playback responses with Maxell LN (an "average" ferric) were excellent. No matter what it says on the box of tape, you have to go by what you get with the tape and machine.

Cassette Tests

After completion of the previous article on cassettes, samples were received from Denon, SDS, and Maxell. Denon supplied C-60 samples of the ferric DX3 tape and the ferri-cobalt DX5. The latter is recommended for the FeCr position, calling for normal bias and 70-microsecond EQ. SDS provided samples of their HE formulation in C-90, C-60, and C-120 lengths. The above tapes received the same schedule of tests as made in the major survey. Maxell sent new LN and UD formulations. Too few samples were received in time for this addenda to completely check consistency or to clarify some minor discrepancies. The results reported here for the Maxell tapes should be considered as preliminary. The table of manufacturers' specifications lists pertinent information as received. Test results for the Denon and SDS tapes are also tabulated. Please note that Denon DX5 is a different type of formulation and that it

calls for 70-microsecond EQ. It can be compared with the previously reported FeCr tapes.

Denon DX3: This recently introduced tape evidenced high MRLs, very good signal/noise ratio, and the most extended response at -20 dB and the lowest modulation noise for all ferric tapes tested to date. Bias, sensitivity, and skew were very consistent among the three C-60 samples. No C-90 samples were received to test and compare. The sensitivity variations were less than 0.2 dB, and there was one minor dropout. Overall, one of the best ferrics.

Denon DX5: This FeCo formulation, designed for use with FeCr settings, required careful bias and EQ setting for the best results. Its signal/noise ratio was lower than the true FeCr tapes, but it was superior to them in response at 0 dB, and MRL at 3 and 10 kHz. The high-end limit at -20 dB was easily extended to match any FeCr tape, albeit with a slight drop in MRLs. The C-60s received were consistent in bias and skew, but there were sensitivity variations with a total spread of 1 dB. There was one major, six medium, and three minor dropouts. *In toto*, an excellent performer.

Maxell LN: With just one sample each of C-90 and C-60, consistency could not be checked. The preliminary data obtained showed better frequency responses and MRLs compared to the data in the September issue, though the claimed improvements in signal/noise ratio and modulation noise were not apparent in this round of tests. While in general, there was evidence of worthwhile changes, the few samples available by deadline didn't allow the apparent discrepancies to be resolved.

Maxell UD: A fast look was also given to some new C-90s received of this modified formulation. Improvements noted included MRLs about 2 dB higher, responses slightly more extended and signal/noise ratio about a dB higher. One of the samples had a few minor dropouts; it would have been helpful to have had more samples to determine what was typical. In essence, these preliminary tests indicate that one of the best ferrics has become better yet.

SDS HE: With extended responses at both levels and higher-than-average MRLs across the band, this ferric tape is worthy of consideration for most purposes. Considerable overbiasing (re: 400-Hz peak) was necessary for flat response, especially with the C-120s. Bias requirements and skew were consistent among C-90s, but there were sensitivity variations of up to a dB and some high-end breathing (in level). C-60s required 0.9 dB less bias (-1.8 dB) and were 1.5 dB more sensitive. C-120s required 0.6 dB more bias (-0.3 dB), and even then had a high peak around 10 kHz. The C-120s were 2.5 dB less sensitive than the C-90s. There were random, but continual, sensitivity variations of 0.3 dB, and five minor dropouts.

With the above comments, we have reported on all formulations that we have been able to get samples of. The manufacturers are always in the process of refining the product even if they don't always give the formulation a new name. The results reported for the modified Maxell LN and UD are examples of this ongoing improvement. Future reports will be made as needed to keep readers informed on the constantly changing state of tape technology. A

TEST RESULTS

BRAND OR MANUFACTURER	DESIGNATION	RESP. -3 DB @ kHz		MRL (dB re 0 dB) AT 4 FREQS. (Hz)				S/N RATIO	MOD NOISE	400-Hz SENS.	BIAS	EQ	WTD PK W&F %
		0 dB Level	-20dB Level	HDL ₃ = 3%			Sat.						
				100	400	3k	10k	dBA	-dB	dB	dB	dB	
Denon	DX3	7.3	17.9	+6.6	+6.2	+2.0	-9.2	55.8	50.0	+2.2	+0.2	0	0.085
Denon	DX5	7.5	21.5	+5.0	+5.2	-3.8	-5.0	58.6	45.8	+0.8	-0.2	-2	0.075
SDS	HE	7.7	17.2	+1.7	+1.9	+3.3	-7.7	52.7	45.1	+1.5	-0.9	-1	0.08

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Equipment profiles

Nakamichi Model 730 Stereo FM Receiver



MANUFACTURER'S SPECIFICATIONS

FM Tuner Section

Mono Sensitivity: 12.0 dBf (2.2 μ V).
50-dB Quieting: Mono, 18.3 dBf (4.5 μ V); Stereo, 38.3 dBf (45 μ V).
S/N: Mono, 75 dB; Stereo, 68 dB.
Muting Threshold: 20 dBf (5.4 μ V).
Frequency Response: 30 Hz to 15 kHz, +0.5, -1.5 dB.
THD: Mono, 0.1 percent at 1 kHz; Stereo, 0.15 percent at 1 kHz.
Capture Ratio: 1.5 dB.
Selectivity: 70 dB.
Spurious Rejection: 90 dB.
Image Rejection and I.F. Rejection: 85 dB.
AM Suppression: 55 dB.

SCA Rejection: 70 dB.
Stereo Separation: 45 dB at 1 kHz, 30 dB at 10 kHz.

Amplifier Section

Power Output: 104 watts per channel, 8 ohms, 5 Hz to 20 kHz, with no more than 0.1 percent THD (150 watts per channel, 4 ohms).
Damping Factor: 100 (1 kHz, 8 ohms).
IMD: Less than 0.004 percent at rated output.
Frequency Response: Phono, RIAA \pm 0.3 dB; High Level, 10 Hz to 30 kHz +0, -1.0 dB.
Input Sensitivity: Phono, 2.0 mV; High Level, 100 mV.
Phono Overload: 120 mV.

S/N: Phono, 83 dB "A" Weighted; High Level, 94 dB; Main Amp, 115 dB.
Bass and Treble Control Range: \pm 12 dB at 20 Hz and 20 kHz.
Output Levels: Rec Out, 100-300 mV variable; Preamp Out, 1.0 volts; Headphone Out, 60 mW/8 ohms.
Contour Control (Maximum): -12 dB at 20 Hz, -23 dB at 3 kHz, -14 dB at 20 kHz.

General Specifications

Power Requirements: 100-120V/220-240V, 50/60 Hz, 400 watts (max.).
Dimensions: 19 $\frac{1}{8}$ in. (50 cm) W x 3 $\frac{1}{2}$ in. (8.9 cm) H x 14 $\frac{1}{2}$ in. (36.8 cm) D.
Weight: 38 lbs. (17.27 kg).
Price: \$1200.00; optional remote control system, \$190.00.

There is so much that is new and different about this, Nakamichi's first integrated receiver, that it would take several more pages of this magazine to fully describe it than have been allotted to this test report. We will therefore simply attempt to discuss some of the *highlights* of this FM-only receiver. The low-silhouette black, knobless front panel is very reminiscent of the styling treatment used by Bang and Olufsen in their award winning industrial designs for receivers, but with a Nakamichi touch or two added. All major control functions are handled by touch-sensing switches. A long, narrow slot along the entire width of the upper section of the panel houses a linear FM dial scale and pointer at the right, for about two thirds of its length, while the remainder of the slot is taken up by a striped, illuminated green filter and film shutter that regulates how many of the green stripes can be seen from the front of the receiver. This serves as an indication of volume level (calibrated from 0 to 10), which is controlled by touch-sensor switches that actuate a motor to drive the actual volume-control potentiometer.

Additional touch-sensor switches along the central section of the front panel include an audio mute switch, five program selector switches, three tape monitor switches (off, plus

two tape decks), a stereo/mono switch, Dolby FM switch, hi-blend switch, FM muting switch, four pre-set FM station switches lettered A through D, and up- and down-scan tuning switches. Along the very bottom of the panel are five small illuminated sliders. These control bass and treble response, channel balance, volume-contour pre-set, and FM muting threshold. Two stereo phone jacks are also positioned along the bottom edge of the panel.

The rear panel of the Nakamichi 730 is a bit more conventional in its layout. A 75-ohm coaxial connector is at the upper left and next to it are 300-ohm antenna terminals, while just below is a 20-dB attenuator switch and a chassis ground terminal. Phono, AUX and two sets of tape inputs and output jacks are also located in this area of the rear panel, and the recorder output jack level is controllable by means of a miniature control and knob just above these jacks. What a splendid idea for matching record output levels to the needs of one's particular tape deck, thereby enabling the user to operate the tape decks record level controls at most convenient points of rotation!

Preamp-out/main amp-in jacks, shipped with interconnecting jumpers, come next, followed by two convenience

a.c. receptacles and a master power on/off switch which is normally left in the "on" position so that the optionally available remote control unit can turn the unit on and off and so that the front panel "touch sensor" power switch circuitry can also turn on the rest of the unit. Spring-loaded, color-coded speaker terminals (only enough for one pair of speakers) are located at the extreme right of the rear panel.

Circuit Features and Highlights

A close examination of the detail view of Fig. 1 discloses that the tuning system of the Nakamichi 730 employs a conventional tuning capacitor. How, then, can it scan up and down the dial, remember four pre-set stations, and lock in when stations are properly tuned? (Most receivers and tuners with this capability employ varactor tuning diodes.) By having the tuning capacitor driven by a tiny motor, that's how! The 730 employs a most unique tuning system. A touch of one of the scanning sensors starts the tuner scanning for stations. The command is committed to IC memory. The tuning motor turns, and the rotation is transmitted through gears and a timing belt to the variable capacitor. If the level of a signal scanned is above threshold, the tuner next checks noise level for an indication of quieting and seeks out the center of the channel as indicated by the zero-point of the

detector's "S"-curve. The motor stops rotating, and green tuning indicators on either side of the dial pointer glow. Seven seconds later the system "locks on" to the signal. This system offers tuning precision within ± 5 kHz of channel center.

The variable capacitor includes an AM section, even though there is no provision for AM reception in this receiver. The AM variable capacitor is actually used in connection with the four-station pre-set feature, its capacitance serving as part of a discharge circuit, with capacitance varying in accordance with the angle of rotation of this capacitor, which is mounted concentrically with the main FM tuning capacitor sections.

Mode and function selection are controlled using logic-controlled, touch-sensor switches, as previously explained. Figure 2 shows the basic circuit for function selection. Touching sensor 1 causes a resistance change which turns on Q1. This command is committed to a C-MOS memory, and an electronic analog switch routes the proper audio signal. The analog switches of the 730 are entirely nonmechanical and can therefore be located at the most convenient point inside the receiver, reducing point-to-point wiring.

Figure 3 shows the basic volume control circuit. Touching the right-pointing sensor applies voltage to the positive side

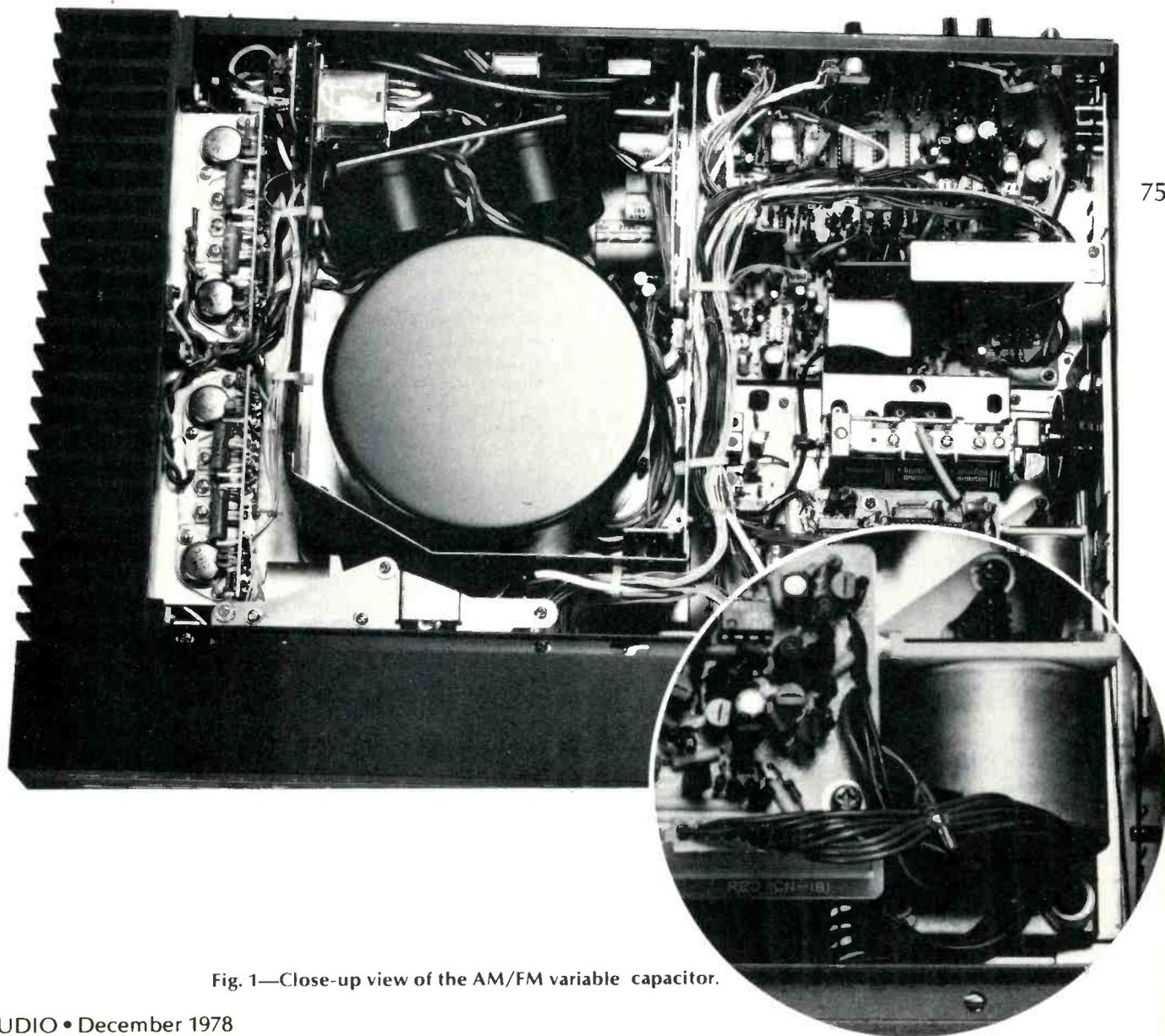


Fig. 1—Close-up view of the AM/FM variable capacitor.

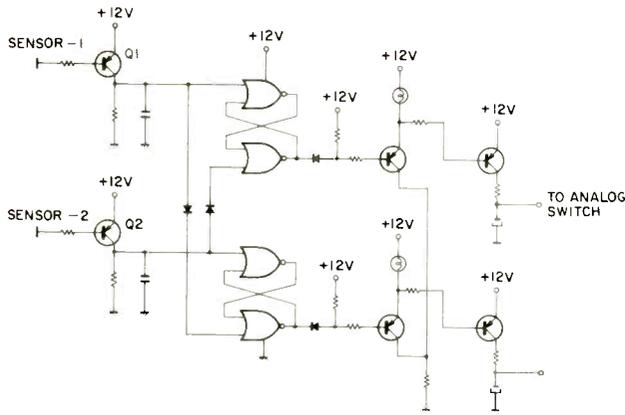


Fig. 2—Function selector network.

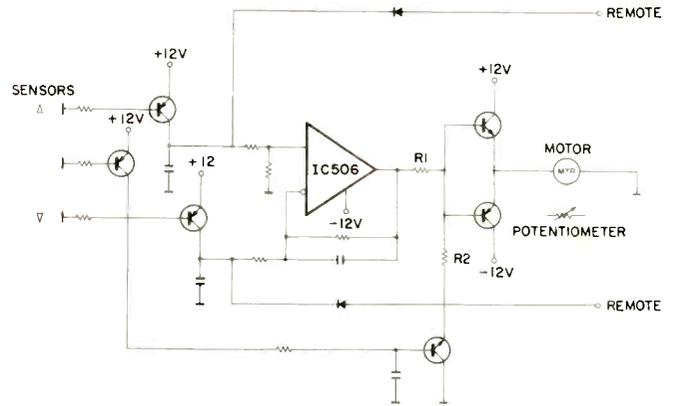


Fig. 3—Volume control network.

of IC-506, while touching the left-pointing sensor applies voltage to the negative side. The motor begins rotating accordingly, and this rotation is transmitted and gear-reduced down to the volume-control potentiometer. Clutches are provided at minimum and maximum settings of the volume control. If the user touches either directional sensor *plus* the center sensor, output voltage of IC-506 is divided by R1 and R2, and motor speed is reduced by a factor of two, for fine meter adjustment. Figure 4 illustrates the mechanical arrangement which controls the volume control and its associated green-striped display visible from the front panel.

As for the more conventional portions of the receiver, the front end employs a dual-gate MOS-FET in its r.f. stage, while four carefully matched stages of ceramic filtering are used in the i.f. section. This combination filter, plus a surface wave filter and a two-stage, linear-phase LC filter, provides excellent selectivity and extremely flat group-delay characteristics in the i.f. circuitry. The MPX circuit employs the now-familiar phase-lock loop principle.

The phono preamplifier incorporates a triple-transistor circuit originally developed for Nakamichi's 610 preamplifier. The three devices act as a single transistor, having one-third the internal impedance of a conventional transistor.

According to Nakamichi, the power amplifier feedback configuration of the 730 overcomes the trade-off between conventional amplifiers and d.c. configured amps (good current stability for the a.c. amp at the expense of better low frequency response and lower phase error exhibited by dc

amps). The 730 power amp uses a double negative-feedback circuit illustrated in block diagram form in Fig. 5c. The main feedback loop (R1, R2) does not include C1. In addition, current through C1 is very low, since R3 is much greater than R1. Distortion is therefore minimized by the double negative-feedback approach. The circuit also benefits from good direct-current stability, since the impedance of the negative input of the feedback amplifier is sufficiently greater than R3. This double negative-feedback principle is used in the preamplifier as well as in the power amp section.

FM Tuner Section Measurements

Figure 6 contains plots of quieting and distortion characteristics of the tuner section of the Nakamichi 730 receiver in both mono and stereo modes, for a 1-kHz, 100 per cent modulated test signal. S/N in mono reached 79 dB, while in stereo the best S/N obtained was 72 dB. Harmonic distortion was an incredibly low 0.06 per cent in both mono and stereo for a 1-kHz test signal. As shown in Fig. 7, THD in both mono and stereo remained consistently low at all frequencies of interest, rising to 0.15 per cent at 6 kHz for stereo. Figure 8 is a plot (taken with our spectrum analyzer) of frequency response (in stereo), stereo separation (lower curve) and stereo separation with the high-blend filter switched on. At 1 kHz, stereo separation measured 50 dB, decreasing to 41 dB at 100 Hz, and to 37 dB at 10 kHz. The 50-dB quieting point was obtained with input signal strengths of 12.4 dBf (2.3 μ V) in mono and 35.6 dBf (33 μ V) in stereo. Stereo switching threshold was set at 25.2 dBf (10 μ V), while muting threshold was variable from 14.7 dBf (3.0 μ V) to 31.2 dBf (20 μ V). Frequency response for both the 75-microsecond and Dolby 25-microsecond settings was down less than 1.0 dB at 15 kHz. The action of the Dolby circuitry is graphically displayed in Fig. 9. Note that at lower modulation levels, the high frequency response is attenuated progressively (as it should be) by the built-in Dolby FM-playback circuitry.

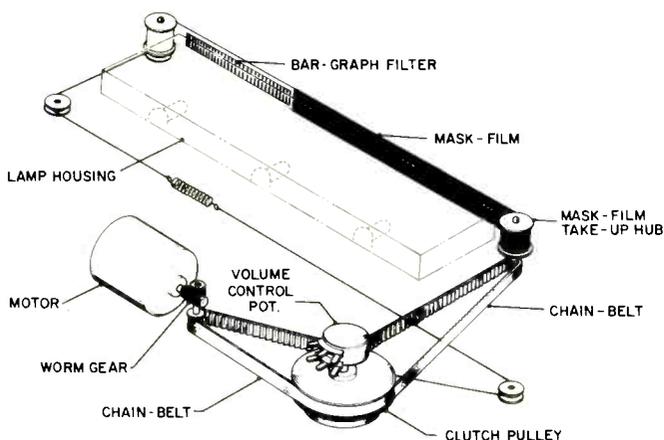
Capture ratio measured 1.4 dB, a bit better than claimed. Selectivity measured 75 dB, while spurious, i.f., and image rejection all measured approximately 90 dB. AM suppression was exactly 55 dB as claimed. Sub-carrier products were all lower than residual noise level in stereo, and were therefore better than 72 dB down.

Amplifier Measurements

Harmonic distortion of the power amplifier section of this receiver is so low at all but near-rated power output levels that it is completely buried beneath the residual noise level and cannot be isolated by our test equipment (including our spectrum analyzer). The graphs plotted in Fig. 10, therefore, merely depict the points at which any THD could be

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Fig. 4—Volume control mechanism.



The evolution of the revolution.

The new Bose® 901® Series IV Direct/Reflecting® speaker.

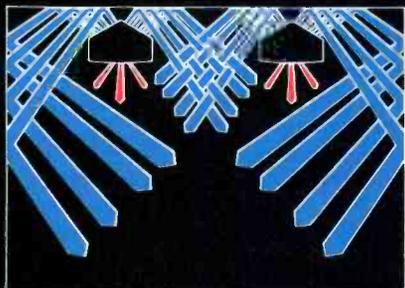
When Bose introduced the original 901® speaker, high-fidelity critics around the world hailed its revolutionary approach to sound reproduction.

"Bose has, in a single giant step, produced one of the finest speaker systems ever made." (USA)

"The orchestra is there in front and the atmosphere of the concert hall all around." (Belgium)

"Bose contains more technical innovations than any other speaker of the past 20 years." (Austria)

"...sets new standards for loud-speaker music reproduction." (France)



Now the 901® has evolved. Again. Introducing the Bose 901 Series IV Direct/Reflecting® speaker system. With new equalizer controls that consider your room as part of the speaker design. And a new answer to the problem of choosing an amplifier.

It is a known fact that moving a speaker just a few feet in a room will alter its performance. And that the variances in a speaker's performance from one living room to the next can be vast. This is a problem all speakers have regardless of design. Except one.

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As a result, the 901 Series IV speakers perform as well in the living room as in the demonstration room.

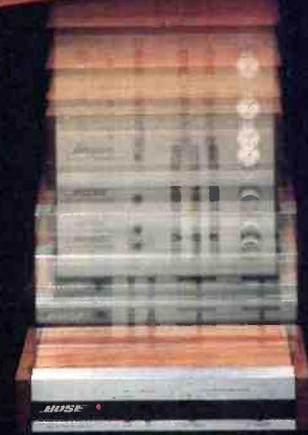
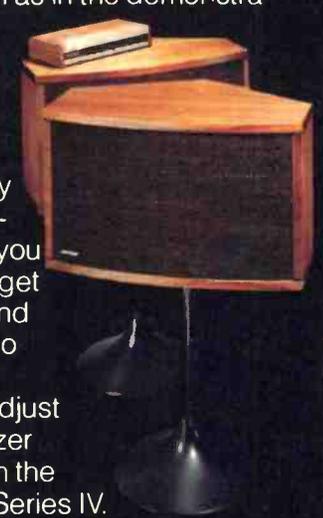
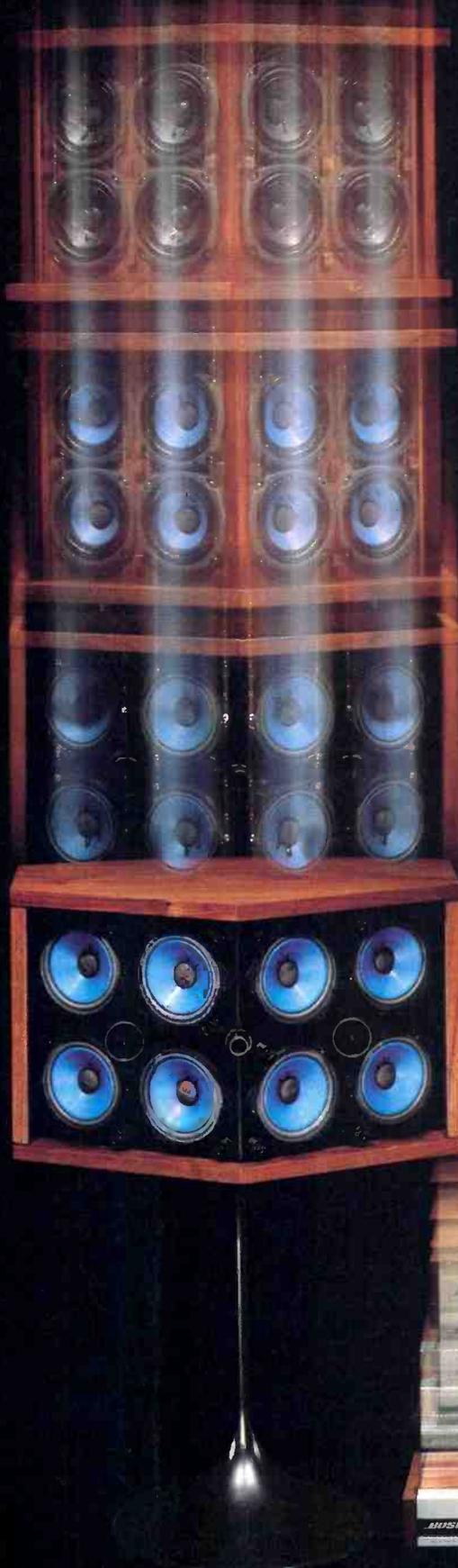
Were our engineers to design a speaker specifically for your living room, you would not get better sound than you do when you properly adjust the equalizer controls on the Bose 901 Series IV.

And the 901 IV provides a simple answer to the problem of choosing the power rating of your amplifier or receiver. Choose any amplifier you wish. The 901 IV provides surprisingly loud sound with as little as 10 watts per channel. Yet it is durable enough for us to remove all power limitations on the 901 IV. There is no power limit. Period.*

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Direct/Reflecting® speaker is famous. And you can match it to virtually any amplifier.

We think that once you hear the new Bose 901 IV Direct/Reflecting® speaker, you'll agree. The revolution has evolved.



*There is a power limit in commercial applications. For information, contact Bose Customer Service.

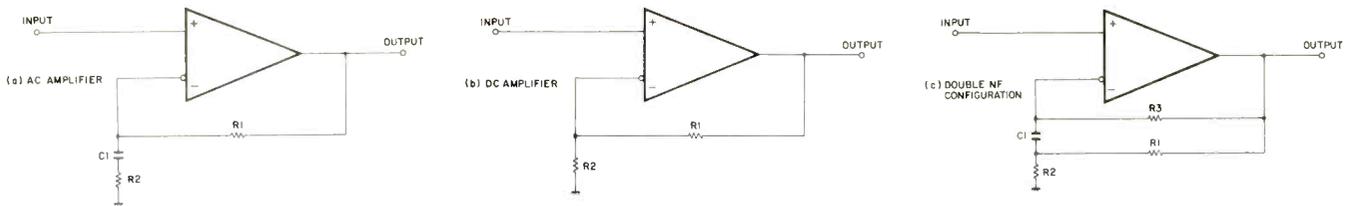


Fig. 5—Three basic negative-feedback circuit designs.

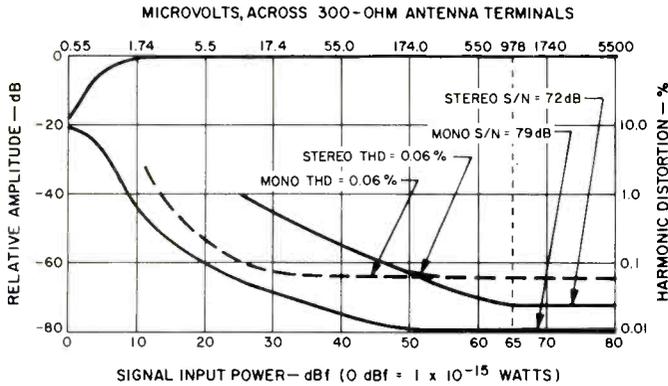


Fig. 6—Mono and stereo quieting and distortion characteristics.

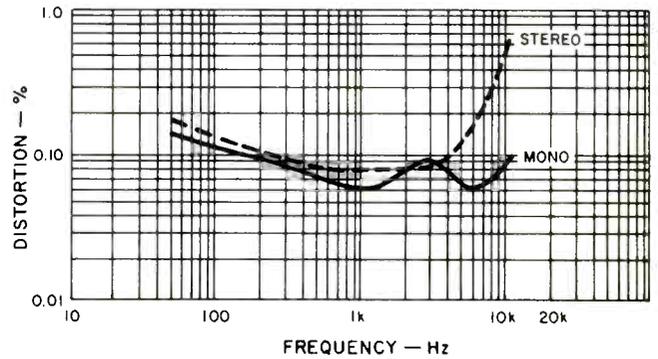


Fig. 7—Harmonic distortion vs. frequency, mono and stereo FM.

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observed. The amplifier delivered 111.75 watts for rated THD of 0.02 percent at 1 kHz. Full-power bandwidth extended from 15 Hz to 21 kHz (for rated power at rated THD), and FTC rated power measured 108 watts per channel, as opposed to the 105 watts claimed. Dynamic headroom measured exactly 1.0 dB, while clipping headroom was a modest 0.21 dB above rated output. Damping factor, measured at 50 Hz, was over 100. Figure 11 is a plot of harmonic distortion versus frequency for a rated output of 105 watts per channel into 8-ohm loads.

