The Authoritative Magazine About High Fidelity

# AUDIO

DECEMBER
1969
60¢

STEREO EQUIPMENT & RECORD REVIEWS


Special Report: 4-Channel Sound

Guide to Speaker Specifications, Part II

Unusual LP Album Gifts

Inside the Moog Synthesizer

Pick of the Audio Books

The *Philadelphia* Orchestra "Pops"

Audioclinic

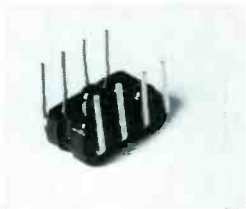
Annual Article Index

. . . and much more

# How man's conquest of the moon helped Scott develop the world's most advanced AM/FM Stereo Receiver

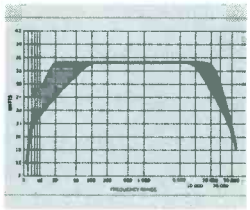
The billions of research dollars expended towards America's race to the moon helped foster the development of many entirely new electronic devices. Alert Scott engineers realized that the adaptation of some of these devices could result in significant advances in the performance of high fidelity components . . . a realization that inevitably led to the development of the 386 AM/FM stereo receiver.

The 386 represents a level of sound quality and performance characteristics that is a giant-step ahead of any stereo component ever before available . . . utilizing entirely new features that help you control incoming signals with a degree of accuracy never before possible . . . incorporating new assembly techniques that guarantee superb performance over periods of time previously thought unattainable.



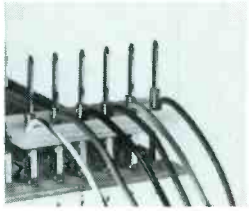
There are 7 ultra-reliable Integrated Circuits in the 386 . . . more than in any other receiver now on the market. These 7 circuits include a total of 91 transistors, 28 diodes, and 109 resistors!

Quartz crystal lattice filter IF section, never before found in a receiver in this price class, ends the need of IF amplifier realignment, and gives very low distortion and high selectivity.



Higher power at lower distortion: The shaded area indicates where competitive receivers tend to rob you of full response in the extreme lows (organ, bass drum) and highs (flutes, triangles, etc.)


Perfectune, a computer logic module, decides when you've reached the point of perfect tuning *and* lowest distortion, then snaps on the "Perfectune" signal light.



Wire-wrap terminal connections and plug-in printed circuit module construction result in the kind of reliability usually associated with aerospace applications.



**386 Specifications**

Total power (± 1 dB) 170 Watts @ 4 Ohms. IHF Dynamic power, 67.5 Watts/channel @ 4 Ohms; Continuous power, both channels driven, 42 Watts/channel @ 4 Ohms, 35 Watts/channel @ 8 Ohms; Distortion < 0.5% at rated output; Frequency response (± 1 dB), 15-30 KHz; IHF power bandwidth, 15-25 KHz. FM usable sensitivity (IHF), 1.9 μV; FM selectivity, 42 dB. Price, $349.95.

**H SCOTT®**

For detailed specifications, write:
H. H. Scott, Inc., 111 Powdermill Road, Maynard, Mass. 01754
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# Ever see a sonic boom?


You're looking at our A-1200U tape deck. Most people would rather listen to it. Even though it's already started its own sonic boom. And no wonder: the A-1200U is our standard four-track model, with all the famous TEAC craftsmanship at an ear-boggling low cost. And plenty of unique features, like the popular ADD recording for simultaneous playback and recording on separate tracks. This is the machine that breaks the price barrier to your sound investment. Without breaking you.

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# AUDIO

December 1969 Vol. 53, No. 12

Successor to RADIO, Est. 1917





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Check No. 3 on Reader Service Card →

# It takes nerve to ask $1,000 for an FM/FM stereo receiver. Unless you have the stuff to back it up.

This is our SA-4000 stereo receiver. It costs $1,000. But don't look for it at your Panasonic dealer yet. Because the first 25 units in existence have been snapped up by audio laboratories. They're ripping it apart to see how we created it.

For $1,000, the SA-4000 better be something special. It is. How special? Try to tune it. You'll discover it's the first stereo receiver in history without a tuning knob. That's only for openers.

Nobody's ever combined the best pre-amp, the best power-amp, and best tuner into one unit before. This kind of ingenuity, creating a whole new generation of audio equipment, is commonplace at Panasonic.

It's happened 14,048 times, so far. That's how many patent rights and designs have come out of our 50 research and development labs. Where the hackles of 2,500 engineers and scientists go up when somebody says, "It can't be done." Many of the audio components they've created never existed just 5 years ago.

But the real key to quality is this: Every component, from the tiniest transistor to our 36-inch woofer, is manufactured in one or another of our 80 factories. Tested, inspected, and quality controlled by 40,000 master technicians. That's why we're so absolutely certain of their compatibility. Their excellence. And their reliability.

Nobody makes audio equipment like Panasonic.

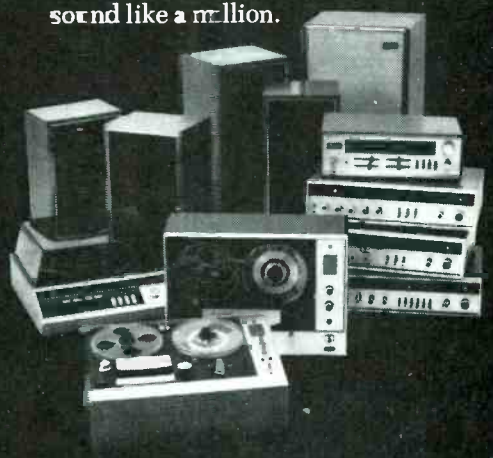
And this goes not only for our $1,000 receiver. But our 4 other stereo receivers as well. The same imagination. The same rigid quality control. The same loving attention to detail is present in all our stereo receivers. They'll give you sound that'll knock your ear on its ear.

Our 4-track stereo tape decks are packed with little miracles of audio engineering. Every circuit is married to every transistor. To every component. That's love.

Speakers? Take your choice from 5 new Panasonic multi-speaker systems. Each set of woofers and tweeters is acoustically matched for the purest sound. With a range wide enough to wake up an Airedale.

You've never heard stereo component systems like these before. Because nobody ever made them before. The speaker systems. The tape decks. They're all compatible with our $1,000 receiver. And with our less expensive receivers.

Stop by any dealer we franchise to handle the Panasonic Audio Equipment line. If he doesn't have the $1,000 unit in stock yet, listen to our less expensive models. They sound like a million.

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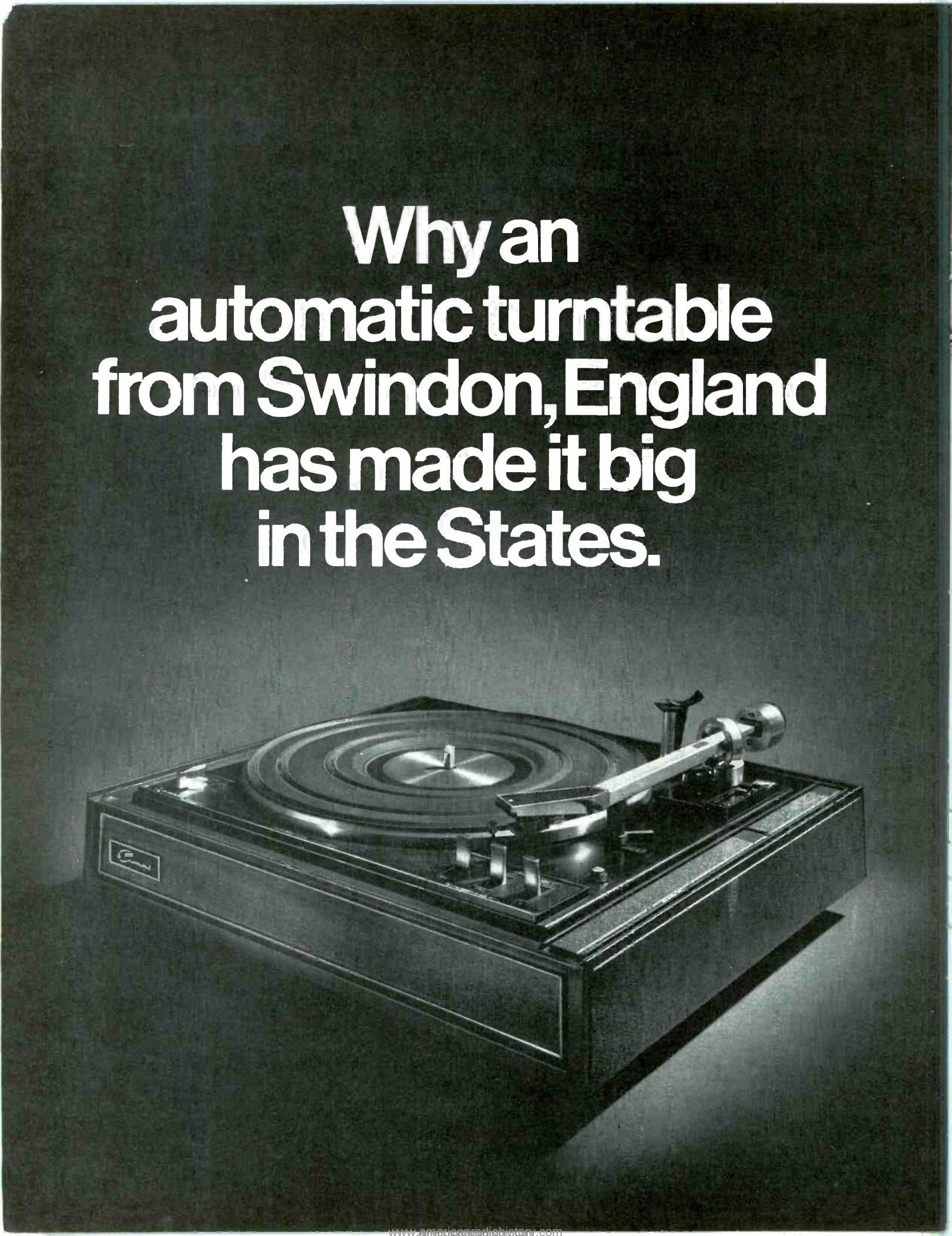
For your nearest Panasonic Audio Equipment dealer, write Panasonic, 200 Park Avenue, New York 10017.

# Why an automatic turntable from Swindon, England has made it big in the States.



H. V. Slade (1889—1961)

At the risk of seeming immodest, we've had a smashing success in the United States.

There are more Garrards being used in component stereo systems here than all other makes combined.

Even *we* find this curious.

But the die was cast thirty-odd years ago.

### Not parity, but superiority

H. V. Slade, then Managing Director of Garrard Limited, decreed, "We will sell a Garrard in the U.S. *only* when it is more advanced than any machine made there."

A commitment to, not parity, but absolute superiority.

That policy has not changed to this day.

Spurred by it, Garrard of England has been responsible for every major innovation in automatic turntables.

In the thirties, Garrard pioneered the principle of two-point record support. Still the safest known method of record handling. Oddly, still a Garrard exclusive.

In the forties, we introduced the aluminum tone arm. Today, widely used by makers of fine equipment.

By 1961, increasingly sensitive cartridges had led us to adapt a feature originally developed for professional turntables: the dynamically balanced tone arm, with a movable counterweight to neutralize the arm and an adjustment to add precisely the recommended stylus tracking force.

In 1964, we added an anti-skating control, and patented the sliding weight design that makes it permanently accurate.

Then, in 1967, Garrard engineers perfected the Synchro-Lab motor, a revolutionary two-stage synchronous motor.

The induction portion supplies the power to reach playing speed instantly. The synchronous section then "locks in" to the 60-cycle frequency of the current to give unvarying speed—and unvarying reproduction — despite variations in voltage.

### "We're bloody flattered"

This year one of our competitors has introduced a copy of our Synchro-Lab motor on its most expensive model.

To quote Alan Say, our Head of Engineering, "We're bloody flattered.

"After all, being imitated is a rather good measure of how significant an innovation really is."

The new Garrard SL95B features still another development we expect will become an industry standard.

Some years back we pioneered viscous damped tone arm descent for gentler, safer cueing. Ever since, we've been troubled by the logic of offering an automatic turntable with a damped tone arm that wasn't damped in automatic cycle.

This year we've added a linkage system between the changer mechanism and the damped tone arm "jack."

So, for the time being at least, Garrard has the only damped tone arm that is also damped in automatic.

Other 1970 Garrard refinements include a counterweight adjustment screw for balancing the tone arm to within a hundredth of a gram. A window scale on the tone arm for the stylus force gauge. And a larger, more precise version of our patented anti-skating control.

### Un-innovating

At the same time, we've eliminated a feature we once pioneered. A bit of un-innovating, you might say.

Garrard's disappearing record platform is disappearing for good.

We've replaced it with a non-disappearing record platform. A larger, stronger support with an easy-to-grasp clip that fits surely over the record stack.

A small thing, perhaps.

But another indication that H.V.'s commitment remains with us.

### $44.50 to $129.50

Garrard standards do not vary with price. Only the degree of refinement possible for the money.

There are six Garrard component models from the SL95B automatic turntable (at left) for $129.50 to the 40B at $44.50.

Your dealer can help you arrive at the optimum choice for your system.

**Garrard**

Check No. 5 on Reader Service Card

# What's New In Audio

## 14-Speaker System

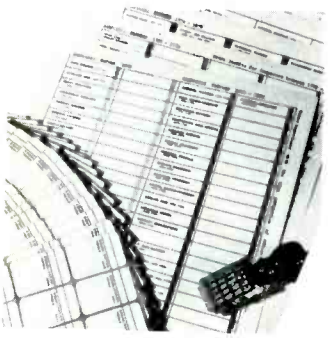
The LWE Division of Acoustron Corp. introduced the LWE IV, a four-way, 14-speaker system with "inverse feedback electronic suspension" and "room gain control." Available in an oiled walnut cabinet at $950 and in its "Instant Kit" format (unfinished cabinet and without grille as pictured here) at $725, the transducer complement consists of four 15″ woofers, four 8″ mid-bass, four 6″ mid-range, and two 5″ horn-type tweeters. The enclosure is an air-tight design, measuring 51½″ H x 36¼″ W x 20″ D, including kick base.

Frequency response of the LWE IV is said to be 20-20,000 Hz ±3 dB. Crossover points are at 150 Hz, 1000 Hz, and 4000

Hz. Nominal impedance is 4 ohms, and power handling capacity is 100 watts rms/channel minimum. The speaker system's control panel consists of high frequency, high mid-frequency, and low mid-frequency controls, a phase switch, auxiliary amplifier jack for bi-amp use, a main input connector for standard stereo operation, and the LWE "Room Gain" control, which is part of the unit's inverse feedback circuit that permits the user to compensate for room acoustic deficiences. In addition, the LWE IV incorporates negative feedback "electronic suspension." Available in traditional, mediterranean, and modern styling.

Check No. 105 on Reader Service Card

## Record Index Kit



Old Colony Sound Lab, Philadelphia, Pa., announces a new version of its "Recording Index Kit" for LP-record or magnetic tape music collectors. The kit includes an adjustable rubber stamp, 250 pressure-sensitive labels, and 250 printed composer names. The stamp is designed to stamp characters vertically rather than horizontally, and is used to print serial numbers on the labels which are wrapped around the disc sleeve or tape box. The user makes a 3″ x 5″ card file by making composer guides with the printed names provided in the kit, and filing a 3″ x 5″ index card for each work of that composer on the indexed recording. The card lists the name of the work, the serial number and performers. $8.95.

Check No. 106 on Reader Service Card

## Garrard Turntable Module

Garrard introduces module turntables with magnetic cartridge, base, and dust cover. The Module SLX-3, (pictured) whose turntable features and mechanism are based on the company's

top-of-the-line SL95B turntable, is powered by a "Synchro-Lab" motor, and comes pre-mounted on a slim-style base with an elliptical-stylus magnetic cartridge already installed, and includes a three-way dust cover. The unit's very light tracking force is preset.

The SLX-3 incorporates cueing and viscous-damped tonearm descent in both automatic and manual modes. Three control tabs activate the motor for automatic play (stack of records or manual), turn the motor on or off, and control viscous-damped cueing, respectively. The dynamically balanced tonearm can be adjusted by a counterweight, while stylus force can be adjusted by turning a screw at the rear of the arm. Tracking force may be determined by readout through a window scale. In addition, the unit includes a sliding weight anti-skating control and a two-point support platform for playing a stack of records. $99.50 complete.

Check No. 107 on Reader Service Card

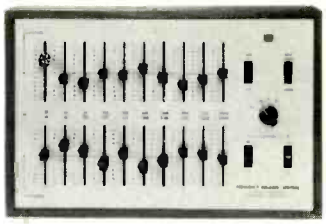
## Roberts Tape Deck

Roberts' new 3-motor, automatic-reverse tape deck, Model 650XD, features a 3-speed hysteresis synchronous capstan motor that operates without belt shifting, two induction motors, automatic shutoff, sound-on-sound, slide-pot controls, twin VU meters, Cross-Field tape heads, and a 4-digit counter with pushbutton re-set. $399.95.

Check No. 108 on Reader Service Card

## Stereo Tone-Control System

The Advent Corp., Cambridge, Mass., has introduced a device called the "Frequency Balance Control," which can be added to most component amplifiers and receivers. It is designed to improve tonal balance of recordings and stereo equipment, and to compensate for varying room acoustics.



Consisting of 20 linear level controls (10 per channel), each adjusts the output of a single octave in the audio spectrum over a range of ±12 dB. Each channel is switched to insert or remove the frequency balance control, and to compare left and right channels. $200.00.

Check No. 109 on Reader Service Card

## H-K Compact Music Systems

Harman-Kardon announces release of five new compact music systems, each of which features omnidirectional speaker systems. Ranging in price from $219.50 to $529.50, the Model SC1825, at $299.50 (photo), is said to be the "best value" system in the line since it is a combination stereo FM/phonograph/control center with two HK-25 omnidirectional speakers. Other models are stereo phono systems, tape cassette/phono systems, and stereo FM/tape cassette/phono systems.

Check No. 110 on Reader Service Card

## Stylus Cleaner

Elpa Marketing Industries has introduced the Cecil Watts phono cartridge "Stylus Cleaner." It consists of a lint-free, treated pad, packaged in a handy storage case, to clean styli without causing damage to them. $1.25.

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# S.E.A. receivers that deliver from JVC

They deliver sound custom-tailored to suit any room. Carnegie Hall or your pantry. Built-in Sound Effect Amplifiers (S.E.A.), exclusive with JVC, do the trick.