In an attempt to determine, even if indirectly, the sort of low-level distortion components we were dealing with here, we combined our spectrum analyzer with the facilities of our Sound Technology Model 1700B and, using the analyzer in its linear sweep mode, we first displayed a reference 1-kHz signal at rated output (full scope face peak shown in Fig. 12). We then established a new top-of-scope-face reference of -70 dB by using the distortion components output jack of the 1700B as a signal source to be fed to the analyzer and allowed the analyzer to sweep linearly from 0 to 20 kHz. The first "blip" visible to the right of the reference fundamental signals represents second order harmonic content and is 96 dB below rated output! Third order distortion is even lower, at -105 dB with respect to referenced out put. That's a third

order distortion amounting to 0.00056 per cent — considerably lower than our distortion analyzer (or anyone else's that we know of) can read!

Tone-control action of the receiver is quite conventional, with turnover frequencies well positioned in the audio spectrum, as shown in the sweep-frequency photos of Fig. 13. Sensitivity and the signal-to-noise measurements were made in accordance with the new IHF Amplifier Measurement Standards and may therefore be a bit difficult for the reader to interpret until some experience has been gained with these new standards. Nonetheless, on the basis of the new measurement techniques, S/N in phono measured 82 dB ("A" weighted, for a 5-mV input reference and a 1-watt output level reference). High-level-input signal-to-noise ratio, measured in a similar manner (0.5 volt input reference level), was 85 dB. Phono sensitivity (referred to 1-watt output) was 0.24 millivolts, while high-level input sensitivity was 10 millivolts (for 1-watt output). RIAA equalization was accurate (with absolutely no deviation) from 30 Hz to 10 kHz and was a miniscule -0.2 dB down at 15 kHz. At minimum volume settings, signal to noise (this time referred to full rated output) was 105 dB "A" weighted.

Using the volume preset control in its loudness contour settings in combination with a fixed setting of the main volume control of the receiver resulted in an adjustment and

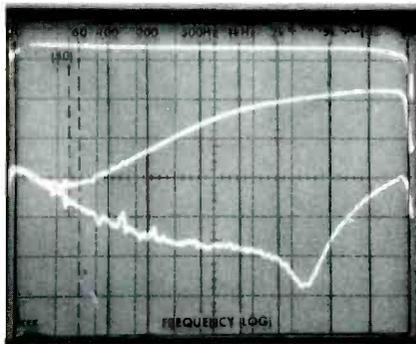
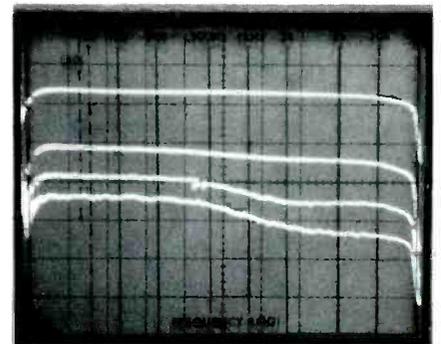


Fig. 8—Frequency response and separation. Middle curve shows decreased separation when Hi-Blend filter is used. (Each vertical division is 10 dB.)

Fig. 9—Action of Dolby N/R FM circuitry at various modulation levels.



0.05%
NAB WRMS

0.05%
NAB WRMS

Neatness counts.

You are looking at graphic measurements of wow and flutter in two different cassette decks. The nice, neat one is ours. The one with the funny spikes is the competition. What is really interesting about this comparison is that the numerical specification for wow and flutter for both machines is identical: 0.05 percent.

How can that be?

The reason is that conventional measurements do not account for some kinds of disturbances caused by momentary tape speed variations. Many manufacturers simply ignore or overlook the spikes. We don't. Because we can hear them. And

if we can hear them, you can hear them. So we build tighter tolerances into our parts—such as our precision-machined reel tables and shafts that prevent cogging of the cassette hubs. The fact is that we use a lot of unconventional methods of getting rid of a lot of conventionally ignored distortions.

We figure our most important test instrument is our ears. You can build good cassette decks in the laboratory. But you build great ones in the listening room. That's why our engineers listen, under dynamic test conditions, to every single electrical and mechanical component of our cassette decks

that can affect the texture of the sound you hear.

You'll find that every one of the new Harman Kardon cassette decks has the features, specifications, the look and the feel you'd expect from equipment made by one of the world's great high fidelity manufacturers.

But you'll find some thing else too.

The clean, open sound that comes only when a company listens and pays attention to details that others tend to overlook.

That's what makes us so neat.

Come listen soon.



harman/kardon
Hear all the music.

55 Ames Court
Plainview NY 11803

Pictured: The new hk3500 Dolby® cassette deck. Not shown: Models hk3500 and hk2500.

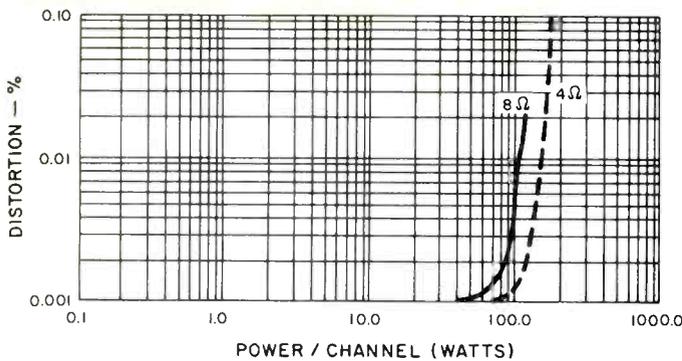


Fig. 10—Power output at 1 kHz vs. distortion.

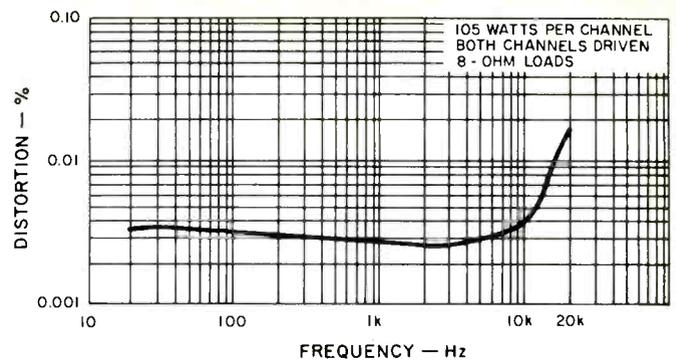


Fig. 11—Harmonic distortion vs. frequency.



contour range illustrated in the sweep-frequency 'scope photo of Fig. 14. As we have commented in several previous reports, this approach to loudness compensation (also used by such firms as Yamaha and Sherwood) makes a good deal more sense than the arbitrary volume control/loudness switch arrangement supplied by most other receiver manufacturers, since it works independently of program source levels and speaker efficiencies.

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Listening And Use Tests

Here is another receiver whose measured specifications fail to tell the whole story. To begin with, the unit is an absolute delight to use. Touch-sensor switches work positively and correctly — every time. Tune scanning speeds have been carefully calculated to be neither too fast nor too slow, and the volume control adjustment method is actually smoother than you could obtain with a conventional rotary control knob and, frankly, a lot more fun to use.

The tuner section zeros in on center-channels as accurately as any tuner we have ever adjusted manually, which means that the distortion values we read on the bench are the ones we actually obtained (and that you will obtain) when using the tuner section for actual FM program listening. Every aspect of human engineering has been analyzed and correctly interpreted in the overall design of this receiver.

As for the amplifier and its ability to reproduce music faithfully, it is certainly the equal in performance to Nakamichi's separate amplifiers which we have much admired in the past. Bass is tight and well defined, and transient recovery is so good we found it hard to believe that the amp is *not* a d.c. design.

If you were to judge this magnificent receiver on the basis of watts per dollar alone, you will of course conclude that it is very high priced. Certainly you can buy 105 (or more) watts per channel for far less than \$1200.00. But if you are the type of audio enthusiast who seeks a measure of elegance and sophisticated performance embodied in the Nakamichi 730 receiver, its price will be of secondary importance to you. After all, many people thought this little company was a bit crazy when they introduced a stereo cassette deck selling for well over \$1000.00 a few years ago. It was the instant success of that deck (now in its second edition) and subsequently designed products in the same category that probably enabled Nakamichi to enter the more competitive field of tuner, amplifier and now receiver manufacturing. I suspect that the same Nakamichi followers (or people like them) who "dared" to buy the first three-head Nakamichi cassette decks ever produced will feel no differently about the first, twin motor-driven receiver from that same innovative firm.

Leonard Feldman

Enter No. 90 on Reader Service Card

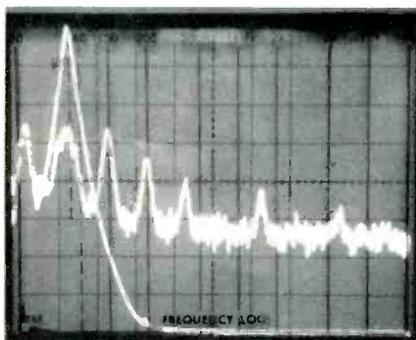


Fig. 12—Spectrum analysis of harmonic distortion components of amplifier section. Reference 1-kHz signal, reaching top of display, is at -70 dB, 2nd-order distortion is approximately -96 dB below rated output, while 3rd-order distortion is down more than 105 dB!

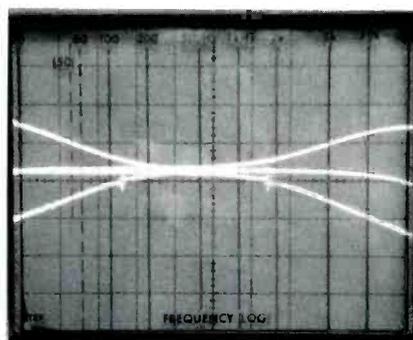


Fig. 13—Tone control range.

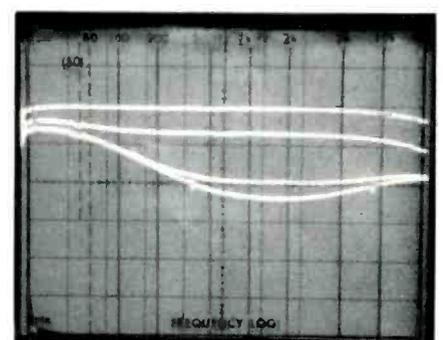


Fig. 14—Loudness compensation available through combined use of volume and volume preset controls.

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...introduces the world's most powerful 50 watt receiver.

The new Hitachi SR 804 stereo receiver has the revolutionary Class G amp that instantly doubles its rated power from 50 to 100 watts to prevent clipping distortion during those demanding musical peaks (note the clipped and unclipped waves in the symbolic graph above). The SR 804 is conservatively rated at 50 watts RMS, 20-20,000 Hz into 8 ohms with only 0.1% THD.

Class G is just one example of Hitachi's leadership in audio technology. Power MOS/FET amplifiers, R&P 3-head system cassette decks, Uni-torque turntable motors, and gathered-edge metal cone speakers are just some of the others. There's a lot more. Ask your Hitachi dealer.

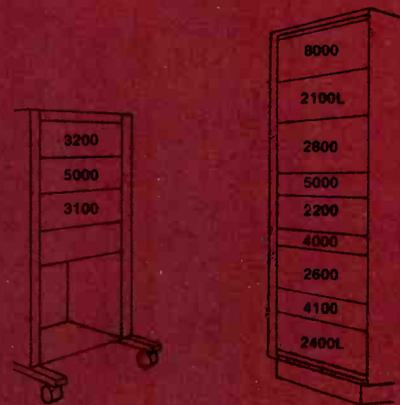
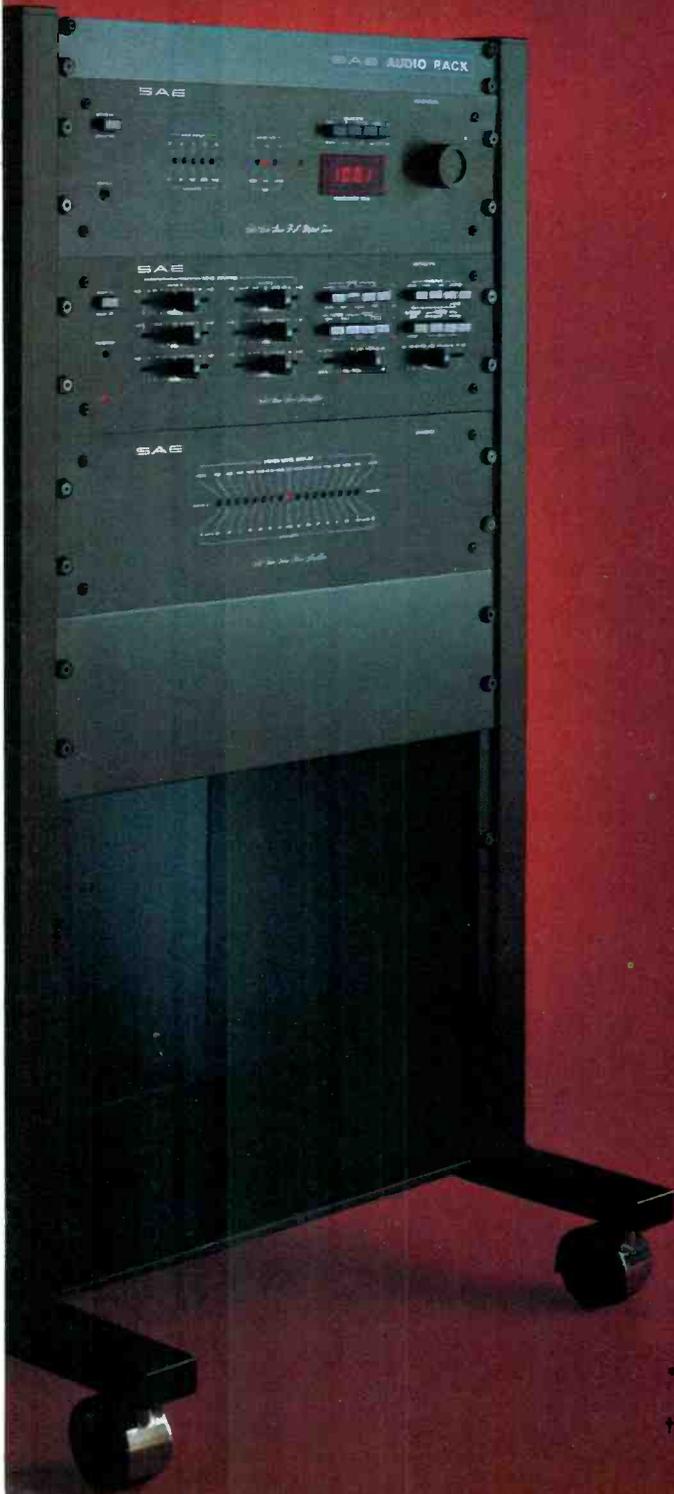


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*Minimum RMS watts per channel, both channels driven into 8 ohms from 20Hz to 20kHz at less than 0.05%.

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to the Ridiculous

which some people would say is extreme. But to the true audiophile it is the ultimate answer. Bold. Sophisticated. Sonically alive.

This super system features an 8000 FM Digital Tuner with steep quieting and phase lock loop for low distortion; a 2100L Preamp with LED level display and a two stage phono circuit; a 2800 Parametric Equalizer, developed in the recording studio to provide the maximum flexibility obtainable in tone control systems; a 5000 Impulse Noise Reduction System which dramatically reduces the effects of record scratches; a 2200, 100 watt* per channel fully complementary Stereo Power Amplifier; a 4000 Electronic Crossover to make even the best speakers sound better; a 2600, 400 watt* per channel super high power amplifier; a 4100 Time Delay Ambience System for the re-creation of a live environment; and a 2400L, 200 watt* per channel fully complementary Stereo Power Amplifier pictured in the professional's choice, our 60 inch C-10 equipment rack all for a suggested price of \$6250.00†.

The extremes of audio excellence—and everything in between— from SAE.

For more information about the sublime to the ridiculous, write:

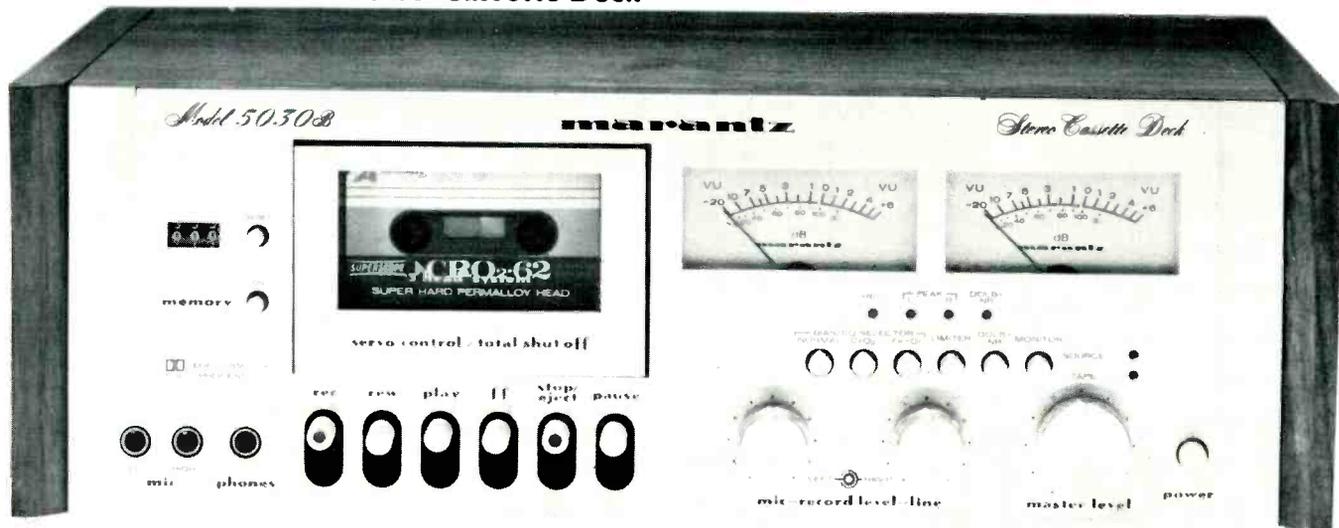
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Scientific Audio Electronics, Inc.

P.O. Box 60271 • Los Angeles, California 90060



Marantz Model 5030B Stereo Cassette Deck



MANUFACTURER'S SPECIFICATIONS

Frequency Response: 35 Hz to 14 kHz, 35 Hz to 17 kHz with FeCr or CrO₂ tapes.

Signal-to-Noise Ratio: 58 dBA, 64 dBA with Dolby N/R.

Input Sensitivity: Mike, 0.16 mV; Line, 50 mV.

Output Level: Line, 800 mV; Head-
phone, 43 mV.

Flutter: 0.05 per cent W rms.

Wind Time: 105 seconds for C-60 cas-
sette.

Dimensions: 17-3/8 in. (441 mm) W x
5-3/4 (146 mm) H x 11-11/16 (297 mm)
D.

Weight: 14.8 lbs. (6.7 kg).

Price: \$419.95.

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The Marantz 5030B cassette deck offers a true three-head design for a medium price. The record and playback heads are actually separate structures, but mounted within a single metal enclosure. A shielding board between the two heads minimizes cross feed. Access to the heads for cleaning and demagnetizing is quite good with the door cover removed (easily snapped out) and the unit in *Play* mode without a cassette. Loading and unloading is direct and was smooth in action. Medium force was required to actuate the tape motion levers, lighter than most units with this design. It was possible to go into *Play* from winding, but undesirable tape loops were formed when doing so. The tape counter includes the useful memory function. The meters have fluorescent scales, blue from -20 to -1 and red from 0 to +6, without any direct illumination. Below are the LED record and Dolby NR status lights and peak-level indicators for each channel, which offer some advantage over a single one for both channels. Three push-button switches select bias and EQ for low-noise, FeCr or CrO₂ tapes. Similar switches provide on/off control for Dolby NR and a limiter, and monitor selection, source or tape, which has two associated status lights.

The input-level control facilities are superior to most decks with full mike and line mixing and an always-useful master level pot. The knobs on the mike and line dual-concentric pots are of good size and finely knurled. As the non-clutched knobs in each set are very close to the same diameter, both channels can be adjusted at the same time if desired. Mike input and headphone jacks are on the front panel, and line in and out phono jacks are on the rear panel. A ground post and a multiplex filter switch are also on the back panel, a location which may keep the switch position out of mind. Accessory handles are available for rack mounting.

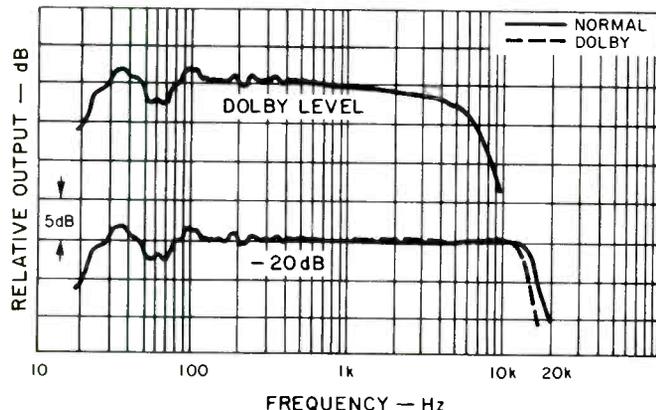
Soldering on the PCBs was excellent. The trimmed leads seemed a trifle long, but there were no danger spots, and troubleshooting would be facilitated. Wirewrap was used for intercard wiring. Adjustments were labelled, and parts were identified. It was noted that higher wattage resistors were mounted on ceramic standoffs and that the rugged bottom and side construction of the chassis was well suited to rack mounting.

Performance

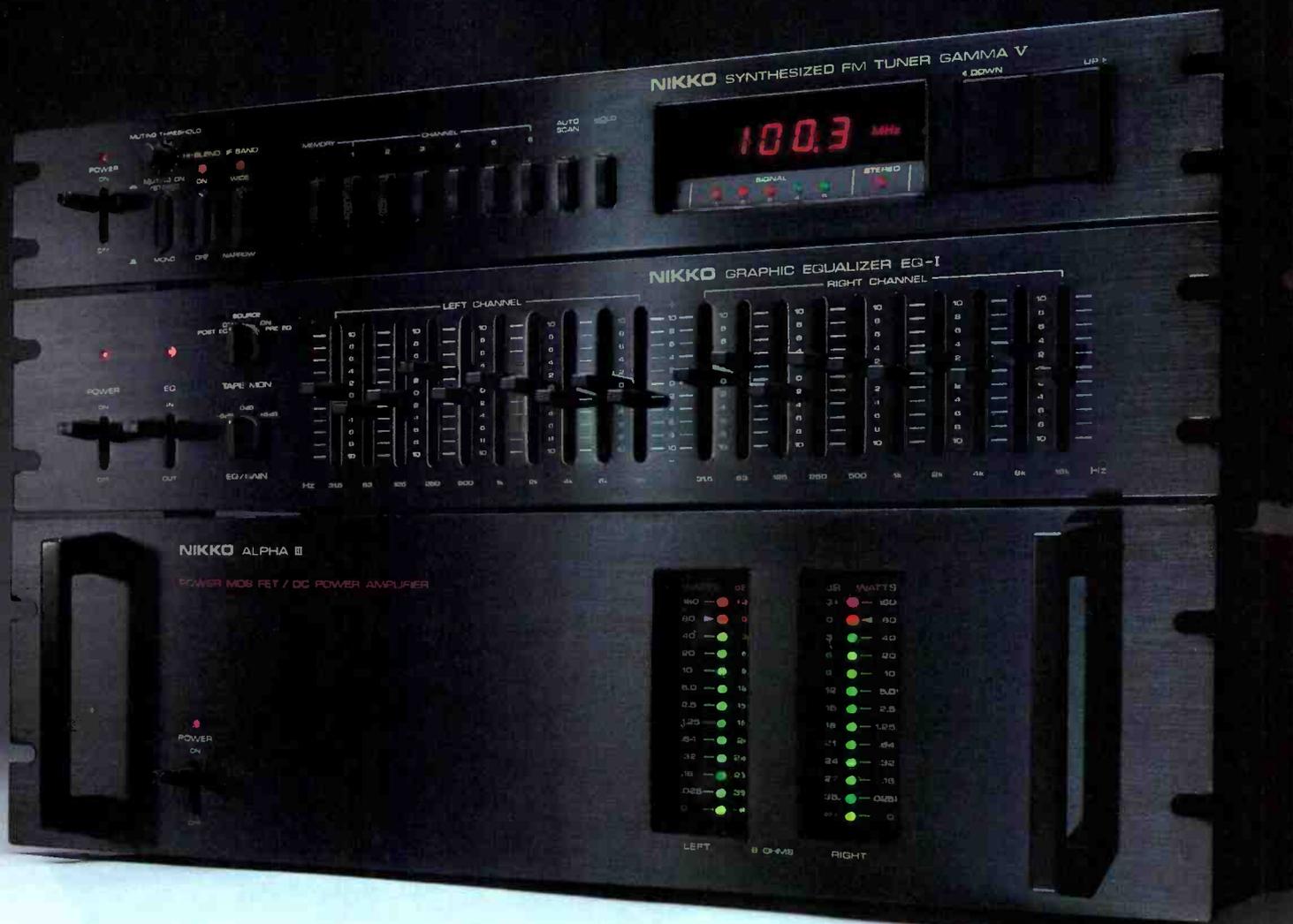
The playback responses with standard tapes were generally very smooth, but there was a dip of about 5 dB with the 63 Hz tone. Playback of standard levels gave indications about a dB low, and play speed was about 0.7 per cent fast. Record/playback responses were best with Sony UHF, Sony FeCr, and TDK SA. Results were also good with other tapes with similar bias requirements, such as Ampex Grand Master, Audio Magnetics High Performance, Scotch Master III, etc. Over the majority of the band, the responses 20 dB below Dolby level were very flat, with deviations of less than a dB with all three tapes. Also to be applauded were the very minor deviations when switching to Dolby mode, especially with TDK SA. High end limits in normal mode were 5.8, 3.1, and 6.3 kHz at Dolby level for Sony UHF, Sony FeCr and TDK SA, respectively. With the level 20 dB lower, roll-off was at 16.1, 20.3 and 19.5 kHz for the same tapes.

At 100 Hz and below, head contour effects were evident, especially with the broad dip around 60 Hz, almost 3 dB

Fig. 1—Frequency response with Sony UHF.



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deep. The -3 dB point was actually reached at 23 Hz in all cases, certainly very good. One hopes that future designs will show less deviation in this region. The playback of a recorded 10-kHz tone showed close to 70 degrees phase discrepancy between channels, indicative of the challenge of mounting head sections in perfect alignment. The phase jitter was just 20 degrees, the best ever measured on a cassette deck. The multiplex filter was down 26 dB at 19 kHz, 29.5 dB at 18.6 kHz. Bias was of low level in the output, whether switched to *Source* or *Tape* playback.

The relative level of third harmonic distortion was measured vs. record level from -10 dB (re: Dolby level) to the 3 per cent distortion point. The plotted curves were unusual in two respects. First of all, amplitude compression appeared without the expected high rise in distortion, causing the curves to bend flatter rather than more sharply upward. The net result was that overload was more gradual than with other decks, particularly with Sony UHF. The other different-from-normal aspect was the lowest distortion performance with a chrome-type tape (TDK SA). Low-noise tapes have that distinction with most decks. On the other hand, TDK SA showed slightly higher HDL₂ than the other two tapes. HDL₅ was very low for all tapes at all record levels. HDL₃ vs. frequency with TDK SA at 10 dB below Dolby level was low over most of the range, but on the high side around 5 kHz. The use of Dolby reduced distortion products for all tapes at all levels across the entire frequency band, much better results than with most decks.