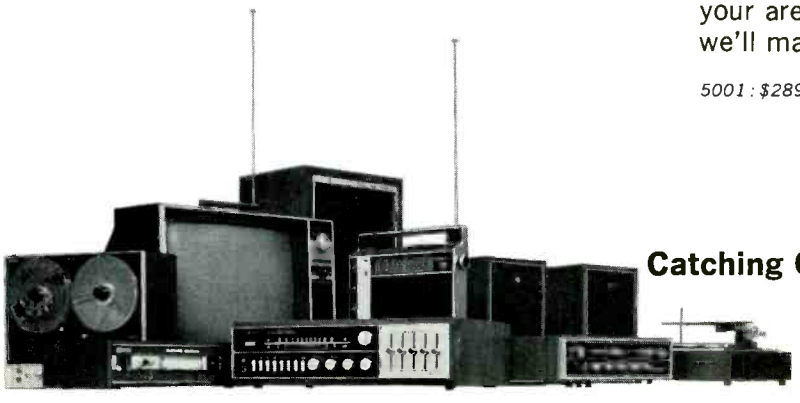
Here's how these powerful, precision-engineered stereo units stack up: Model 5040, a mighty 200 watt receiver with an 18 to 30,000Hz power bandwidth and a negligible 0.5% in distortion. Integrated circuitry and Field Effect Transistors insure extraordinary AM, FM and Multiplex reception. Powers up to six speaker baffles.

Model 5003—a hint less powerful at 140 watts. Power bandwidth from 20 to 30,000Hz, distortion less than 0.5%. Features FET circuitry, automatic stereo switching, multi-speaker system selection and muting switch.

Model 5001, a 60 watter with IC and FET circuitry. Power bandwidth from 20 to 30,000Hz with less than 0.8% distortion. Same sophisticated circuitry, many of the same features as the larger models.

Get more information about JVC's S.E.A. receivers and the name of the dealer handling JVC products in your area. Just drop us a line and we'll make the introduction.

*5001 : $289.95, 5003 : $369.95, 5040 : $449.95.*



**Catching On Fast**

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# COMING IN JANUARY

**SPECIAL FEATURE: Audio and Video Tape Machine Buying Guide**

**Quadrasonics on the Air**—Len Feldman describes the technical details of broadcasting four-channel sound over a single stereo FM station.

**Build a Variable-Frequency Generator**—C. G. McProud gives details on how to build a source of variable frequency so that the user can easily change the pitch of a record or tape played on a machine which does not incorporate a vernier frequency control, or to experiment with electronic music, or to learn how a variation in supply frequency affects equipment performance.

**Splicing Tapes and Applications**—Andrew Persoon discusses various aspects of splicing tape used to join pieces of magnetic tape . . . and more.

**PLUS:**
Equipment Profiles, Record and Tape Reviews, and other regular departments.

**ABOUT THE COVER:**
The Yuletide spirit dominates the page, supplemented by the audio goodies in the form of article titles.

# Pick of the Audio Books

**Audio Cyclopedia, 2nd Ed.,** by Howard M. Tremaine. Howard W. Sams & Co., Inc., Indianapolis, Ind. Hardbound, 1757 pages, **$29.95.**

This marvelous reference book, almost three-inches thick, is a revised edition of the one published ten years ago. It covers every phase of audio in a question and answer style, supplemented by many explanatory drawings and photos. With the contents sectionalized in 25 parts, each one devoted to a particular phase of audio—"Basic Principles of Sound," "Vacuum tubes, Transistors, and Diodes," "Audio Amplifiers," "Disc Recording," "Pickups," "Magnetic Recording," "Motion Picture Projection Equipment," "Loudspeakers, Enclosures, and Headphones," "Test Equipment," "Audio-Frequency Measurements," and "Installation Techniques" are some examples—and an index that uses a simple-to-locate paragraph numbering system, information is readily located. The author, Howard M. Tremaine, died shortly after completing this work, which stands as a proud monument to him. *Audio Cyclopedia* is heartily recommended to anyone who has a serious interest in audio, whether professional or consumer equipment. Without a doubt, it's the most comprehensive and helpful audio (FM and other radio frequency subjects are not covered) reference volume available.

**FM From Antenna to Audio** by Leonard Feldman. Howard W. Sams & Co., Inc. Indianapolis, Ind. Softbound, 159 pages, **$3.95.**

FM radio is covered here in a clear, down-to-earth manner, amply supported by many drawings. Much of the material presented here was originally published in serialized form in Audio Magazine as "ABZs of FM," and includes chapters on AM versus FM Broadcasting, Noise and Interference in FM, Signal Propagation and Receiving Antennas, as well as four chapters on FM circuit sections, and a chapter each on FM Receiver Measurements and FM Receiver Alignment. Recommended for anyone who wishes to understand how FM works.

**How to Select and Use Hi-Fi and Stereo Equipment, Vols. 1 and 2** by Murray P. Rosenthal. Hayden Book Company, Inc., New York, N.Y. Softbound, 114 pages (Vol. 1) and 104 pages (Vol. 2), **$3.95 ea.**

Volume 1 of this two-volume set covers loudspeakers, enclosures, amplifiers, tuners, and receivers, while Volume 2 concentrates on record players, tape recorders, and hi-fi troubleshooting. The author takes the reader by the hand and explains how it all works, and gives the criteria for buying component equipment. These nicely illustrated texts should serve the rank beginner in stereo hi-fi very well.

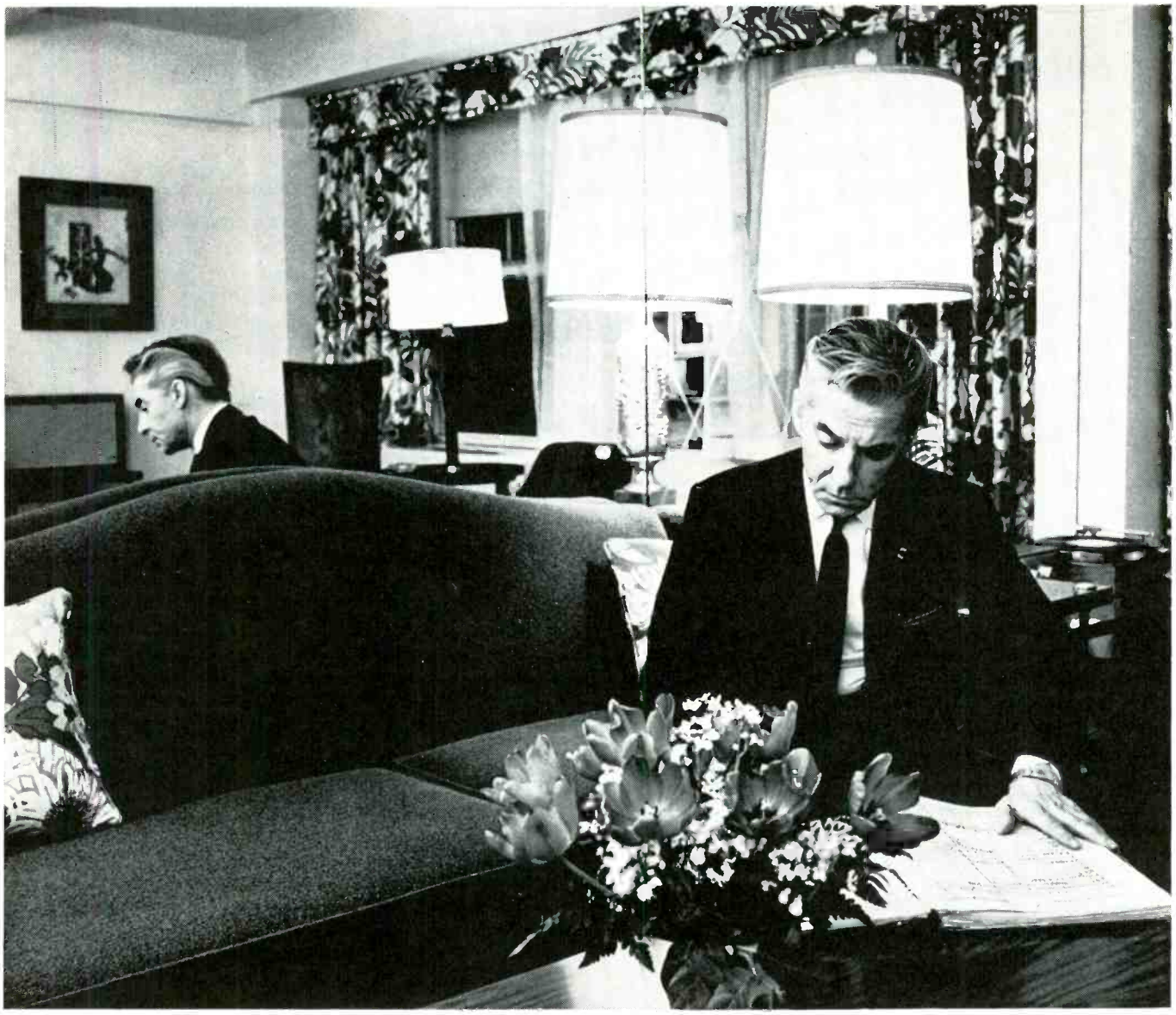
**Installing & Servicing Home Audio Systems** by Jack Hobbs. Tab Books, Blue Ridge Summit, Pa. Hardbound, **$7.95;** softbound, **$4.95,** 256 pages.

Here is a technician/audio dealer book that covers the audio equipment servicing field from the technical end. Contents include: How to Repair Stereo FM Equipment, Tape Recorders, Mobile Radios, Automatic Record Players, Audio Preamps and Amplifiers, and AM Receivers, as well as Test Instruments for Audio Servicing, and Selling and Installing Home Audio Systems. There are over 150 illustrations. Servicing tips based on the author's experience and troubleshooting shortcuts, together with technical descriptions of audio and hi-fi equipment and related service data round out the book.

**Audio Systems Handbook** by Norman H. Crowhurst. Hardbound, **$7.95;** paperbound, **$4.95,** 192 pages.

This all-around audio *systems* book spans home entertainment, commercial sound, and studio installations. Approaching the subjects from a practical view, with theory used only to clarify discussions, there is much knowledge to be gleaned from this book that is not available elsewhere. Some of the subjects covered are decibels and impedances, level limitations, insertion gain, equalizers, mixers, filters, distribution systems, commercial systems, studios, loudspeaker systems, microphone characteristics, power margin, electrical and electronic crossovers, electronically-generated audio, reverberation, and much more. In addition, information on how to assemble a system, recording and broadcast studio standards are discussed. A very worthwhile addition to the library of any audio engineer and enthusiast.

# Herbert von Karajan has led the world's great orchestras and opera companies in their own halls and theatres. At home, he listens to them with Acoustic Research equipment.



Few musicians have achieved the international distinction accorded Herbert von Karajan. His performances of Wagner's **Der Ring des Nibelungen** cycle at The Metropolitan Opera parallel his remarkable series of recordings of the same cycle, released by Deutsche Grammophon. These recordings, together with a large number of others of the classical symphonic literature, stand as a musical landmark to the world's listeners.

Herr von Karajan is also a man of unusual technical proficiency, being thoroughly familiar with the engineering aspects of recording and sound reproduction. His technical understanding is not limited to books, either; he is an adept jet airplane pilot, for example.

At nis home in St. Moritz and in his Essex House suite in New York, he uses a high-fidelity system consisting of an AR turntable, AR amplifier, two AR-3a speaker systems, a Sony TAH-10 headphone adapter and Sennheiser MDH-414 headphones.

Write for a free catalog listing AR speaker systems, turntables, amplifiers and accessories.

AR

**Acoustic Research Inc.**

24 Thorndike Street, Cambridge, Massachusetts 02141

Overseas Inquiries: Write to **AR International** at above address.

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# Audioclinic

JOSEPH GIOVANELLI

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

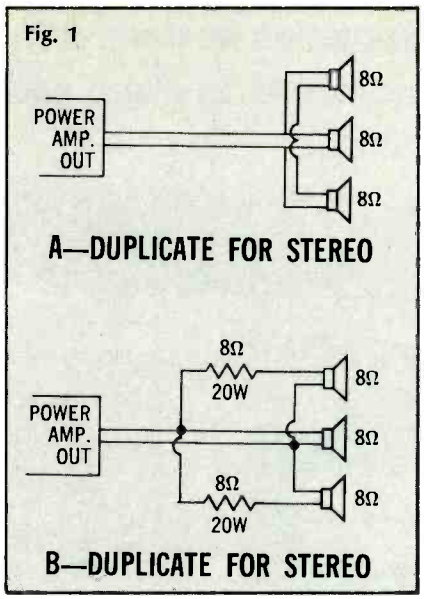
## Adding an Extra Speaker

*Q. I have a stereo receiver which is equipped to handle two sets of stereo speakers. At the present time I have two sets of high-efficiency speakers hooked up, 8 ohms each. Because my receiver can handle speakers having 4- to 16-ohm impedances, can I hook up a third set of speakers without doing damage to my receiver?—Capt. Ronald J. Slakie, Athens, Ga.*

A. As things stand now, you cannot connect additional speakers to your equipment. When you have two 8-ohm speakers connected to your equipment, this load represents a total impedance of 4 ohms, which is the lower limit of your amplifier's operating impedance.

One way to add the third speaker is to connect it in series with one of the speakers now in use. This connection will actually increase the impedance of this combination of series-connected speakers to 16 ohms. The total impedance of one 8-ohm speaker connected "straight" and the series combination of two 8-ohm speakers will be roughly equal to five ohms. This is about the lower limit of impedance tolerance set by the manufacturer of your amplifier. See Fig. 1A for the schematic of this setup.

Another way out of this problem is to connect one speaker as you now have it. You then can connect a second speaker, but, in series with an 8-ohm resistor having at least a 20-watt rating. You then must connect the third speaker to your amplifier,




but again in series with a second 8-ohm resistor having a 20-watt rating. See Fig. 1B for this arrangement.

Note that in both of these schematics that only one channel is shown. The circuits must be duplicated for stereo.

These latter two speakers will suffer from a 6-dB reduction in power being fed to them, with the remaining power lost as heat in the resistors. However, this method might be all right, if these extension speakers are for background listening. The speaker which is connected directly to the amplifier with no series resistor will have full power delivered to it. I mean full power in the sense that none is wasted as heat. Actually, this speaker will have half of the available amplifier power being fed into it.

## High Impedance

*Q. I am confused by the use of the term, "high impedance." I will bet that others are, too! The term is used so loosely these days.*

*In one place it will state, "high impedance, 600 ohms or higher." In another manual, (referring to the same thing), it will say: " . . . high impedance, 10,000 ohms or higher." Therefore, what is "high impedance"? Is anything 600 ohms or higher O.K.?*

*Experts tell us that even a slight impedance mismatch between driver and load is important. How is it then that we are also so often told that the load can be 600 ohms or higher?* John M. Geene, Jr., Vallejo, California

A. High impedance? As I use the term, high impedance is 10 k ohms or higher. 600 ohms never becomes high impedance in my thinking. I refer to 600 ohms as either low impedance or medium impedance, depending what I am discussing.

If I am discussing mikes, I think of 600 ohms as medium impedance. Low impedance is 50 or 200 ohms. High impedance is 10 K ohms or higher.

If I am thinking about cathode or emitter followers or line windings on output transformers, 600 ohms becomes low impedance.

It is fortunate that when manufacturers refer to high impedance in connection with any given product, the impedance is usually stated in definite numbers.

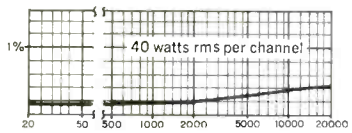
As to the second part of your question, there is a good reason why we can get away with mismatched impedances *under certain conditions.* When connecting loudspeakers to power amplifiers, we do want to obtain a reasonably close impedance match between the two. When such a match exists, maximum power will be transferred from the amplifier to the loudspeaker.

When feeding a preamplifier into a power amplifier, we are not concerned at all with transferring maximum power; our interest is in transferring maximum voltage from the preamplifier's output to the power amplifier's input. Power amplifiers operate on a voltage basis rather than on a current or power basis insofar as their inputs are concerned. This maximum voltage transfer can be accomplished only when the impedance of the power amplifier input circuit is considerably higher than the output impedance of the preamplifier. Therefore, no rule is being violated when connecting a preamplifier having a 590-ohm output impedance into a power amplifier having an impedance of 500 K ohms.

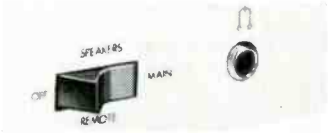
In fact, if you fed a preamplifier having an output impedance of 600 ohms into a power amplifier having an input impedance of 600 ohms, bass frequencies would be attenuated considerably, because the coupling capacitor at the preamplifier output is calculated so that frequency response will be maintained only when the preamplifier is fed into a high-impedance input circuit in the power amplifier. AE

# THE HEART OF YOUR DYNACO RECEIVER SYSTEM

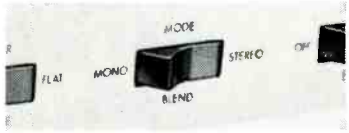
SCA-80 amplifier



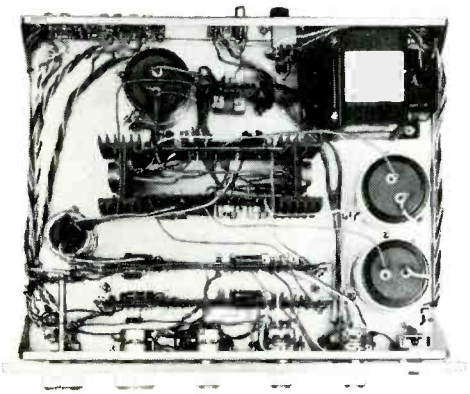

The SCA-80 delivers 40 watts per channel rms continuous power from 20-20,000 Hz at 8 ohms. Plenty of power for driving 4 ohm speakers too.




Front panel low-impedance headphone jack is always live. Rocker switch permits you to choose between main and remote speakers too, or turn speakers off.




Center channel speaker can be driven without an auxiliary amplifier with mode switch in BLEND, which also reduces unrealistic stereo separation when using headphones.



Open, uncluttered layout facilitates kit construction. Four etched circuit boards are factory assembled and tested.

The Dynaco FM-3 tuner ($99.95) is completely compatible with the SCA-80. The SCA-80/FM-3 system delivers up to three times more continuous power across the audio band than other one-piece receivers in the same price range.

## ALL THIS FOR ONLY $169.95*

*$249.95 factory-assembled.

See at your dealer or write for information.