The signal-to-noise ratios at Dolby level were 54.1, 58.4 and 57.4 dBA for Sony UHF, Sony FeCr, and TDK SA, respectively. With a record level to cause HDL₃ = 3 per cent, the results

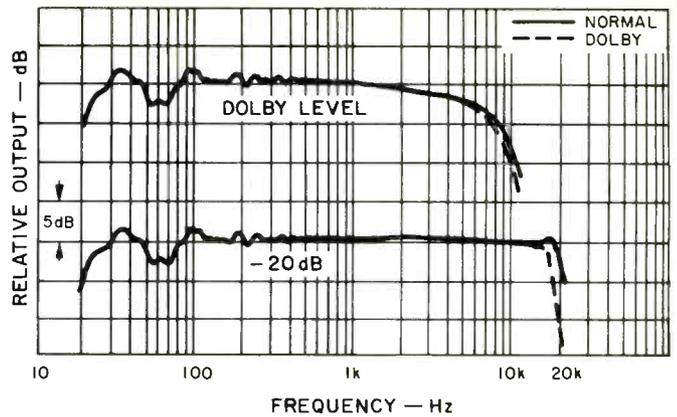
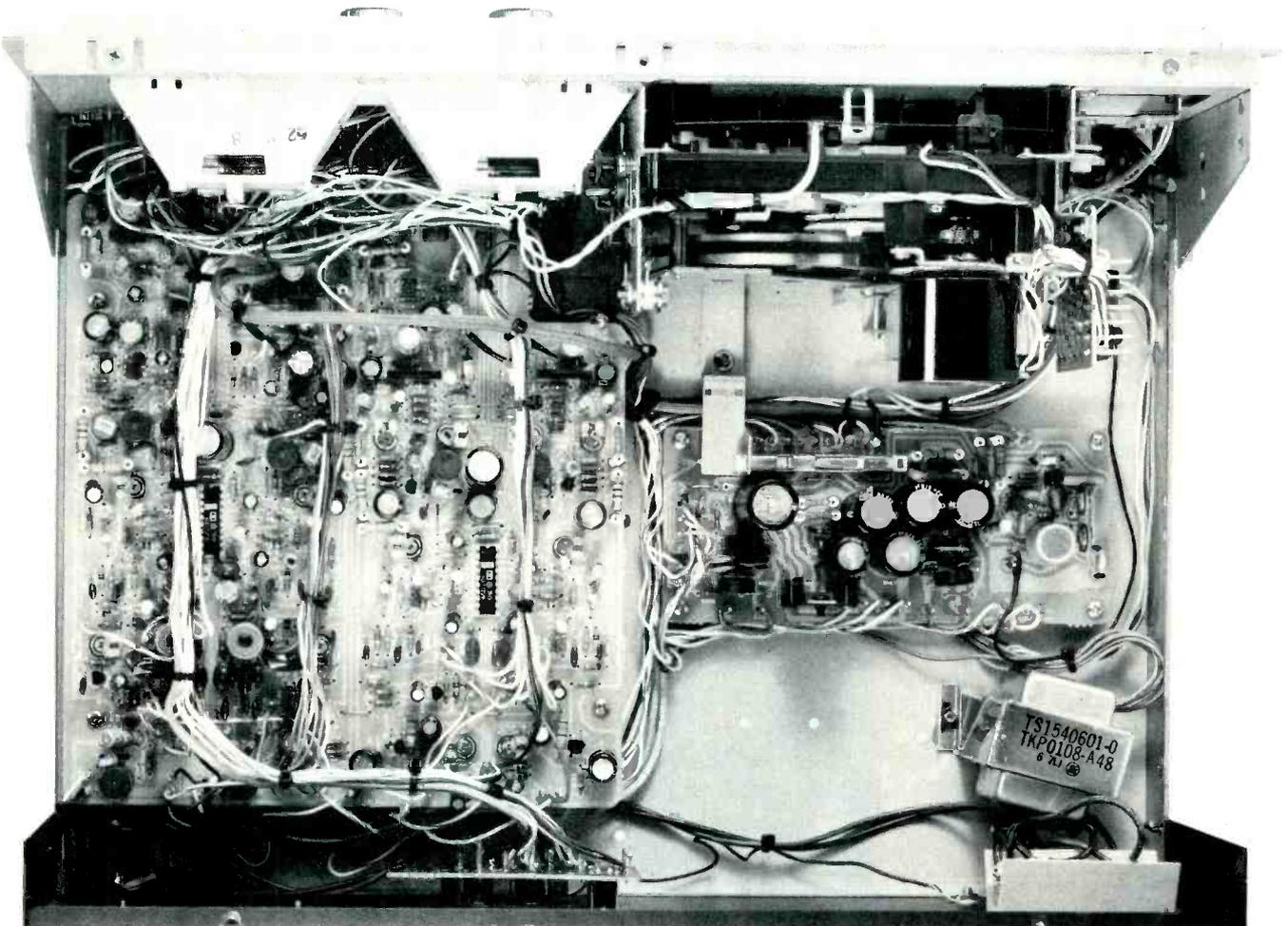


Fig. 2—Frequency response with TDK SA.

were 58.1, 60.8 and 60.4 dBA for the same tapes. With Dolby mode and HDL₃ = 3 per cent, the figures were 66.5, 68.0 and 68.0 dBA for the same order. On a CCIR/ARM basis, the ratios for Sony UHF, Sony FeCr and TDK SA at HDL₃ = 3 per cent were 55.1, 58.5 and 57.7 dB respectively, and 65.2, 68.6 and 67.8 dB with Dolby, for the same order. All in all, excellent performance, especially in light of the amplitude compression noted earlier. Erasure and crosstalk were both more than 80 dB down, and separation was 46 dB, better than many decks.

Mike input sensitivity was 0.19 mV, and input overload was at 60 mV. Line sensitivity was 71 mV, higher than the spec, and overload was at 4.0 volts. Output clipping appeared at a level equivalent to a meter indication of +15. The master



the unreel deck



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The AD-6900U features Full Logic operation and exclusive Double Needle Meters.

Full logic feather-touch push button controls and dual motor operation make the going easy, and the feather-touch operation with Cue and Review can't be found on any other cassette deck. And no other reel-to-reel or cassette deck offers Double Needle Meters that combine both VU and Peak functions on each meter.

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RC-10 Remote Control

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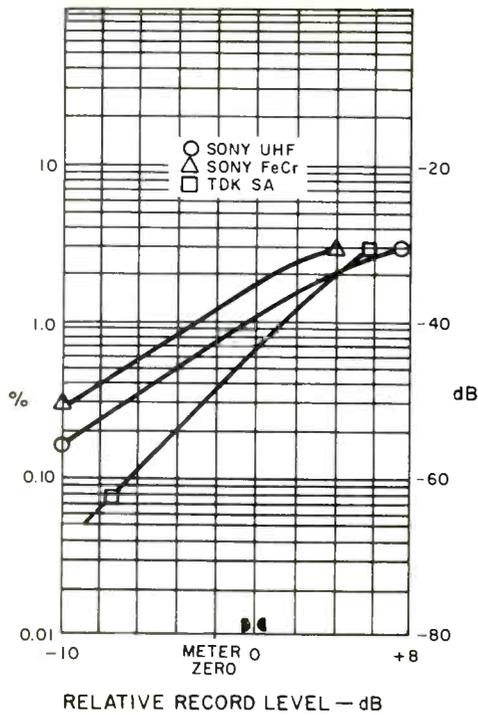


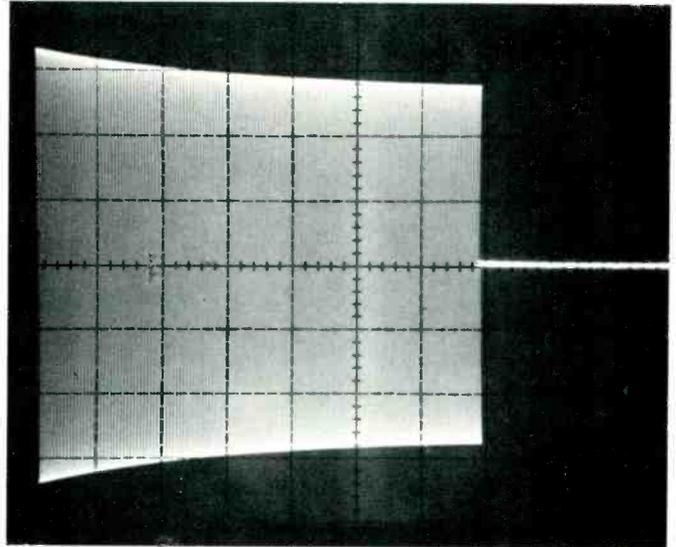
Fig. 3—Percentage of third harmonic distortion vs. 1-kHz record level with Sony UHF, Sony FeCr, and TDK SA.

88

input level pot sections tracked within a dB down 55 dB from maximum setting. The mike and line level pots also tracked very well. The line output levels were 640 mV at meter zero, 770 mV at Dolby reference (+2 meter). The headphone output was 39 mV with 8-ohm loading, a little under the specified 43 mV, but more than adequate for all the phones tried. In fact, the lack of an output pot made the use of sensitive phones impossible because of the high levels. The frequency response of the level meters met VU standards, but the action was a little sluggish, getting to just -2 with the standard 300-mS burst. The meters read high with below zero input levels and read low with above zero signals, but with adequate accuracy. The peak indicator thresholds were at +3 with a 1-kHz CW input. They were still turning on with a tone burst that was just one cycle of 1 kHz, excellent response. The limiter threshold was at a somewhat low -2 on the meters. Even very high-level signals were reduced to

meter zero, perhaps more than necessary. A 140-mS burst with a CW level 15 dB above meter zero was limited to +2 even at the very start of the burst, with reduction in level to +½ by the end of the burst.

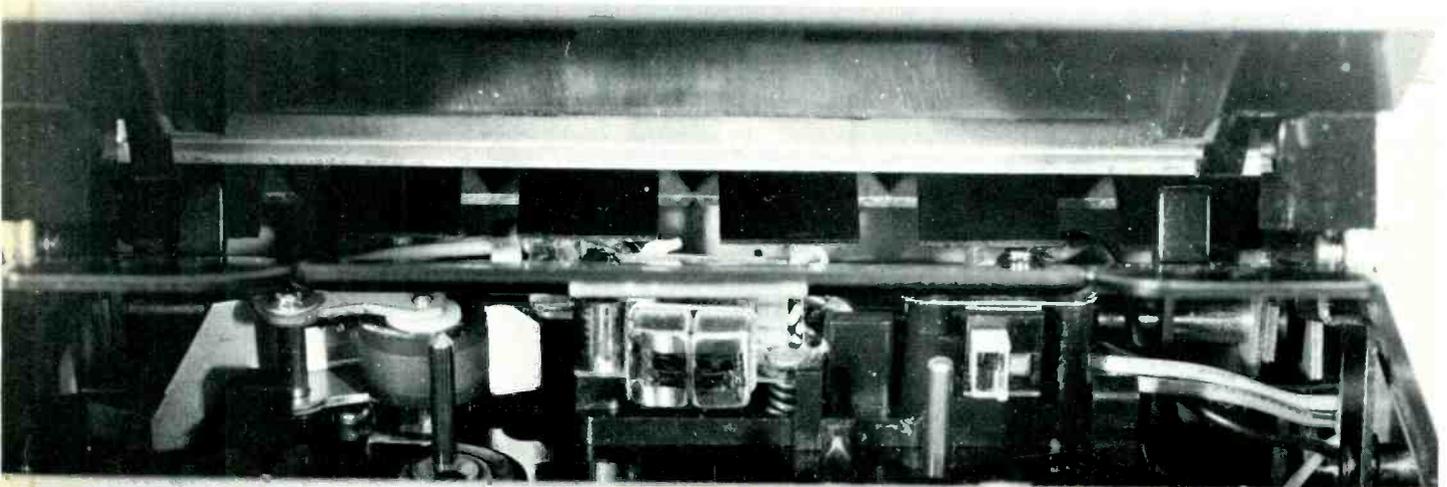
Tape speed was plotted with changes in line power with a 120-V reference. Increases in line voltage on playback caused more of a change in tape speed, but the variation was less than 0.2 percent. Flutter plots were made to both W rms and weighted peak standards. In each case, the recorder was started three different times after tape-motion switching and re-entering play mode. The flutter performance was consistent with typical values of 0.05 percent W rms and 0.08 percent wtd pk, meeting its tight specification. The average wind time was 97 seconds, within spec, but a little on the slow side.



Action of the 5030's limiter.

In-Use Tests

Cassette loading and unloading and head cleaning were all easy tasks. The medium pressure required to actuate the tape-motion levers was much lower than many decks with the same approach. The combination of input pots, including the master, and the excellent peak indicators facilitated setting and adjusting levels. Meter action appeared to be acceptable, although tests had shown it a bit sluggish according to the standard. The fluorescent scales seemed attractive,



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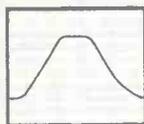
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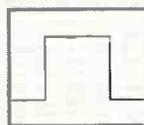
Our engineers discovered that even with exceedingly low harmonic distortion, amplifiers typically lack the ability to react quickly enough to an input signal, particularly at the mid and upper frequencies. This is called transient intermodulation distortion (TIM).

The result can be seen on an oscilloscope as a square wave that's distorted. And heard as poor spatial imaging and loss of detail. While some manufacturers have dealt with a square wave's rise time, only Kenwood High Speed Transistors produce high frequency square waves that decay as fast as they rise.

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allow a much faster change in voltage (slew rate) than ever before. So no matter what the music demands, the amplifier can match it exactly.

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High Speed Transistors are used for the first time in our Audio Purist Group, shown above. Because it takes a very sophisticated and demanding listener to appreciate this new technology.

We're convinced that in a world of compromise, some people still demand the very latest state of the art. Building high fidelity equipment for them will always be our commitment. For more information and complete technical specifications, please write us.

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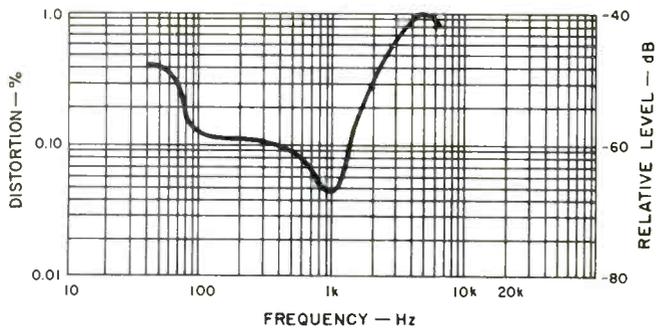


Fig. 4—Level of third harmonic distortion vs. frequency at 10 dB below Dolby level using TDK SA.

but were a little difficult to use with low-level illumination. The lack of an output pot made *Normal/Tape Play* matching impossible in the evaluation monitor system.

The instruction book is very well written with pertinent and lucid comments and excellent illustrations. There is no list of recommended tapes, which may be better than listing many that wouldn't be that good a match. This reviewer, however, encourages manufacturers to let the consumer in on what tapes are used to set the machine up. Alternatively, a statement on the bias provided at various settings would be a guide.

For the great majority of the sources copied and played back, there was nothing to fault in reproduction. Switches between normal and Dolby generated no detectable changes

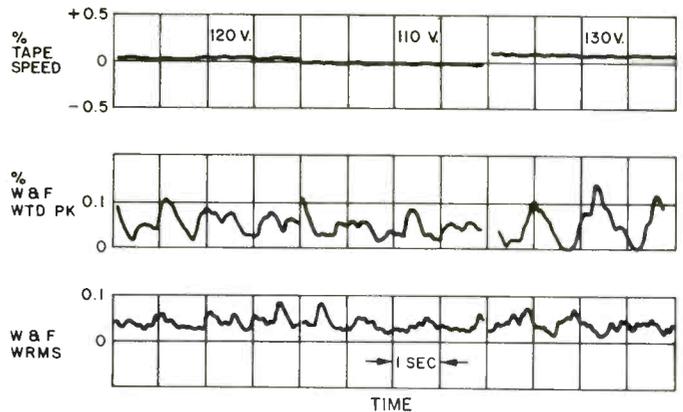


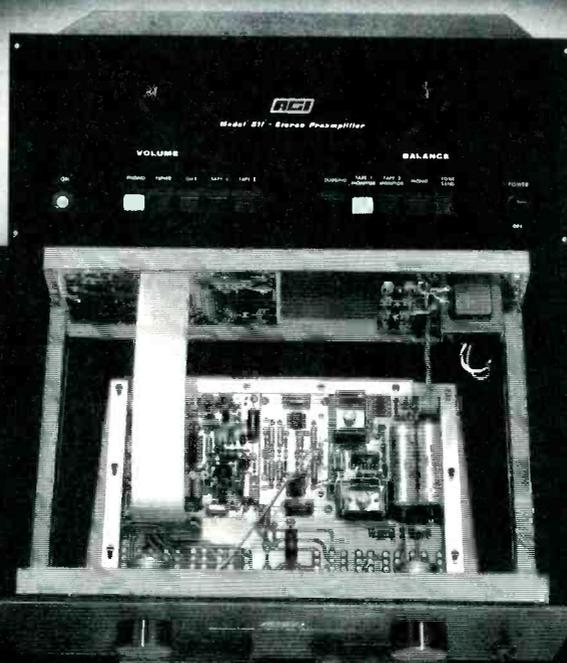
Fig. 5—Tape speed vs. line voltage and flutter.

except for the lower noise in Dolby. With its three-head system, the Marantz 5030B could be checked easily and quickly for any form of overload during the record process. With just one source with a lot of bass, there was some evidence of a change in the playback, judged to be from the dip around 60 Hz. All record, pause, and stop clicks were down at tape noise level, with the exception that the latter stood out a bit in Dolby mode, with its lower noise level. The Marantz cassette deck has a few minor limitations: the lack of an output pot was the most important to me. On the plus side, the 5030B offers tape playback while recording, very flat response over most of the audio range, high signal-to-noise ratios, excellent input mixing/level control, low flutter and phase jitter, and a good limiter.

Howard A. Roberson

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JVC Model QL-7 Direct-Drive Turntable



92

MANUFACTURER'S SPECIFICATIONS

Speeds: 33 $\frac{1}{3}$ and 45 rpm.

Motor: 12-pole, 24 slot, d.c. servo.

Wow & Flutter: Less than 0.25 per cent W rms.

Rumble: Better than 63 dB (IEC-B).

Tonearm: Static balance.

Tonearm Effective Length: 254 mm (9.6 in.).

Tonearm Overhang: 15 mm (0.6 in.).

Tracking Force Range: 0 to 3 gms.

Dimensions: 18 $\frac{3}{4}$ in. (47.6 cm) x 15 $\frac{3}{4}$ in. (38.7 cm) x 6 $\frac{1}{4}$ in. (15.9 cm).

Weight: 23.8 lbs. (10.8 kg).

Price: \$299.95.

When quartz-controlled, single-play, direct-drive turntables first came on the scene, they were extremely expensive, but the increasing demand combined with technological design and production improvements to bring prices down in a rush. An example of this is the JVC QL-7 which costs under \$300.00 and boasts some of the same features and specifications as the super-luxury units costing up to \$1000.00, plus it looks good in the bar-

gain. True, it doesn't have the variable speed facility, but this refinement adds a lot to the cost and, in reality, very few people really need it. Again, there is no digital display, but in terms of wow and flutter, rumble, and general good engineering nothing has been skimmed on.

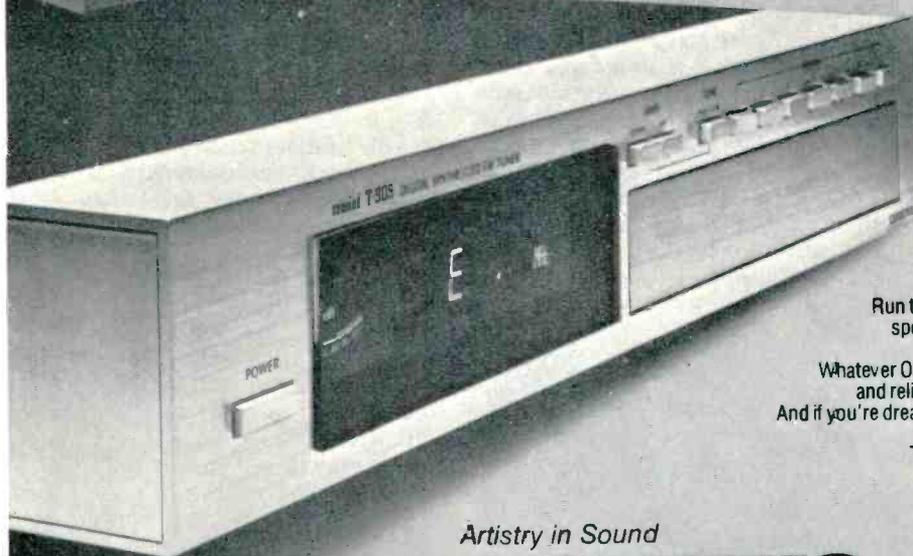
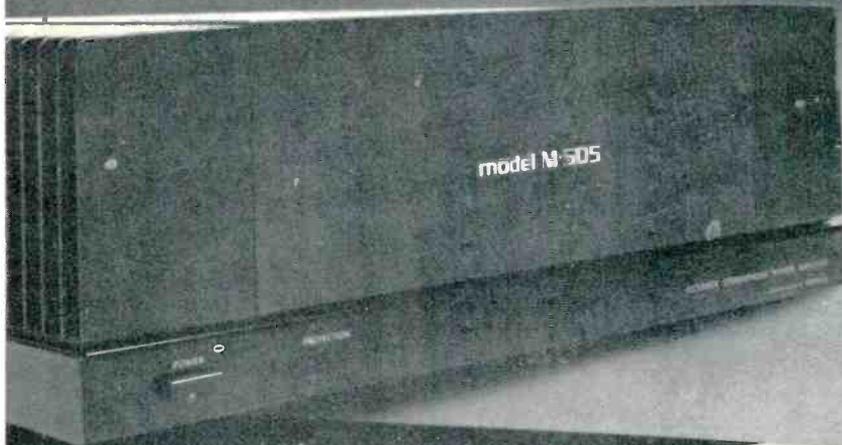
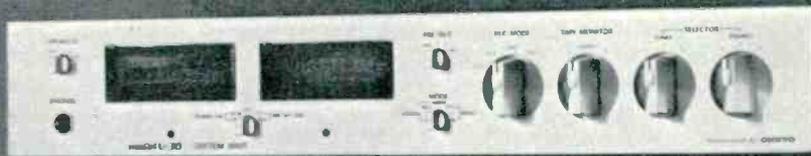
The 12-pole d.c. motor is servo-controlled with a quartz-crystal reference, and an integral signal generator provides the correction pulses. The 4-lb.

die-cast platter is surrounded by a polished, angled ring on which the controls are mounted. The small thumbwheel *On/Off* switch is on the left, and next to it, towards the front, are three tiny contact switches for 33 $\frac{1}{3}$, 45, and *Stop*. The strobe light is located behind a plastic window at the center, with the relevant markings cut into the side of the platter.

The tonearm is the conventional S-shaped type measuring a bit under 10



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AKG P8ES Stereo Cartridge

MANUFACTURER'S SPECIFICATIONS

Stylus Description: Elliptical, 0.2 x 0.7 mil tip radius, and 0.42 mg effective mass.

Frequency Response: 10 - 28,000 Hz, measured using B&K QR-2010.

Output Voltage at 5 cm/sec: 3.75 mV.

Tracking Force Range: 0.75 to 1.25 grams.

Optimum Tracking Force: 1.0 gram.

Compliance: 35×10^{-6} cm/dyne.

Channel Separation at 1 kHz: 35 dB.

Channel Separation at 10 kHz: 25 dB.

Channel Balance: Within 2 dB.

Frequency IM Distortion at -6 dB: 0.5 per cent or less.

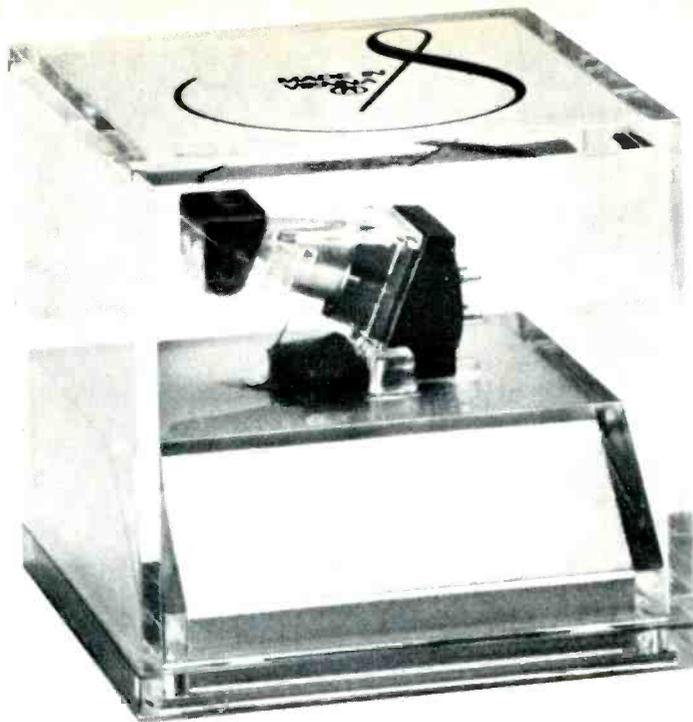
Impedance: 860 ohms and 280 mH.

Optimum Load: 47,000 ohms and 470 pF.

Weight: 5.86 grams.

Replacement Stylus Assembly: X8S (elliptical tip).

Price: \$135.00.



96

When the name AKG (Vienna, Austria) is mentioned, one automatically thinks of high-class professional microphones of world renown. Today, among other products, AKG manufactures a line of stereo phono cartridges, all using the variable reluctance principle. These cartridges utilize a patented transversal suspension (TS) for the stylus cantilever which is centered symmetrically in a small hole in a very thin, gold-plated metal plate. The plate and the gold-plated soft iron armature are connected to each other by a rubber element which is vulcanized to both metal parts by a special process, resulting in a knife-edge bearing of incredibly small size. The knife-edge pivot is claimed to suppress torsional and axial movement so that no spurious signals are generated. Due to the design's complete symmetry, the same mechanical conditions exist for transverse excitation in all directions. The large permanent magnet with high flux density in the air gap is not a part of the moving stylus assembly, thus reducing the effective mass of the stylus.

The overall appearance of the line of cartridges is similar, with the model P8ES being at the top of the line. The cartridge comes packed in a plastic cube. The necessary hardware is located in the bottom of the cube and included a screwdriver in the model we tested, the AKG P8ES. Also included is an individual response curve for the cartridge and directions for mounting the cartridge.

The shape of the cartridge bottom is such that it must be absolutely parallel to the record to avoid rubbing the record surface, particularly on warped records. Although the supplied wedge is meant to be used to mount the cartridge in a record-changer arm, we found that it may have to be used in a single-play tone arm if the arm cannot be adjusted so the bottom of the cartridge does not rub the record surface.

Measurements

As is our practice, measurements are made on both channels, but only the left channel is reported. During the test period the average temperature was $75^{\circ}\text{F} \pm 1^{\circ}$ (23.33°C) and the relative humidity 65 per cent ± 3 per cent.

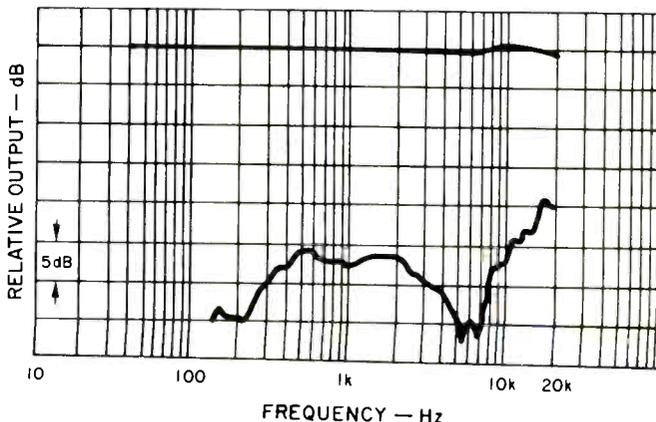
Frequency response, using the Columbia STR-100 test record and our reference tonearm, an Audio-Technica AT-1009, mounted on a Technics SP-10 turntable, is flat within a -0.5 dB from 40 Hz to 6 kHz, then starts to slowly rise to $+2$ dB at 10 kHz, finally descending to -1 dB at 20 kHz. The

optimum tracking force for the cartridge we tested was at its maximum recommended tracking force, 1.25 grams. The optimum anti-skating force was 2.0 grams. Separation was superb, being 21.5 dB at 1 kHz, 37 dB at 5.6 kHz, 28 dB at 10 kHz, and 19 dB at 20 kHz. The load resistance was 47 kilohms and 470 pF capacitance. Square-wave response shows a single cycle of overshoot, but no ringing. This cartridge has one of the lowest IM distortions we ever measured.

The following test records were used in making the reported measurements: Technics SFC-TR100; Micro-Acoustics TT-2002; Shure TTR-103, TTR-109, TTR-110, TTR-115; Columbia STR-100, STR-112, SQT-1100; JVC TRS-1007; Stereo Review SR-12; Deutsches HiFi No. 2, and the Nippon Columbia Audio Technical Record (PCM) XL-7004.

Wt. 5.95 g; d.c. res. 970 ohms; ind. 320 mH; opt. tracking force 1.25 g; opt. anti-skating force 2.0 g; output 0.68 mV/cm/sec; IM distortion (4:1) $+9$ dB lateral, 200/4000: 1.1%, $+6$ dB vertical, 200/4000: 1.3%; crosstalk (using Shure TTR-109) -35 dB; ch. bal. 0.75 dB; trackability: high freq. (10.8 kHz pulsed) 30 cm/sec, mid-freq. (1000 + 1500 Hz, lat. cut) 31.5 cm/sec, low freq. (400 + 4000 Hz, lat. cut) 24 cm/sec; Deutsches HiFi No. 2, 300-Hz test band tracked cleanly to 86 microns (0.0086 cm) lateral and 55.4 microns (0.00554 cm) vertical. This is extremely good and very few cartridges can track these bands. The arm-cartridge resonance curve showed a resonance peak at 6 Hz with an amplitude of 7.5 dB. Although the peak resonance frequency is a little low with the Audio-

Fig. 1 — Frequency response.



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Technica AT-1009 arm, we could not detect any adverse effects during the listening period.

The Micro-Acoustics Test Record TT-2002 was used to check the tracking and transient ability. The AKG P8ES cartridge encountered no difficulty in playing all the tracking ability bands. The percussion levels check the cartridge for both vertical and lateral tracking ability. The transient ability of the P8ES is excellent since the computer-generated high, low, and high/low mixed frequencies presented no problem to this cartridge.

The P8ES performed superbly on all bands of the Shure Audio Obstacle Course Era III (TTR-110). With the newer Shure Audio Obstacle Course Era IV (TTR-115) test record, the tracking ability of the P8ES did not quite pass level 5 (+12 dB above the reference level) of the flute and flute-bell test. These are one of the most severe high-frequency trackability tests to be found and very few cartridges will track beyond level 4 of this test for it is truly an "obstacle course." In general, the results clearly point out the excellence of the transient and tracking ability of the AKG P8ES phono cartridge. In this aspect, the P8ES does not have to take second place to any other cartridge known to us.

Listening Evaluation

Our listening tests are performed both prior to actually testing the cartridge parameters and again after all tests have been completed. The equipment used for the listening evaluation is identical to that used in the report last month. When we first heard some of our records played with the AKG P8ES cartridge, we were surprised by the transparency of the sound and it was probably due to the low IM distortion of the cartridge. The P8ES has excellent sonic clarity and bass response. We did not notice any high frequency effects from

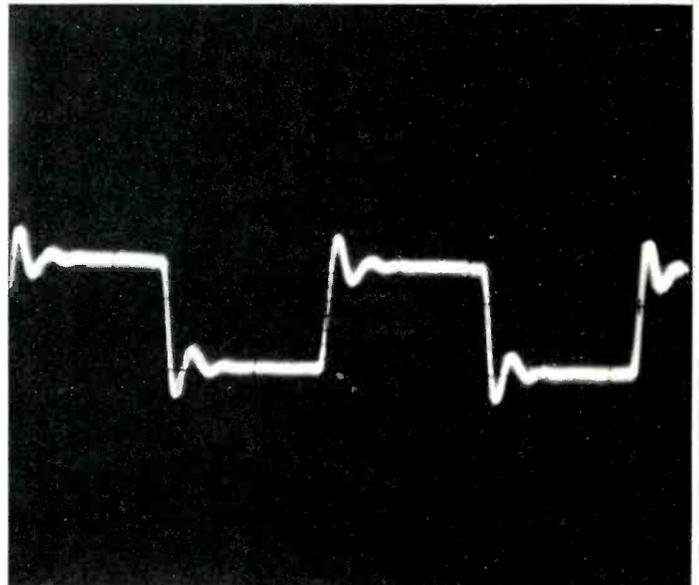


Fig. 2 — Response to 1-kHz square wave.

the 2 dB peak at 10 kHz. The P8ES did not appear to introduce either a sound of its own or coloration.