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IN EUROPE WRITE: DYNACO A/S, HUMLUM, STRUER, DENMARK

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# EMBELLISHED BAROQUE

EDWARD TATNALL CANBY

THE REVIVAL OF Baroque music—that bouncy, colorful art of the seventeenth and eighteenth centuries so popular today among younger people—is entering a new and interesting phase. Advanced ornamentation. You make it up yourself.

The first phase of the Baroque revival, as we oldsters know, began far back at the turn of the century with the reappearance of the first "old instruments," the harpsichord and the recorder (plus an occasional lute or other exotic artifact), and with the movement towards a return to the original Baroque instrumentations, replacing those "modern arrangements" that had previously been taken for granted. That first phase still continues, amazingly, through a whole range of "new" old instruments—Baroque oboes, bassoons, flutes, with their crude finger holes, Baroque violins (the same but with different bows and less string tension), even the Baroque valveless brasses, only yesterday considered unplayable, the lip techniques for producing the tones have been lost a century and a half ago. From these we have moved on still further back into a wide array of Renaissance and Medieval instruments. These ancient and clumsy affairs are now put to work again by musicians, mostly young, who play as though old-music performance with professional virtuosity were the easiest thing in the world.

Phase Two, however, is bringing Baroque music into another and trickier area, moving beyond the physical technique into that free, stylized *improvising* by the player—or singer—of music not written down at all in the Baroque scores. Embellishment of extensive proportions was taken for granted in the period and, indeed, it provided a great deal of the performing interest. Without it, no matter how "authentic" the playing technique, and the instrument, Baroque is sadly underperformed today. But we are only beginning to move with confidence into the kind of performing that actually occured in the past. Too many musicians just can't improvise.

The trend in "classical" music since the eighteenth century has gone all the other way, towards an ever more rigid and complete written-down score in which the composer supposedly indicates *everything*—except, of course, that evanescent thing called interpretation. Thus, today, most classical musicians are trained up to play exactly what is put before them, note for note. To add extra notes to Beethoven is unthinkable! Few classical performers learn to make music on their own in any intelligible way. Most are incapable of improvising so much as a phrase in good style—any style. (Those who can often quit classical for the freedom of jazz or pop, where their abilities can be put to musical use.)

And so it is a shock to discover, as they now discover, that they *must* make up their own Baroque, or slavishly follow somebody else's ghost-written additions.

Not that we haven't known about this right along, most of us. But knowing is one thing and practising quite another. Somehow, until now, most performers have managed to dodge the whole problem of Baroque ornamentation, beyond a trill or so (more often than not done incorrectly) or the use of someone else's "realization" of the Baroque skeleton *continuo* accompaniment. Fortunately, the wide acceptance of Baroque has begun to turn the tide. Though plenty of pros, as well as amateurs, still play their ornaments haphazardly if at all, the correct basic ornamentation is at last getting around. The trill on a cadence, for instance, always done from the note *above* (as a dissonance) and always played in strict time; or the decorative mordent, *on* the note and moving down (not up) and back. These and a few simple variants go a long way, and any Baroque music is the better for their addition, as the ear quickly hears. The right places are easy enough to find, after a bit of experience. Millions of listeners already know exactly where they should be and how they should be played, even if not all the pros do.

Phase two of Baroque performance goes a lot further. In addition to simple turns and trills there were more elaborate kinds of melodic ornamentation, particularly in the slow movements, and in repeats, where the composer wrote over-simple melodies that were never intended to be played as such. Fast movements got their share too, though there was less room there for extra notes. As played—or sung—in good Baroque performance, the elaborations may seem almost to obliterate the melody yet, if the styling is good, the ear still follows the basic shape and the music, so to speak, remains itself.

Harpsichordists and recorder players, probably because theirs were the first revived old instruments, are now leaders in Baroque authenticity. Harpsichordists *always* play correct ornaments; they always work out their own *continuo* accompaniments direct from the skeletal bass line and chord figures provided by the Baroque composers. And for many years harpsichordists have been embellishing melodic lines freely and in style, all as a matter of course. Even old Wanda Landowska did it, a half century ago. Similarly, recorder players have tended more and more to play their own cadenzas and to add notes wherever a flight of fancy may suggest, though the art is more difficult and more conspicuous on the recorder.

Flute players and pianists, trained on modern instruments, notoriously ignore the Baroque embellishment. These two sorts of Baroque performer now lead the pack in terms of adventuresome, but quite proper, alterations of the Baroque printed note. The other instruments follow less surely. The vocalists are scarcely beginning to flounder in *their* art, which was once the finest of all Baroque expressions; and our orchestras are hardly beyond the faint beginnings of understanding, in spite of some well informed conductors.

And yet—as always we find on records the kind of inspiring leadership that now can have enormous influence in the musical world; for the best of the embellished Baroque is quite marvelous to hear. Two excellent

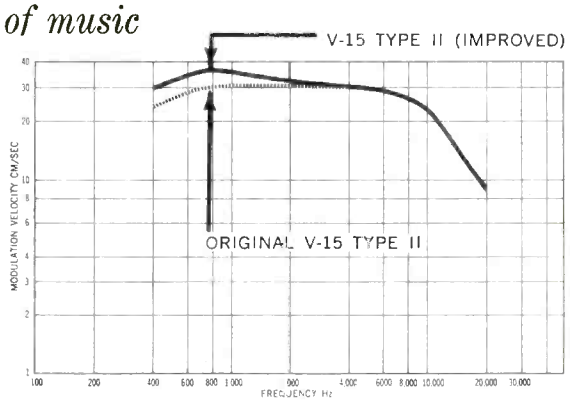
(Continued on page 14)

# THE SOUND OF A DIFFERENT DRUM

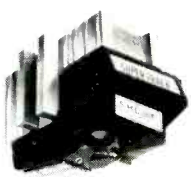
## *Higher trackability in the "backbone" region of music*

The grand structure of orchestral music relies heavily upon tympani, tuba, contrabass, bassoon, bass drum, and other low register instruments to form the solid foundation upon which the harmonies and melodic line are built. Unfortunately it is exceedingly difficult to track these passages when they are cut at high velocities. Even the Shure V-15 Type II, the world's highest trackability cartridge, required raising the tracking force when playing recordings containing this type of program material. We took this as a challenge and have prevailed. The top line of the graph at right shows the increased bass and mid-range trackability of the IMPROVED V-15 Type II. Practically speaking, it means you can reduce 1¼ gram tracking force to 1 gram, or 1 gram force to ¾ gram for records with high velocity bass register material. No increase in price ($67.50 net), but you will significantly extend record and stylus tip life.

**NOTE:** You can attain this superior bass and mid-range trackability with your present V-15 Type II by using the IMPROVED VN15E stylus at $27.50. Look for the word Shure in red letters on the stylus grip.




TRACKABILITY CHART (1 GRAM STYLUS FORCE)



SHURE

**V-15 TYPE II (IMPROVED)**

SUPER TRACKABILITY PHONO CARTRIDGE



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## BAROQUE

*(Continued from page 12)*

new records, among a good many illustrate the present state of the art in this interesting new phase of Baroque.

Hans-Martin Linde, on one record, plays four of the Handel Sonatas opus 1 on his alto recorder with Gustav Leonhardt on harpsichord *continuo* and August Wenzinger playing the bass line on a viola da gamba. Of these three, only the gambist plays the *literal* printed notes—and his part is not essential. Leonhardt plays his own *continuo* realizations, above the same bass, via his right hand. Linde's recorder embellishes the Handel solo line of these ultra-familiar sonatas with an astonishing quantity of tasteful extra melody, richly conceived but never overdone, notably in the many repeats which—one may now understand—were intended as opportunities to show off via well-turned embellishment. Recorder and flute players as well as Baroque listeners in general should find this recorder an ear-opener.

As for the orchestras, they now know about the "double-dotting" of the dotted-type rhythms (long, short) in Baroque overtures and most recent orchestral recordings are properly played in this respect. But added melodic ornament is something else again. It must, of course, be planned ahead if chaos is to be avoided, for all must play the same. Yet surely there *was* embellishment.

The Germans, inevitably, were the first to move into this dangerous and difficult area and their added figurations, over and above the printed scores, are the most natural. But a new English recording of Handel overtures and suites (in original scoring, of course) by the English Chamber Orchestra shows what the British are doing. Here, Handel is treated to a considerable amount of extra figuration, generally to good effect though a few additions sound forced; the musicians, I seem to hear, must have thought the idea a bit silly. They were wrong, their conductor was right.

**Handel: Sonatas for Recorder, Op. 1** Hans-Martin Linde; Gustav Leonhardt, harps., August Wenzinger, vla. da gamba. **RCA Victrola VICS 1429 stereo ($5.98).**

**Handel: Overtures.** English Chamber Orch., Bonynge. **London CS 6586 stereo ($2.50).**

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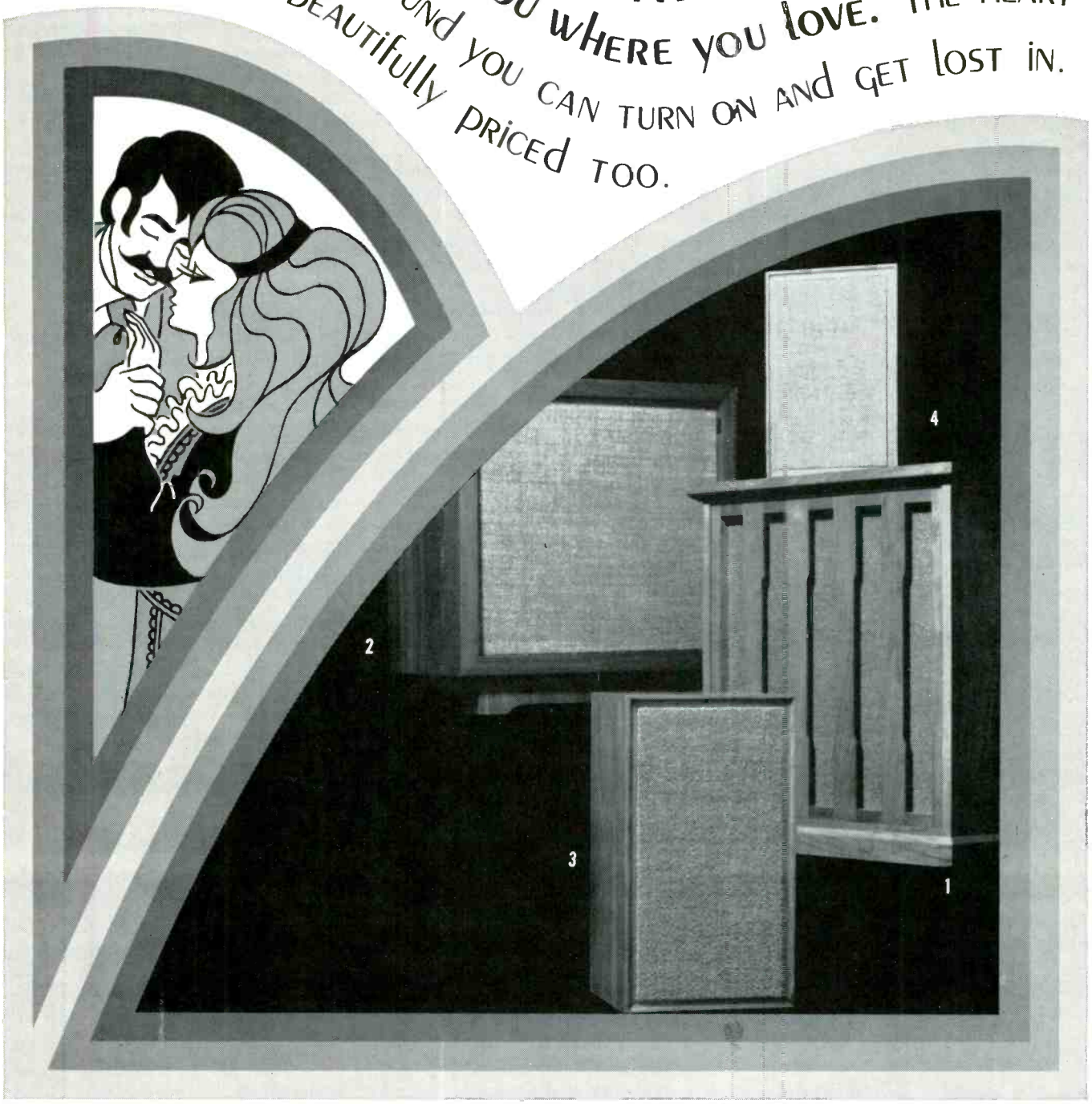
Four brand-new speaker systems that hit you where you love. The Heart line... personal, living sound you can turn on and get lost in. Beautiful! And beautifully priced too.




1) The President 2) The Vegas 3) El Paso 4) El Dorado
For some lovely specs, plus more detailed information about this fine new group of speaker systems, see your University dealer or write Heart Line, 9500 West Reno, Oklahoma City, Oklahoma 73126.

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# Tape Guide

If you have a problem or question on tape recording write to Mr. Herman Burstein at AUDIO, 134 North Thirteenth Street, Philadelphia, Pa. 19107.

**HERMAN BURSTEIN**

## Electronic "Ticks"

*Q. I have an elderly, semi-professional, tube-type tape recorder that seems to have developed an electronic tic. After the recorder has been in operation several hours, every now and then there is a popping noise in the speaker and the VU meter swings widely. This also happens when the machine has the amplifier on, no signal fed in, and the motor stopped. My guess is that some capacitor is defective, but with some 27 capacitors in the amplifier, what would be the logical ones to check?*

*Another question: Would it be worth the trouble to take the power supply off the present chassis and put it on a separate chassis in order to reduce hum?*—Carl Stoffels, Park Forest, Ill.

A. If your trouble does lie in a capacitor, you might first check those in the rectifier circuits. Then go to the first stage of the recording circuit, assuming that the trouble lies in the record amplifier. If the trouble appears to exist only in playback, then start with the first stage of the playback circuit. Possibly the cause of your trouble is external to the tape recorder; that is, some other electrical device on the same line may be transmitting an impulse to your tape machine as the former goes on or off.

*Usually* one can secure a reduction in hum by putting the power supply on a separate chassis and away from the rest of the electronics. However, the degree of success cannot be known until one tries.

## Tape-Head Connection

*Q. I have a tape recorder which I had hoped to use to duplicate tapes on my other equipment, which includes an amplifier. Knowing the electronics of it to be inferior to the rest of my equipment, I connected the tape heads to the tape head input of my amplifier. However, the results were very unsatisfactory; I experience a loud hiss or "rushing" sound even at low level. Will you please try to explain the cause for this.*—Grady W. Cook, Forest Hill, Md.

A. Faulty playback equalization might be the cause. More specifically, there may not be enough bass boost, so that, in relative terms, the treble frequencies (mainly responsible for hiss) are not attenuated sufficiently. Another possibility is poor design of the amplifier, or failure to use low-noise components in the case of resistors and transistors.

## Taping Records

*Q. I have a few questions that need answering before I buy a tape recorder. The records I wish to tape are all mono. I already have some mono tapes that I recorded on a mono tape recorder two years ago. I recently played back my mono tapes on a friend's stereo tape recorder, but the result was a mixing ("crosstalk") of the two tape sides.*

1. *Why does this happen?*
2. *How can this fault be remedied?*
3. *Are there stereo tape machines on the market that will successfully play back my old mono tapes without any alterations.*
4. *Can I record and play fresh mono tapes on a stereo recorder without producing the mixing action that occurred with my old tapes?*

*A friend told me that I could use four-track stereo tape to record mono discs, and that the same music would be present on the two tracks that are playing back. He also said that if I use only one channel of the stereo recorder when taping mono records on four-track stereo tape, I will be able to record separate mono programs on each of the four tracks, thus doubling the taping capacity. Then I could play the tape on the corresponding channel.*

5. *Is this possible (four-track mono)?*
6. *If so, how would I do it?*
7. *Would I be sacrificing fidelity?*
8. *Will a mono tape sound better played back on a stereo rather than on a mono recorder?*
9. *Does the new low-noise tape on the market require expensive, highly sophisticated tape machines for good reproduction?*
10. *How long may I store my tapes before print-through occurs?*
11. *Exactly what is print-through?*
12. *Is rubbing alcohol suitable for cleaning tape heads?*
13. *Are there American recorders that will operate on both 60- and 50-Hz current?*

—Grand Hicks, APO, New York.

A. The answers to your questions in the order asked are:

1. If you are using both sections of a stereo head, the lower gap spans part of the lower mono track, resulting in crosstalk. 2. Use only the upper section of the stereo head, corresponding to the left channel. 3. Yes. 4. Yes. 5. Yes. 6. Follow the tape machine's instructions. This means recording tracks 1 and 4 with the upper section of the tape head, and then recording tracks 3 and 2 with the lower section. 7. No. 8. If you play music through two channels and two speakers it will generally sound better than if played through one speaker. That is, a broad sound source usually sounds better than a narrow one. 9. No. However, an adjustment in bias current and in recording level is required. 10. Most print-through occurs in the first few hours of storage. After that, print-through increases very gradually through the years. Print-through can be decreased by winding and rewinding the tape before playing it. Its audible effects can be lessened by storing the tape tail out, that is, with the last recorded material toward the outside of the hub. 11. Print-through is magnetization of tape layers by adjoining tape layers, so that one gets pre-echoes and/or post-echoes of the material on adjoining layers. 12. Usually yes, but check with the tape machine manufacturer. 13. Yes, some.

## Amplifier Shut-off Modification

*Q. I have a *** tape recorder, designed so that an automatic shut-off switch stops tape motion when the tape runs out. I am interested in providing some modification which will shut off the amplifiers as well. Is this possible?*—David Simon, Kaneohe, Hawaii.

A. This may be possible, and relatively simple, by rewiring the a.c. supply so that all of it (not only the portion intended for the transport) goes through the auto shut-off switch. Æ

# Sony separates the sound from the noise.

**Noise-Reduction System.** This exclusive Sony circuit automatically reduces the gain of the playback amplifier during quiet passages of the recorded material which is when background noise and tape hiss is most predominant. Sony "SNR" provides the purest playback of all recorded tapes—automatically.

**Three Motors.** Two high-torque spooling motors plus a two-speed hysteresis synchronous capstan drive motor.

**Feather-Touch Push-Button Operation.** Relay-operated solenoid controls for all tape-motion modes. Four-digit tape counter. Stereo headphone jack. Two speeds. Two VU meters. Four-track stereophonic and monophonic recording and playback. And more.

**ESP Automatic Tape Reverse.** A special sensing circuit indicates the absence of any recorded signal at the end of a tape and automatically reverses the tape direction within ten seconds.