In conclusion, the AKG P8ES had no difficulty playing the listed or any other record in our collection. It is a cartridge which plays cleanly and one of the best in terms of tracking ability. Our conclusion is that the P8ES ranks among the top cartridges with very few others being its equal. B. V. Pisha

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Reference Recordings

A rigorous listening evaluation was conducted utilizing the specific records listed below as well as many of the records listed in past reports. These excellent recordings demonstrate quite effectively the ability of the P8ES to reproduce difficult as well as high level recordings, such as the high velocities present on many of the direct-to-disc recordings, without adding anything of its own to the music. The AKG P8ES is especially superb in reproducing the singing voice, having a clarity and naturalness that is seldom found.

Direct to Disc

Tchaikovsky: *Capriccio italien, op. 45*; Rimsky-Korsakov: *Capriccio espagnol, op. 34*, The Boston Pops, Fiedler — Crystal Clear CCS 7003.
Creation: *Super Rock at the Highest Voltage* — Toshiba-EMI LF 95016.
J. Fukamachi: *Sgt. Pepper's Lonely Hearts Club Band* — Toshiba-EMI LF-95014.
E. Kitamura: *30 Years in 30 Minutes* — Toshiba-EMI LF-95012. (These Toshiba-EMI discs are distributed by Audio-Technica.)
Bill Berry & Ellington All-Stars: *For Duke* — M&K Sound RT-101 (M&K Sound Corp., 8719 Wilshire Blvd., Beverly Hills, Calif. 90211.)
Spectrum: *Direct Flight* — Direct-Disk DD-104. (Direct-Disk Labs, 16 Music Circle Sound, Nashville, Tenn. 37203.)

Pulse Code Modulation (PCM, Stereo)

B. H. Soran-Bushi: *Billy Harper* — Denon YX-7522-ND.
Bach: *Organ Concert, K. Vad* — Denon OX-7048-ND.
Mussorgsky: *Pictures at an Exhibition*; Ravel: *Pavane pour une infante defunte*, Tokyo Metropolitan Symphony Orches-

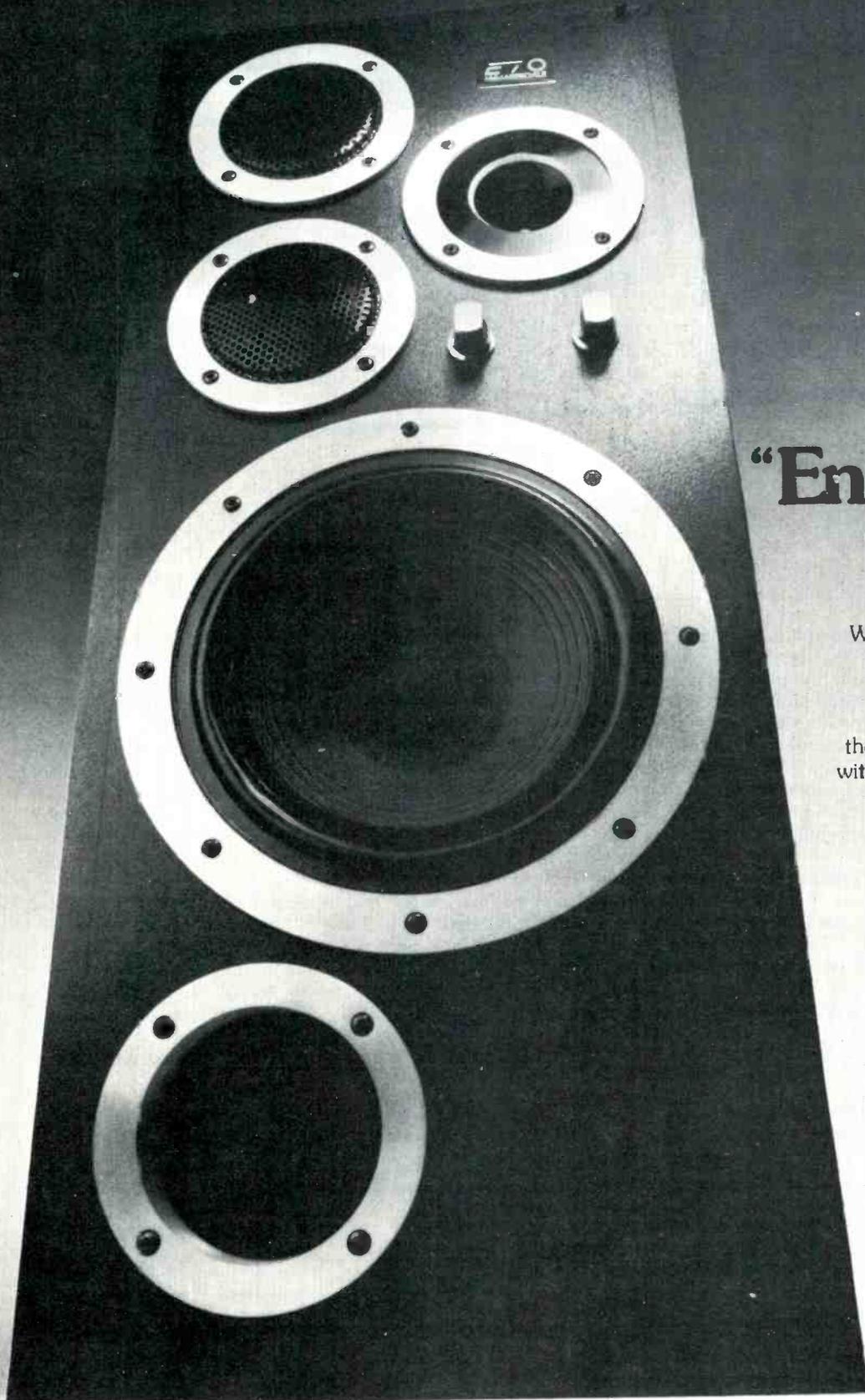
tra, Fremaux — Denon OX-7072-ND. (These Denon PCM records are distributed through American Audioport dealers.)

Stereo

Beethoven: *Symphony No. 3 in E-flat Major ("Eroica")*, Chicago Symphony Orchestra, Solti — London CS 7049.
Beethoven: *Missa Solemnis*, Chicago Symphony Orchestra and Chorus, Solti — London OSA 12111.
Bruckner: *Te Deum; Mass No. 2 in E minor*, Vienna Philharmonic Orchestra, Mehta — London OS 26506.
Floyd Cramer: *Looking for Mr. Goodbar* — RCA APL 1-2644.
Bartok: *Violin Concerto No. 2*, Kyung-wha Chung, violin, London Philharmonic Orchestra, Solti — London CS 7023.
Wagner: *Meistersinger (Act 1); Tristan (Prelude)*, Chicago Symphony Orchestra, Solti — London CS 7078.
Pavarotti: *Bravo Pavarotti! His Great American Triumphs* — London PAV-2001-2.
Music for Percussion, Vol. 1, Tristan Fry Percussion Ensemble, Gardiner — Gale GMFD1-76-004. (This excellent recording, distributed by Audio-Technica through their dealers, rivals the better PCM and direct-to-disc records).
Check Up Your Sounds, Vol. 1, Audio Symphony — RCA (Japan) RVL-1. (Also distributed through Audio-Technica, this highly recommended record should be owned by every audiophile to evaluate their system).

Quadraphonic-SQ

Enoch Light & Light Brigade: *New Recordings of the Big Band Hits of the 30s, 40s, and 50s* — Project Three PR2-6005/6 Q.
Donizetti: *Gemma di Vergy*, Caballe — Columbia M3-34575.
Annie, Original Cast Recording — Columbia PS-34712.



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The computer-optimized Wharfedale E's. Beautifully designed and crafted. For the sophisticated connoisseur of sound.

Unusually efficient (94dB/W/m), the E's are clean and easy-to-listen-to, with notably good transient response. Distortion is inordinately—and inaudibly—low.

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Aiwa Model AD-6550 Stereo Cassette Deck



MANUFACTURER'S SPECIFICATIONS

Frequency Response: 20 Hz to 15 kHz, 20 Hz to 17 kHz with FeCr and CrO₂ tapes.
S/N Ratio: 65 dB with FeCr tape and Dolby NR.

Input Sensitivity: Mike, 0.3 mV; Line, 50 mV.

Output Level: Line, 775 mV.

Wow & Flutter: 0.05 W rms.

FF & RWD Times: 90 seconds for C-60 cassettes.

Dimensions: 16 ⁹/₁₆ in. (42 cm) W x 5 ¹⁵/₁₆ in. (15 cm) H x 13 in. (33 cm) D.

Weight: 16.5 lbs. (7.47 kg).

Price: \$450.00.

100

The Aiwa AD-6550 is an attractive, smooth-working cassette deck. The friction roller-damped door of this front loader allows easy loading, and, with removal of the front glass, maintenance tasks are quite simple. The good-sized tape-motion control levers provide the essential interlocking, but also provide some conveniences in operation. *Rewind* and *FFWD* controls are obtained with the *Rewind* and *FFWD* controls when in *Play*. It is also possible to go directly from either wind mode to *Play*. The same lever performs both stop and eject functions; a second push is required for ejection when the tape is moving. The pause lever also performs as the timer start switch, possible in either play or record. To the left of the illuminated cassette compartment are the power switch and the jacks for microphones, headphones, and a DIN-type plug. Between the two large, well-illuminated meters are peak indicators for +3 (yellow) and +7 (red). The indicator lamps for record mode and Dolby NR are to the left, as is the counter.

Pushbutton switches control counter reset, memory *On/Off*, left meter function (VU or tape time remaining), line or microphone input, and Dolby NR. The dual concentric record-level

pots have very large knobs with fine knurling and a smooth friction clutch, producing a high-quality feel. The smaller output level control also has fine knurling and a smooth feel. The tape selector switches provide three settings of bias and EQ. Bias can be set for LH (low noise), FeCr, or CrO₂ tape types. The EQ settings are labelled 120, 70, and 70 microseconds, so the switches will line up for the great majority of cases. Associated with the LH bias position is an adjustment pot which can be set anywhere from 90 to 110 percent of normal bias, with a detent at 106 percent. This is a very useful feature for any user who might use tape that does not match a fixed setting. The particular implementation by Aiwa is well thought out in the range of bias offered and in the use of a small knurled-bevel knob. This design detail allows adjustments to be made when needed, but is immune to inadvertent changes.

The line-in and line-out phono jacks are on the rear panel along with a ground post and a record player sync jack. The latter is for connection to Aiwa turntables which will release the deck's *Pause* when the tonearm sets down. The majority of the circuitry is on one large PCB, with a few other PCBs of

Fig. 1—Record/playback response with BASF Studio tape in Normal and Dolby N/R modes.

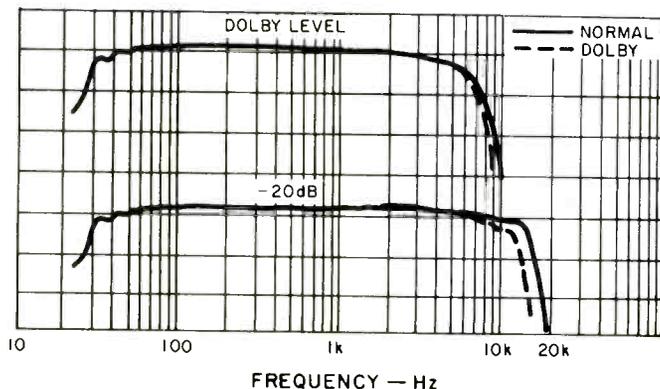
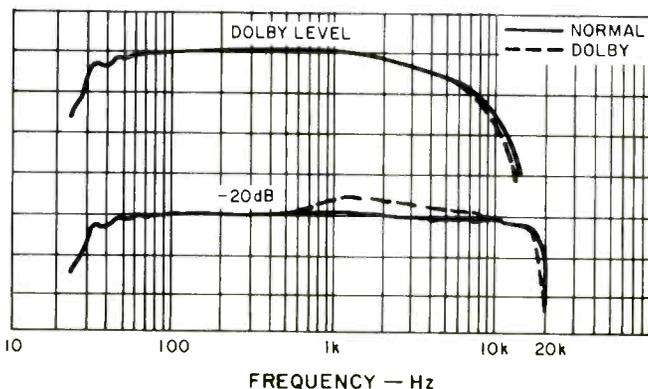


Fig. 2—Record/playback response of Scotch Master III FeCr tape in Normal and Dolby N/R modes.



This new tuner, amplifier and turntable are all by LUX.

We'll leave the speakers up to you.

The tuner and integrated amplifier are from LUX's new Studio Standard Series, our newest and most modestly priced line of separates. Their features and performance, however, are anything but modest.

The T-4 tuner, for example, has LUX's exclusive Accutouch tuning system. The knob physically locks at every station that exceeds the muting threshold—from 5 to 300 μ V. LUX's closed-lock-loop tuning circuit is precisely referenced to the station's carrier frequency for lowest-distortion reception. And the i.f. bandwidth is adjustable—wide (normal) or narrow—to accommo-

date station density throughout the FM band.

The L-5 integrated amplifier has a DC direct-coupled power amplifier section with frequency response extending from 5 Hz to 100 kHz, +0, -1 dB. Bass and treble tone controls have switchable turnover frequencies, plus total tone defeat. Subsonic filter in addition to low and high-cut filters. And when tape checks are not in use, a special switch actually disconnects them from the amplifier, preventing loading which causes preamp distortion.

The PD-272 is LUX's lowest-priced turntable. Its servo-controlled

direct-drive brushless DC motor is totally free of the cogging (pulsing) that plagues many other direct-drive motors. And the straight, statically-balanced tonearm has a nested tube construction and internal damping that deal very effectively with resonance. Another feature: the vertical pivots extend through the arm, minimizing lateral play.

Altogether, these three components will deliver a clean, virtually distortion-free signal to your speakers. We'll leave that final decision to you and your LUX dealer—whose taste is as high in speakers as in electronics and turntables.

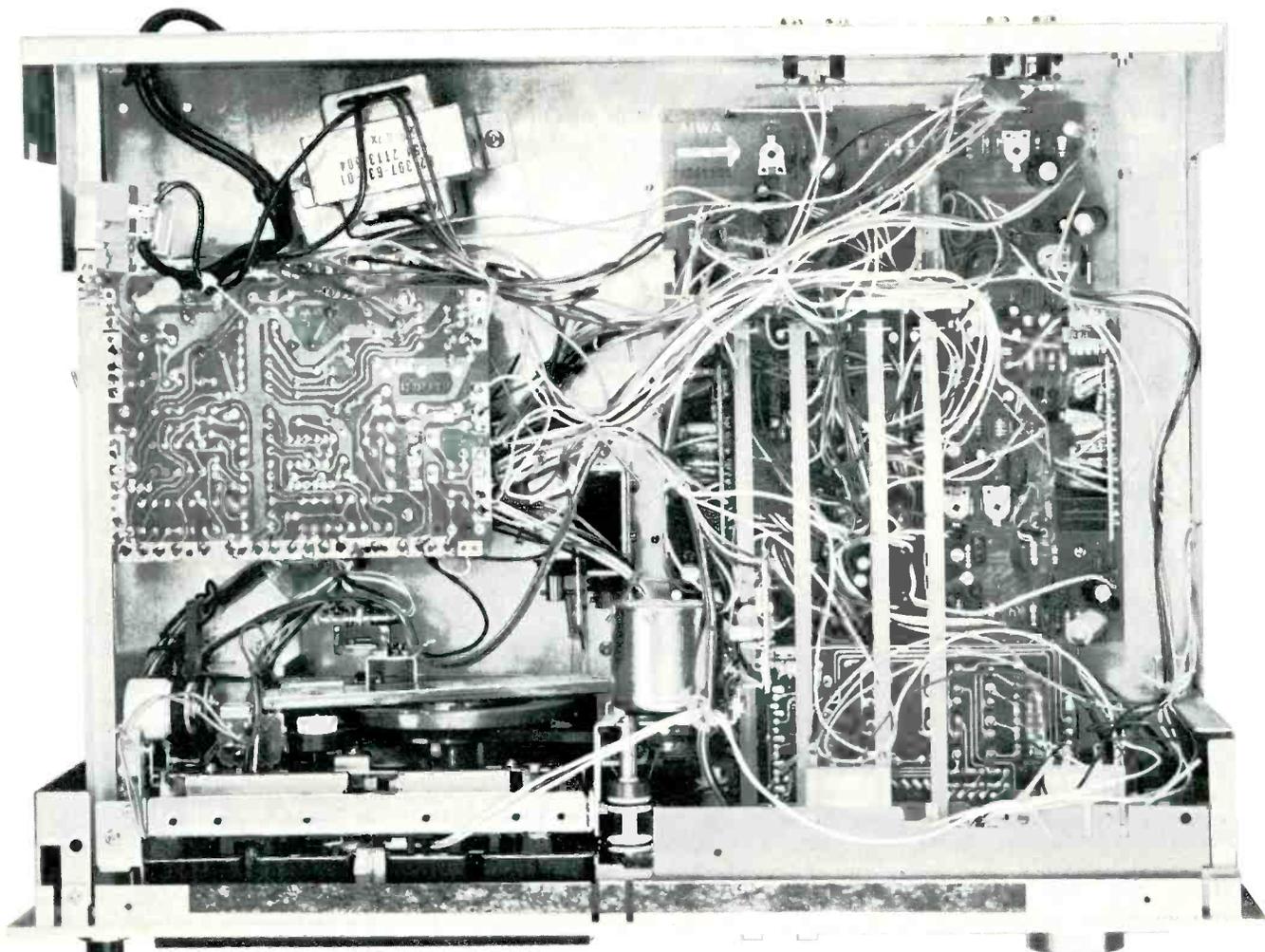
LUX Audio of America, Ltd.

160 Dupont Street, Plainview, New York 11803 • In Canada: White Electronics Development Corp., Ontario

Luxman T-4 AM/FM stereo tuner. Usable sensitivity, 10.3 dBf (1.8 μ V); 50-dB quieting sensitivity, 14.7 dBf (2.8 μ V). S/N: 75 dB. Alternate-channel selectivity, 85 dB (narrow), 40 dB (wide). THD (at 1 kHz) 0.08% (wide). (Luxman T-2, AM/FM stereo tuner, similar to T-4, less Accutouch and CLL.)

Luxman L-5 integrated amplifier. 60 watts per channel minimum continuous power into 8 ohms, 20-20,000 Hz, with no more than 0.03% total harmonic or intermodulation distortion. Damping factor: 80 at 1 kHz (8 ohms). Phono signal-to-noise ratio better than 92 dB (IHF-A ref 10 mV input). (Luxman L-3, similar, but 35 watts per channel, 20 Hz-20 kHz, 0.04% THD.)

Luxman PD-272. 12" die-cast aluminum platter with high density mat, 3.96 lbs. Detachable hinged cover, adjustable isolating feet. Separate pitch control ($\pm 4\%$), each speed. Rumble: better than 70 dB (DIN B); wow and flutter: better than 0.03% (WRMS).



faces are well illuminated and of good size, but they seemed a little "busy." Part of that impression was probably from the inclusion of the tape-time-remaining scales on the left meter, which were proven to be accurate for this purpose. The thresholds of the "+3" and "+7" indicators were within 0.5 dB with a CW signal. With very short tone bursts, the turn-on points remained substantially the same, which shows excellent design, and is not as common as it ought to be.

Tape speed was about one per cent fast, and there was no change in speed from 100 to 130 V line power. Tape speed variations and wow & flutter were measured at the beginning, middle, and end of a cassette (see Fig. 6). There were some slight variations in tape speed, but nothing ever occurred that was audible. The flutter was always lower than the specified 0.05 per cent W rms with the exception of a couple peaks at the beginning of the cassette. A typical value was about 0.03 per cent W rms, and just 0.035 per cent Wtd

Peak, superb performance for a cassette deck. Winding for a C-60 cassette took 90 seconds, on the slow side, albeit done smoothly.

Listening & Use Tests

Cassette loading and unloading was very easy with the AD-6550 deck. The accessibility for maintenance tasks was fairly good with the door open and was very good with the heavy glass cover off, easily removed by loosening two thumb screws. The fine knurling of the pots and the flats at the index points, in conjunction with the smooth rotation, gave a continuing impression of high quality. The lever action of the bias and EQ switches was quite good, and there were no miscues with the button switches. All tape motion controls worked smoothly and without any sort of failure, despite the purposeful punching around by this reviewer. It was discovered that it was possible to go directly from either



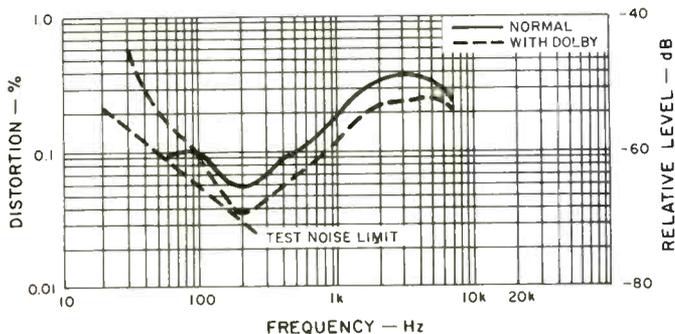


Fig. 5—Third harmonic distortion vs. frequency for normal and Dolby modes at 10 dB below Dolby level (200 nWb/m) with Scotch Master III FeCr tape.

wind mode to *Play*. It was smoothest when *Play* was pushed slowly, which automatically stopped the tape before resuming tape motion. Timer start worked as stated with use of the pause control. The LH (low-noise tape) bias control was essential in matching some of the tapes tried, and the range provided was sufficient to peak up the performance of every tape formulation checked. For the potential user who might want to try different tape types, this is one of the best features that Aiwa has included. As misadjustment of the bias control can be very detrimental, the bevel-headed knob was poked and bumped to make certain of its resistance to inadvertent changes. No changes were detected, proving the good human engineering for this function.

The text and illustrations of the instruction book were good, in general, but there should be more detail on setting

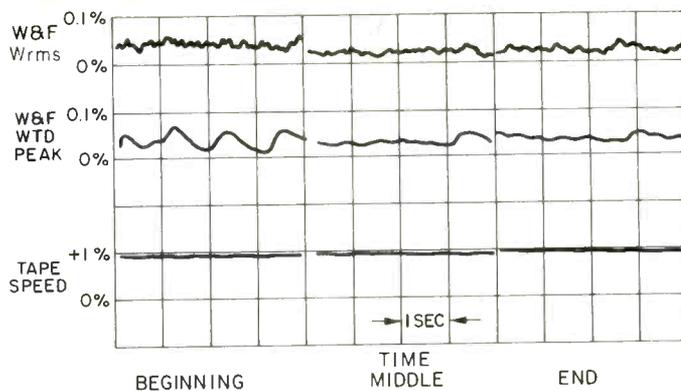


Fig. 6—Tape speed variation and wow & flutter measured at the beginning, middle, and end of a cassette.

bias. Some illustrations had a confusing layout, and there was no schematic. Recording various sources for listening tests was greatly facilitated with the VU meters and the +3 and +7 peak indicators, which emitted bright flashes even for very short transients. Record levels were set lower than originally planned, but the playback was quite noise-free in Dolby mode. At these levels, the tape saturation effects shown in the 200 nWb/m record/playback response for Scotch Master III were not apparent. The general impression was of smooth reproduction, aided no doubt by the flat frequency responses and the low flutter. It would be nice to have mike/line mixing and some things different as indicated earlier, but the AD-6550 cassette deck as it is combines excellent performance with special features of its own.

Howard A. Roberson

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CORELLI, CALINDA AND CANTATA

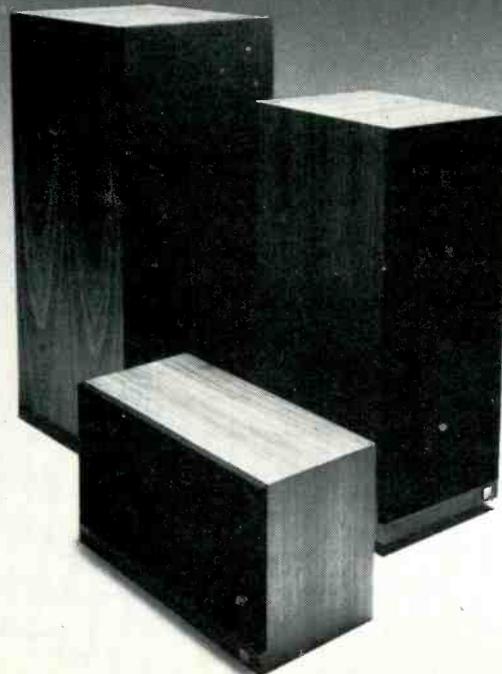
Each of these popular loudspeakers is an excellent example of the KEF total system design approach, whereby the drive units, the cabinets and the electronic circuits are developed together, using the computerised digital analysis techniques which KEF pioneered. The Corelli, designed for shelf mounting, offers remarkable bass performance and surprisingly high power handling from such a compact system. The Calinda and Cantata are tall, elegant floor-standing loudspeakers with a special arrangement of the drive units which give a truer frequency response, greater clarity and a sharper stereo image than any previous speakers of comparable size.

And because we make all our own drive units, we can offer a consistency in manufacture and performance which is unrivalled in the Hi-Fi industry.

Write for literature and the name of your nearest dealer.

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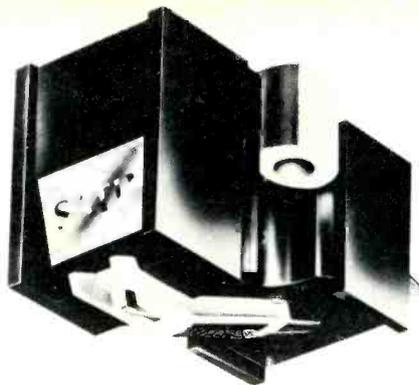


Enter No. 31 on Reader Service Card

Satin M-18BX Moving-Coil Phono Cartridge

MANUFACTURER'S SPECIFICATIONS

Type: Moving coil.
Stylus: Diamond, 0.1 x 2.5 mils (Shibata).
Cantilever: Beryllium.
Tracking Force: 0.5 - 1.5 grams.
Output Level: 1.2 mV \pm 2 dB at 1 kHz (5 cm/sec rms 45°).
Frequency Range: 10 Hz - 40 kHz.



Crosstalk at 1 kHz: 30 dB.

Impedance: 16 ohms.

Load Impedance: 30 to infinite ohms.

Compliance: 20 x 10⁻⁶ cm/dyne.

Weight: 9.5 grams.

Replacement Stylus: 18-NBX.

Price: \$350.00.

U.S. Distributor: Osawa & Co. (U.S.A.), Inc., 521 Fifth Ave., New York, N.Y. 10017.

Satin Co., Ltd., of Kyoto, Japan, introduced the first moving-coil cartridge that did not require a pre-preamp or a transformer, but instead could be inserted directly into the phono input jacks of most preamps. The Satin cartridge is a true moving-coil cartridge without the use of rubber or iron in its construction. Only the coil oscillates in the magnetic field. The cantilever pivot is fixed at one point (similar to that in a cutting head), and the cantilever does not rotate around its axis.

The amount of voltage produced by a moving-coil cartridge is wholly dependent on the size of the coil, the strength of the magnet, and the travel distance of the coil in the magnetic field. The Satin M-18BX has an aluminum ribbon coil (pancake form) made from an extremely thin aluminum ribbon which permits more turns of aluminum wire in a limited space. This also brings the weight of the coil to a relatively low level. This very light coil moves in a 250-micron gap in which the anisotropic Alnico 9 magnetic structure concentrates a magnetic flux density of 15,000 Gauss (average magnetic flux density in a moving-coil cartridge is about 2000 Gauss). The amount of coil movement is controlled by an electro-dynamic damping system.

The current Satin M-18BX cartridge has been improved over the version originally available. The improvement consists of a continuous outer ring-loop of beryllium-copper alloy surrounding the aluminum ribbon coil, which loop is grounded so as to act as a shorted turn to increase damping of the high frequencies, thus reducing the brightness. This feature is known as electromagnetic damping.

It is a rare moving-coil cartridge where the user can replace the stylus assembly without returning the cartridge to the factory for this work. The Satin M-18BX stylus assembly is held in place by a magnetic force, thus permitting easy replacement of the stylus assembly by the user.

This cartridge is designed to work into a load impedance ranging from 30 ohms to infinity. This low impedance is advantageous because it permits the use of longer phono cables and cable capacitance is less critical.

The body of the Satin M-18BX is physically large and cannot be mounted in a universal cartridge shell, such as the Audio-Technica Model AT-N, because there is no room to move the cartridge forward when adjusting the cartridge for correct overhang. However, the cartridge mounts easily in

the Technics cartridge shell whose front lip is about 3.5 to 4 mm high.

The cartridge pins are smaller than usual, thus it is necessary to either pinch the existing shell jacks to a smaller opening or replace the four wires with those supplied with the cartridge. Otherwise, the original shell wire jacks will be too loose for effective contact.

It is advisable, because of the heavy magnetic flux, to use turntables whose platter is made of nonferrous metal, otherwise the ferrous platter will pull down on the cartridge, resulting in a greater and uncontrolled tracking force.

As is our practice, measurements are made on both channels, but only the left channel is reported. During the test period, the average temperature was 74° F \pm 1° (23.3°C) and the relative humidity 71 per cent \pm 3 per cent.