**Positive Head Protection.** An automatic tape lifter protects heads from wear during fast-forward and reverse.

**Non-Magnetizing Record Head.** Head magnetization build-up—the most common cause of tape hiss—is eliminated by an exclusive Sony circuit which prevents any transient surge of bias current to the record head.

**Automatic Sentinel Shut-Off.** When tape is not threaded, or end of reel is reached, Automatic Sentinel Shut-off disconnects power to tape mechanism without disconnecting power to pre amplifier.

**Sony Model 666-D.** Priced under $575.00. For your free copy of our latest tape recorder catalog, please write to Mr. Phillips, Sony/Superscope, Inc., 8142 Vineland Avenue, Sun Valley, California 91352.

SONY SUPERSCOPE The Tapeway to Stereo

You never heard it so good.

# Letters

## "Bridged" Channels

• About 1959 the Better Business Bureau commented unfavorably on some manufacturers calling a 3-speaker stereo array working out of 2 channels, "3-channel stereo." I'll have to admit my personal guilt in publishing a paper in 1958 referring to such a system as "derived 3 channel." I admit the culpability, especially as Steinberg and Snow (*Symposium on Auditory Perspective 1934*) had already named this "2 channel with bridged center speaker."

I'd offer a defense of sorts since I have shown that such a system, properly executed, is *closely equivalent* to 3 channels, but the fact remains that there are only 2 explicit channels no matter how many speakers are used.

Since some manufacturers have splurged with advertising like "1 + 1 = 3," I regret my error. Now that Pandora's box is open I guess there is no way to put the fallacy back under the lid, but I have tried to use the Steinberg and Snow term and at least refer to the additional speakers as "bridged" and not "3, 4-, or 5-channel."

PAUL W. KLIPSCH
Hope, Arkansas

*Mr. Klipsch is not referring to the new four-channel systems, which are true four-channel systems. See page 22.—Ed.*

## Construction Notes

• In regard to my "Austere Preamp" article in the October issue, I should like to add a note to clarify a point, and also correct something that did not come out on the schematic for benefit of readers who are building the unit.

If a very-low-output cartridge is used, and it is found that phono gain is inadequate, the circuit can be modified to double the gain, for 5-mV sensitivity. Simply change the 150-ohm resistor to 68 ohms, and the 100 $\mu$F 6V electrolytic to 200/6. This electrolytic, incidentally, is shown backwards on the phono board layout (reverse polarity for correct operation).

As for high-frequency response, the worst-case condition—listed in the specification as −3 dB @ 32 kHz—occurs *only* at half-volume setting (−6 dB), with 400 pF cable capacitance load (maximum permissible). It will be an octave better (−3 dB @ 64 kHz) if 200-pF cable capacitance is used, which would still allow an 11 ft. run of Belden 8421 cable. The low-frequency response is flat to 0 Hz (d.c.) because there are no coupling capacitors in the volume control circuit.

The power supply diode can be a GE type #509. Because the input filter capacitor has 130 V on it, it must be a 150-V unit.

The phono preamp follows the RIAA curve, held within 0.4 dB from 30-10 kHz by the 5% feedback components. Rather than call the high-level input distortions "unmeasureable," I would call these basically 0 at 1 V out; this is the benefit achieved by having no output amp, and therefore no nonlinear elements of any kind in the output "circuit." The simplest design may well be the best after all.

JOHN L. GRAUER
Great Neck, N.Y.

# You can't beat the system

## if it starts with a BSR McDonald turntable

A hi-fi system is only as good as its turntable. The best amplifier and speakers can't change sour notes into sweet music. All they can do is amplify the distortion from an inferior turntable.

That's why experts insist on BSR McDonald by the world's largest maker of automatic turntables. They're made in Great Britain by precision craftsmen who put the accent on flawless quality. You'll find such professional features as cueing and pause control, micrometer stylus pressure adjuster, dynamic anti-skate control, a vernier adjustable counterweight, just to mention a few.

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# EDITOR'S REVIEW

## This and That

Recording industry spokesmen are predicting that pre-recorded tape sales will equal record disc sales within five years. The prognosticators, backed by strong market research departments, visualize the 33⅓-rpm and 45-rpm discs capturing 50 per cent of the recorded music sales, while cassette and stereo-8 pre-recorded tapes rake in the other half.

Total 1969 sales volume for recorded music is expected to reach $1.1 billion, according to researchers, with $330 million of this figure represented by pre-recorded tapes. Stereo-8 is far out front, with about $250 million confidently predicted; pre-recorded cassettes are expected to pull about $50 million in consumer sales this year, while all other pre-recorded tape versions (4-track, open reel, and Playtape) combine for $30 million.

Discs are expected to hold their own after the smoke settles, however, because this format represents the primary source for talent. Furthermore, it is unlikely that pre-recorded tape prices will ever be as low as disc prices due to the higher production costs of tape and tape packaging. In light of the foregoing, it is interesting to observe that Ampex Stereo Tapes has announced that it will produce and market LP and single discs in the near future.

* * *

Acoustic Research, Inc. also announced its intention to produce discs. This will be part of the company's "Contemporary Music Project" program that will provide American composers with the technical, financial and administrative resources to produce and distribute FM broadcast transcriptions and stereo records for home use (the latter will be available for approximately two dollars). Deutsche Grammophon will do the record mastering and pressing from multi-channel tapes supplied to them by AR.

"Music to read books by" is an innovative step taken by Philips Records with its recently released LP album, "Music to Read 'The Prentenders' By." The concept is called "Discobook," which will be recorded music scores based on a piece of literature. Now if they can only sync the music to one's reading speed. . . .

The hi-fi component industry's first permanent high fidelity exhibit is expected to be maintained in New York City at 443 Park Ave. So., starting sometime in early 1970. A sound theatre is planned for speaker manufacturers who wish to demonstrate the aural qualities of their products. Loudspeaker operation in other exhibit areas will not be permitted, though non-speaker components may be demonstrated with use of headphones. Plans include a literature and information booth.

* * *

The sound of sound is being featured at the Museum of Contemporary Crafts, 29 W. 53rd St., New York, N.Y., October 25, 1969 through January 4, 1970. Exhibited here are selected sound experiences created by artists who work in a variety of disciplines. For example, there are "sounding sculptures" that are activated by light or tone, an 8-ft.-tall gong and hammer, metal earphone-like objects which emit delicate Eastern sounds when placed on the head, works that create certain sounds when set in motion by a gentle push. A plastic ball is set afloat in the air in response to an amplified hand clap, sound is altered by moving one's hands over the base of a sculpture, and so on.

In addition, there is a chamber of silence (an anechoic chamber), a Moog synthesizer which is programmed to play itself (daily noon-hour live demonstrations are given), visual music, a film program related to sound, and new electronic musical instruments, including a group-operated synthesizer-type instrument.

* * *

Instruction in audio recording technology, and audio engineering and acoustics marched forward in 1969. The Institute of Audio Research, Inc., New York City, was formed by Al Grundy and Irwin Diehl, for example, with educational programs in audio recording and seminars in advanced theory. Eight-week programs began in the latter part of 1969, with two classes held each week. Gotham Audio Corp. held a three-day "Disc Recording Seminar" at the Sterling Forest Conference Center some 55 miles from New York City in which the entire field of disc recording, both theoretical and practical, was covered. Similar seminars will be held at other parts of the country by Gotham Audio. A new chair in the fields of audio engineering and acoustics was established at the Massachusetts Institute of Technology through a bequest of C. J. LeBel, one of the founders of the Audio Engineering Society, to his alma mater. Dr. Amar G. Bose was appointed the first Clarence Joseph LeBel Professor of Electrical Engineering at the prestigious engineering school.

*A.P.S.*

**Seasons Greetings from all of us to all of you**


PHOTOGRAPH BY FRANZ EDSON

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Only Pickering's XV-15 series of cartridges features 100% Music Power. With the Pickering, a harp sounds like a harp, a trumpet has the biting sound that you expect from a brass instrument, the flute has a rich romantic tone, the orchestra is the full-throated instrument the composer called-for.

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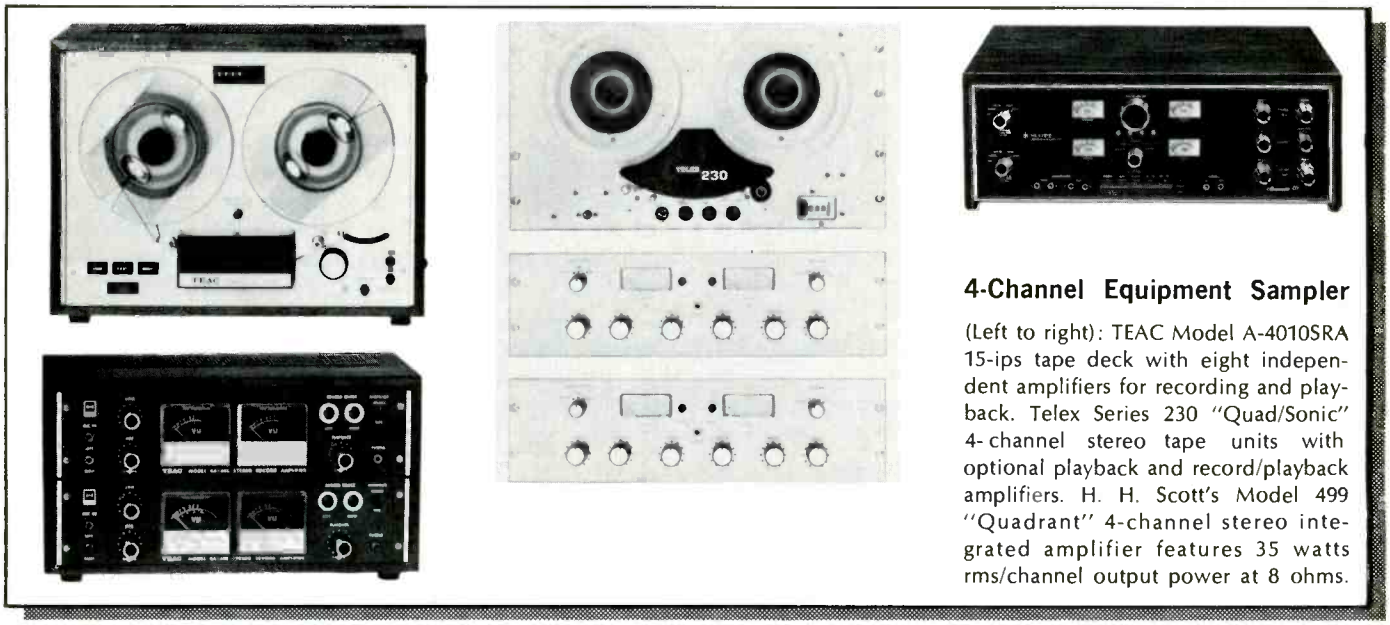

**4-Channel Equipment Sampler**

(Left to right): TEAC Model A-4010SRA 15-ips tape deck with eight independent amplifiers for recording and playback. Telex Series 230 "Quad/Sonic" 4-channel stereo tape units with optional playback and record/playback amplifiers. H. H. Scott's Model 499 "Quadrant" 4-channel stereo integrated amplifier features 35 watts rms/channel output power at 8 ohms.

on a four-channel multiplex system that would overcome the alleged sideband spillage, and afford full 15-kHz fidelity, in contrast to the reported 10-kHz limit of the Halstead System.

No sooner had four-channel tape been announced, than the word began to circulate that "this time the disc is well and truly dead . . . they can't put four channels on a disc." As usual, the pundits of gloom were a bit premature. It is unquestionably going to be difficult to put four-channel sound on a disc. But we must remember that the record industry has collectively probably over one hundred million dollars worth of pressing plants and allied installations. If there appears to be a public demand for four-channel sound, you can be sure that every effort will be made to produce a four-channel disc, rather than lose this tremendous investment. In this connection, it is worth noting that a story in *Time* Magazine reported that a bassoonist named Peter Scheiber had worked out a "coding system to compress four channels into two, overlay them on tracks in either disc or tape, and then retrieve them again." *Time* claimed its music editors heard a demonstration of the four-channel disc, which "was quite good, but not as good as equivalent tapes." The Scheiber process reportedly has one great commercial virtue: compatibility with existing hi-fi systems, for it requires only an "encoder" at the recording studio and a "decoder" in the home of the listener (with all the additional speakers and amplifiers, of course). Whether this is a valid system is a moot point. A friend of mine who is Chief Engineer of one of the major record companies attempted to contact Scheiber, and actually reached him on the telephone, but Scheiber would give out no information whatever regarding his system. [EDITOR'S NOTE: *Bert Whyte advised, in a last-minute telephone call, that two very reliable sources said they heard the 4-channel disc operate—and it works!*

I talked with Jerry Minter of Components Corp., who way back in 1957 had developed an FM carrier system for two-channel stereo discs, and asked him about the possibility of a four-channel disc. He seems to think it would be possible to achieve by multiplexing, and said that the technology of today is better able to cope with the high frequencies that would be necessary to cut on a disc. He says that he routinely cuts 40 kHz onto discs for special purposes, and that Philips and several other companies have cartridges capable of reproducing this frequency. I asked him if, even at the 1-gram tracking forces of today, the high-frequency carrier would survive many playings, especially in view of the photomicrographs of Woodward at RCA Princeton, which revealed extensive groove wall damage after just one play. He believes this would not be a factor, pointing out that he has reduced turntable speeds to bring the 40 kHz to the point of audibility, and that even after numerous playbacks the frequency was still in evidence. So one must conclude that the four-channel stereo disc is not an impossible dream.

Now that we have established that four-channel sound is on the way to becoming a commercial reality in one or more formats, it might be pertinent to take a closer look at what it is and what we are trying to accomplish. Let us confine ourselves to recorded tape at present, since this will be the first medium that will be generally available to the public. Vanguard will soon issue open-reel 7½-ips tapes with four channels on standard quarter-inch tape, with the four channels "in line" and all running in the "forward play" mode. Very wisely, Vanguard has decided to designate channels one and three as the front-left and front-right channel, and channels two and four as the rear-left and rear-right channels. This will make the four-channel tape compatible with present quarter-track tape recorders, so that one could purchase a four-channel tape and be able to play it on the front stereo speakers in the normal fashion. At a later date, when four-channel playback facilities have been purchased, the tape will be totally utilized with its rear channels.

To play four-channel tapes you obviously need a tape machine with the four-channel in-line head, four playback preamplifiers, your present front stereo speakers and stereo amplifier and *another* stereo amplifier and pair of speakers for the rear channels. That is a lot of gear, and it is going to be expensive initially until some special


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made-for-four-channel equipment reaches the market. Obviously another stereo amplifier and pair of speakers is easy to acquire, apart from the cost, but what about the four-channel tape playback machines? Well, if you are one of those proverbial Texas oil barons, it is a simple matter to buy an Ampex or a Scully four-channel recorder; they are standard catalog items. There would be a drawback even with these machines, however, since they use one-inch-wide tape. You would have to induce a company to make you four-channel copies in this tape width. Since we are breathing this rarified financial air, we might as well go whole hog and buy a pair of Dolby A-301 noise reduction units and ask the company to furnish a Dolby compressed copy. Then we could run the tapes through the A-301 expansion section and we would have our 10 dB of noise reduction right at home!

As a practical matter, we will have to stay with the quarter-inch tapes. Oddly enough, there are some four-channel in-line machines already available in this width. TEAC has a unit which records and plays in this format (and sells for about $1200). Telex reportedly has a similar machine with a Viking playback only unit to sell for $289. Wollensak demonstrated an open-reel four-channel deck at the AES show (expected price is under $500). Other tape machine manufacturers are expected to follow suit. Kingpin in the quarter-inch four-channel recorder market is Crown International. They have been making machines in this format for some time for people who want this facility without the expense of the one-inch recorders. Expense here is a relative thing: the one-inch machines are about twice the cost of the quarter-inch units.

Crown has very kindly sent me their top quarter-inch four-channel machine. It's a real beauty. Computer-logic transport, four record and playback preamplifiers, four 5-inch VU meters, and the ability to use up to eight microphones. It uses the big 10½-inch reels and can record 15 ips and slower speeds. It is a fairly heavy unit, and is therefore more transportable than portable. Nonetheless it is all in one case and I took this unit to the Vanguard studios and dubbed some four-channel copies right from their four-channel one-inch masters. Thus, I have had four-channel sound in my home for some time now and can give you my impressions and observations a little later on.

## What Four Channels Accomplish

But first let us examine the purpose of four-channel stereo. As you know, ever since the dawn of high-fidelity sound, the advertising copywriters have been waxing rhapsodic about how this or that amplifier, speaker, or other component brings you sound with "glorious concert-hall realism." Only the most naive believe this nonsense, as most of us are very aware that, unfortunately, even the most expensive state-of-the-art stereo system just does not furnish us with the totality of the concert hall experience. Psycho-acoustics plays a very important role in our home listening. The recording engineers work very hard and employ all sorts of techniques to incorporate in their recordings the acoustic ambience of the hall in which they are recording. At home, we play back these recordings at the sound level which gives us the psychological approximation of concert hall level. It all helps, but hardly anyone deludes himself that he is experiencing the physiological and emotional involvement that comes with their total immersion in the sound field of the concert hall.

A great deal of research has proven that what is missing in the home listening situation is the literal re-creation of the acoustic environment of the concert hall. It is obvious that physically we can't place a symphony orchestra in our living rooms. So we will have to depend on psycho-acoustic trickery. The best place to start seems to be the creation of a sound field in our listening rooms which our ears will accept as analagous to the ambience of the concert hall. When we sit in a concert hall listening to an orchestra, the transient sounds that reach us in the first 10 to 20 milliseconds establishes the directional qualities that tell us where the sound is coming from and determines the placement of individual instruments. After that initial period, the sound is bounced and reflected countless times from the walls, floors, and ceilings, and is incident on the listener in fairly equal levels from all parts of the hall. The listener is thus sitting in a reverberent field which gives the hall it's characteristic sound.

The closest approximation we have had of concert hall sound up to now is a properly made binaural recording heard through earphones. By sealing out external sounds, the earphones and the recording act almost like some sort of time machine, transporting us back to the hall and re-creating all the directional and reverberent characteristics of the sound in the hall. Dealing with speakers in the home makes our task more difficult. So in order to create that reverberant field, which seems to be the essence of the concert-hall experience, it was decided to utilize extra channels of sound specifically recorded for that purpose. The question was, of course, how many channels would be necessary?