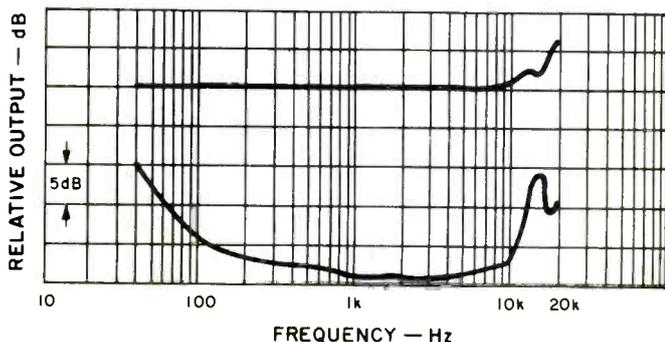
Frequency response, using the Columbia STR-100 test record and our reference tone arm, an Audio-Technica AT-1009, mounted on a Technics SP-10 turntable, is flat within 1 dB from 40 Hz to 7 kHz, rising slowly to +7 dB at 20 kHz. This peak is probably due to the tip mass resonating with the compliance of the test-record vinyl. Checking the 20 to 40 kHz response, we noted that there was sufficient rise at 30 kHz to work efficiently with a CD-4 demodulator for CD-4 record playing. Since CD-4 is in a quiescent state, we did not investigate this aspect of the cartridge. Separation over the audio range was quite good, being 24.25 dB at 1 kHz, 23 dB at 10 kHz, 15 dB at 15 kHz, and 20.5 dB at 20 kHz. The optimum tracking force for the cartridge we tested was 1.4 grams and the optimum anti-skating force was 2.25 grams. Because of its low impedance, capacitance appeared to have no noticeable effect. Square waves show a very fast rise time and a single cycle of substantial overshoot that quickly dies out, leaving a reasonably good square wave. The square wave indicates that there is a high frequency resonance of about 30 kHz.

There are a number of preamplifiers available today that do not have enough phono input sensitivity to be able to accept the rather low voltage (0.78 mV or 780 μ V) from the Satin M-18BX. In such instances, we recommend the use of the Verion Type-S step-up transformer to supply the necessary voltage for the phono input stage. We have tested this combination and find it to be superb, with no apparent loss of sound quality. We have found the Verion transformer to be one of the best cartridge transformers available today.

The following test records were used in making the reported measurements: Micro-Acoustics TT-2002; Shure TTR-103, TTR-109, TTR-110, TTR-115; Columbia STR-100, STR-112, STR-120, SQT-1100, JVC TRS-1005, TRS-1007; Deutsches HiFi No. 2; Nippon Columbia Audio Technical Records (PCM) XL-7004-6.

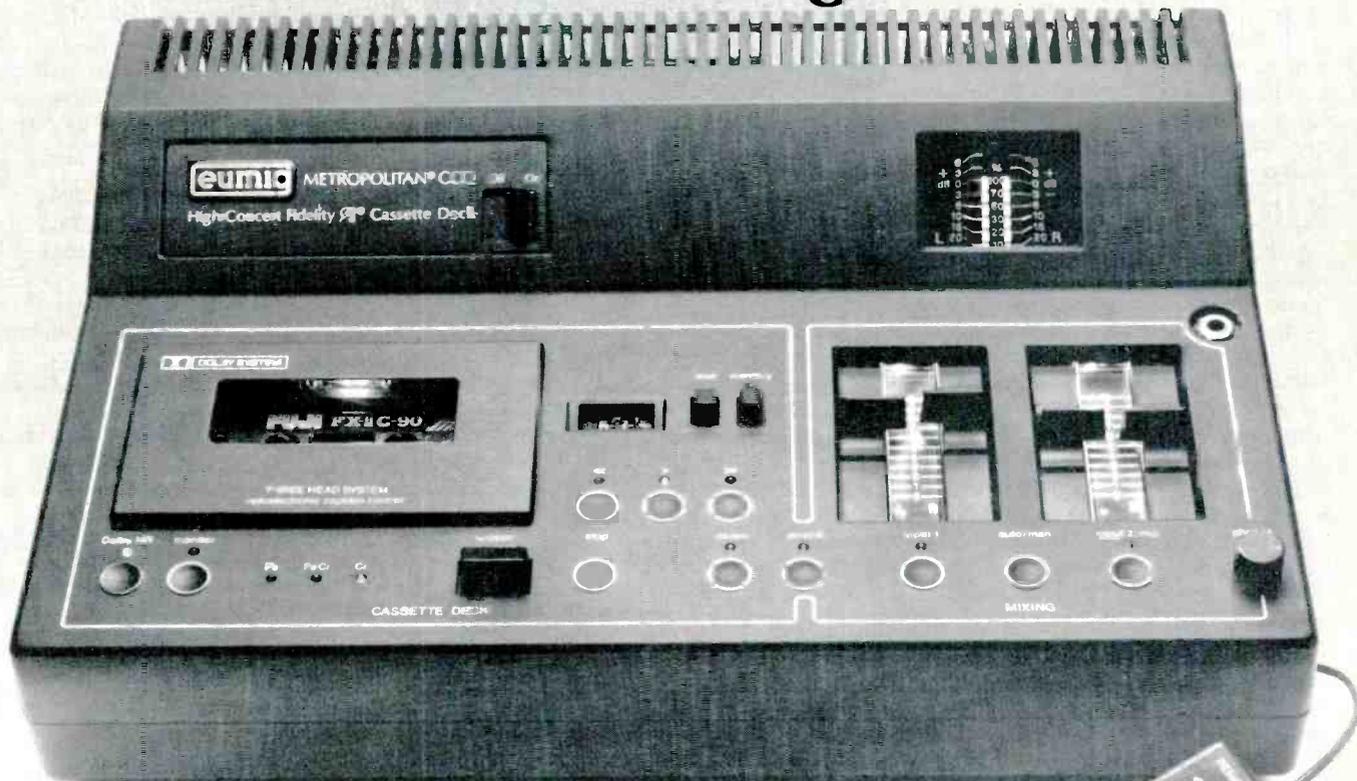
Wt. 9.39 g; d.c. res. 14.75 ohms; ind. 9.3 μ H; opt. tracking force 1.4 g; opt. anti-skating force 2.25 g; output 0.22 mV/cm/sec; IM dist. (4:1) + 9 dB lateral, 200/4000 1.1 per cent, +6 dB vertical, 200/4000 3.2 per cent; crosstalk (using Shure TTR-109) -30 dB; ch. bal. 0.5 dB; trackability: high freq. (10.8 kHz pulsed) 30 cm/sec, mid-freq. (1000 + 1500 Hz lateral cut) 25 cm/sec, low freq. (400+4000 Hz lateral cut) 24 cm/sec;

Fig. 1 — Frequency response and separation.



The Eumig CCD.

Opto-electronically engineered for absolute recording excellence.



Eumig, one of the world's leaders in electro-mechanical research and development, has introduced a revolutionary new technology to cassette recording. It's the OPTO-ELECTRONIC SERVO CAPSTAN DRIVE SYSTEM incorporated in the unique Eumig CCD. This technology offers so many advantages that the Eumig CCD will out-perform every other cassette transport.

Ultra-Precision: The unique Eumig photo disc

Other decks use old-fashioned belts and flywheels to control the capstan. In the Eumig design these are replaced by a lightweight disc, photo-etched with 2500 radii, spaced precisely 1/50mm apart. When rotated, these radii create 15,000 pulses per second for instantaneous optically-sensed speed corrections. Wow and flutter is a mere 0.05% WRMS, and speed accuracy is $\pm 1\%$.



The Eumig photo disc weighs about 1/70th as much as a typical flywheel. When combined with an almost inertia-free, coreless drive motor, the CCD offers a startup time of less than 0.04 seconds, which means you never hear the wowing sound after a pause in recording. And the CCD boasts the fastest rewind time in the world—an astonishingly low 40 sec. (C-60).

Rugged reliability

The Opto-Electronic Servo System is only one among many dramatic advantages of the Eumig CCD. It offers three precision heads of our own design, mounted in a die-cast aluminum carrier made at our own facilities (as are virtually all parts of the CCD), for greatest precision. The Eumig CCD is engineered

with circuit boards rather than wires, for utmost reliability.

Advanced technology features

The comprehensive features of the CCD reflect Eumig's innovative technological approach. Two parallel LED displays allow simultaneous monitoring of both channel levels. Full solenoid/MOS logic is operated by feather-touch controls with logic-programmed LED indicators, and the flexible two-input mixing facilities use strictly DC controlled circuitry.

Perfect recording every time

Perfect performance is guaranteed with every type of tape because the Eumig CCD offers virtually flat frequency response to 20,000Hz (chrome); Dolby calibration adjustment for different tape sensitivities; and an azimuth adjustment to optimize high frequency performance with each and every tape.

The Eumig CCD, probably the finest deck in the world, is now available for \$1300, including full-function remote control, at select audio outlets throughout the country. Write to us for the name of the dealer nearest you. Then listen and compare. We believe you'll agree—it's incomparable.

Eumig (USA) Inc., Lake Success Business Park, 225 Community Drive,
Great Neck, New York 11020, (516) 466-6533

Enter No. 22 on Reader Service Card

Deutsches HiFi No. 2 300-Hz test bands tracked to 86 microns (0.0086 cm) lateral at 16.20 cm/sec at +9.66 dB level and 55.4 microns (0.00554 cm) vertical at 10 cm/sec at +5.86 dB level. Arm-cartridge resonance +4.25 dB at 6.8 Hz.

The Micro-Acoustics TT-2002 test record was used to check for tracking and transient ability. The Satin M-18BX cartridge had no difficulty in playing all tracking ability bands, including one with the highest level a modern stereo cutter head can record. However, the sound of a small bell appeared to be a bit too bright. The stereo percussion levels check the cartridge for both vertical and lateral tracking ability. The computer-generated high, low, and high/low mixed frequencies presented no problem to this cartridge in terms of transient ability.

The Shure Audio Obstacle Course Era III was a challenge inasmuch as the musical bells were tracked only to level 4 (+10 dB), after that the definition was lost. The violin became strident after level 4. Both the sibilance and bass drum tests were passed at all levels without difficulty. With the newer Shure Era IV Obstacle Course, the Satin M-18BX cartridge sound became strident with some breakup apparent at level 5 (+12 dB) for the bells, flute, and harp and flute. The sound lost definition after level 3 (+8 dB) of the flute and bells, but passed the harp bands at level 5. These results indicate that the Satin M-18BX cartridge is able to track just about any record and that it has a good transient response.

Listening Tests

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Our listening tests are performed both prior to actual laboratory tests and after all tests have been completed. When we first listened to the Satin M-18BX cartridge, we were amazed at the transparency that caressed our ears — truly unexpected. This was one of the most transparent sounds we have ever heard. Sonic clarity was excellent, as was the bass response. Even on extended listening, the cartridge still did not appear to impart sound or coloration of its own to the music.

The cartridge has a rising high end, as seen in the frequency response curve, and in view of this, we would caution users about combining the cartridge with speakers having an extended or rising high frequency response. However, we did not experience too bright a sound in our listening tests.

Records that are moderately to highly warped may be difficult to play since the cartridge has a very small clearance between the record and the cartridge body and, of course, cyclic rubbing of the cartridge and record can be quite annoying.

Cueing this and many other cartridges is difficult because the stylus tip is not readily visible. The record listening public would be ever grateful to the cartridge manufacturers if they would all mold an easily visible vertical center line on the front of the cartridge as well as on the head shell front. This line would assist in centering the cartridge on the shell and, most importantly, would be helpful in placing the non-visible stylus in the correct groove or band space when playing a record beyond band one.

The equipment used for the listening evaluation included a Technics SP-10 turntable with the Audio-Technica AT-1009 tonearm, Technics SP-10, Mark II turntable with its EPA-100 tonearm, Crown IC-150A preamplifier, a pair of Crown DC-300A amplifiers, each used in the monophonic mode, a pair of stacked Duntech DL-15B speakers for each channel, and a Columbia SQL-400A SQ decoder. A Platter Pad was used on one turntable, and the speakers were connected to the amplifiers with Polk Audio high definition, low distortion speak-

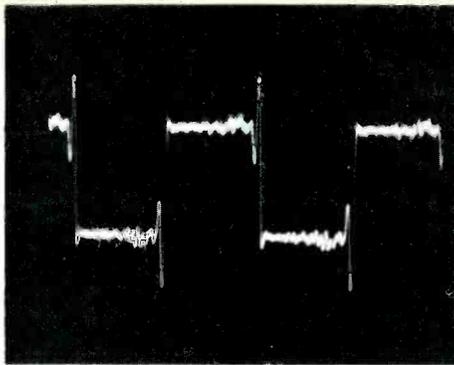


Fig. 2 — Response to 1-kHz square wave.

er cables terminated with an RC network.

A rigorous listening evaluation was conducted utilizing the specific records listed below as well as some of the records listed in previous reports. The records in themselves are excellent and were chosen to evaluate the capabilities of the Satin M-18BX cartridge to reproduce all manner of recorded sound as well as high levels without adding anything of its own to the music.

Stereo

Walter Carlos: *Switched On Bach* — Columbia MS-7194.

Pavarotti: *Hits from Lincoln Center* — London OS-27577.

Elgar: *Violin Concerto*, Chung, London Philharmonic Orchestra, Soli — London CS-7064.

Brahms: *Symphony No. 3 in F. Major, Variations on a Theme of Haydn*, The Cleveland Orchestra, Maazel — London CS-7095.

Liszt: *Les Preludes; Prometheus; Festklänge, Vol. 2*, London Philharmonic Orchestra, Solti — London CS-7084.

Stravinsky: *Oedipus Rex*, London Philharmonic Orchestra, Solti — London OSA-1168.

Direct to Disc

Lee Ritenour: *Gentle Thoughts* — JVC Direct Disc V1DC-1-E.

Lee Ritenour: *Sugar Loaf Express* — JVC Direct Disc V1DC-2.

(Both the above are super direct-to-disc recordings that should be heard by all audiophiles. They are available at most major record stores as well as audio stores.)

Virgil Fox: *The Fox Touch, Vol. 2* — Crystal Clear CCS-7002.

The Third: *Take the A Train* — Toshiba LF-95001.

Vivaldi: *Vivaldi Tricentennial* — Sonic Arts Laboratory Series No. 8.

Mozart: *The Joy of Mozart* — Sonic Arts Laboratory Series No. 9. (The above three discs are distributed by Audio-Technica.)

Quadraphonic — SQ

Chicago: *Chicago VIII* — Columbia PCQ-33100.

Earth, Wind & Fire: *Spirit* — PCQ-34241.

Anthony Newman: *Organ Orgy* — Columbia MQ-33268.

Pulse Code Modulation

Le Gallard: *Les Clavecinistes Francais* — Denon OG-7003-ND.

Invitation to the Pop Classical Music, Vols. 1 & 2 — Denon SX-7004/5.

Digital to Analog

Holst: *Suites Nos. 1 & 2*; Handel: *Royal Fireworks Music*; Bach: *Fantasia in G*, The Cleveland Symphonic Wings, Fennell — Telarc Digital 5038. (Although this is not the first digitally recorded symphony, this disc, which is being distributed by Audio-Technica, is the first to be released commercially; Crystal Clear was the first commercial company to record a symphony digitally and used the Stockham/Soundstream system. This is a good digital-to-analog recording, with only a few nits to pick — a lack of some highs, the bass drum tuned too high at 36 Hz, and some coarseness to the sound. However, in general, there is some great sound on this disc and, in particular, the impact of the bass drum is very good.)

Conclusion

Anyone desiring a moving-coil phono cartridge without the expense of a pre-preamp, head amp, or a step-up transformer (so long as their preamp has sufficient sensitivity), should seriously consider obtaining the Satin M-18BX for inclusion in their audio system.

B. V. Pisha

Enter No. 95 on Reader Service Card

Optonica ST-3636 AM/FM Stereo Tuner



MANUFACTURER'S SPECIFICATIONS

FM Tuner Section

IHF Sensitivity: Mono, 1.6 μ V (9.3 dBf)

Selectivity: Wide, 35 dB; Narrow, 80 dB.

Capture Ratio: 2.0 dB.

AM Suppression: 50 dB.

S/N Ratio: Mono, 75 dB.

Image Rejection: 120 dB.

I. f. Rejection: 110 dB.

THD: Wide, Mono, 0.1 per cent; Stereo, 0.15 per cent at 1 kHz; Narrow,

Mono, 0.2 per cent; Stereo, 0.3 per cent at 1 kHz.

Stereo Separation: 45 dB at 1 kHz.

AM Tuner Section

Sensitivity: 250 μ V/M, internal antenna.

Image Rejection: 60 dB.

I. f. Rejection: 60 dB.

THD: 0.7 per cent.

General Specifications

Audio Output Voltage: FM, 0.65 V fixed, up to 1.2 variable; AM, 0.25 V fixed, up to 0.46 V variable.

Dimensions: 17.4 in. (44.2 cm) W x 5 $\frac{5}{8}$ in. (14.3 cm) H x 14.7 in. (37.3 cm) D.

Weight: 18 $\frac{3}{4}$ lbs. (8.5 kg).

Price: \$300.00.

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Optonica's Model ST-3636 is one of the lowest priced tuners currently available that features selectable i.f. bandwidth in its FM section, not to mention incorporating an unusually fine AM section compared with what's generally available in high fidelity tuner and receiver components. As a basic design, the tuner comes very close to being an "ideal" product in its price category.

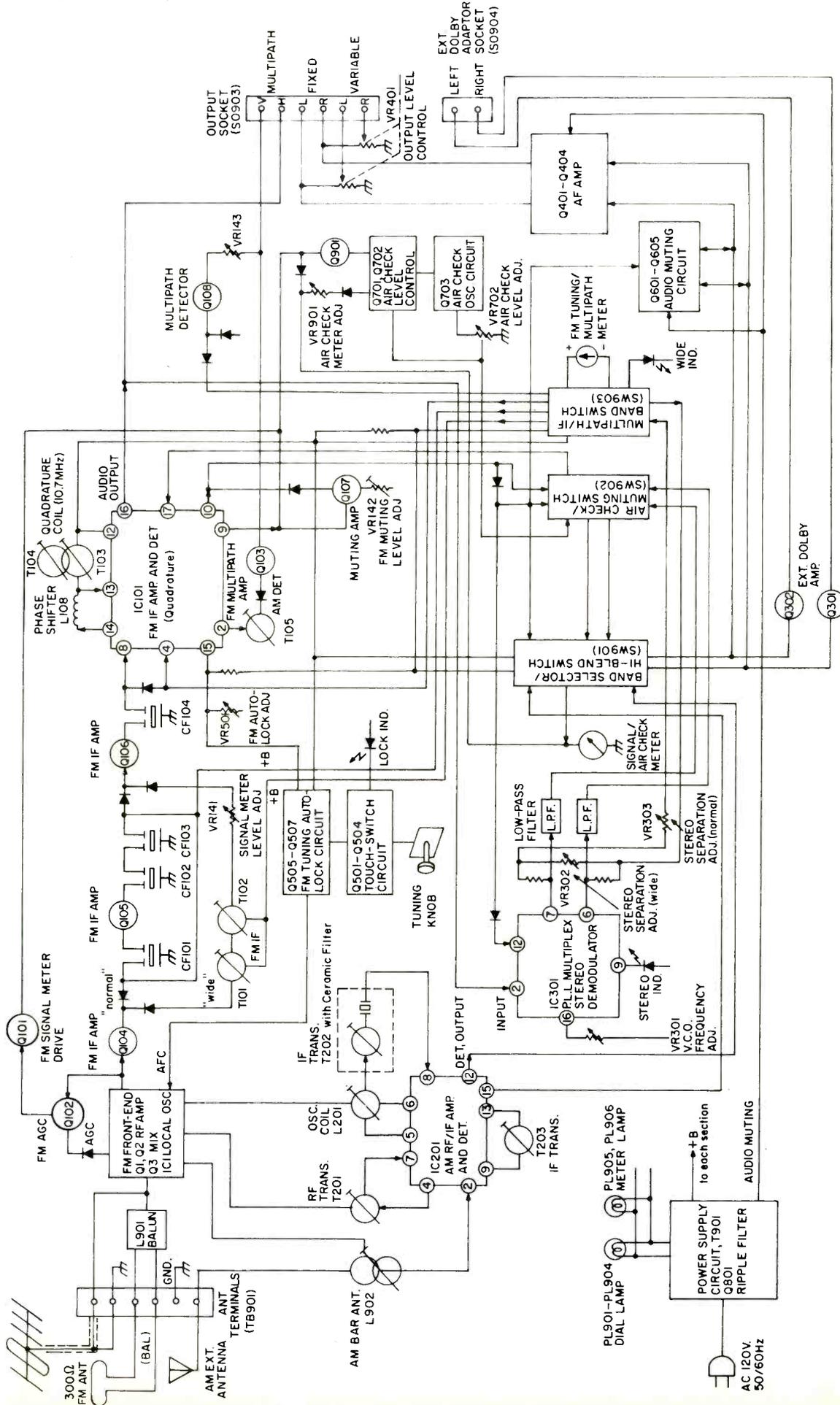
The simple, clean look of the front panel is suggestive of a high-quality component. Twin meters are separately framed and illuminated on the lower portion of the panel below the dial scale opening. Each meter serves a dual purpose... the signal-strength meter doubles as a modulation meter when

the built-in air-check test tone is activated, enabling the user to preset recording levels on an associated tape deck, while the center-of-channel meter doubles as a multipath indicator.

Controls to the left of the meters include a power switch and an output level control. A large flywheel-coupled tuning knob is to the right of the meters and two toggle switches are to the right of it. The first switch selects "normal" or wide-band operation of the i. f. section and also selects the "multipath" mode of the meter. When this setting is used, it is possible to monitor multipath audibly in addition to observing its minimization on the meter as the antenna is rotated.



Fig. 1—Block diagram of the Optonica ST-3636 tuner.



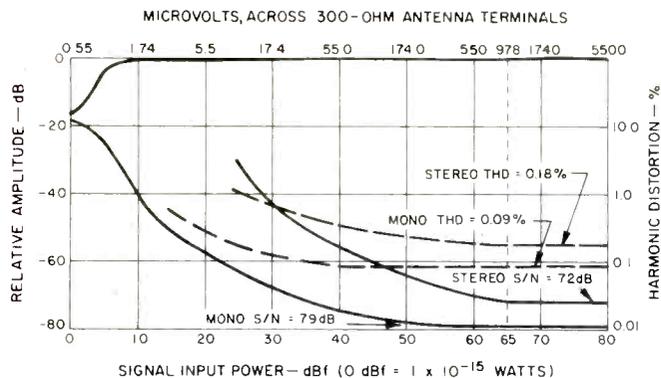


Fig. 2—Mono and stereo quieting and distortion characteristics in the FM section.

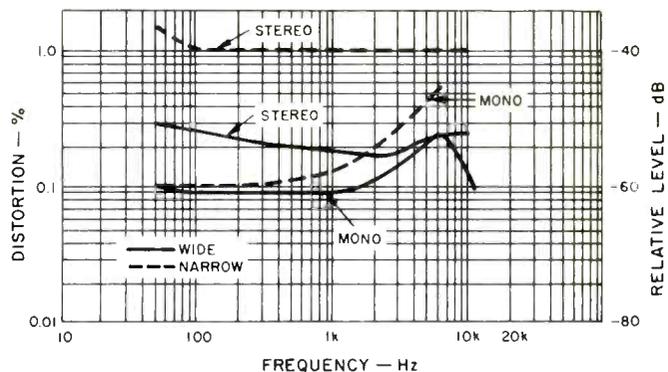


Fig. 3—Distortion vs. frequency.

The second toggle switch turns muting *On* and *Off* and activates the internal air-check test tone. A selector switch at the extreme right has settings for *AM*, *FM*, *FM-high-blend*, and *FM mono*.

The dial area on the ST-3636 is fairly narrow and numbers are set behind the front dial "glass," requiring a shoulder- or head-height installation for easiest observation of the dial

frequencies. The FM frequencies are linearly calibrated. The dial area also contains three indicator lights, one for stereo reception, one for denoting "wide band" i.f. mode (when it is selected), and one for "opto-lock" tuning, an AFC-like feature which is non-defeatable (except when holding onto the tuning knob).

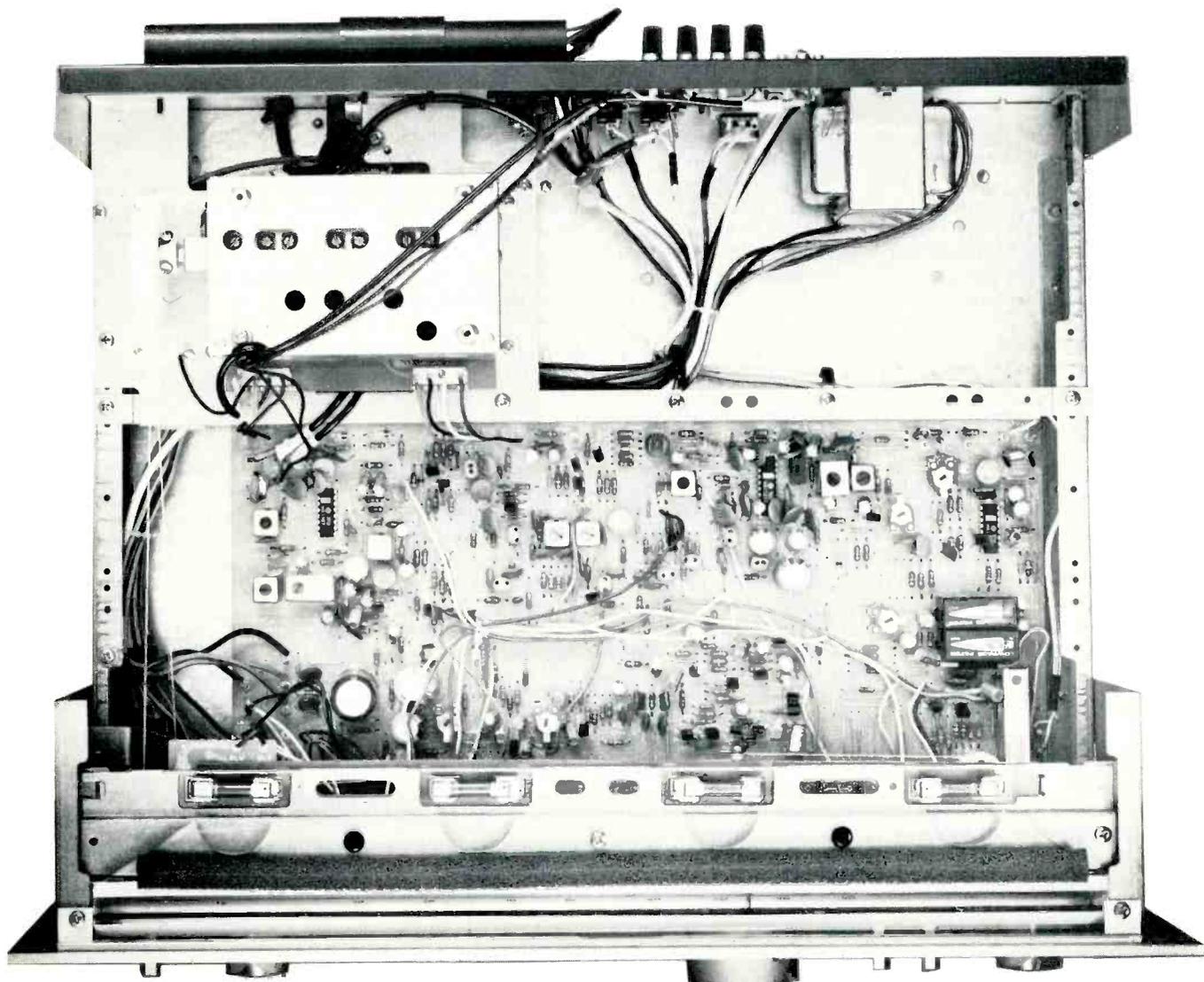


Fig. 4—Frequency response and channel separation in the FM wide-band mode.

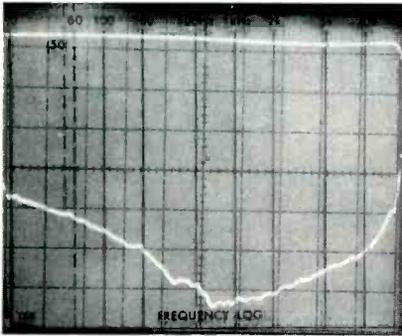


Fig. 5—Frequency response and channel separation in the FM narrow-band mode.

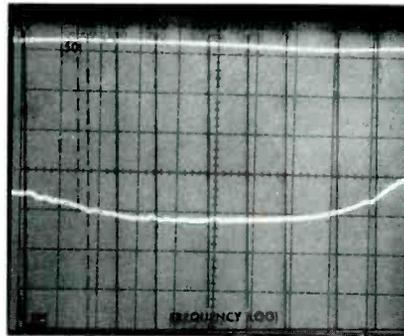
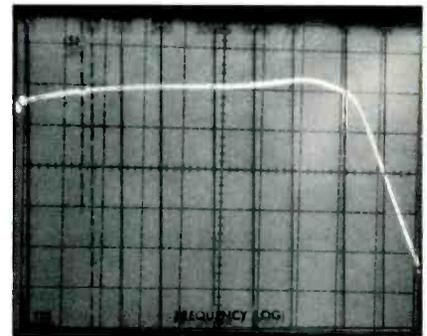


Fig. 6—AM frequency response.



Circuit Details

A block diagram of the ST-3636 circuitry is shown in Fig. 1. The front-end section consists of three dual-gate MOS-FETs and one integrated circuit used for the local oscillator. The i.f. amplification is accomplished by three transistors. In the wide i.f. position, double-tuned transformers are used with one ceramic filter to set i.f. bandwidth. In the narrow setting (normal), four ceramic filters are used to increase selectivity and narrow the pass band. Diode switches are turned *On* or *Off* by means of the front-panel, bandwidth-selector switch to determine which of the two signal paths will be followed.

The FM-detector circuit employs a quadrature detector IC, which also provides further amplification and limiting (IC-101 in Fig. 1). IC-301 is the multiplex decoder which includes a phase-lock-loop circuit. Outputs from the decoder are passed through a low-pass filter to eliminate or reduce sub-carrier products. Signals are then passed through buffer/amplifier stages, Q-401 and Q-403, prior to their application to the fixed and variable output terminals of the tuner.

FM Performance Measurements

The graphs in Fig. 2 show quieting and distortion characteristics of the ST-3636 when operated in the "wide" mode. Signal to noise measured 79 dB in mono and 72 dB in stereo, while usable sensitivity was $1.8 \mu\text{V}$ (10.3 dBf) in mono and $7 \mu\text{V}$ (22.1 dBf) in stereo. The 50-dB quieting point was reached with input signal levels of $2.7 \mu\text{V}$ (13.8 dBf) in mono and $37 \mu\text{V}$ (36.6 dBf) in stereo. Distortion, for a 1-kHz test signal, was 0.09 per cent in mono and 0.18 per cent in stereo.

When we attempted to repeat these measurements in the "normal" or narrow setting we realized that this particular unit was somewhat misaligned. So long as we kept our fingers on the tuning knob, we were able to keep stereo THD down to around 0.18 per cent in the "narrow" mode. When we let go of the knob, THD increased to around the 1.0 per cent level. Obviously the "opto-lock" circuit was misaligned with respect to the quadrature detector in our particular sample, and unfortunately, there is no way to defeat this feature unless one holds onto the tuning knob. While we would have expected some increase in THD when using narrow band i.f. setting, this amount of increase was not caused simply by the restricted bandwidth, though we expect this difficulty is not basic to the tuner's design. This experience also serves to show that with a wide band i.f. system, slight detuning (caused by the "opto-lock" AFC circuitry) is not as serious as it is in the case of a narrow-band system. Figure 4 is a plot of frequency response and stereo separation in the "wide" mode and is excellent across the entire audio band of interest (more than 50 dB at 1 kHz). In the "normal"

bandwidth mode, separation decreased, as might be expected, and results are shown in Fig. 5. Under these test conditions, separation at 10 kHz measured 32 dB but again, by holding onto the tuning knob and retuning for optimum, we were able to increase this separation reading to 36 dB.

Stereo threshold was set at $7 \mu\text{V}$ (22.1 dBf), while muting threshold was measured as $9.0 \mu\text{V}$ (24.3 dBf). Selectivity, in the wide mode, measured 83 dB, while in the narrow mode it was exactly 35 dB as claimed. Capture ratio measured 1.0 dB in the wide mode, decreasing to 2.2 dB in the narrow mode. The i.f. and image rejection were both better than 100 dB. Overall frequency response from 30 Hz to 15 kHz was flat within ± 0.5 dB.

AM frequency response was exceptionally good on this tuner, particularly in this price class, and is indicated in the 'scope photo of Fig. 6. It was within ± 2 dB from 50 Hz to 6 kHz, most unusual for a high-fidelity AM/FM tuner. Listening tests to the AM section confirmed its superiority over other AM tuner sections recently tested.

Use and Listening Tests

Our FM listening tests were confined to the wide-band mode. In that mode, reception quality was quite good, though the tuner's rather low AM suppression, made it mandatory that our antenna be properly oriented for minimum multipath interference. Once that is done, reception quality is indistinguishable from that of tuners costing considerably more than this one. In the owner's manual, we were advised to adjust the built-in air-check tone so that it indicated "60 per cent modulation" on the associated meter and to then adjust our connected tape deck for "OVU" indications on its meters. We found that with most programming this arrangement worked well and allowed us to make recordings from FM stations that nicely fit between the "noise floor" and "tape saturation" levels of our tape equipment. This is a handy feature that eliminates the usual scramble for the record level controls when one begins to record an FM program where levels almost always come as a surprise.

Properly set up, Optonica's "opto-lock" tuning circuitry does go a long way towards making tuning idiot proof, though the sample we tested was not able to deliver all of the excellent performance of which this tuner is capable. It is believed that our sample is the exception that proves we testers are not usually supplied specially selected sets, and we feel that quality control and alignment of all those other Optonica ST-3636s is better than what was applied to our test sample. It should further be pointed out that even with the misalignment, the unit was delivering very high levels of performance in many areas.

Leonard Feldman

Michael Tearson

Jon Tiven

The Column



Who Are You: The Who
MCA 3050, stereo, \$7.98.

The afternoon **Who Are You** arrived at the radio station I was filling in on the afternoon shift and they told me to do with the album as I saw fit, so I played it straight through. For about two weeks the advance single *Who Are You/Had Enough* had been monopolizing air time unmercifully, a dazzling, tantalizing sneak that kept expectations for the album rising like broken thermometers. Suffice to say, the album instantly fulfilled them.

With the passage of time it sounds no less monumental, even though it has been a turbulent month since the disc's release. Drummer Keith Moon, the living embodiment of the lunatic Who spirit, is dead. On the album's cover the chair he's sitting in says: "Not To Be Taken Away" on it. The four of them look so old and tired in the picture, and the loss of Moon seems so sudden and stupid. But, the album is still a mother . . . rock and roll of mythic proportions.

As usual Glyn Johns is coproducer, this time with engineer Jon Astley. They have lavished it with a classic Who sound, very reminiscent of **Who's Next** and **Quadrophenia**, but bigger. This is especially true following the flaccid **Who By Numbers**, for which **Who Are You** is a sweet vindication. The most obvious new element is Peter Dinklage's growth on synthesizers, which wash over the album like waves, often to superb stereo effect. These effects work equally well

through speakers or headphones, creating a strong cinematic sense.

The album opens with *New Song* which sets the album's tone at the outset. In it Townshend writes "I write the same old song with a few new lines/And everybody wants to hear it," and this is true throughout the album.

Who Are You really breaks no uncharted ground, instead it's just a recycling and updating of The Who. The sound in the hands of its creators works just like it's supposed to. The material is strong and proud. Townshend knows just what he's doing in *New Song* and its mirror image *Music Must Change*. His *Sister Disco* relates how the standard Townshend hero, the kid with the big chip on his shoulder, gets into a fight and splits . . . a glorious song. But nothing tops *Who Are You*, the song is an anthem. Every time I hear it, I still get chills that very few songs can give me.

Bassist John Entwistle's contributions are no less impressive. *905* is a timely and witty piece about test tube babies. *Had Enough* is every bit the match for *Who Are You*, even angrier and more hostile — "I've had enough of being nice" — it ripples with strength. Clearly weak material, a plague on **Who By Numbers**, is no problem here.

Looking ahead, Peter Dinklage has stated that The Who will go on with different drummers, that this is the way Keith would want it . . . but it can't and won't be the same. By circumstance alone, **Who Are You** is an

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era's end. It is an album for the ages from one of the only two serious contenders for the title of "World's Greatest Rock and Roll Band." M.T.

Sound: B+ Performance: A+

Cats On The Coast: Sea Level
Capricorn CPN 0198, stereo, \$7.98.

Sea Level, the core of which was made up of three members of the former Allman Brothers band, now stands independent of that past association. When the Allmans broke up in the Spring of '76, Sea Level formed with non-Allman Jimmy Nalls, on guitar and Allman, Jai Johnny Johanson on drums, Lamar Williams on bass and keyboardist Chuck Leavell giving the band its dominant musical direction. He has guided them away from Southern boogie towards jazz in a manner that has been exciting, rather than painful, for former fans.

Along the way, Sea Level has gathered a slew of new devotees and, in the past year, three new players — Randall Bramlett on keyboards, saxophone and vocals; Davis Causey on guitar, and George Weaver on drums (Jai Johanson, after 20 years on the road, has taken a leave of absence to spend more time with his family). Without breaking stride, the new members

have easily integrated their individual styles into the group's.

The unit is now complete and, it follows, so is their musical identity. Where the sound of the first album was a bit thin, **Cats On The Coast** has a richer sound, but like the last album, their music is fresh and filled with a vitality so real that it can almost be touched.

Storm Warning is Leavell at his best. The instrumental suite is a jazz-influenced boogie borne on a magnificent free-flowing melody. The other instrumentals on the album are nearly as impressive. The title cut and especially *Midnight Pass* allow the band room to stretch out. Randall's sax solos shine, and often Davis and Jimmy, who are recorded on separate channels, sound as if they are one exceptional player instead of two.

While Chuck writes most of the instrumentals, Randall and Davis carry off all but one of the remaining songs. The opening cut, *That's Your Secret* is a standout.

In an age when goods are manufactured in a slap-dash manner, it's refreshing to hear a group that understands the value of attention to detail. It shows both in their music and even the liner notes which are readable and easy to understand.

Stewart Levine's production is impeccable. There doesn't seem to be a sound not intended, and the clarity of the individual voices is exceptional.

The complexion and makeup of Sea Level have changed in the last year, but thankfully the level of musicianship and music has not.

Janet Melaragni

Sound B Performance: A+

Don't Look Back: Boston
Epic FE 35050, stereo, \$7.98.

Double Vision: Foreigner
Atlantic SD 19999, stereo, \$7.98.

Caravan To Midnight: Robin Trower
Chrysalis CHR 1189, stereo, \$7.98.

Between these three records you've probably got more sales than on Bob Dylan's last ten albums put together — that's speaking conservatively. Boston and Foreigner pride themselves on shipping two million copies of each record the day of release, but unfortunately I must pronounce both of these albums D.O.A. (dead on arrival), passionless exercises of high amplification and adolescent trade-my-lust-for-yours lyrics. Although Foreigner is by far the better group and actually has composed two decent songs on their new meal ticket, neither one of these groups would be missed had they nev-

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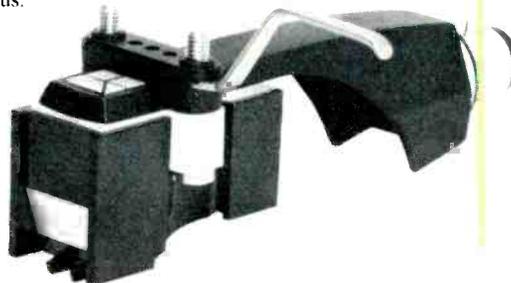
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er existed or merely been ignored by the public. Everything they have to contribute is merely an echo of Free, Led Zeppelin, Queen, The Yardbirds, and The Vanilla Fudge, and young musicians looking for someone to emulate certainly will find these two wanting of substance. Mr. Trower, on the other hand, is just beginning to get beyond his Hendrixian leanings and is actually playing in a mildly original style which combines Seventies technology and the feel of Memphis Soul Music.

But it's only fair to attack these records individually, so let's start with Boston, the sitting ducks. Their songs are almost universally awful, their stupidity undeniable as you survey their lyric sheet, and every guitar solo leader Tom Scholz plays should be footnoted (his steal for the single comes from Jimmy Page's *Happenings Ten Years Time Ago*). The new album sounds even more mechanized than the last, but I suppose that it's hard to keep one's humanity and humility when success comes too soon. As with their last album, most of these songs would seem to have been written years ago, and instead of aging gracefully, they all sound like vinegar, with the possible exception of Brad Delp's *Used To Bad News* which seems a cut above the rest of the tunes. After seeing the

band live, I can only add that if there is even a trace of artistry on their records, it is completely gone by the time the floodlights hit, where these studio "Wizards" seem like fish out of water, each racing through his bit as quickly as possible without concern for what anyone else is playing.

Next on the bill is Foreigner, who resemble a band (they have a drummer who can keep a beat, for starters) and are seasoned veterans of the rock circuit. Mick Jones bashed his brains against 10,000 seaters with *Spooky Tooth*, Lou Grammatico was part of a blatant Free imitation called *Black Sheep* that never got anywhere, and Ian MacDonald's stint with King Crimson didn't make him rich though he achieved a modicum of fame. Louis does a fair Paul Rodgers imitation, Mick combines an interesting rhythm style with fast-but-derivative licks, and drummer Dennis Elliott has some distinctive rhythms which seem to be more responsible for the Foreigner sound than anything else save the production. The title cut and *Hot Blooded* are exciting, which makes one almost ignore the fact that they're lifted, but the rest of the album seems flabby and uneven for an album well under 40 minutes in length (although Boston is even worse, giving their listeners just over 30 minutes for their seven-ninety-

eight). *Double Vision* isn't bad, but if I was in Louis Grammatico's shoes, I'd wonder why Foreigner is making millions when *Black Sheep* fell flat when the main difference is not a musical one.

Robin Trower's been at this game a lot longer than any of the rest of these musicians, and as a veteran with a significant amount of success behind him, he can afford to take chances. He doesn't worry about his latest album selling quadruple platinum just to match his last album's success — he's found an audience that he can steadily rely upon to follow his career so he can do what he pleases. The funny thing is that the group he came from, Procol Harum, started as something close to a blue-eyed soul group (*Whiter Shade of Pale* and *Hamburg* were very r&b) that turned to psychedelia and followed their more baroque leanings, whereas the reverse is true of Robin's career. He started as a three-piece group that was strictly Heavy Metal and has now produced an album that resembles Al Green singing with the Jimi Hendrix Experience. Now Robin is not the best guitar technician in the world but he plays with a certain amount of style and feeling, and his band manages to keep a solid groove while Mr. Trower and singer Jim Dewar wail away in their

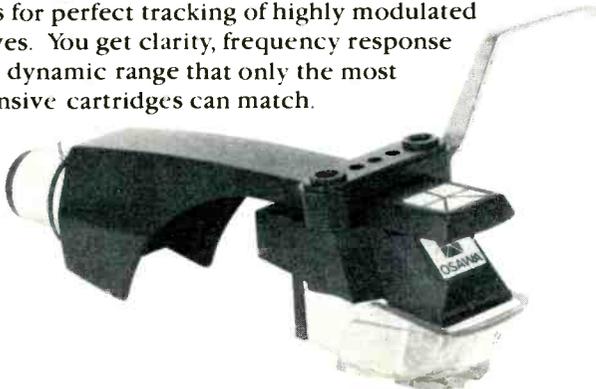
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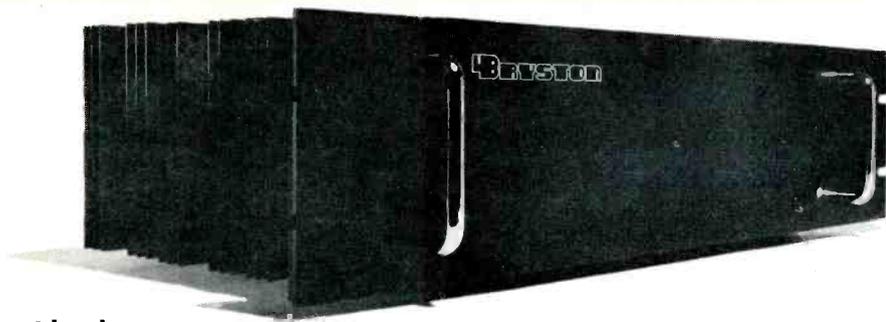
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plaintive tones. There are four or five interesting songs on **Caravan To Midnight**, and although they're in no great hurry, the band is headed in the right direction. I must add that for a streamlined Seventies band, they've taken a more esoteric and original approach to success. While Foreigner and Boston may reach more people, Trower will reach deeper, and any kind of a depth to a band of this nature in 1978 is not only a rarity, it is highly commendable.

J.T.

Boston

Sound: C Performance: D-

Foreigner

Sound: B Performance: B

Trower

Sound: B+ Performance: B+

The Man Machine: Kraftwerk
Capitol SW 11728, stereo, \$7.98.

I don't want to give you the wrong impression of **The Man Machine**, but there is an expression used with computers GIGO, four letters which stand for the phrase "Garbage in, garbage out." What this infers is that machines are only as good as the people who program them, and their capacity to deliver depends solely upon what they digest. Kraftwerk is using highly technical equipment to produce original sounds, and I have no quarrel with their methods. In fact, I admire the way that they orchestrate their tunes, using synthesizers in a manner so deceptively simple it mesmerizes the listener.

Unfortunately, the Hutter/Schneider/Bartos team hasn't much composing ability, and if any of these tunes were performed without the aid of the electronics, they would fall flatter than Ralf Hutter's singing. The instrumental parts of the album are quite pleasing to the ear, but yet again the group doesn't show much innovative flair when it comes to chord progressions. All they are about is *sound*.

Now this isn't to say that electronic music cannot be incorporated within pop music successfully, for Donna Summer and Brian Eno have both demonstrated that with the proper knack, there is some complementary relationship between transistor instruments and the transistor radio. I'm afraid Kraftwerk's strength lies in endless repetition, which can be edited down to a nice three-minute single but doesn't hold up on an elpee. J.T.

Sound: B+ Performance: C

Not Shy: Walter Egan

Columbia JC 35677, stereo, \$7.98.

Brash kid, Egan. He makes up these songs about teen thrills and chills, "Blonde in the Blue T-Bird" stuff. Coproducing the album with Fleetwood Mac's Lindsay Buckingham, he gets a brighter, spunkier version of the Mac sound, reinforced further by Stevie Nicks' harmonies on half the cuts. If Walter is not always surprising or a blazing original, still he is good light fun, especially as cruising music. Take him or his music too seriously, and they both fall apart. Take it light and it treats you right. M.T.

Sound: B

Performance: B

Toby Beau: Toby Beau

RCA ALFI-2771, stereo, \$7.98.

Toby Beau is made up of five singer-songwriter-musicians from the Rio Grande Valley who are, curiously enough, managed by the same company that handles comic strip rockers, Kiss. But, don't make any judgment from that fact.

Their debut album is a sparkling collection of tunes which run the gamut from chip-kicking, rollicking bluegrass tunes to cry-in-your-beer cowboy blues, all performed in a crisp, pure manner with clear vocal harmonies mixed with guitars that lash out driving, uncompromising rhythms. They combine this rhythmic sense with beautifully written lyrics, turned in by each member of the band, and come up with what seems a sure-fire recipe.

The actual recording of the album could have been cleaner. Fortunately the lucid, uncluttered production by Sean Delany overcomes some minor technical flaws, such as a bit too much surface noise.

Toby Beau works as an album. The variation and balance of songs flow, opening with a rocker, building through a frenetic pickin' tune, then mellowing to several lilting ballads. *Same Old Line* is particularly lovely, and *My Angel Baby* is a direct descendant of '50s rock'n'roll. Side two opens with a train song, evens off with *Buckeroo* (which really highlights the group's incredible harmonies), softens, gets lively again, and then closes with the most memorable tune on the album. *Broken Down Cowboy* opens with high, almost angelic, a capella harmonies which rivet the listener to his speakers.

It is a sincere pleasure to find a new musical outfit that's this talented. So all you Outlaws, Charlie Daniels, Eagles, and Firefall fans, be on the listen for Toby Beau. Janet Melaragni

Sound: C-

Performance: A

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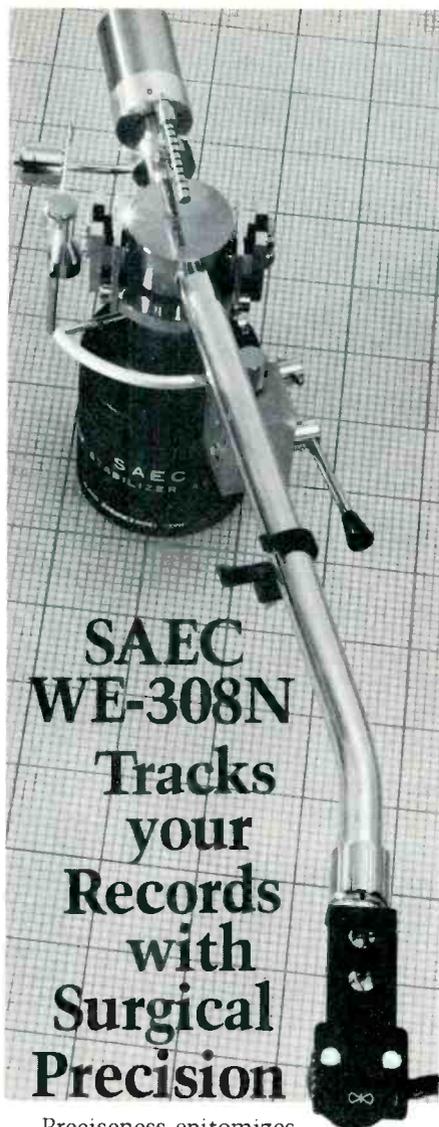
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Jazz & blues



Cumbia & Jazz Fusion: Charles Mingus
Atlantic SD 8801, stereo, \$7.98.

Charles Mingus, crippled by illness and confined to a wheelchair for the past year, recorded these remarkable sessions on March 10, 1977, at Atlantic Records in New York City, and on March 31st and April 1st, 1976, at Dimarphon Studios in Rome. Certainly this onslaught of physical afflictions did not impair the creativity and the riveting, often molten, intensity of Mingus' music.

Both the title piece on side one and the *Music for Todo Modo*, taking up all of side two, are film scores. "Cumbia & Jazz Fusion" is a movie dealing with the cocaine traffic between the U. S. and Columbia; the music features Mingus' recent band augmented by horns and Latin percussion. The score is 27-minutes long and begins with a chorus of bird calls and jungle sounds, then introduces a series of folkish themes derived from native rhythms of the Cumbia Indians of Columbia. A propulsive vamp gives the performance a driving exuberance as Mingus lays down a pulsing bass *ostinato* shaded by Gary Anderson's contrabass clarinet. The Indian themes are tossed around by the oboe and bassoon, while the ensemble textures grow in intensity, then the themes are run through Latin, bop, blues, ballad, and brassy Ellingtonian-growl variations. This shifting kaleidoscope of sound gives way, every so often, to several incisive solos — crisply reflective piano statements by Bob Neloms and agitated tenor breaks by Ricky Ford; there is

even a brief vocal passage by Mingus and drummer Danny Richmond debunking *Shortnin' Bread*. All of these seemingly disparate elements are brilliantly welded into the whole. This is indeed a major musical statement from the bassist-composer, one that ranks with *Pithecanthropus erectus*, recorded in 1956.

Todo Modo on the second side is, by way of contrast, somber and reflective. Now in his middle years, Mingus appears to have moved away from much of the anger and tension of his youthful recordings. This is an intriguing, haunting piece of unusual power. It opens with unaccompanied jazz horns and moves into richly voiced ensembles evoking images of cathedrals — Mingus here makes brilliant use of the brass voicings of Italian liturgical music. The "Todo Modo" film deals with a series of murders, and also explores the murky, mordant relationships between church and state in Italy — not exactly a subject to intrigue the American film audience with its *kitschy* tastes and shallow interests — I have doubts as to whether it will ever be shown here. However, the Mingus score transcends the film proving again that Mingus can successfully incorporate diverse musical elements into an intriguing palate of sound. These two performances make this an important and classical jazz recording. The sonics from both sessions are crisp, clean, and bright.

John Lissner

Sound: B+

Performance: A+

Footwork: John Hammond
Vanguard VSD-79400, stereo, \$7.98.

Bluesman John Hammond's latest release is a strong dose of the compelling solo acoustic guitar performances that have long enthralled his club audiences. Drawing on a wide repertoire of blues and related material, Hammond's emotional interpretations of classics by such seminal country blues figures as Robert Johnson display unquestionable conviction and an often riveting intensity. As an added treat, there's two duets with veteran barrelhouse pianist Roosevelt Sykes that successfully recreate the refined texture of the early urban blues.

One of Hammond's greatest interpretative strengths as a solo guitarist is his skill at capturing the essence of songs typically associated with full band performances. On this set he tackles Bo Diddley's *Who Do You Love*, substituting an insistent, muscular rhythm pattern for the telltale Bo Diddley beat, but retaining the key guitar licks which have always gone hand in hand with the song. *Go No Further*, a Little Walter Jacobs number, receives a similarly spirited guitar and rack harp treatment, featuring the stop-time arrangement that marked the first cutting of this tune. Neither track suffers for want of sidemen; Hammond's cohesive interpretations leave no holes which need to be filled. It's the presence of well-crafted reworking of Chicago tunes alongside of 12-string guitar versions of such moving rural chestnuts as Blind Willie McTell's *Broke Down Engine* that make listening to this album such a pleasure.

If you're a blues purist who's always found Hammond's vocals a touch affected, then you'll be relieved to know that they take a back seat to his relentlessly driving slide guitar work and snarling, moaning harp. The album's only weak spot is Mose Allison's *Everybody Cryin' Mercy* where the lyrics seem contrived and didactic next to the homespun wisdom of the giants of the rural blues. **Footwork** should please both Hammond's fans and all lovers of acoustic blues guitar.

Roy Greenberg

Sound: B Performance: A

The Grip: Arthur Blythe
Indiana Navigation IN1029, stereo, \$7.98.

The Grip is one of the few definitive contemporary jazz releases to come out in the last 12 months. It ties together many of the concerns which the *avant-garde* has been experimenting with in a tight, concise, and exciting package. Arthur Blythe has chan-

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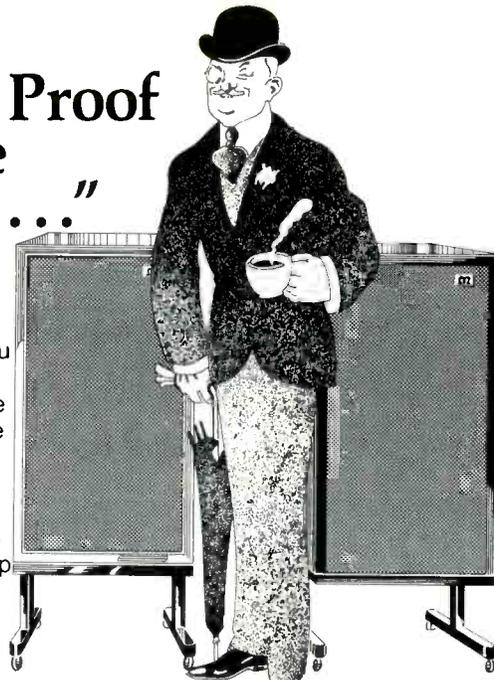
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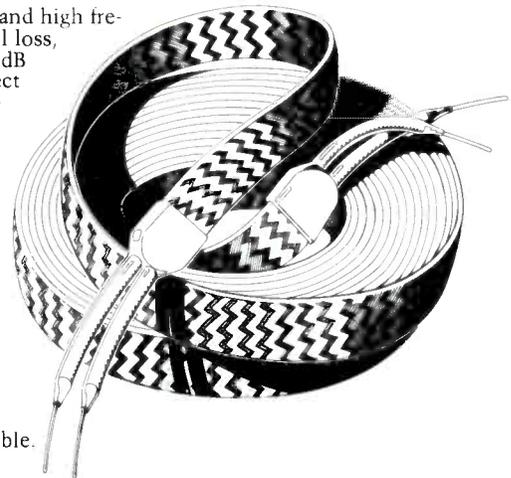
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neled all the feelings and moods that have existed throughout the history of jazz into **The Grip**. The instrumentation of the band itself comes from all eras of the music. Bob Stewart's tuba is from the formative years in New Orleans. Muhamad Abdullah plays percussion which reaches even further back into the music's roots. At the other extreme is the cello, played by Abdul Wadud, which entails the more recent European influence on jazz. Holding it all together are the mainstays of the music—Ahmed Abdullah on trumpet, Steve Reid on drums, and Arthur Blythe on alto.

The emotional flow through time goes deeper than instruments, though. *Spirits in the Field* is a wailing dirge that travels from the funeral marches of Sidney Bechet to the mournful screams of Albert Ayler. The interplay on the title track is as coherent as a Chicago jam, but with much more spontaneity and intuitiveness. *Lower Nile* reaches the exoticism of African tribalism in a driving sax and percussion dance.

Arthur Blythe has honed a clear statement of where the *avant-garde* stands at the moment. His own horn playing is full and nimble amidst the pulsing weave of his sidemen. **The Grip** captures this tight band in a very live sounding concert.

Write to India Navigation P.O. Box 559, Nyack, NY 10960 *John Diliberto*

Sound: B

Performance: A -

The Pablo All Stars Jam

Pablo 2308-210, stereo, \$6.98.

There are rollicking moments here — notably those supplied by Clark Terry's rich, perky flugelhorn, Oscar Peterson's sprightly piano, and Milt Jackson's dancing vibes. These are the moments that succeed in raising this Montreux Festival above the level of a routine jam session. Clark Terry is the best all-around performer on this album, he is bouyant on *Samba del Orfeo* and has a lovely solo on *God Bless the Child*. British nightclub owner, Ronnie Scott, is in fast company as he displays a hard-edged, acrid style that is a pastiche of Coltrane and Joe Henderson. The best single solo is Peterson's virtuosic work on *Pennies from Heaven*. Beginning with a restated melodic line, he gradually shifts to dazzling, single-note runs, and climaxes with a crashing chordal finalé.

John Lissner

Sound: B+

Performance: B+

Top of the pile

Tchaikovsky: Capriccio italien, Rimsky-Korsakov: Capriccio espagnol: Arthur Fiedler & The Boston Pops. **Crystal Clear CCS-7003**, direct to disc, \$15.98.

Crystal Clear's direct-to-disc recording of the Boston Pops Orchestra, like Sheffield's recent recordings of the Los Angeles Philharmonic, is a bold move away from the multi-microphone excesses which plague most current orchestral recording. While Sheffield opted for a single stereo M-S (mid-side) microphone, Bert Whyte, the engineer on the Boston Pops sessions, chose the spaced-apart (left-center-right) microphone array which he has favored since his early days with Everest Records. In the spaced-apart array, the microphones are arrayed across the front of the ensemble with perhaps 15 feet between them. Localization results both from amplitude differences and time differences. The chief virtue of this approach is that it conveys a high sense of ambience; the listener seems to be transported into the recording environment. The M-S approach, on the other hand, relies entirely on amplitude cues for localization and generally provides more accurate imaging in the ensemble itself.

Once the microphone locations and, just as important, the arraying of the musicians were established, the recordings were made without any apparent manipulation of gain. As with all straightforward pickups, M-S or spaced-apart, things seem to work best when the playback level approaches that of the real thing. Thus, the listener had better be prepared for an extremely wide dynamic range. Those audiophiles whose systems tend to roll off at the high end may be disappointed at the lack of sheen on massed strings that we have gotten used to in more "up front" recordings. There is no doubt, however, that the sound on this record is far more representative of what one is more likely to hear in Boston's Symphony Hall, or any other good concert hall for that matter.

Purely as a matter of taste, some listeners may take some issue with the ratio of direct to reverberant sound in these recordings. Although we have all become acclimated to closer-in approaches in which musical details are often drawn out to an unnatural degree, there is no question in these recordings that the musical details are

all there and that all nuances are natural ones, entirely in the hands of Maestro Fiedler.