Years ago someone stated that if you built a brick wall across the stage in front of an orchestra and then had the orchestra play into an infinite number of microphones, through an infinite number of amplifiers, through an infinite number of speakers in front of the wall, in acoustic terms the wall would disappear. In other words the answer is that we should use as many channels of sound as possible. In practical terms, it would seem that we must be satisfied for the present with four channels. This would consist of two speakers facing the auditor as in the normal stereo mode; these would be fed by two channels carrying most of the sound energy, with all of the directional information and a large proportion of the reverberation. In addition, two speakers at the rear of the auditor would be fed by the other two channels of the tape and would carry only hall reverberation, except in the rare special case of the Berlioz Requiem or with music specially composed for the four-channel medium.

The Vanguard four-channel tapes were recorded in the manner just described. Needless to say, recording in this fashion is very critical and is different for every hall. The rear-channel microphones must be carefully chosen as to type and pattern. Their placement in the hall in relation to the front microphones is all-important. This is, of course, a matter

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subject to a great deal of experimentation and I don't think anyone will be insulted if I say that much more experimentation lies ahead in the area of standardization, even though standardization in this process will probably be very broadly interpreted.

## Personal Observations

At this point in time I have heard the original Vanguard four-channel demonstration, the AR demonstration at their listening room in New York, several demos at the October 1969 Los Angeles Hi-Fi Show, and, as noted, I have been living with my own four-channel system at home for some time now. For the most part I have heard the Vanguard tapes, but also heard some Columbia tapes at the AR room. Thus I have heard four-channel sound under a variety of conditions and have drawn a few conclusions.

In my home set-up, I have the outputs of the Crown four-channel recorder feeding into a Sony and a McIntosh preamp; the Sony feeds into the magnificently powerful Crown DC300 amplifier which drives the front speakers. The McIntosh feeds into a McIntosh 2105 amplifier which drives the rear speakers. The McIntosh amplifier has two big power meters, which are a real help in setting the rear channels. I have fed the four channels into bookshelf-type speaker systems, into very big conventional speakers, and into reflecting- and omni-directional-type speakers.

On the Vanguard tape is a work for string orchestra, the Berlioz "Requiem," which as you probably know was scored for a brass band in each corner of the hall, the Mahler "Third Symphony," which has two sections on the tape—one that is straight orchestral, the other calling for a children's choir "high in the rear" of the hall. Then there is a pop section with songs by Joan Baez and Buffy St. Marie, and a wild instrumental work that deliberately exploits the rear channels' gimmicky aspects of four-channel sound.

How does "surround stereo" sound? Well, once you establish the tricky output ratios between the front and rear speakers you are in for a unique sonic experience. At its best, it simulates very closely the sense of being in a concert hall. At it's worst (mostly in the pop material) you dismiss the rear channels as gimmicky. You expect the Berlioz Requiem to be sensational in the original four-brass-band scoring—and it is! The Mahler Third is impressive, too, with the childrens choir. However, I was more interested in the results with the straight orchestral music. After all, there are very few works scored for performing forces in the rear of the hall, and you can't justify four-channel sound just for these few pieces.

There has been a natural tendency at the demos I have attended to turn up the rear reverb speakers too high—probably just to make sure you know you are listening to four-channel sound. However, this negates what you are trying to accomplish because you hear behind you various instruments which just don't belong there. As a result, this can cause a listener to become quite dis-oriented. The whole idea is to simulate the concert hall environment in your living room, which can be a fairly subtle thing to accomplish. As I noted, balancing the system is critical. And balancing requirements vary, depending on where you choose to place your listening seat. Sit closer to the front speakers and you need more sound from the rear and *vice versa* for the rear speakers. You find yourself creating an idealized concert hall seat, depending upon the size and physical layout of your listening room. Once adjusted, with what may appear to be very little contribution from the rear channels, one has but to ask someone to switch off the rear channels while you are in the listening position to note the dramatic difference in realism. The idea is to get just enough rear channel to enhance the reverberent field and have the walls of your living room "dissolve into the concert hall."

As mentioned earlier, much experimentation is needed to optimize this rear-channel pickup in the hall, and since I am fortunate enough to have four-channel recording facilities I will be trying some ideas of my own as well as those of an engineer friend of mine. We will be recording some local choruses and school and community symphony orchestras.

A word at this point about four-channel sound and the type of music most suitable for its application. The most legitimate use is quite naturally with classical music. With pop music, anything goes. They talk about the "mind blowing" potentials of this medium when fully exploited, and I can't argue with that. Since pop music has long since abandoned any relationship to reality, why not go a step further?

Now I think it pertinent to discuss certain other aspects of four-channel sound. For one thing, it is not a panacea for sonic ills that will transform poor speakers and amplifiers into good ones. One of the claims made for four-channel sound is that it eliminates the stereo listening axis between the speakers. This it just does not do. After many hours of listening to four-channel stereo I have come to the conclusion that the type of speaker you use has a profound influence on the success of this process in the simulation of the concert hall environment. Don't misunderstand me, though. With careful balancing between front and rear, all speakers are capable of enhancing the realism of the sound. But I have found that the optimum degree of realism is to be found with the omni-directional and reflecting type of speakers, rather than with conventional types, large or small. When you think about what we are trying to accomplish with four-channel sound, this is not an unexpected result. The rear microphones are picking up reverberent information which is non-directional; the front mikes directional information plus reverberation. It would appear it is best to use speakers which create larger sound images than their physical size. Conventional speakers would work nicely if there were enough of them and enough channels to feed them information. In other words, enough point sources and you develop a complete sonic image.

Is four-channel stereo worthwhile? Is it worth all the expense and bother? Well, I think that it definitely works and will work better in time to come as we learn more about microphoning for the rear channels. It goes a long way toward the ultimate goal of bringing the concert hall ambience into the home. That the degree of realism is different for different kinds of speakers doesn't lessen its positive advantages. After all, a pint of ice cream tastes just as good as a gallon; there is just more to enjoy in the gallon. Æ


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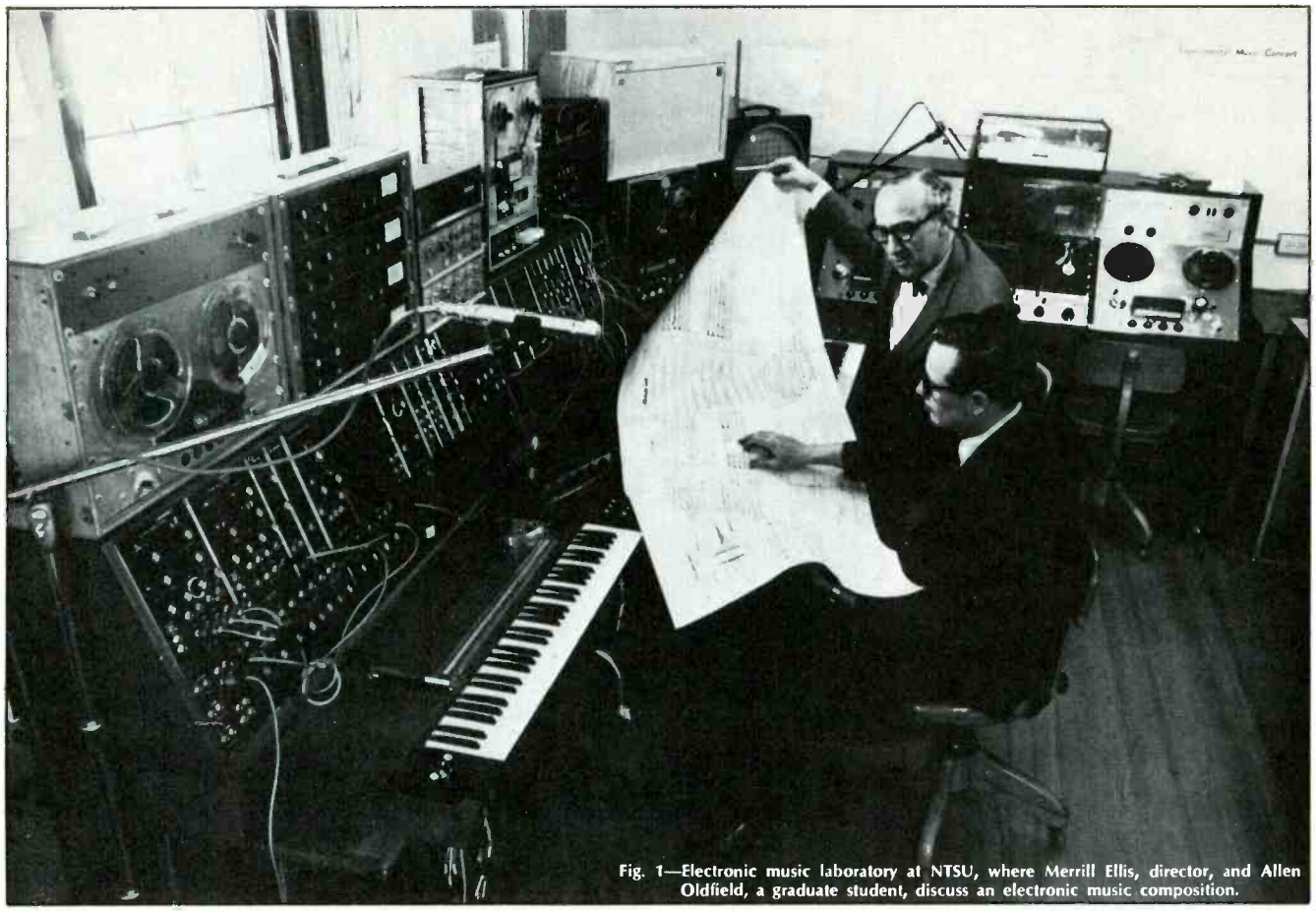

Fig. 1—Electronic music laboratory at NTSU, where Merrill Ellis, director, and Allen Oldfield, a graduate student, discuss an electronic music composition.

# INSIDE THE MOOG SYNTHESIZER

**Everyone is familiar with the kinds of sounds the synthesizer creates. Here is an explanation of how it creates them.**

ROBERT C. EHLE

ELECTRONIC MUSIC IS TODAY a vital part of the curriculum of many music schools. Of all the varieties of musical composition taught today, electronic musical composition is perhaps the most practical due to its growing application in the commercial areas of music. In addition, due to the frustration of the composer in contemporary society, it has become the most desirable outlet for original creative expression, normally suppressed by a public taste geared to nineteenth-century musical practice.

The contemporary composer or student of composition comes to electronic music with great expectations. Among these are the intention to escape from the necessity of finding sympathetic performers, a desire to escape from the equal-tempered scale, conventional sounds, and musical instruments, and in general, a situation where the available materials for musical composition have been so thoroughly worked that only a genius could find new means of expression in them. Electronic music offers a means to this end.

Among the various types of electronic music equipment available, that built by the R. A. Moog is among the most popular. The writer has taught techniques using the Moog synthesizers at North Texas State University for several years.

The University has two Moog synthesizers. The first, essentially a "Synthesizer I," is used for most teaching purposes and is ideally suited for this application because of its relatively simple construction. The other is a special-purpose performance instrument containing special mixing and patching conveniences which facilitate rapid change of sound parameters in real concert situations. They also make comprehension of the instru-

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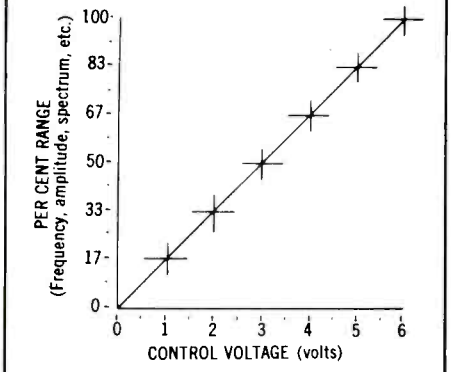

Fig. 2—Voltage characteristics of Voltage-Controlled Modules.

ment difficult for the student. This article describes the "Synthesizer I," actually an earlier version of the model currently available. Differences between versions, while significant, can be avoided in the present material as they do not affect the principles of operation which are the primary concern here. Thus, if the user encounters discussion on a particular component not in his particular synthesizer he can skip to the next section.

The purpose of this article is not so much to give directions for specific compositional procedures as to give him a comprehension of the principles of operation of the Moog synthesizers (and other similar instruments) so that he will have an idea of how one works out his own procedures.

As a background to the present discussion the reader is referred to the writer's article "Techniques for the Synthesis of Electronic Music,"[1] which covered material in a basic way, unrelated to specific items of equipment.

## GENERAL DESCRIPTION

Detailed descriptions of the components in Moog synthesizers are available in the Moog Electronic Music Composition-Performance Equipment catalog[2] and the various manuals and specification sheets supplied with the equipment[3]. The descriptions given here are general in nature and are intended to tie the technical descriptions to the specific applications in music.

First, the synthesizers are modular in construction. Each module is an independent unit having only power supply circuits internally connected. Thus, the user makes all signal-flow connections on the front panel. A typical synthesizer contains most or all of the following modules:

Oscillators (two or more)
Controlled Amplifiers (one or two)
Filters—High-pass, Low-pass, Band-pass (fixed and variable)
White-Sound Source
Reverberator
Mixer
Control Devices (keyboard, linear controller, etc.)
Sequence controllers (envelope generator, sequencer, paper tape reader, small digital computer, etc.)
Envelope Follower

In a Moog synthesizer, as in any well designed instrument, all modules are compatible which allows all outputs to be connected to all inputs for special needs. In each case. the impedances, voltage and current levels, and frequency responses match so there are no technical limitations on interconnections. The basic justification for any interconnection must come from musical requirements.

The Moog synthesizers are all voltage-controlled. This means that of all the parameters of an input signal to a particular module, only the voltage of that signal exerts any controlling influence on the module's performance. Thus. the same parameter of the control signal is effective with all modules. Also, the degree of control exerted by a control signal is linearly related to the voltage of the control signal in most instances. This means that a given incremental voltage change always produces the same relative change in a module's performance anywhere throughout its entire range. This is described graphically by Fig. 2, illustrating a module's output (oscillator frequency, amplifier gain, filter spectrum, and so on as related to the input voltage.

It should be pointed out here that there are other means of controlling electronic music instruments. The Theremin, for example, is capacitance controlled, as is the complex-tone generator built by the writer.[4] Many units are resistance controlled. This is convenient because the variable resistor, or potentiometer, is a common control device in electronics. There are, however, limitations for controlling one module from the output of another, usually in the form of a voltage or current source. Voltage control is probably the most universal and flexible method of those available and it is a good choice also, because digital computers can be made to have voltage outputs by means of a device known as a digital-to-analog converter, thus making them adaptable to voltage-controlled modules.

The modules in the Moog synthesizers have two types of inputs and two types of outputs, present in various combinations on each module as required. The four types of inputs and outputs are as follows:

Signal inputs,
Signal outputs,
Control inputs,
Control outputs.

The arrangement of inputs and outputs by type of module is given in the following table:

| Type of Module | Inputs | Outputs |
|---|---|---|
| Oscillators | Control | Signal |
| Controlled amplifiers | Control<br>Signal | Signal |
| Filters | Signal<br>Control* | Signal |
| White-sound source | None | Signal |
| Reverberator | Signal | Signal |
| Mixer | Signal | Signal |
| Control Devices | None | Control |
| Sequence controllers | Control*<br>Trigger* | Control |
| Envelope follower | Signal | Control |

* on some models

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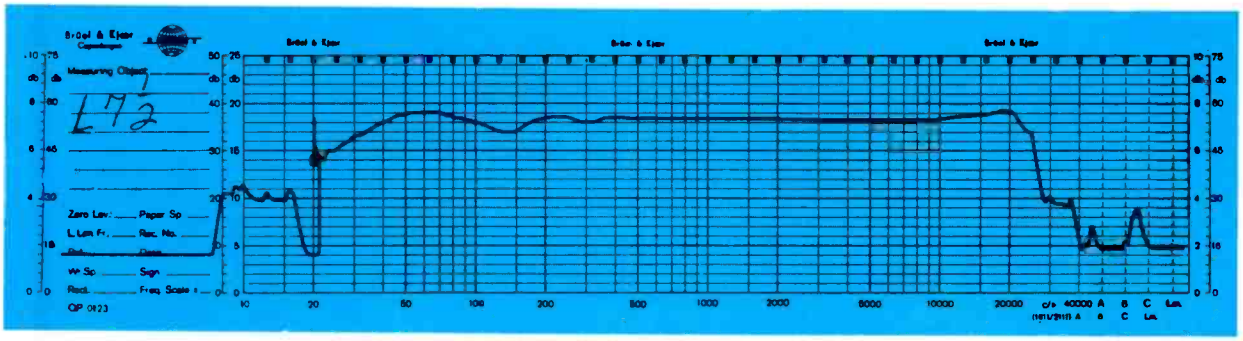

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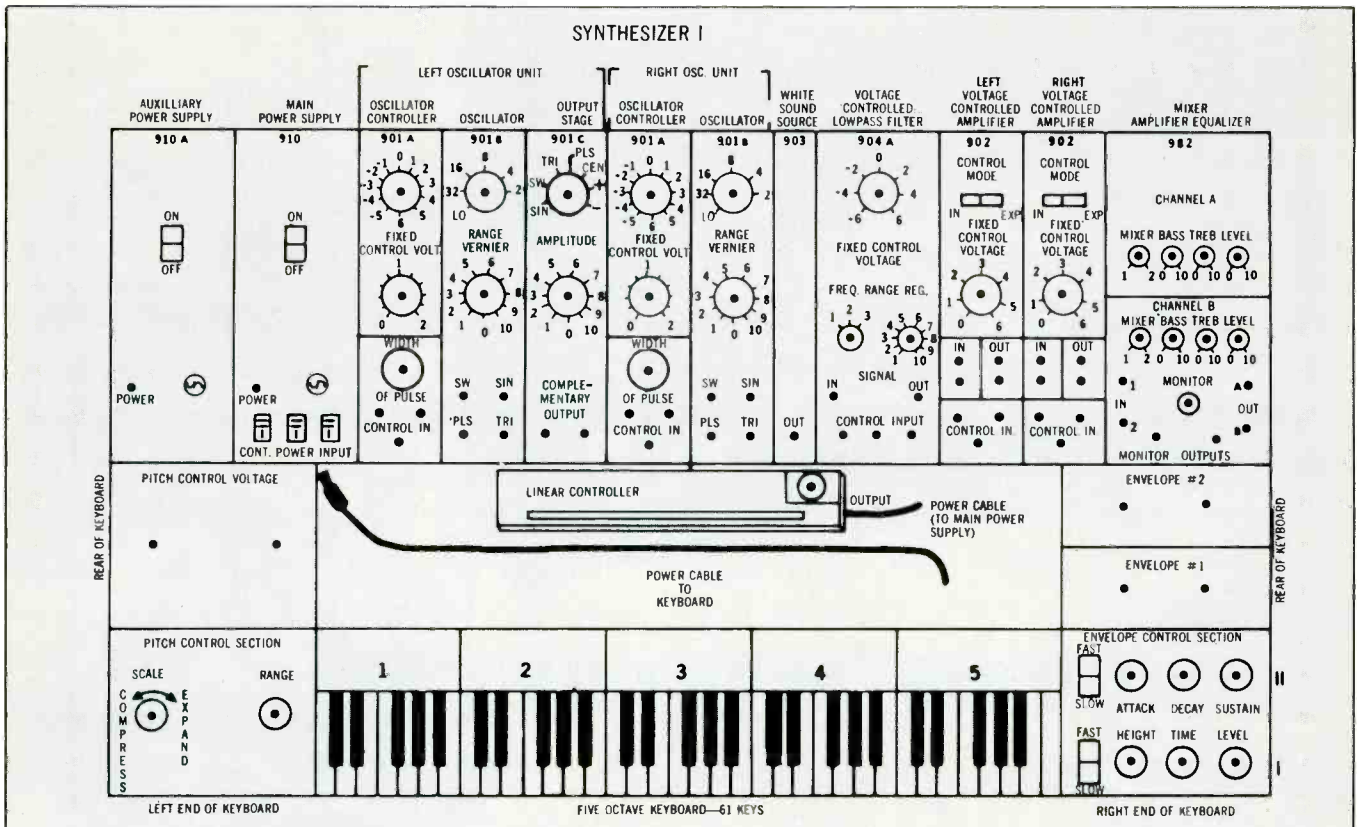


**Fig. 3**—Front panel controls and connectors on the Moog Synthesizer at North Texas State University.

The breakdown given above is interesting as it defines the role of each module in terms of the ways it can be made to interact with other modules. First, it is necessary to define the distinction between signal and control inputs or outputs.

A signal is a voltage waveform with a periodic frequency between 20 and 15,000 Hz. It is, thus, within the audible range and can be converted into sound with the proper amplifiers and speakers.

A control voltage is any alternating, direct, periodic, or non-periodic voltage. It may or may not be within the audible range and may or may not be converted into sound. That feature making it a control voltage is that it is not converted into sound but is used directly as a control for another module.

With these definitions given, it is possible to continue with their application to the various types of modules. A device having a control input may be controlled by another device with a control output. Note, however, that those devices having signal outputs only, such as the white-sound source, may still be employed as control-voltage sources. The distinction means that the output of these devices will always be in the audible range.

A device having control outputs only produces no signals in the audible range and may be used only to control other devices (as in the case of the keyboard). Devices having both signal inputs and signal outputs are inserted into the signal path for modification applications such as amplitude modulation, filtering, envelope control, and so on, and they require an input before any output signal will be available. Note that in no case does any module have only inputs, as this would be an absurd situation.

The following basic rules should be followed in interconnecting the synthesizer:

1. Signal inputs may receive only signal outputs.
2. Control outputs may drive only control inputs.
3. Control inputs may receive both signal and control outputs.
4. Signal outputs may drive both signal and control inputs.

In addition to the above rules, it is necessary to establish a complete signal-flow through the synthesizer from signal sources in the oscillators to the final output in the mixer to the monitor system.

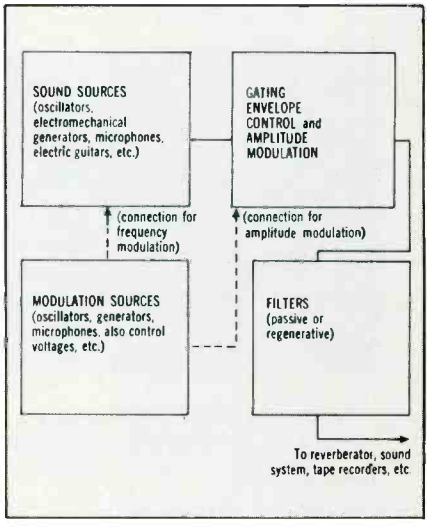


**Fig. 4**—Block diagram of typical sound synthesizing or modifying system.

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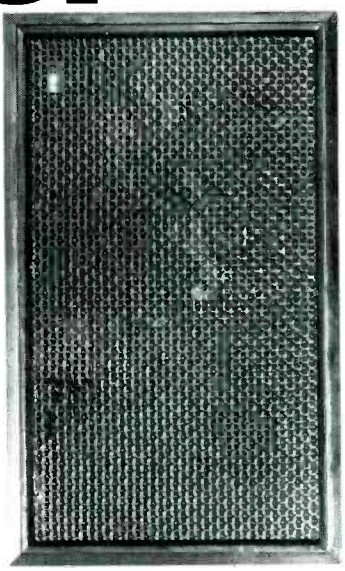
[4] R. C. Ehle, *A Complex-Tone Generator for the Electronic Music Studio*, AUDIO, October, 1966.

# Fisher is ahead in the race for bass.



For a long time, the bookshelf speaker system with the "best" bass was the one with the most boom.

The fact is, most good bookshelf speakers today incorporate the acoustic suspension principle. Invariably, they can all deliver big bass in a corner, or on the floor. And, just as invariably, there'll be a lot of bass coloration, resonance, and overemphasis of certain bass frequencies.

**Introducing the XP-9C.**

At Fisher, we suspected that the first bookshelf system capable of solid, resounding bass outside of a corner or floor location would sound far cleaner than any other bookshelf speaker on the market.

We gave our engineers the assignment.

And they gave us the new Fisher XP-9C. The smallest speaker system ever to use a fifteen-inch acoustic suspension woofer.

This woofer, with its massive 12-pound Alnico magnet and extremely high compliance, has a free-air resonance of 10 Hz! And in its compact cabinet will produce natural-sounding bass to below 30 Hz. No doubling. No audible distortion.

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Then, to insure a crisp mid-range, a pair of matched, 5-inch mid-range drivers take over at precisely 500 Hz. With their airtight enclosures they handle only those frequencies between 500 and 1,200 Hz, and can't interact with the bass.

The total effect is cleaner, more exact bass than any other bookshelf system can achieve, anywhere you choose to place the XP-9C's.

**On to treble.**

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We invite comparisons between the Fisher XP-9C and any other speaker system. Bookshelf, or floor standing.

Compare them for overall sound, of course. But pay special attention to the bass.

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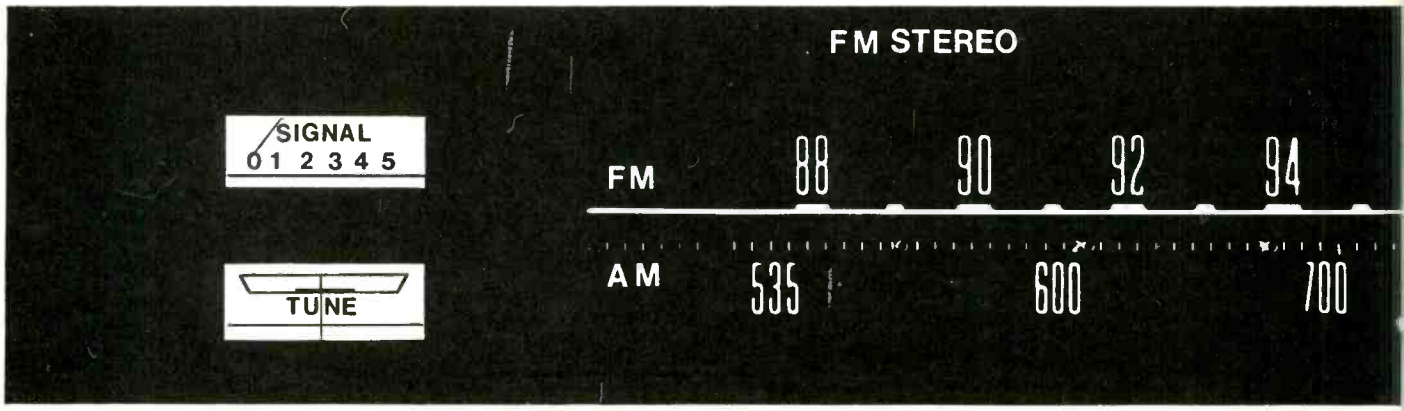


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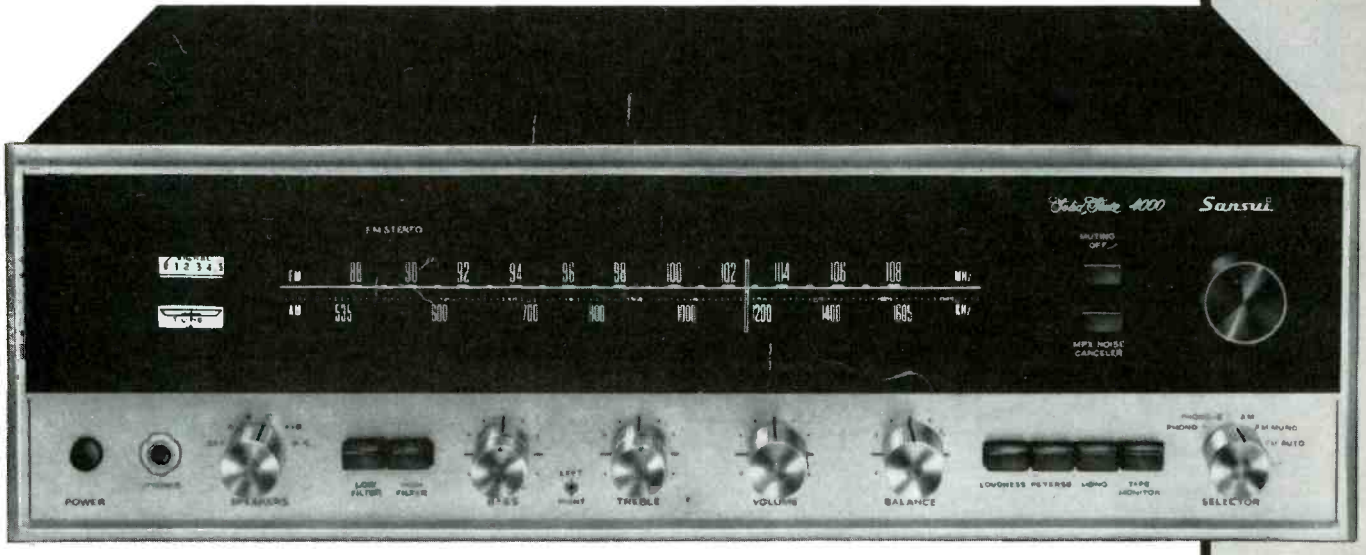


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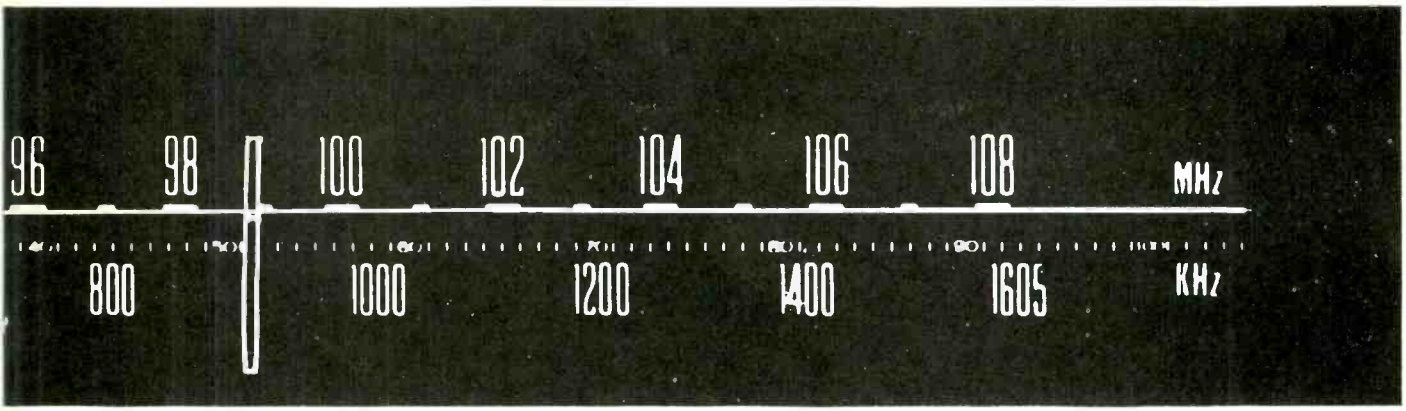


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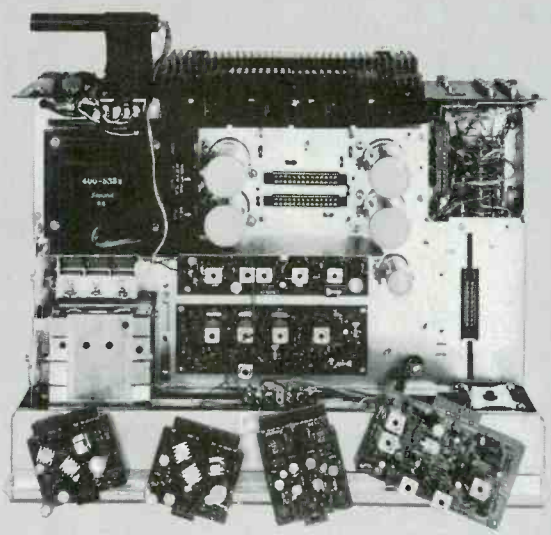

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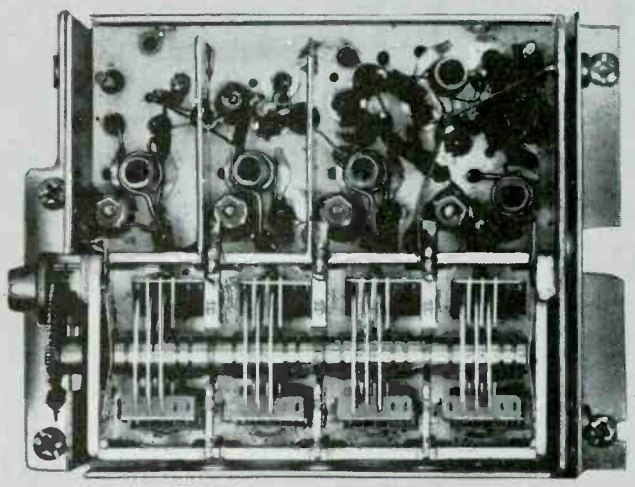

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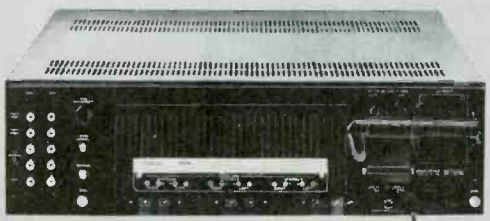

**REAR VIEW**
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# *Layman's Guide to*
# LOUDSPEAKER SPECIFICATIONS

**Part II: Definitions and Explanations Continued from Last Month**

**VICTOR BROCINER**

*Exponential Horn*—See "Horn."

*Flare*—See "Horn."

*Flat Speaker*—a speaker system with a very shallow cabinet; also used to refer to a speaker with flat frequency response.

*Frame*—The basket-like structure attached to the magnet assembly, within which the cone is mounted. It must be strong and rigid, and not vibrate. Frames are made of stamped sheet metal, castings, or plastic.

*Free-edge Cone*—See "Whizzer."

*Hangover*—See "damping." An under-damped speaker cone tends to keep on oscillating after the actuating signal has stopped. The prolonged tone has approximately the resonant frequency of the speaker, but it can be excited by any signal that stops suddenly, principally in the bass range. It is readily recognizable because it has a characteristic frequency of its own. The resulting "one-note bass" is quite noticeable at the ends of syllables in male speech. To the uninitiated, the first impression may be of good bass response. Hangover is caused by under-damping. It is sometimes (mistakenly) called "overhang."

*Helmholtz Resonator*—An acoustic resonator consisting of an enclosure with a hole in it, sometimes with a neck or duct. A good example is a bottle or jug. Its resonance is easily noticed when one blows across its mouth. The cabinet of a bass-reflex enclosure is a Helmholtz resonator.

*Horn*—A passageway or pipe that expands in cross-section as the distance from the diaphragm increases, used to couple a speaker unit to the air. A megaphone is a simple horn. A horn is not an amplifying device. It is an acoustic transformer, producing improved transfer between the diaphragm and the air by impedance matching. Horn speakers are much more efficient than direct radiators. The mouth diameter of a horn must be equal to about ¼ wavelength at the lowest frequency to be reproduced. Low-frequency horns are quite large, but may be reduced in size by folding and by placement in the corner of a room. Horns are used mainly for tweeters and some mid-range speakers. When the diameter expands in proportion to distance, the horn is called *conical*. If only one dimension of a rectangular cross-section increases linearly, the expansion is *parabolic*. Other laws of expansion give rise to *catenoidal*, *exponential*, and *hyperbolic* horns. The exponential is in widest use. The rate of expansion of an exponential horn's cross-section is called the flare rate, sometimes misspelled "flair."

The shape of the mouth affects the sound distribution pattern. A round mouth is, of course, symmetrical. A slit-shaped mouth results, surprisingly enough, in wide distribution in a plane *at right angles* to the center line of the slit. (Diffraction horn.) The distribution patterns of simple horns vary considerably as the frequency changes. Means to make dispersion uniform include directive vanes, acoustic lenses, radial horn design and multi-cellular construction.

*Horn Speaker*—A driver unit coupled to a horn.

*Infinite Baffle*—Theoretically, a baffle that is infinite in extent would prevent doublet action from restricting the low-frequency response; it would separate the front radiation from the rear radiation at all frequencies. A hermetically sealed enclosure behind the speaker also does this, which is why it is called an infinite baffle. An acoustic- or air-suspension speaker is a special type of infinite baffle.

The perfect front-from-back separation of the infinite baffle might suggest that a speaker so mounted is good down to d.c. It isn't. The low-frequency is determined by the resonant frequency of the system, the moving mass, and the damping.

*Ionic Speaker*—An ionic speaker uses a varying electrostatic field to set in motion a mass of air ionized by a high-voltage radio-frequency field. The resulting "air diaphragm" is horn-loaded. Ionic speakers are capable of extremely extended high-frequency response, up to 100 kHz or so, because there is no massive diaphragm. They require a power supply and r.f. oscillator.

*Linearity*—Exact proportionality between the excursion of a diaphragm and the signal current (or voltage) driving the voice coil. Lack of linearity results in distortion. There may be non-linearity in the cone suspension, and in the magnetic driving system. The suspension must be made of such material and so designed that its motion is proportional to the applied force over a large excursion. In the driving system, an end of a non-overhanging voice coil may move out of the magnetic gap, where it encounters a greatly reduced value of magnetic flux, so that less force is developed to drive it. Or the magnetic

Voltage supply in your city can vary as much as 10%. And even a 2% variation causes a significant tape speed change in tape decks with induction motors and a difference in reproduced sound that is intolerable.