If your playback system extends down to the 30 Hz region, you have a very pleasant surprise in store. Part of the rollicking fun of both *Capriccios* is in the battery; the bass drum in particular is deep and solid and in perfect proportion to the rest of the ensemble. We examined the signal on the record with a Bruel & Kjaer Model 3347 1/3-Octave Real Time Spectrum Analyzer and found considerably energy during peaks rarely encountered on orchestral recordings centered in the 31.5 and 40 Hz bands. It is an unfortunate fact that most major classical record producers shy away from this kind of honest low end purely in an effort to get either more apparent level or more playing time on a disc. Part of the direct-to-disc philosophy, here as elsewhere, is to put it *all* on the disc, with both level and playing time adjusted as need be.

About the performances, all that needs to be said is that these two war horses are given good workmanlike readings; it is awfully hard to go wrong with these pieces.

One of the pitfalls of direct-to-disc recording is that you take what you get in the way of pressing quality — there are no second chances. Although these discs were pressed in Germany, presumably by Teldec, the noise level, while quite good by American standards, was high enough to be disturbing during softer passages — a minor flaw, however.

Producer Ed Wodenjak has given technical credit where it is due. Among them are Bert Whyte (who needs no introduction to the readers of *Audio*), Stan Ricker (one of the few top-flight disc mastering engineers), and John Curl (one of the best known circuit design consultants in the high fidelity industry). Crystal Clear has also singled out the Ortofon Company and its new DSS 732 stereo cutterhead used in this release. *John M. Eargle*

Stockhausen: Zyklus pour un batteur. Teruyuki Noda: Eclogue for Flute and Percussion. Sumire Yoshihara, percussion, Masami Nakagawa, fl. **RCA Mastering Lab RDC-1**, stereo, (45 rpm) (direct to disc).

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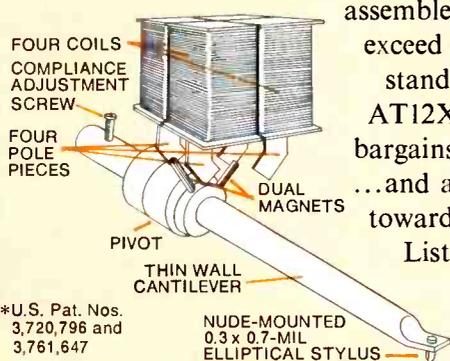
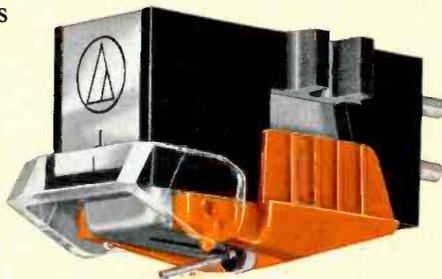
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fi process, to put it mildly — such a battery of booms, bams, socks, and other explosions you never heard, nor so well. Wotta powerhouse percussionist! It's a girl and she reminds me of that tiny black ball of fire who has been around the U.S.A. percussion circuit in recent years, starting off (where I saw her) with the National Orchestral, a New York training orchestra. She and Sumire Yoshihara should get together and blow a few fuses.

It's not only assorted percussion sounds, pitched and unpitched, that we have here. There's the modern flute, notoriously tough to record in its excruciating higher and louder registers. It's OK here if your ears can take it. Excellent pressing, very quiet — is it Japanese, or domestic RCA?

Vivaldi: "Spring" Concerto in E (The Four Seasons); Sonata for Violin and Continuo in A, Op. 2; Concerto Gross for 2 Violins, Cello and Strings, Op. 3 No. 11 (L'Estro Armonico). Heiichiro Ohyama, vl., Cremona Chamber Ensemble. **Sonic Arts 8**, stereo, direct to disc, via *Audio-Technica*.

A Japanese violinist in California and a d-to-d processing also from that state, a very good record in every way. Mr. Ohyama got his fiddle basics in Japan, went to Europe for further study, and then to Indiana University — a notable music department — for still more. Thus, in addition to being highly musical, he is well informed and plays Vivaldi not only in good style but also in the current style — for Baroque playing has changed mightily in these past years. The direct-to-disc process gives a marvelous sheen to the individual strings, two instruments in the *Sonata* (with harpsichord) and a small ensemble orchestra in the *Concerti*. The playing is lively and accurate, musical and never pretentious, especially in the solo *Sonata*, the best item on the disc. It was perhaps unwise to choose just one of the *Four Seasons*, the four concerti which are usually played together and should be but this is a minor complaint.

The solo violin is recorded rather loud, but then the entire ensemble is heard close — to and in a fairly intimate place, an excellent idea and pleasant change from too much superb-reverb. (This music *should* be smallish and current styling rightly makes it so.) So I can safely rate the balance of instruments as good. P.S. — Remarkably silent surfaces — and not a word about where they come from.

Sound: A Recording: B+ Surfaces: A

AUDIO • December 1978

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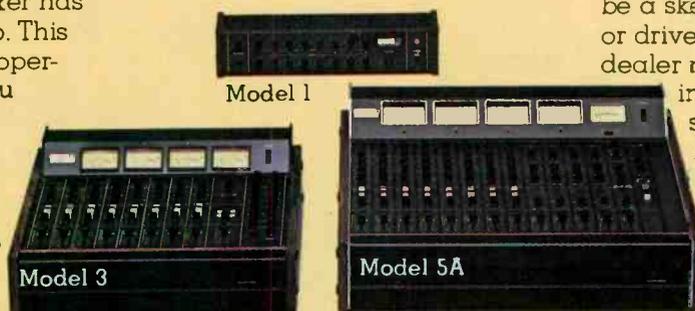
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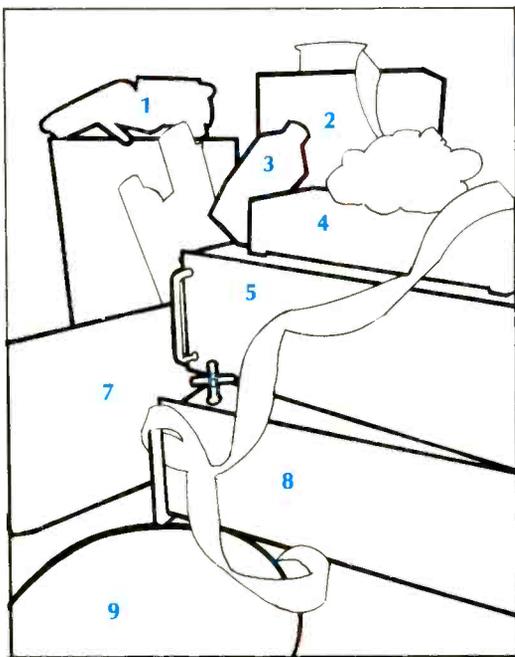
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Here is a group of Christmas gifts that won't put you in hock for the rest of the year. 1) Discwasher's Organizer includes the Zerostat antistatic pistol, SC-1 stylus cleaner, and Discwasher record cleaner with D3 fluid in a walnut base, \$46.00. 2) Fulton FMI-80 speakers have smooth, extended response with moderate efficiency, \$199.00 ea. 3) Realistic Sound Level Meter has a range of 60 to 126 dB with either A or C weighting, \$39.95. 4) PS Audio's PS-II phono stage offers passive RIAA EQ with high overload capability, \$119.95. 5) ADC Sound Shaper Two has 12 sliders controlling octave-wide bands for each of two channels, \$279.95. 6) Stylift can be used with any manual turntable to lift the arm at the end of the record, \$19.95. 7) TEAC's 25th Anniversary Commemorative Box contains an E-1 demagnetizer, 3-oz. bottles of head cleaner, rubber cleaner, and stainless polish, swabs, and a wipe, \$60.00. 8) Sansui's TU-717 tuner boasts 1.8- μ V sensitivity and 80-dB selectivity, \$370.00. 9) Fiesta Filipina from DW Labs has a binaurally recorded live performance of Philippine music with nearly 50 dB of dynamic range, \$12.95.



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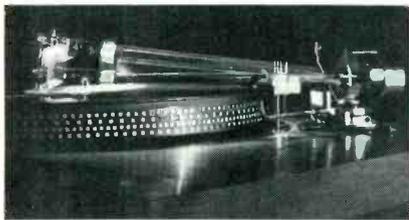
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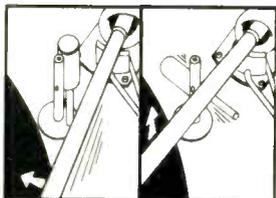
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Theater music

Donald Spoto



d. garile

The Act: Liza Minnelli, Original Broadway Show, **DRG 6101**, stereo, \$7.98.

There is nothing redeeming about DRG's original cast album of **The Act**, which is, I'm sorry to report, doing a very brisk business indeed. At first hearing, this Liza Minnelli vehicle is loud and crude, sounding more like a traffic jam than a Broadway musical. Apart from the fact that the songs are sloppily orchestrated, the main problem with the John Kander-Fred Ebb numbers is Miss Minnelli herself. Her voice is unappealingly dry and hoarse, and her phrasing is noticeably unnatural and forced. The two passable songs in the show, *It's the Strangest Thing* and *My Own Space*, could probably be saved from total catastrophe if rendered by another performer.

Even worse than the content is the recording itself. It is always either too loud or not loud enough and never terribly clear. The newly-born DRG is not off to an auspicious start, either technically or contextually. I hate to scold an infant enterprise and a show that many seemed to admire, but it's time to level a critical finger at sloppiness in creation and execution.

On the Twentieth Century. Madeline Kahn, John Cullum, Imogene Coca and the original Broadway Cast. **Columbia 35330**, stereo, \$8.98.

Curiously, this album improves after you've seen the show; it's hard to be impressed by the disc alone, especially considering that one of the weaker numbers of **On the Twentieth Century**

follows its booming overture. If you know the great Howard Hawks comedy film on which it's based, you're in for still another disappointment; the Ben Hecht-Charles MacArthur script is not well served by Betty Comden and Adolph Green, whose book and lyrics rarely rise above the banal.

Occasionally Cy Coleman's score does, however. The duet for Madeleine Kahn and John Cullum (in the roles created by Carole Lombard and John Barrymore) is called *Our Private World*, and it has a wonderfully intricate melodic line, deceptive in its simplicity. The voices of the principals alternately blend and contrast. And *Repent*, the comic number written for the religious nut aboard the crack train, is more subtle than Imogene Coca's delivery suggests, as she shifts arbitrarily from sub-bass to squeaky alto, creating a caricature rather than a character. The best number, however, is the Sextet, which is very close to opera, elusively witty in the style of Gilbert and Sullivan, and recalling those stirring *bel canto* finales from the 19th century.

The album, which the composer himself produced, is dedicated to the late Goddard Lieberson, who was responsible for the production of many of Columbia's great past recordings. Lieberson would have been pleased with the result here. The record is crisp, all the tones deliciously preserved. The jacket itself must have cost a bundle, as it sports over a dozen color photos in its double-fold, while the smashing show logo (by Nicholas) makes the cover itself worth the price.

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Classical reviews

Edward Tatnall Canby



Mendelssohn: The Five Symphonies. Leipzig Gewandhaus Orch., Leipzig Radio Chorus, soloists, Kurt Masur. **Vanguard Cardinal VCS 10133/6** 4 discs, stereo, \$15.92.

Am I seeing things? If these Vanguard Cardinal records are \$3.98 apiece, as Schwann indicates, then this is the biggest all-time bargain I ever ran into. At a lot higher price it still would be a remarkable buy, and maybe is, if the Schwann is a misprinting. These are every bit as good in essential respects as any four \$8.95 imports.

Five Mendelssohn symphonies, including one with large chorus and three solo voices, two sopranos, and a tenor! I admit the idea daunted me at first, and delayed my playing. Mendelssohn has an awful way of just going on and on, a million little notes with never a pause for a decent breath — at least as we all too often hear him played. Now, at last, I understand. It is a matter of HOW he is played! Phew, what a difference.

I knew all these works more or less, and a few of them very well, notably the often played *Italian Symphony*, which is the one that comes off best

and most easily. But, that one aside, I have always thought, from the performances I've heard, that the poor composer really was overworked, tired, and flagging in inspiration most of the time. He died young, of overwork in all truth. But now, now I know. It is the modern orchestra and the modern conductor! They are bored before they start and they sound it mostly until they finish . . . prejudice.

This recording comes from the famed Gewandhaus, the oldest Symphony Orchestra anywhere and always one of the best, down through 236 years to date. But much more important, in 1835 Mendelssohn himself took over this orchestra and revitalized it into one of the most exciting performing organizations of the period — it was then that he gave first performances such as that of the "Great" Schubert *C major Symphony*, previously unknown, and the revived *St. Matthew Passion* of Bach, which started off the whole Bach revival still continuing today. So in Leipzig Mendelssohn is something more than a patron saint. He is their musical George Washington, combined with Abraham

Lincoln. THAT is what you hear in these performances! A top orchestra (and chorus and soloists) uniquely inspired. Even the tinniest ear cannot fail to hear it.

I went from one to the next, through all these Symphonies, expecting each to be as usual, the plodding *Reformation*, the heavy-footed *Scotch*, even the *Song of Praise (Lobgesang)*, Number 2, as vast as the Beethoven *9th* doubled. And in each I was amazed; the music soared, the expression was as passionate and romantic as Schumann himself. Astonishing! The orchestra plays with such genuine feeling and such unanimity of ensemble that a hundred other versions are, for my ear, simply put to shame. And the chorus! I awaited its entry in *Lobgesang* with some doubt; here, surely, would be the bathos, the boredom. Instead, electric! Absolutely beautiful singing, clear and true. And then, two glorious sopranos and a heartfelt German tenor, each of them top rank as executants . . .

That isn't the end. The recording is so fine that I kept turning things up louder and louder. You guessed it. I

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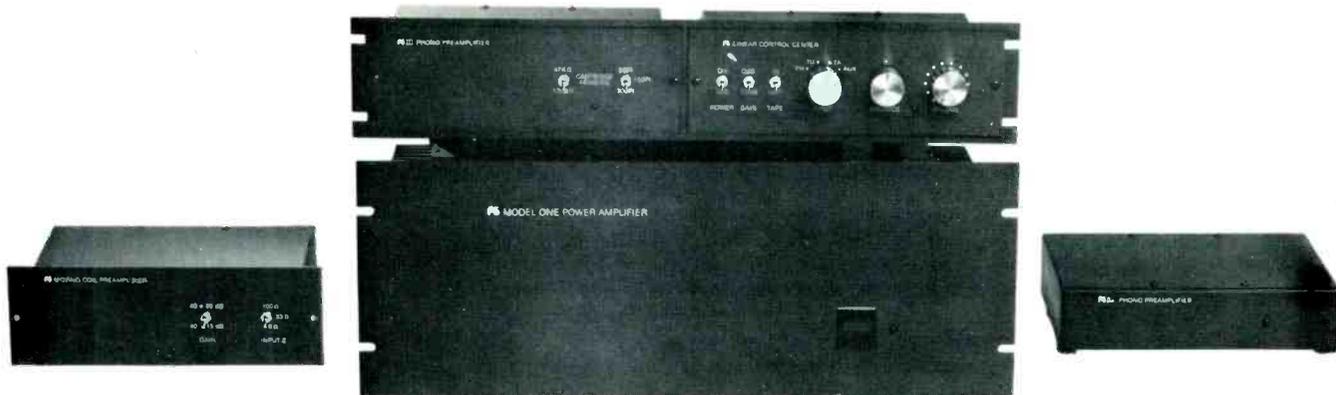
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actually blew a fuse on my main amp. That, too, held up this review.

Sound: A- Recording: A to B+
Surfaces: B-

Weber: Grand Duo Concertant, Op. 48. William O. Smith: Five Pieces for solo clarinet. Spohr: Six German Songs, Op. 103 (with clarinet). Melvin Warner, clar., Allan Dameron, pf., Diane Ragains, sopr. **Crystal S332**, stereo, \$7.98.

Crystal is emerging as one of the best of the many small record labels producing primarily local recital material in the classical field. This recording is a real find — the sort that keeps a long-time record reviewer alive and excited. My first impulse is simply *thanks!* — fervently. To know that our music remains alive and well (and some of it a lot better than Jacques Brel, by the way. . .).

One of the finest clarinet recordings I have yet to hear, this one. First, an unusually interesting and well-integrated "program" of works by three composers, one of them contemporary, the other two early 19th century, and second, a splendid clarinetist, one might say audibly charismatic, whose playing is a joy to hear, and along with

him two other excellent musicians, piano and voice. Good recording, too, balanced nicely to favor the clarinet but never immodestly, always cooperatively in the sound. (How many recording engineers, large and small, have yet to learn the lesson of modesty for the solo?) The piano is ever so slightly in the background; the soprano voice, more importantly, is also kept in place and never unpleasantly close or loud — which makes the vocal music itself far more easily accessible to the musical ear.

The Weber piece is one of those marvelous clarinet virtuoso items by that composer that seem as fresh as Summer peaches and cream, all smiles and felicity—yet manage also to be astonishingly brilliant and dazzling. Melvin Warner is a "natural" for such music — his clarinet even sounds like an early-type one, full of color and expressiveness; there is that sense of exultant strain, an "edge" to the tone, which we find in the best jazz playing today but seldom in classical. It is right, that exulting strain! And typical of the period. The clarinet was a wild, Romantic instrument in those days, far from the discreet, ultra-smooth elegance of the classical clarinet as mostly played today.

The Spohr songs, slightly later, are of

the type celebrated in Schubert's famous and beloved *Der Hirt auf dem Felsen*, a long concert aria of a song with clarinet obbligato and piano. These Spohr songs are charming, limpidly lovely music for the same combination, if neither as lengthy nor as intense as the Schubert. Soprano Diane Ragains has a somewhat American harshness in her louder tones but she is highly musical and, as noted above, the engineer has placed her to the very best advantage for the music. The Spohr songs fill up Side 2.

The remarkable thing about modernist Smith's music (he's the guy who can play two notes at once on his clarinet) is how easily it follows after the Weber. Huge jumps, squawks, blats, high squeaks — even so, there is no loss of interest and a considerable rapport with what has gone before. Credit goes to Smith and to Melvin Warner for his superb playing.

Sound: B Recording: A- Surface: B.

Summer Prayer (Amemiya: Natsu Nebutsu; Monochrome Sea. Morton Feldman: The King of Denmark. Yasukazu Amemiya, solo percussion. **RCA RVD-2154**, stereo, via Audio-Technica.

Most confusing. This RCA Japanese import features a solo percussion genius, as player and composer, and the implication is that nobody else is around—he does it all himself. Two major works of his own and a third by the American Morton Feldman (but *Summer Prayer* was composed in America). On the record jacket, however, there are listed for *Summer Prayer* no less than 111 separate musical instruments, including “mouth whistle” three times, one foot switch, one thunder sheet, one slapstick, one vibraslap, a shaker, a bongo, one musical saw, a huge array of Japanese soundmakers, a flute, and practically all the known Western standard percussions, like tam-tam, wood blocks, cymbal, string bass (!), xylophone, marimba, bass drum — all that, plus one prepared piano (!), two loudspeakers, and one tape recorder. You figure it out. Well, one picture shows the studio, and it does look like a percussion junk shop.

I liked the Morton Feldman best, and for the usual reason — he says more with less. So much Japanese music is obsessed with complexity and virtuosity! But this man is good — or his dozen or so helpers (?) are good. And the sound is good too, though there is no indication that it is either digital or direct-to-disc. I don't think much of these surfaces. Quite some background noise and a lot of tiny ticks.

Sound: A- Recording: A- Surfaces: B-

Janet Baker sings Beethoven and Schubert. Engl. Ch. Orch., Leppard. Philips 9500 30, stereo, \$8.95.

Our private Maxwell's Demons got to work on my review of this superb disc in the September issue and I can't let the record pass on into typographical limbo. The intense and musical Janet Baker sings Beethoven on side 1, a “WoO” work (work without opus number) — somebody didn't believe my spelling — and, heaven forbid, not a “grand Italian classic area” but an ARIA, no less; oof! How can such things happen? (Editor's Note: Well, Ed, I'll tell you . . . — E.P.) Then, topping even this work, the even grander classic Italian ARIA, *Ah perfido*, Op 65, which lost its rightful italics. Italian, after all, and shouldn't it be in italics? Anyhow, it is one of the finest Beethoven records I know and well worth the right spelling, as well as the steep price. Not to mention the equally wonderful Schubert on side 2, correctly spelled in my review.

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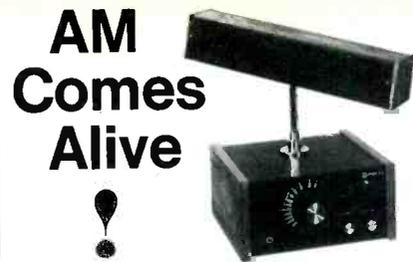
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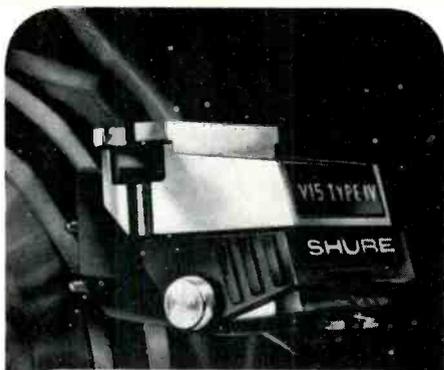
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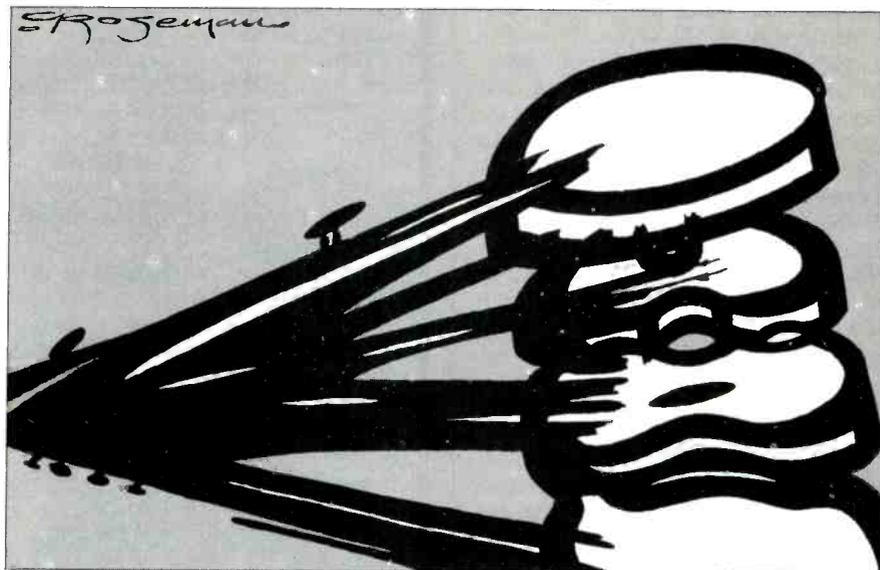


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Folk bag



Merchants Lunch: Red Clay Ramblers Flying Fish FF055, stereo, \$7.98.

A few years ago, an old-timey revival string band called the Red Clay Ramblers recorded an album for Folkways Records. They were proficient and spirited, but not all that different from a number of old-timey bands featured on Folkways.

Then they switched labels, made a couple personnel shifts which added significant new instruments and personalities to the band, played for and acted in a New York stage production, and began making music that gravitated further and further from their North Carolina origins. Now, with **Merchants Lunch**, the Red Clay Ramblers firmly establish themselves as America's premier "whatzit band."

If you don't know what a whatzit band is, listen to the first three cuts and you should begin to get the idea. The title tune is an "old timey rag hokum vaudeville country jazz rock'n'roll" whatever, with a trucker lyric worthy of Dr. Demento, crisp 20s-jazz muted trumpet, and an unorthodox blend of fiddle, banjo, and piano. This is followed by *A Beefalo Special*, in which a bizarre crazy-scat a cappella vocal intro gives way to a rip-sno-tin', neo-stringband instrumental spotlighting swooping jazz fiddle by Bill Hicks, staccato Jim Watson mandolin, and decorous piano ripples by Mike Craver. *Woman Down In Memphis* is a long-forgotten Carson Robison/

Frank Luther gem with a slinky strip-joint rhythm, a full-bodied and boozy trio vocal, and sleazy muted trumpet by Jack Herrick. If you'd care to pigeon-hole these three cuts into an already existing musical category, be my guest. It sounds like "whatzit" to me.

To prove they haven't fallen completely off the deep end, the Ramblers also do several great old-timey numbers. The Galax-flavored *Molly Put the Kettle On* reminds me of *The Eighth of January*. Charlie Poole's raggy *Milwaukee Blues* is sung by Watson in his inimitable razor-sharp tenor. Dave Macon's *Rabbit in the Pea Patch* romps from beginning to end. Side two, band three is an intriguing medley which starts in Ireland (*Kildare's Fancy*), shifts to a Celtic-flavored American tune (*Ships Are Sailing*), and winds up squarely in the Appalachians (*High Yellow*). *Daniel Prayed* is another in the Ramblers' continuing series of a cappella shape-note hymns.

Fragile-voiced Mike Craver's Tin Pan Alley orientation shows itself on an Ian Whitcomb-reminiscent solo version of *Melancholy. I've Got Plans*, with its nostalgic melody, steady tenor guitar rhythm, and Craver's pop-piano interlude, also has a distinct 20s flavor, though the offbeat lyrics give it away as an original by the band's banjoist and dominant personality, Tommy Thompson. Fats Waller's *Sweet and*

Slow, with an extended piano/trumpet/fiddle intro and a euphonious harmony vocal is a fitting conclusion to what should go down as one of the landmark albums of folk-rooted eclecticism. Don't miss it, whatever it is.

Tom Bingham

Sound: B +

Performance: A -

Live At McCabe's: Byron Berline and Sundance

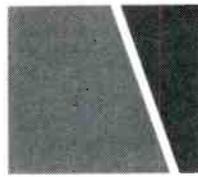
Takoma D-1061, stereo, \$7.98.

There's so much incredible picking on this album, I wish I could give it an unhesitant recommendation. Unfortunately, something very important is missing — that indefinable spark called "feeling."

Perhaps the trouble is these musicians have so finely honed their technical skills, that it's all too easy for them. They leap into a tune, flash away at top speed for a few minutes, then leap back out. The audience at Santa Monica's fabled McCabe's Guitar Shop is understandably dazzled by it all. But the home listener can't help but notice the absence of any true emotional commitment, the common element which lies at the heart of all great bluegrass, past or present.

If such considerations don't bother you, or if you're able to appreciate instrumental facility for its own sake (admittedly, the thing that keeps me returning to the album, despite my reservations), you should find much to your liking here. Vince Gill stands out with consistently inventive mandolin breaks; *Tear Drops In My Eyes*, *Free Born Man*, and *How Mountain Girls Can Love* provide excellent examples of his work. Berline's Texas-rooted fiddling and Dan Crary's flatpicking are, as usual, awesome, while the other guitarist, Allen Ward, is no slouch either. Banjo ace John Hickman can no doubt dash off long strings of three-finger rolls in his sleep. Dobroist Skip Conover is the band's most concise soloist, while his glissandos add much to the ensemble sound.

The singing combines the pop-influenced, California newgrass of the Country Gazette (the band most responsible for Berline's current fame) with harmonies more attuned to traditional bluegrass. A substantial portion of the material comes from the classic masters (including two songs each by Bill Monroe and Reno and Smiley), though *Free Born Man* was penned by Keith Allison and Mark Lindsay of Paul Revere and the Raiders fame. Interestingly, the 50s-grass favorite, *Good Woman's Love*, gets a mellow newgrass ballad treatment, while *Free Born Man* is done in a neotraditional

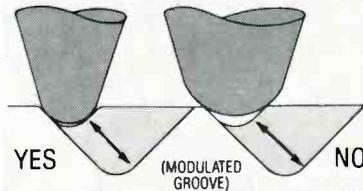


fact: a stylus tip does not a cartridge make. so why all the fuss?

The stylus tip is only part of the complex stylus and cartridge structure, and performs a single function — it positions the entire stylus assembly so that all groove undulations are traced without damaging the record. The production of a top-quality tip calls for exquisite micro-craftsmanship, precision polishing, unwavering uniformity, and exact orientation. *(However, important as it is, an exotic diamond stylus tip configuration simply isn't a cure-all for what might ail an otherwise deficient cartridge, regardless of high-flying claims you may have heard or read.)*

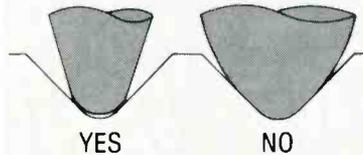
Here are the basic criteria a top-quality stylus tip must meet:

IT MUST FIT THE MODULATED GROOVE

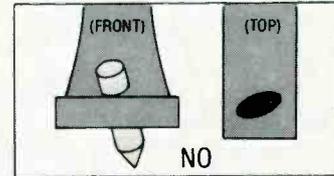
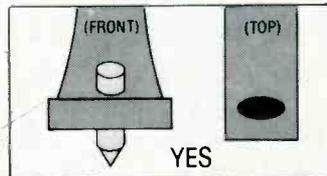


If the tip is shaped so it's oversized at its contact points, it can rise out of the modulated groove (the arrows indicate modulation of one groove wall) and "crest" at the record surface, causing extreme distortion and noise.

IT MUST NOT "BOTTOM" IN THE GROOVE



A slightly-undersized or too-pointed stylus tip may ride the groove bottom, lose contact with the groove walls, mistrack, and generate high noise levels.



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assessment of their ability to communicate with contemporary audiences (see *Audio*, November, 1976).

The three albums under discussion here demonstrate that a substantial audience remains for the Bolick's simple, timeless Appalachian sensibilities. Moreover, they illustrate that the music is too vital and meaningful to be dismissed as merely a fossilized relic of a forgotten past. The more one listens, the more one realizes that the Blue Sky Boys' music has retained its value not just as entertainment but as the cultural expression of a generation, an environment, and a worldview which has too often been ignored in our increasingly complex, urbanized society.