The Concord Mark II stereo tape deck completely ignores fluctuations in line voltage. It is driven by a hysteresis synchronous motor which locks onto the 60 cycle power line frequency and maintains constant speed (within 0.5%) regardless of voltage variation from 75 to 130 volts. So if you're about to buy a tape deck that doesn't have a hysteresis synchronous drive motor, you're liable to negate any other fine feature it might have.

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The hysteresis drive Concord Mark III has all of the features of the Mark II plus pressure-sintered ferrite heads for extended frequency response and virtually no head wear. It sells for under $260.

The hysteresis drive Mark IV, the top-of-the-line Concord deck offers all of the performance and conveniences of the Mark II and III including wide gap record, narrow gap playback heads, tape source monitoring, sound-on-sound, echo recording. Plus, a dual capstan tape transport mechanism with electronic automatic reverse, no metal foil or signal required on the tape. Superior recording performance plus the convenience of automatic reverse and continuous play. A superb instrument with the finest performance money can buy, and it's under $330. Audition the new Concord Mark series, the tape decks with the hysteresis synchronous drive motor. For "all the facts" brochure, write: Concord Electronics Corp., 1935 Armacost Ave., Los Angeles, Calif. 90025. (Subsidiary, Ehrenreich Photo-Optical Industries, Inc.) EPI

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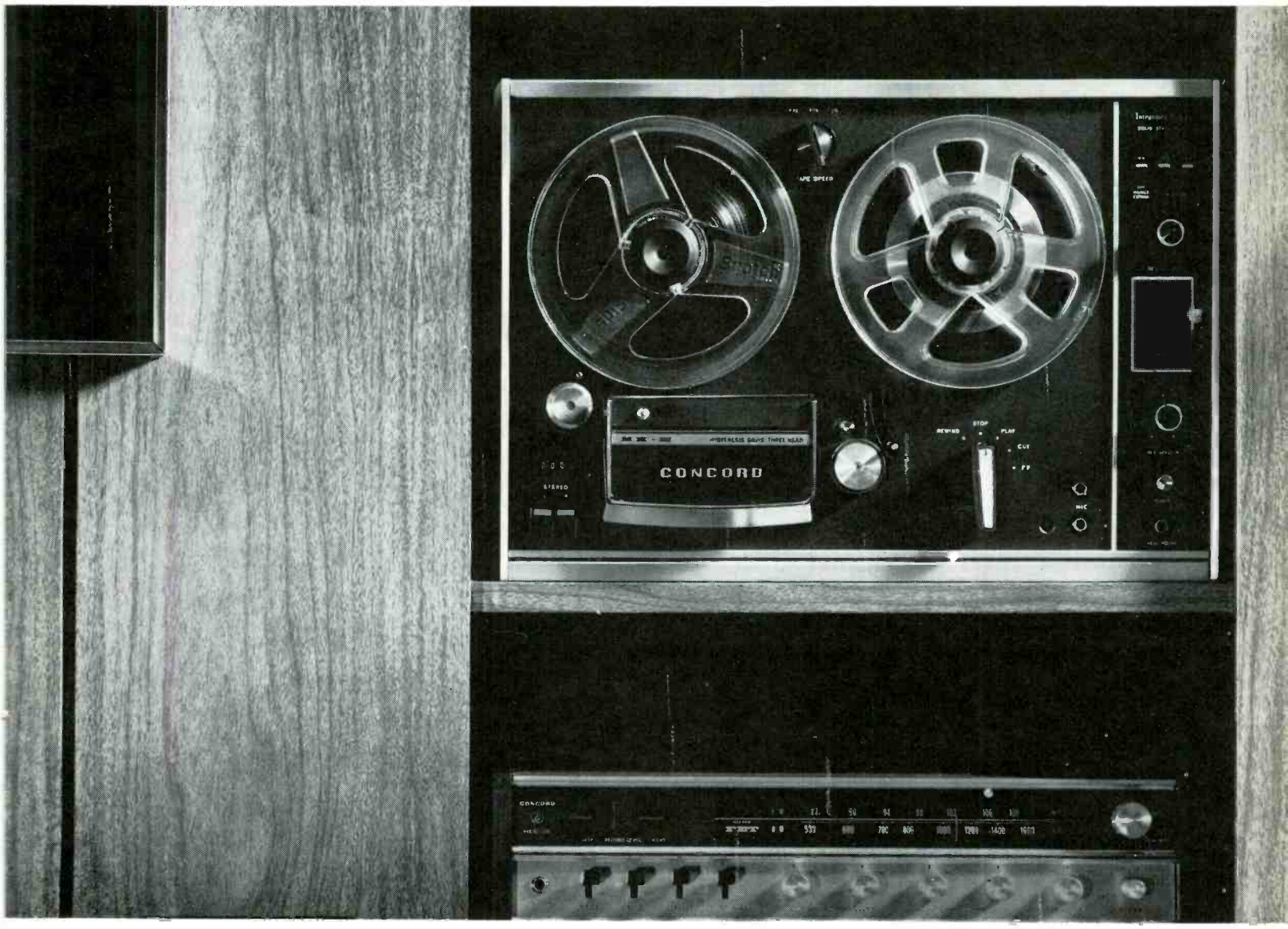


# NEITHER AIR CONDITIONERS, TV SETS, WASHERS NOR ANY OTHER ELECTRICAL APPLIANCE CAN KEEP THE HYSTERESIS-DRIVE CONCORD MARK II FROM ITS PRECISELY APPOINTED SPEED.

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field itself may not be uniform. Linearity is also used to refer to the relationship between acoustic power output and electrical power input. A speaker is sometimes called linear when it has a flat frequency response, but this practice is to be deplored.

*Loading*—A speaker cone has difficulty in effectively moving the air to create sound, because of the different properties of the cone and air. Coupling is said to be poor because of impedance mismatch, especially at comparatively low frequencies. Improving the coupling is called loading the speaker. A horn loads a speaker. Placement in a room corner also loads it (in the bass range) because its output, which would otherwise be omnidirectional, is concentrated into one-eighth of a sphere. Putting a speaker in a closed box loads it because it confines the rear wave which otherwise interacts unfavorably with the front wave. But the elasticity of the air in the box does *not* load the speaker in a similar manner, although it does affect the motion of the cone. A very inexact but illuminating analogy is an electric motor driving a pump. Increasing the water pressure loads the motor, and makes it do more work (up to a point). But adding a flywheel does not do so, although it affects the way in which the motor speeds up or slows down.

*Magnet*—A magnetized piece of iron alloy or ceramic (sintered iron oxide plus non-metallic components) that produces the steady magnetic flux in the gap. The size, weight and material of the magnet are frequently considered direct indicators of the performance of a speaker. Actually, magnet *size* in itself is not indicative. See "Magnetc Flux." When magnet weights are spoken of it is important to distinguish between the weight of the magnet itself and that of the entire magnetic structure which, of course, is much greater.

*Magnetic Flux*—In a dynamic speaker there is a radial magnetic field in the air gap in which the voice coil moves. Magnetic flux density is the degree of concentration of the lines of magnetic force—the strength of the field. Flux density is expressed in lines per square centimeter or *gauss*. A fairly high figure is 10,000 gauss; 20,000 gauss or more is extremely difficult to attain. High flux density increases the electrical damping of a speaker. The *total flux* is measured in *maxwells*. The power of a magnet is dependent on the area as well as the flux density. The flux density multiplied by the area is the measure of the power of the magnet. Total flux is usually a nice, big number, but its significance, like that of flux density, is really not as great as "gap energy," which follows.

The principle of operation of the dynamic speaker was described under "Dynamic Speaker." The voice coil conducts the current through the gap a number of times (in the same direction); the force created by the magnetic field is proportional to the flux multiplied by the number of turns. The greater number of turns requires more space. Thus the amount of work that can be done by the magnet-coil combination when a given current is flowing in the coil is proportional to the volume of the space between the magnets, that is, the volume of the gap. Speaker efficiency is directly related to the gap volume and the flux density (although other factors enter in as well). The two are combined in a figure known as the *gap energy*. Gap energy is a better "figure of merit" with regard to the efficiency of a speaker than either flux density or total flux. However, it is most unusual to see it specified.

*Mass*—The mass of the moving system of a speaker is related to its efficiency, just as the weight of an automobile has an effect on the acceleration obtainable with a given engine power. The moving system of a dynamic speaker consists of the voice coil, which is usually wound on a form, and the diaphragm (cone). These all have mass, which has an important effect on the efficiency and frequency range. In an electrostatic speaker the diaphragm is driven directly without the use of a voice coil. Not only that, but it is driven over its entire surface, so it does not have to be rigid, and can be made extremely light. The ionic speaker also has obvious advantages in this respect.

At frequencies appreciably above resonance, up to its high-frequency cut-off, the motion of a direct-radiator dynamic speaker is determined almost entirely by its mass; the suspension stiffness and the air resistance have little effect. (Think of a huge, heavy piston in a steam cylinder, rigged up to wave a small fan back and forth in the air. For a given amount of steam pressure, the motion will be determined by the inertia of the piston far more than by the fan.) The lighter the moving system, the better. However, the cone must not be so light that it becomes mechanically weak and buckles. Reducing the voice-coil weight either increases its electrical resistance loss (as when aluminum is substituted for copper) or reduces its driving force if its volume is made smaller. (See "Gap Energy" under "Magnetic Flux.") There is an optimum combination of the two factors working in opposite directions. It exists when the mass of the voice coil is equal to the mass of the cone plus the mass of its air load. The reverse is not true: if the voice-coil mass is fixed, the cone mass should not be made equal to it, but as small as possible.

In a horn-loaded speaker, the "transformer" action of the horn changes the low acoustic resistance of the air at its mouth to a high resistance at its throat, where it becomes an appreciable part of the total load on the diaphragm so that the moving-system mass has less influence on the motion of the diaphragm. The relationships are more complicated than in a direct-radiator speaker. For very high frequencies the efficiency is again greatly dependent upon the mass of the voice coil and diaphragm (which is another way of saying that in this range a horn speaker behaves more like a direct radiator).

*Middler*—A speaker covering the middle frequencies. The lower frequency limit may be as low as 200 Hz and the high limit several thousand Hz. Occasionally called "squawker" (!).

*Mouth* of a horn—The opening of the farthest from the driver unit.

*Multicellular Horn*—See "Horn."

*Open-Back Cabinet*—Used in television sets, table model radios, and "package" consoles. The speaker operates as a doublet, with no deep bass response. An open-back cabinet acts like a short tuned pipe which reinforces sound output at its half-wave resonance. In consoles this generally produces a peak in the 100-150 Hz region which creates the illusion of good bass response but is actually

poorly damped "boom," especially objectionable when a male voice is being reproduced.

*Passive Radiator*—In a bass-reflex cabinet, the air in the port acts as if it were an auxiliary diaphragm, oscillating back and forth in the port opening. A freely-suspended cone without a driving element does the same thing. It is used to add mass when needed, as in a small cabinet (see "Ducted Port") and eliminates the need for a duct. It also ensures that there is a piston-like movement of the air in the port; in an ordinary opening the air tends to move unevenly. A new element is introduced: the compliance of the suspension. This can be designed to make the system act more like a closed box at frequencies below its operating range, reducing the chances of speaker overload and distortion.

*Phase-Inverter Speaker*—See "Bass Reflex."

*Port*—See "Bass Reflex."

*Q*—This is a term never mentioned in speaker specifications but it is useful to designers because it affects bass response and damping. In a mechanical system capable of sustained or damped oscillation, Q is proportional to the mass and inversely proportional to the resistance or damping. To be exact, $Q = 2\pi f_o m/R$ where $f_o$ is the frequency of resonance. The low-frequency response of a speaker in a sealed enclosure is determined by the system Q. If Q=0.5 (critical damping), response is down 6 dB at resonance, and there is no overshoot with square-wave input. For Q=1 the system is slightly underdamped and there is a very small bump above resonance. For higher values of the Q the bump becomes sizeable; transient response is poor. If a speaker is over-damped, its response slopes gradually downwards with decreasing frequency, even above resonance. This is why so many high-efficiency direct radiators have "crisp" bass. With bass-reflex cabinets the situation is more complicated; in general, speakers require more damping (lower Q) for response without a peak.

Reference has been made to the system Q; what really determines performance is the Q of the speaker system when damped by the amplifier. This is where the amplifier damping factor comes into play.

*Resonance*—As used with speakers, resonance has a very different meaning from its musical one. A deep, resonant voice may be an asset, but a resonant speaker is not. Resonances in speaker systems may result in either exaggerated or diminished response in narrow regions of the frequency range. A so-called fundamental resonance occurs at the low-frequency end of the operating range of all cone speakers. If this is properly damped (see "Damping") it is useful in maintaining flat frequency response. Without proper damping it produces "hangover," which means that notes do not start and stop cleanly. In multi-speaker systems, there may be resonances for each speaker. To top it all, cones themselves have multiple resonances caused by cone break-up that result in harsh-sounding reproduction. These, too, can be damped through the use of suitable cone materials, and by placing pads of felt or fiberglass behind the speaker cone.

A woofer's fundamental resonance is a factor limiting its bass response. Low-resonance woofers are often referred to in specifications; they are desirable, if the damping is correct. The resonant frequency is considerably higher when the woofer is mounted in a cabinet.

*Ribbon Speaker*—A dynamic speaker using a stretched, straight flat ribbon conductor instead of a conventional voice coil. The magnetic gap comprises a straight narrow slit with a maximum amount of flux concentrated in it. The ribbon is extremely light, acts as the diaphragm, and is horn-loaded. The ribbon type of speaker is used only as a tweeter.

*Skiver*—See "Surround."

*Sound Absorbing Material*—Material such as open-cell foam, or material composed of loosely-spaced fibers such as glass wool, absorbs sound by converting it into heat. It is used in speaker enclosures to prevent reflections which cause multiple resonances. Sound absorption decreases greatly below frequencies around several hundred Hz. (By the way, the heat generated is of extremely low energy, so do not fear that your speaker cabinet will start to smolder if you play it very loud.) At low frequencies, material that maintains the instantaneous air temperature constant through its heat capacity has the effect of increasing the effective size of the cabinet and lowering the system resonance, extending bass response.

*Spider*—The flexible washer-shaped support at the apex of the cone, keeping the voice coil centered in the gap. Most speakers use soft impregnated cloth with circumferential corrugations. Flat foam discs are also in use. In tweeters and mid-range speakers using dome-shaped diaphragms, the diaphragms are quite rigid and may be held in good alignment by the surround alone. In woofers the spider must be quite flexible and capable of large axial movements of the voice coil with linearity, to prevent distortion.

*Spurious Responses*—See "Cone Break-Up." Speakers can also emit (usually very small amounts of) rustling, creaking, crackling, and tinkling noises which bear no relationship to the program material, as distortion products do. There are also puffing and wheezing noises that are created by air being forced through various small passageways in the speaker structure, which is why the domes fastened to the cone over the pole piece often have openings backed by gauze or felt. Horns of horn speakers that are not solid enough also can produce unwanted noises, as can speaker cabinets that are insufficiently massive or rigid. Small leaks in cabinets can produce whistling sounds.

*Stiffness*—the inverse of *compliance*. Can be applied to a cone, a suspension (spider and surround) or a speaker frame in which case it is respectively good, bad, and good!

*Surround*—the surround is the ring-shaped section between the outer edge of the cone and the rim of the frame or basket. Surrounds may consist of corrugations in the outer edge of the cone itself, often with the material reduced in thickness. In woofers a separate piece of impregnated cloth is in greatest use. It may be corrugated or in the form of a "half-roll" (U-shaped cross-section). The same requirements of flexibility and linearity apply as for spiders. See also "Edge Damping." Sometimes called "Annulus."

*Total Flux*—See "Magnetic Flux."

*Throat*—The end of a horn nearest

the diaphragm of the driver unit.

*Tweeter*—A high-frequency speaker using a very light diaphragm and voice coil—the latter usually of aluminum wire.

*Two-Way Speaker*—

*Three-Way Speaker*—It is extremely difficult to design a single speaker to cover the entire audible frequency range. The requirements for good bass and for good treble, with uniform dispersion, are completely at variance with each other. Consequently the better speaker systems usually include two or more speakers; in this way, each speaker operates over a more restricted frequency range in which it can function efficiently. The proper ranges are directed to their respective speakers by means of an electrical dividing network. Two, three, or even more speakers may be used.

Not all multi-speaker systems are of this type. In some designs a large number of identical speakers are used. Even in two-way and three-way systems, the number of speakers may not be indicative of the number of sections into which the entire range is divided. Several woofers, mid-range speakers, or tweeters may be used to provide more power handling capacity or wider dispersion.

Different types of speakers may be combined in multi-speaker systems. Sometimes the tweeters are horn speakers; the middlers may also be horns. The woofers are most often direct radiators.

The crossover frequency or frequencies in two-and three-way systems are determined partly by economics and partly by theoretical considerations. Two-way systems using small tweeters for good dispersion usually cross over in the 2000 to 4000 Hz region because the tweeters cannot carry much power at lower frequencies. "Theatre type" systems with large high-frequency horns may have a crossover as low as 500 Hz; the large horn will permit this, the woofer retains good dispersion in this low range, and the crossover frequency is considered desirable for psychoacoustical reasons. A similar low crossover is to be found in three-way systems, where a mid-range speaker spans the spectrum between several hundred and as high as 5000 Hz. In more complicated systems a supertweeter may be used for the very highest frequencies. In each case the objective is to use each speaker over the range in which its performance is as flat and smooth as possible, and to maintain a good polar characteristic over the entire frequency range.

Dividing networks must be designed to eliminate the unwanted frequencies from each speaker. For example, a woofer with a peak at the upper end of its range requires a crossover frequency sufficiently below the peak and a cut-off or filter slope sharp enough that the peak is not audible. Similarly, a small tweeter must have its low-frequency input curtailed sufficiently to ensure that the lower frequencies do not overload it. Sharp cut-off filters produce delay distortion (transient distortion), which some experts maintain is important; others disagree. The more elaborate networks usually have a slope of 12 dB per octave. More parts are needed for sharp cut-off, increasing the cost.