Continuity is the hallmark of the Bolick brothers' artistry. The elements of the classic Blue Sky Boys' style — their poignant close-harmony singing, Bill's rippling mandolin tremolos, Earl's spare thumb-picked guitar backdrops, the duo's reliance on songs and ballads extolling basic, upright moral sentiments — have remained virtually unaltered over a 40-year span. Perhaps that's the key to their appeal — the world and virtually everything in it rapidly changes, but the Blue Sky Boys' fidelity to traditional values stays constant through the years.

The County album is derived from private rehearsal tapes recorded in Bill Bolick's den in 1963, without any intention of eventually releasing them. Five of the 10 songs were never commercially recorded by the Bolicks. The whole album benefits from an air of relaxed informality and unself-consciousness quite unlike their drier studio recordings of the 30s. Highlights include country standards like *The Little Paper Boy* and *Don't Let Your Sweet Love Die*, plus the appropriately titled hymn *Beautiful*. Given the circumstances, the recording is much better than you might expect, though the vocals are sharp-edged and the pressing rather crunchy. County Records, P.O. Box 191, Floyd, VA 24091.

The JEMF record is a reissue of an album the Bolicks did for Capitol in 1965. None of the songs appear on any other Blue Sky Boys recordings, even though several are intriguing variants of very well-known folk standards . . . for example, *Jack O'Diamonds*, *Oh, Marry In Time*, and *Will the Circle Be Unbroken*. Performances are impeccable and the recording is excellent. The accompanying booklet provides full documentation for each song, as well as an insightful examination of the Bolicks' career, and an autobiographical essay by Bill Bolick. Incidentally, no mention is made of a bass player, though one is clearly audible through-

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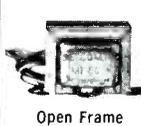
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out. Available from the John Edwards Memorial Foundation, Inc., Folklore & Mythology Center, University of California, Los Angeles, CA 90024.

The Rounder album was recorded in 1975. If any stylistic change can be detected, it may be that Earl's baritone lead vocals are more forceful, though Bill's tenor parts are as tight and resourceful as ever. Again none of the songs have been previously recorded by the brothers. There seems to be an even greater preoccupation with songs about death than ever, but as always they include a few hymns to hold out a glimmer of hope, if only in another world. The mono sound is exceedingly clear, with more body and presence than many modern stereo recordings; indeed, Earl's guitar has never been heard so explicitly, or with such resonance. Rounder Records, 186 Willow Ave., Somerville, MA 02144.

Tom Bingham

Blue Sky Boys (County)

Sound: C Performance: A-

Presenting

Sound: A- Performance: A

Blue Sky Boys (Rounder)

Sound: A- Performance: A

For My Friends of Song: Betty Smith June Appal JA018, stereo, \$6.98.

Betty Smith's gentle way with Appalachian songs and folk ballads first gained attention on a Folk-Legacy album entitled **Songs Traditionally Sung in North Carolina**. Unfortunately, that dry, rather academic-sounding title probably scared off a lot of people who would have otherwise been captivated by the artist's marvelous singing. This second Betty Smith album is, if anything, even more exquisite than her debut.

Her voice is lovely — clear, sweet, with a hint of a Southern twang, yet inviting comparisons with Joan Baez' early Vanguard recordings. But Betty is older, more mature, her phrasing finely honed, and her approach to a lyric highly refined. Nevertheless, she never sacrifices the feeling and sensitivity needed to communicate the timeless truths of the old ballads to the modern listener.

Her guitar and mountain dulcimer accompaniments are well crafted and aesthetically complement her singing. On several cuts, she plays psaltery (sort of a hammered dulcimer which is plucked instead of beaten) in a style derived from Fiddler Beers. Her touch is impeccable, and her settings entrancing, with an effect not unlike a quietly rippling Irish harp.

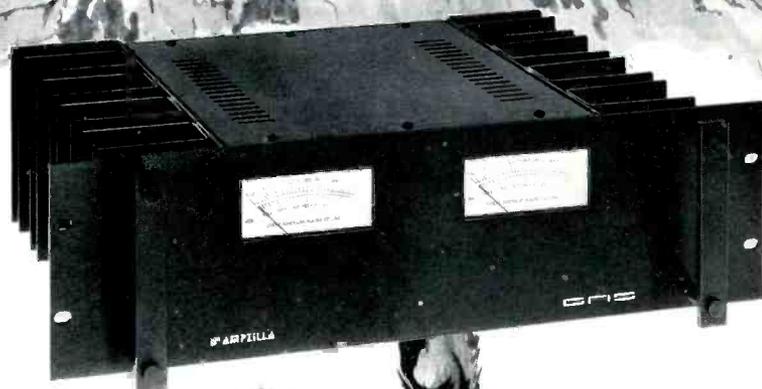
John McCutcheon — who seems to pop up on every June Appal record as producer, performer, or, as in this case, both — adds textures and backdrops on a number of instruments. Other guest appearances include June Appal boss Jack Wright's archaic banjo on *The Ballad of Bascom Lunsford* and Grey Larsen's Oriental-sounding wood flute on *The True Lover's Farewell*.

The songs cover a wide range, from attractive reworkings of old warhorses (*Bury Me Not on the Lone Prairie*, *Little Liza Jane*) to contemporary songs (Jean Ritchie's *Black Waters*, Barry

Etris' haunting *Softly Came the Gypsy*). Other standouts include the unaccompanied Child ballad *Lady Isabel and the Elfin Knight*, the Appalachian *Little Margaret* (which uses the *Shady Grove* melody), the instrumental *Gentle Maiden* (a skillful blend of Smith's psaltery and McCutcheon's hammered dulcimer), and *The Rolling Hills of the Border*, with its gorgeous psaltery part.

On most cuts, the recording is clean, with an appropriately soft focus. On a couple psaltery cuts, though, the voice has a slightly hollow sound. Surface

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noise is moderate, but the album's quiet nature makes it that much more obvious.

Available from June Appal Recordings, Box 743, Whitesburg, KY 41858.

Tom Bingham

Sound: B Performance: A

Pacific Rim Dulcimer Project

Biscuit City BC 1314, stereo, \$6.98.

Those of you who consider the Ap-

palachian dulcimer a rather limited instrument — suitable for gently strummed ballad accompaniments, an occasional adapted fiddle tune, and little else — should find this album a real ear-opener.

Pacific Rim Dulcimer Project features five expert dulcimerists along with multi-instrumentalist Michael Hubbert, performing solo and in various combinations. Together they explore the amazing versatility of the dulcimer, introducing the instrument

to new musical contexts and technical innovations.

Of the five, Neal Hellman most closely carries on the traditional methods of dulcimer playing. Hear his version of the French-Canadian *C'est L'Aviron Qui Nous Meme en Haut*, and his duet with autoharpist Max Krimmel, *The Black Nag*, in which the two instruments mesh like a small plucked-string orchestra.

Michael Rugg forms a snug duo with Hubbert (on fiddle, whistle, and mandolin). Rugg's catchy originals, *Pack Up Your Liver* and *Mojo Clock*, sounds as if they began life as *John Hardy* and *Three Blind Mice*, respectively. They also perform tight arrangements on the Irish *Tralee Jail* and a *Swedish Fiddle Tune*.

Bonnie Carol, who coordinated the project, takes her dulcimer on a sunny Caribbean cruise in her version of Pete Seeger's *Living In the Country*. Her original composition, *Joellen*, is a very pretty, Oriental-flavored tune with captivating string harmony.

The most distinctly contemporary utilizations of the instrument come from Albert d'Ossche' and Robert Force. *Wellyn*, co-written by the two, would not sound out of place with a jazz-rock rhythm section underneath it. The two's forceful dulcimers are played with precision, feeling, and a well-developed sense of coordination. On *Firenze*, the resultant splash of string colors sounds very much like an autoharp. *Cornwall*, by d'Ossche' alone, is an intricate, skillfully executed fingerpicking instrumental. Force also wrote and sings two songs (*Poker Face Smile* and the entrancing *Sing Sailor*), but his sharply twanging, tremulous voice is an acquired taste. (Indeed, the vocals throughout the LP are far less captivating than the playing).

Also included are two highly successful ensemble experiments. *Lotus Eater Blues*, with three dulcimers, electric bass (N.C. Bull), and percussion, is reminiscent of 60s San Francisco rock; Force's lead dulcimer sounds astonishingly like a sitar. On *The Pig Song (Marjorie)*, three different styles of dulcimer, violin, whistle, and multi-tracked percussion enter a layer at a time to evoke a dulcimer equivalent of the New York Pro Musica.

The dulcimers have a beautifully crisp ring to them. All the parts are easily distinguishable and intelligently balanced on the multi-instrument tracks.

Available from Biscuit City Enterprises, Inc., 1106 East 17th Ave., Denver, CO 80218.

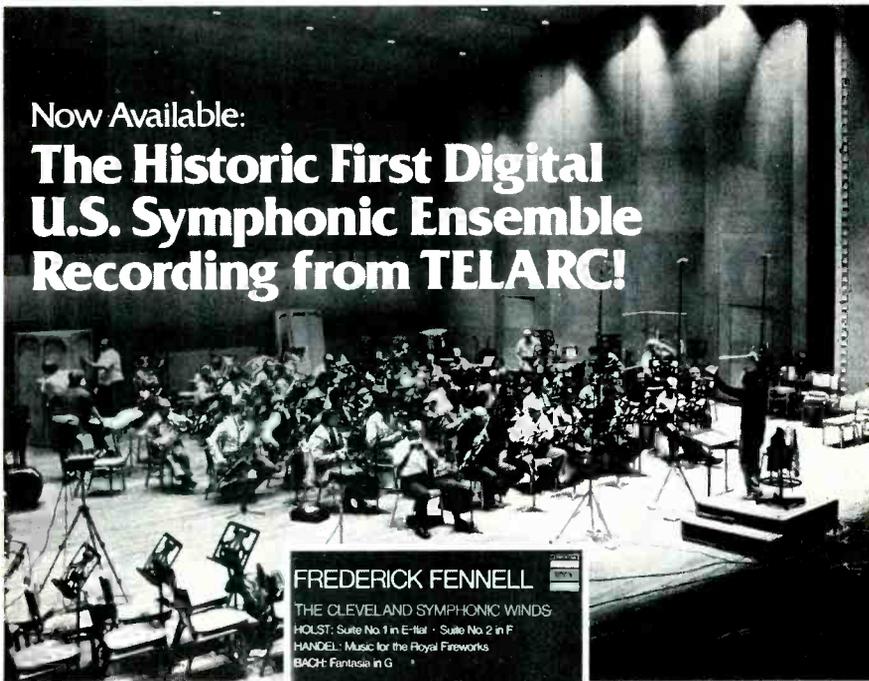
Tom Bingham

Sound: A- Performance: B+ to A

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John S. Wright

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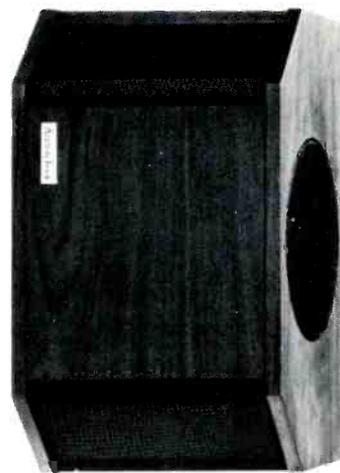
It seems that nearly all the record companies are suddenly issuing guitar music — not electrical but acoustic! The virtuoso Andres Segovia plays a selection of arrangements for guitar, amongst which is the particularly effective Schumann's *Album for the Young Op. 68* on RCA RL 12602. Recorded in his home, the sound is a bit on the dry side with finger action clearly audible. Nevertheless, this is musically a delight for those who will accept such instrumental transpositions. Guitar music from Philips comes in the form of a selection of mainly Spanish music performed by Pepe Romero (9500 295). Being popular music, it is close but ultra-clean. Although not too dead an acoustic, his clinical performances provide good demonstration material. For Erato's contribution to the guitar collection, I chose their record of *Music for Two Guitars* which includes well known works by Scarlatti, Debussy, Rodrigo, et al. (STU 70794). This is very close indeed and could be disturbing if it were not for the thoroughly enchanting music. Played at a low level, a somewhat "in the room" presentation can be achieved — as though the performers were actually there, rather than the listener being taken to another environment.

A fair share of new piano releases as well Needless to say, Brendel's insatiable energy provides yet another winning album. Firstly we applauded his Beethoven, then his Schubert, and now again his Bach. This latest record contains the *Italian Concerto*, the *Chromatic Fantasy*, and *Fugue in D minor*, and accompanying *Choral Preludes*. The sleeve notes consist of an interesting interview with Alfred Brendel by Terry Snow. On Philips 9500 353, the usual superb standards are maintained, perhaps with interpretation verging on the romantic and recorded in an even more than usually live setting. Also on the Philips label (6500 395) Claudio Arrau provides a not unduly sentimental Schumann recital. The tone is rather thinner, but more than acceptable and particularly suited to the *Kinderscenen Op. 15*. Peter Frankl also provides us with a performance of this work together with *Sonatas for the Young* and much else

in his recital of **Schumann Piano Works Volume 2** on Turnabout TV 37100-2S (three records). Originally recorded by Vox the sound is adequate, although rather dry. If perhaps not inspired, the impassioned performances are very much to my liking — particularly at the bargain price the box set is offered. And talking of bargain prices, admirers of Julius Katchen should note that his 1964 performances of the Brahms piano works are available in three separate volumes on the Ace of Diamonds label, the numbers being SDD 532, 533 and 534 respectively. Although much more likely to be purchased for the music than the fidelity, these recordings have aged well with only slight variations in quality between sides.

Still with reference to reissues, a recording made of Simon Preston playing the organ of Westminster Abbey appears on Argo ZK 14. This remains an exceptional record for its sense of a large acoustic and extended low frequency response. Also the background noise is low. Lionel Rogg is recording the complete organ works of Bach for EMI. **Volume 1** is now out on SLS 5087. Since different works have been recorded on different organs it is impossible to be specific with regard to tonal quality but overall the set of five records is light rather than thickly textured. Low frequencies are not particularly extended nor is the ambience convincing. Although Rogg takes a pacey interpretation to many of the works, his expertise is not flamboyant. Obviously a venture of this magnitude is very much for the specialist record collector, but on the basis of the first volume I can at least assure him of excellent surfaces and pressing quality.

Some issues ago I recommended an Argo record of Robert Tear (tenor) singing songs by Aaron Copeland (ZRG 8621). Robert Tear is now accompanied by Timothy Walker playing guitar in a selection of folk songs by Britten, Walton, and Seiber on ZK 39. This unusual combination bears great similarity to the earlier record being, if such is possible, excitingly relaxing performances, almost completely devoid of any strain. Quite differently, EMI has brought the voice of Robert Lloyd forward, positioned just in front



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of pianist Nina Walker, in an intimate atmosphere for their selection of sea shanties and associated songs, simply named *Sea Fever* (ASD 3545). The very masculine bass voice of Lloyd well enhances the rip-roaring fun behind these ballads, but retaining a sense of feeling. Only some slight pre-echo, mostly between tracks, mars this entertaining recital. Much more of the original acoustic than we are accustomed to hear from Decca is retained in their spacious presentation of Spanish songs sung by Pilar Lorengar accompanied by Alicia de Larrocha (piano) on SXL 6866. With almost perfect integration between voice and piano, this is a record which is hard to resist.

It is not without some reservation that I recommend EMI's recording of the Poulenc *Concerto for organ, strings and timpani* and *Concert Champetre for harpsicord and orchestra* on ASD 3489. Simon Preston is in both cases the soloist with the London Symphony Orchestra conducted by Andre Previn. Musically it is enthusiastically performed in a manner that one might expect of Previn. Technically it is most competent in a way you would expect from Parker and Bishop. Nevertheless, there is an edge of brightness combined with some grittiness in the sample pressing that causes me to hesitate from giving it an irrevocable recommendation, but nevertheless feel that it is of such merit as must be drawn to the reader's attention.

Last quarter I had reason to mention, yet again, the Philip Jones Brass Ensemble and this quarter is no exception. A slight deviation from their usual repertoire is a special arrangement by Elgar Howarth of Mussorgsky's *Pictures at an Exhibition* on Argo ZRG 885. It is really quite remarkable how this work lends itself to these superb fat brass sounds recorded in rich acoustics. Although the surface of the review pressing was poorer than average, this, together with their record *Renaissance Brass* (ZRG 823), exemplifies the finest of their work and the best of Argo engineering.

Neville Marriner, this time conducting the Concertgebouw Orchestra, has completed the newest recording available of Holst's popular suite *The Planets*. On Philips 9500 425, I find this to be a not very forceful interpretation, but on repeated playings suspect that its appreciation will be longer lasting. It is not overtly dynamic in the manner to which this work so often lends itself, also not being as distantly recorded as most Concertgebouw discs. Although the brass is especially crisp, the whole production isn't one that



jumps up and says "listen to me, I'm hi-fi." Therefore it is likely to unsettle as many people as it is likely to please. A quite contradictory approach is taken by EMI in the new recording of the Sibelius' *Symphony No. 2* played by the Bournemouth Symphony Orchestra conducted by Paavo Berglund. This is a determined performance with a high cutting level, subsequent low noise, and a wide range, which is not exemplary in detail in the bass due to some wooliness, but this is well compensated for by crisp brass and decent perspective. On ASD 3497, this is a satisfying rendition. In extremely good taste, however, and certainly not for the hi-fi show-off, is the most naturally convincing recording so far of Nielsen's *Symphony No. 5*. From a musical force that we have already found to provide fine sounds with fine interpretations, the Scottish National Orchestra conducted by Sir Alexander Gibson is accompanied by Pamella Dow playing the aggressive side drum which is unscored "as if at all costs it were to stop the progress of the orchestra" and Keith Pearson plays the appealing clarinet. After the battle towards the end of the first movement, the side drum really does march off in disgrace, both musically and positionally. Coupled to the Helios Overture on RCA RL 25148 this is the sort of record that having once been lowered, the tone-arm is difficult to switch off.

With regard to this last sentiment, the same can be said of the Enigma recording of Palestrina vocal works performed by the Pro Cantione Antiqua on K53560. Although musically only of specialist interest, there is an appeal which lives through the centuries and can even exist as a home entertainment media if the engineering allows. It was recorded by Tony Faulk-

ner and so impressed was I with what I heard that I called him to ask the recording location. Knowing him to be a purist, it was obviously with slight embarrassment that he felt it necessary to confess that whilst the artists were recorded with a simple crossed pair of microphones, such was the dryness of the acoustic, some reverberation had to be added later. This, I would rush to point out, was not strictly "artificial" since it was achieved by playing back the tape in another lively church and a modicum of this information blended in. Given the confines of two speaker stereo, it is difficult to detect and certainly in no way impaired by enjoyment of this outstanding disc. Moving forward in time a mere hundred plus years, another specialist recording lies in the CBS Master Works series directed by Jean-Claude Malgoire on 76717. I have had occasion in the past to recommend this man's work with original instruments and his latest offering is of Vivaldi's *The Four Seasons*. I must admit to finding it strange, even strained, when compared to conventional contemporary performances. It is impossible to vouch for the authenticity of the recorded sound under these circumstances, but it is certainly clean and resonant. The final disc I would like to mention in this section of odysseys is by Mozart (no less) and is a recording of his *Adagio in C* and *Rondo for glass harmonica, flute, oboe, viola and cello*. The *Quartet in F, K 370* and the *Quintet in C, K 406* make up the balance of this record, Philips 9500 397. The "glass harmonica" consists of bowls tuned with varying amounts of water, sounded with moistened fingertips run round the edge of the glass. The origin of the instrument can be dated back as far as the 14th century, although some modern composers have employed similar ideas. Again the authenticity of sound of this particular instrument cannot be confirmed, but the overall balance of the recording is rather close for the lushness of the other famous works, but nevertheless this must rank as one of the most intriguing records mentioned.

Continuing their successful series of Haydn Symphonies with Colin Davis conducting *The Concertgebouw Orchestra* (Amsterdam), Philips has recently released the popular *Drum Roll No. 103*, coupled to *Symphony No. 87 in A*, on 9500 303. As related before, these recordings are technically difficult to fault, with a tasteful balance between closeness and ambience, although perhaps minutely strident in places. As would be expected, this light music is performed with a deeper understanding of its underlying great-

ness. In similar vein, in the sense that such music can be used when required as merely for background, Philips have also just issued a second record of Rossini Overtures (including the famous *William Tell*) played by the St. Martin-in-the-Fields Academy conducted by Neville Marriner on 9500 349. The first record was issued some years ago (6500 878) when I made enthusiastic remarks concerning the presentation. It needs, however, to be played at a rather higher than usual level to obtain the best illusion, and while being more contrived than many records on this label, it is extremely similar to their earlier release. Both can be thoroughly recommended.

I am always complaining that I find it difficult to obtain decent opera records. I am also generally not enamoured with the sounds produced by CBS. An exception to these observations lies in a Master Works series three-disc box set of Cilea's *Adriana Lecouvreur* on CBS 79310. I do not feel qualified to comment on the performance, but my music critic friends think it a rave. Although it still contains some of the characteristic colorations associated with this label and is obviously of the contrived type of recording, it contains exceptionally good dynamic and frequency range and crispness, convincing distance effects with satisfactory vocal-to-orchestral balance.

The Kings' Singers have reached their tenth year and to celebrate held a Tenth Anniversary Concert in the Royal Festival Hall. EMI has issued two separate records of the live performance, the first being mainly classical and the second mainly popular (KS 1001 and KS 1002 respectively). Many of the items are contained in their studio recordings such as the *Concert Collection* on CSD 3766 and *Lollipop*s on EMC 3093 which are better recorded but do not have the infectious enthusiasm which only the presence of an audience can bring. In fact, there is some very slight blurring in places but this can easily be forgiven for the sake of the enjoyment provided. If you are not interested in the whole concert, at least give an ear to the second part and tell me you are not amused! The novelty songs, in particular, bear repeated playings and are marvellous for playing to visiting relatives, etc. The melody of *Greensleeves*, in particular, with wording revolving around Green Shield Stamps (Green Stamps in the USA I believe) always causes a laugh, and I am surprised that this has not been issued as a single. It certainly deserves to get onto the charts. Ideal Christmas fare!

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European letter

Donald Aldous



The hi-fi trade — looking at it from the European standpoint anyway — has been in the doldrums for quite a while, but if the support given to several recent British and European hi-fi exhibitions is any yardstick, then business is again on the upturn.

One of the most successful British audio shows is the Harrogate International Festival of Sound, which closed a four-day run recently. This year's event was spread over an exhibition hall and a number of nearby hotels and another variation was having the first two days public, with the closing two for the trade only. This plan seemed to work, although leaflets were consumed rapidly, and most exhibitors were tired by the time the trade visitors arrived.

Let's look at the novelties of this show: One daring innovation was an opening concert by the Black Dyke Mills Band, one of England's leading brass bands. The sound level was very high. In fact, as reproduced sound, it would have been unpleasant listening close up on the peaks, but the clean, undistorted sound merely confirmed

that we still have no hi-fi system capable of reproducing orchestral music with "live" realism. Them's fighting words I know, but having heard symphony concerts in our famous concert halls, I know that despite all the vast array of equipment on demonstration (particularly varieties of loudspeakers), we have a long way to go yet. Maybe that's a good thing for manufacturers and journalists!

One event that attracted dealers and press alike on Monday evening was a lecture by Roy Allison, President of Allison Acoustics; his main theme was to demonstrate the importance of positioning loudspeaker enclosures within the room confines. He showed how locating the enclosure at varying distances from the two walls forming a corner, and varying heights from the floor, significantly changes the audio output response and power at the lower frequencies.

JVC products are well known all round the world, but we were intrigued to learn the company is now offering their MCI pickup cartridge. This is an elegant design using the

moving-coil principle and will cost about \$300.00 in the U.S. This is a design of extreme sophistication with printed-circuit moving coil measuring only 1 mm square.

Undoubtedly a trend is showing itself towards reduction in physical size of amplifiers, radio tuners, and receivers. Matsushita already has a range of equipment intended for shelf-stacking alongside books. Toshiba also promises a bookshelf hi-fi system by the end of the year. Incidentally, to get a foothold in the UK, Toshiba has joined forces with Rank International, the Plymouth-based TV manufacturing company.

Another micro system is the Aurex, which includes a power amplifier, preamplifier, and tuner measuring only 9 by 12 by 7 in. when stacked together. Output power is not sacrificed but using micro-circuits enables the Aurex system to deliver 50 watts per stereo channel. The tuner reads out the station wave length digitally like a calculator display. A micro-cassette is also in the pipeline, and the micro loudspeaker's dimensions are 4.75 by 4.75 by 7.5 in.

Disturbing as it may be to Japanese and American hi-fi manufacturers at Harrogate the "musical" sounds were being made by the smaller British firms, such as Castle Acoustics, B & W, Monitor Audio, Chartwell, Lentek, Celestion, and Richard Allan, all producing admirable loudspeakers for domestic use. KEF and Quad (Acoustical Manufacturing Co.) were not taking part, but will participate in the High Fidelity 78 Autumn Hi-Fi Show at the Cunard Hotel, London. As I write these notes, there is a month to go before this exhibition opens, so I will report it later.

Goodmans has introduced an impressive new range of three loudspeakers employing newly developed or improved versions of drive units with a finish in a soft brown leather-look material with matching African hardwood nosings. The systems are known as the Sigma, which is the largest, a floor-standing design. It is a two-way system, plus passive radiator, with a 205-mm long-throw bass unit with pleated surround, a high-power voice coil and rigid polymer cone matched via a 12-element network, plus the well-proven 25-mm soft-dome HF unit. The passive radiator augments the bass response down to 35 Hz. The Sigma is rated for amplifiers between 20 to 95 watts rms. The Kappa uses the same two drive units, but with a passive radiator. The "baby" of the group is the Beta in a

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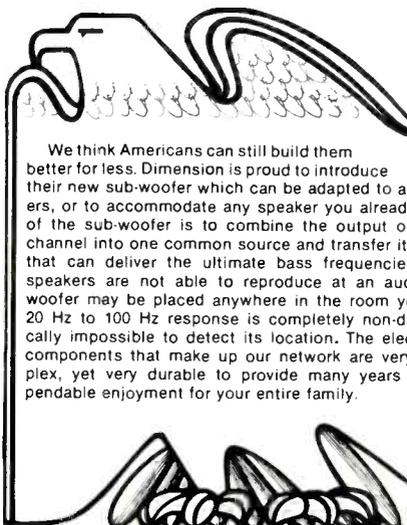


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cabinet of 10.4 litres internal volume and thus suitable for shelf mounting. A two-way system with 165-mm long-throw bass driver and 25-mm dome HF unit, this Beta model will suit amplifiers rated between 18 to 70 watts rms. Goodmans also have some high efficiency models — the HE-1, a three-way, four-unit reflex system and the JE-2, a three-way, three-unit reflex system. These designs have high power handling capability and very high sensitivity.

Still dealing with loudspeakers, as observed at Dusseldorf, the Dutch Audiostatic Electronics' speaker attracted a lot of interest. This is a clean-looking ELS of the folding screen type, measuring 51 in. high. The walls of the demo room were lined with brown hopsack, and frequency response curves and other data were displayed on the studio walls.

Backes and Muller had a well-planned half-hour demonstration at Dusseldorf. This company now has three feedback control loudspeakers: BM7 (two-way system), BM6 (three-way system) with electronic feedback over all three drivers and BM8. The BM8 is an omni-directional, six-sided construction with drive units located on five sides. There are 15 bass drivers (three per side) with metal diaphragms and inductive pickup devices for feedback regulation. Five additional cone units, also with metal diaphragms, deal with the bass/midrange. Five dome speakers with capacitance feedback coupling handle the middle/high frequency range, with five capacitively coupled ribbon units (mounted horizontally) for the extreme high frequencies. The system has 14 power amplifiers, with electronically coupled feedback, driving the ensemble. The speaker is 1.1 metre high and 50 cm. in diameter, and the price is 2,700 DM. The BM9 is a preamplifier suitable for driving the active loudspeakers.

Several critical observers of the hi-fi scene were greatly impressed with the ESS Transar loudspeaker (from Oskar Heil) particularly with an exceptional clarity of detail in its reproduction. Another unusual design at Dusseldorf was the single-unit device housed in a flying saucer-shaped housing some 680 mm diameter and 300 mm thick at its widest point. Stand options are available, as well as suspension systems for ceiling mounting. Sound reproduction was remarkably clear and stereo image well defined. Price, 2,600 DM each. This design is due to Joseph Manger, who has received a cash injection from the German government to initiate production. **A**

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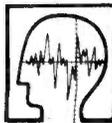


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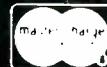
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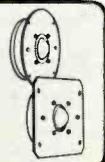
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The first thing a disco DJ wants to know about a turntable is: "Can I play the hustle without the hassle of rumble." While the last thing a classical FM station wants to hear is Pablo Casals accompanied by wow and flutter. That's why so many discos and classical FM stations use Technics professional turntables.

It's also the reason you should use Technics SL-1800 manual, the SL-1700 semi-automatic or the SL-1600 automatic (shown below). Because all three models give you inaudible wow and flutter of 0.025% (WRMS) as well as inaudible rumble of -78 dB (DIN B). That's performance equal to our professional turntables and that's impressive.

How did we do it? With the Technics direct-drive motor plus our 321 element one-chip IC. The "chip" eliminates speed variations and improves accuracy with a lightning-fast circuit that automatically senses the precise speed our direct-drive system needs for accurate rotation, even under sudden loads.

Each turntable gives you low acoustic feedback even at high music levels. Because they all have Technics unique double-isolated suspension system. One suspension damps out vibration from the base, the other from the platter and tonearm.

Equally impressive is Technics computer-analyzed S-shaped universal tonearm. Its gimbal suspension reduces friction to 7 mg. while it greatly increases tracking sensitivity.

And that's not all. Technics turntables also feature oil-damped cueing. A built-in strobe. Pitch controls variable by 10%. And a detachable dust cover.

Technics. The name behind the direct-drive system FM stations use and discos abuse.

Professional performance is something discos and radio stations get from Technics. Now you can get it too.



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