*Voice Coil*—A helically-wound coil of wire, usually on a light cylindrical form, at the apex of the cone, either single or multi-layer. See "Dynamic Speaker." In expensive speakers, edge-wound ribbon may be used instead of wire. The coil may be made self-supporting by cements, without a form. Eliminating the mass of the form permits more conductor material to fill the gap, improving efficiency. The voice coil is made of copper wire in most inexpensive speakers and in most woofers. Forms may be made of duralumin, which is strong and helps to dissipate heat generated in the coil; it also exerts a desirable electrical damping effect on the speaker. In tweeters, aluminum wire or ribbon is so much lighter than copper that this more than makes up for its higher electrical resistance.

*Voice-Coil Excursion*—The distance the voice coil moves from its rest position. At low frequencies it is important that the voice coil be able to move a considerable distance—say ¼" or more. Maximum excursion may be stated in terms of the maximum peak-to-peak value, which is twice the peak value and consequently more impressive. Speakers capable of large excursions are sometimes called "long-throw" woofers.

*Voice-Coil Overhang*—Not to be confused with *hangover* (acoustic or alcoholic). In woofers, the voice coil is often made longer than the depth of the magnetic gap, so that the same number of turns remains in the magnetic field even at the maximum excursion of the voice coil. The driving force remains constant and linearity is maintained. This can also be done by making the voice coil *shorter* than the gap. When the voice coil is longer, some of its turns are always outside the gap and do not contribute to the driving force, and efficiency is reduced; this is the price one pays for better linearity. With a short voice coil, efficiency is maintained but some of the magnetic field is unused, requiring a more powerful magnet. In this case, the price one pays is measured in dollars.

*Whizzer*—A small, stiff, light, free-edge cone fastened to the voice coil in addition to the main cone. At low frequencies it does nothing; as the frequency increases the compliance at the base of the main cone decouples it from the voice coil, leaving the whizzer to propagate the high frequencies which it does with more uniform angular distribution because of its small size. Occasionally the outer edge of the small cone may be partially supported or given some kind of edge treatment.

If properly designed, a whizzer can provide very fine high-frequency response. However, poorly-designed whizzers can produce spurious responses, often producing a sort of sizzling sound which may be how the term "whizzer" originated.

*Woofer*—A speaker designed primarily to reproduce the lower frequencies. Woofers may work up to several thousand Hz but may become quite directional in this region. In more expensive systems a lower crossover frequency between the woofer and tweeter (or middler) is often used, say 500-1000 Hz.

Woofers typically have large cones, heavy moving systems, and large voice coils overhanging the gap (or "underhanging" it—see "Voice Coil Overhang"). The term "large" is relative, actually ranging from perhaps 4" to 30" in diameter; a woofer can be identified, in a multi-speaker system, because it is larger than the middler and tweeter.

*Continued Next Month*

# The Sound Of Koss Electrostatic Stereophones Is Better Than Speakers

The famous Koss ESP-6 now has a partner . . the Model ESP-7 Electrostatic Stereophones. The ESP-7 is lighter in weight, lighter in price. The ESP-6 is completely self-contained and offers 3½ octaves more than conventional headphones. But both deliver the startlingly crisp, smooth and pleasant sound available only in Koss Stereophones.


**MODEL ESP-7**

**MODEL ESP-6**

**MODEL ESP-7** Reproduces 8½ out of a possible 10 octaves (3 octaves more than conventional headsets). Self-energized by small separate energizer mounted in cord and containing transformers, speaker on-off switch, "proper level" indicator, and provision for connecting a second headset (Model ESP-A accessory Stereophones, $59.00). Frequency response 35-13,000 Hz ±6 db. Comes complete with energizer unit and individual machine-run response curve. **$79.00**

**MODEL ESP-6** Reproduces 9 of the 10 audible octaves. Completely self-energized and self-contained. Furnished with connector box and speaker on-off switch and foam lined, sturdy carrying case. Frequency response: 27-19,000 Hz ±5 db. Comes with individual, machine-run response curve as positive proof of performance. **$95.00**

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# IT'SONY

# $200.

Sony has placed its name on an under $200 FM stereo/FM-AM receiver — the Sony STR-6040. We broke the $200 price barrier without putting the slightest dent in quality. We did it by eliminating the unessentials, designing an amplifier with less than a super power rating and by drawing upon advanced radar and microwave technology in the tuner design.

The amplifier delivers 30 watts RMS continuous power into 8 ohms, both channels operating — more than enough to drive even relatively inefficient "bookshelf"-size speaker systems to room-filling volume, without distortion.

The tuner employs a completely passive front end. There is no amplification of the incoming signal frequency. This eliminates two common problems: internally generated background hiss and overloading of weak stations by strong ones (spurious-response rejection is 100 dB down).

The Sony 6040 comes through with flying colors in all areas essential to superior receiver performance. Sensitivity, stereo separation, capture ratio and noise suppression characteristics are excellent. Solid-state i.f. filters are used. With their help alternate channel selectivity reaches a full 70 dB. What's more, they never require realignment.

While we streamlined the 6040, we did provide a number of important operating conveniences: switches for easy selection between the most common program sources, radio or records and for instant comparison between original and recorded program material; automatic stereo/mono circuitry; a headphone jack and an auxiliary input on the front panel; and precise tuning meter.

The Sony name, Sony quality and an un-Sony-like under-$200 price tag. That's the Sony 6040, and that's beautiful music.

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powered to have less torque. Both methods are used to obtain a measure of clutch action. But the drawback with three-motor designs is that they tend to have a fairly small range of torque variations, and the tape is wound on too tightly as the amount of spooled tape increases. Ways of getting over this are to increase the size of the hub of the reel, making the ratio of diameters of full to empty reel a smaller figure, or to run the tape over a swivel guide whose tensioning action is determined by the wrap angle of the tape, as illustrated in Fig. 1.

In this respect, although they cannot achieve the fast winds of a fully powered motor, the clutched take-up mechanisms have the advantage over direct-drive machines, for the tension of the tape can be kept fairly constant throughout the whole of the spooling operation.

Some idea of the extent to which changes in voltage and of load can affect torque of a motor may be gleaned from Fig. 2. These are curves for an asynchronous motor, and are typically those that would be found for a single motor with a belt drive to weight-dependent clutches. The three curves show the connection between torque and speed at nominal voltage (a), and at voltages 10 per cent above (b) and below (c) nominal. The maximum torque of the motor has to be designed to ensure fast rewind at the lower voltage.

Operating torque for normal drive, that is during recording and replay, is small, and can be denoted by the lower dotted line. We see that the difference between the running moment and the stalling moment of the motor for each voltage is quite clearly affected by the applied voltage, and if we expand the end of the curve, as in the lower part of Fig. 2, we can determine the maximum speed variation, allowing for load variations of 10 per cent. In this case we get a figure of around 50 rpm, which is very good for the average domestic machine. It would only be achieved by careful attention to bearing friction of the rotating parts—a procedure which would also reduce the wow-and-flutter figure considerably.

In our investigations, when poor "clutch" action of a direct-drive machine is the fault, we should also look for fouled bearings, or bearings that have lost their lubrication. Not only of the motor itself—where fast winding may be perfect but take-up poor, or reeling-off retarded when running in the stalled condition, as some feed motors must—but also of the idlers or belt jockeys.

A digression is called for at this point. Poor take-up, jerky action, even a halted motor on an under-driven three-motor machine can have the most elementary of causes—dirt. Tape trapped in the flanges of closely machined guides, a sliver of bad splicing in a vital part of the head channel, hardened and/or overtight pressure pads: these are faults so obvious as to be mentioned with an apology to the reader. My experience as a tape recorder engineer shows that far too many faults are caused by the neglect of routine maintenance. And not *all* my customers are mechanical ignoramuses!

After the direct drive, two main types are clutch are found. Weight-dependent clutches form the largest proportion in 'table' machines, designed for horizontal operation. Modifications of them will be found in vertical machines where the inward pressure, which now takes the place of gravitational force, is effected by clamping the reel firmly to the reel carrier. Faults here are always apparent. If in no other way, they will always show themselves as a spool rattle or uneven tape stacking during fast winding.

Perhaps the only particular point that needs stressing is the tendency of spring-loaded locking devices to jam in many types of portable machine. These can be very tricky to mend, especially as so many of them depend on exact spacer washer dimensions. The circlips that provide the locking clamp to the reel carrier spindle are small, and necessarily weak. Care is needed when removing and replacing these.

Although the method of drive is not important to our fault-chasing, in practice we find that troubles in clutches often derive from the method of drive. The transfer of torque of a weight-dependent clutch is generally by a felt ring or disc. Many tape recorders have larger discs on the right side. Take-up torque is greater than the reverse torque of a feed spool. The basic turntables may be similar, but care is needed, as in some machines there are subtle, not always evident, differences between the spools. If you take them off, mix them up, and then refit them, you are in for a pack of trouble and some baffling symptoms.

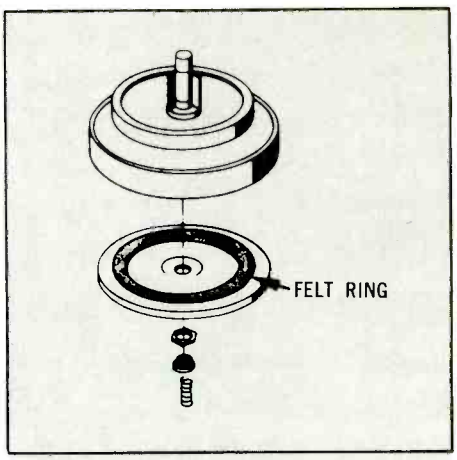


Fig. 3—Typical weight-dependent clutch, with torque transmitted to the upper portion from the driven lower portion by compression of the felt ring, which varies with the weight of tape spooled.


Fig. 4—Older type of Philips clutch assembly which relied upon the dropping action of the auxiliary spindle A allowing the upper turntable to contact the plastic pads B for fast winding. For slipping action, a plastic disc is mounted on the spindle and locked by the shaped block.

As the amount of tape which is loaded increases, the weight compresses the felt and more torque is transmitted from the driven lower part of the clutch to the upper. Figure 3 illustrates the basic type of weight-dependent clutch, and although styles may differ, the general design is as shown, with a lower drum rotated by a belt or an idler, its bearing on the solid base of the deck or a fixed plate, rotating on a common spindle that is also fixed. The upper part has the reel-carrying spindle and a felt ring or disc beneath it, often fixed to it or as

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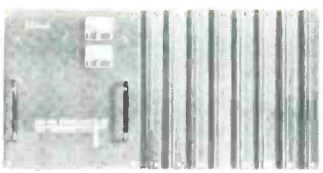

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The new Nocturne Eight Twenty solid state receiver has 140 Watts of power and perhaps the most sophisticated FM stereo tuner ever built.

But it doesn't have an AM radio.

At $299.95, we had to make a choice. So we made the one we thought you would make. We traded the AM radio for an inordinate amount of performance. For instance, the Eight Twenty has enough guts to drive four speaker systems flawlessly, without the slightest sign of strain. The amplifier is unlike any power output stage found in conventional stereo receivers. It employs wideband silicon transistors and a heavy duty power supply which extends the amplifier's response to below 5Hz and above 60,000Hz. This results in flawless reproduction of all harmonics without phase and transient distortion. The output stage uses a quasi-complimentary symmetry design which insures accurate balance and symmetry at the clipping points. A high degree of feedback is used to keep distortion down and stability high. Harmonic distortion products are kept below 0.5% at full output across the audio spectrum of 20-20,000Hz. This insures unusually smooth and transparent sound.

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Newly designed integrated circuits and crystal filters in the I.F. strip make FM tuning as precise as switching the channel selector of a television set. The tuner accepts only the station to which it is tuned, regardless of how close an alternate or adjacent station may be. An FET front end coupled with a four ganged tuning capacitor assures unprecedented sensitivity and selectivity. Crossmodulation has been reduced to the vanishing point.

The new Harman-Kardon Nocturne Eight Twenty doesn't have an AM radio. But it has everything else you could possibly want in a receiver. And at an amazingly low price. Hear it soon at your Harman-Kardon dealer.

For more information, write: Harman-Kardon, Inc., Dept. A-9, 55 Ames Court, Plainview, N.Y. 11803.

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140 Watts, ± 1 db; 110 Watts, IHF

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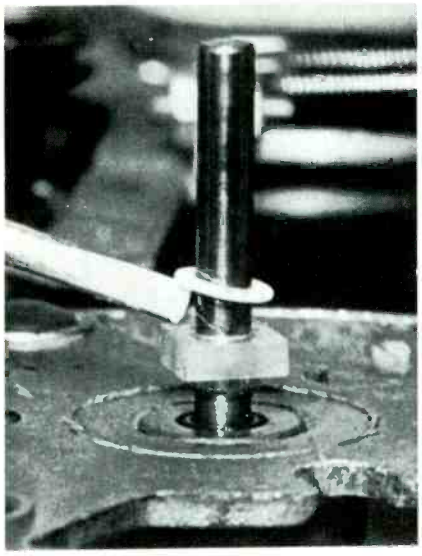


**Fig. 5**—Close-up of spindle and block described in Fig. 4, with Neoprene washer used for adjustment indicated by screwdriver blade.

shown, to the lower disc.

Variations include the use of a hollow spindle for the bottom portion with a linking spindle between upper and lower members. The linking spindle itself carries a disc or other device which is then pressed hard against the driving drum, locking upper and lower sections together for fast winding. See Figs. 4 and 5.

Another type has a spindle running directly through the common bearing, which is hollow, and fast winding is achieved by this spindle being pulled down from below by the lever system interlocked with the function selector.

Many of the cheaper machines have even simpler types of clutch, with only one rotating member. This is usually driven by a belt coupled to the flywheel, in turn driven by a ramped idler wheel or another belt. The reduction, and the use of a fairly slack belt gives a degree of slip and should, in theory, provide an even wind throughout the length of the tape. It will be appreciated—especially by the owner of this type of machine—that variations in external conditions will easily upset the torque, never very constant at the best of times. We have already seen what wide variations of load and voltage have to be accommodated. It is not unusual for a power supply to vary, or for internal conditions to give the same symptoms. So where a 'slack-clutch' design shows signs of poor take-up, make the motor supply your first check, even if the motor may seem to have nothing to do with the fault.

Complicated types of clutch assembly may have grown up during design by one pressure after another being put upon the designer. One such complex style of assembly arises from a basic horizontal design having been adapted to vertical operation, and the fast-winding facility of the original having to be maintained without any modification to other parts of the machinery.

Important features for this purpose in a Japanese unit I examined are the conical springs and 'starfish' washers. These are used to vary the compression. (There is an even worse French design with washers that can be rotated for different pressures, and a German version that uses felt pads in 56 different combinations to vary the coupling pressure. See Fig. 6.) The take-up clutch consists of two plastic rollers with felt between them; these are sprung apart by the conical spring, and the lower roller is idler-driven. The legs of the star spring can be bent for a compromise tension between take-up and fast winding.

**Fig. 6**—Position of felt or cork pads in cutouts of clear plastic lower section gives varying friction for torque compensation. Note shaping of reel carrier underside, giving a small degree of safety slip.

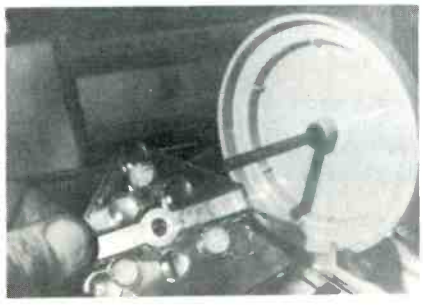
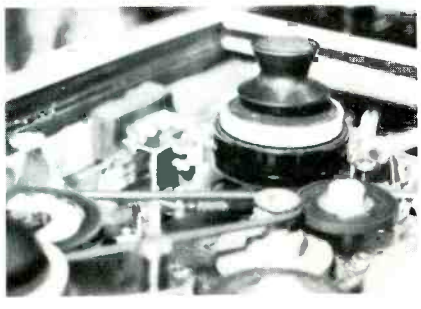


**Fig. 7**—Sony clutches are efficient, with simple fast-wind action by the heavy-tired idler seen at the right locking motor pulley drive directly to both upper and lower sections of clutch.



Sony has used what is perhaps the best variation on this theme, a form of weight-dependent clutch with the lower section firmly driven, and then the two portions clamped together by the insertion of a free-running idler in the system, as in Fig. 7. For fast winding, this 'clamp' simply locks the two portions of the clutch. There is no slip, no complicated adjustment, and no variation of basic drive.

A clutch system that was originally designed for horizontal operation, but has lately taken the conversion to vertical working with aplomb, is that employed by Tandberg and illustrated in Fig. 8. It has a driven lower section, and in this case the two sides have similar drive arrangements but differing adjustments to allow for the different torques. A crossed belt, engages the motor pulley on two sides—which helps reduce several of the belt-drive variations we talked about last time, and doubles a flutter frequency, throwing it well above the bothersome region. In this design, one small drawback is that turning the left spool with the motor off will also cause the right to move, making threading-up a bit tricky. Provision of a 'free' position of the famous Tandberg joystick on latest versions has now eliminated even this small fault.

The device works by the movement of a plastic 'cartridge' with a lug against which two arms press to lift or lower it when the different functions are selected. But during PLAY the tension is really provided by the compression spring. This allows the felt to be compressed sufficiently to give the right amount of friction. The felt is, of course, between the two sections of the clutch.

Small adjustments may be needed, especially of the lefthand assembly to reduce back tension which causes flutter. Most often, these adjustments are needed when going from horizontal to vertical operation. The Tandberg is not the sort of machine to be tossed around—not even the suitcase version. The left arrangement is a bit different from the right, and reference should always be made to the service manual. The auxiliary brake on the left reel-carrier assembly complicates matters.

Adjustment is mainly by the setting of the small screw in the end section

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Revox Corporation guarantees to the original purchaser of a Revox A77 tape recorder purchased from it in the U.S.A., except as to fuses and bulbs: 1) to replace without charge any part failing within twelve months after purchase; and 2) to provide a free replacement in exchange for any part thereafter failing except the record and playback heads, capstan and pressure roller. This guarantee shall be void if the purchase has not been registered with the Revox Corporation within the time specified in the card supplied the purchaser with the recorder, or if the recorder has been modified or altered by anyone other than the Revox Corporation or its authorized representatives, or if the recorder has been damaged by misuse or accident. Transportation charges are not included in this guarantee. There are no warranties or guarantees except those expressed herein.

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# Only Marantz Has Butter

# What's a Marantz?

Any audio engineer or stereo hobbyist will tell you Marantz builds the world's finest high-fidelity components. And has for fifteen years.

This message, therefore, is not to engineers but to professional musicians, serious music-lovers, and beginning stereo hobbyists. We'd like to introduce you to Marantz.

**Never Heard Of Marantz?**

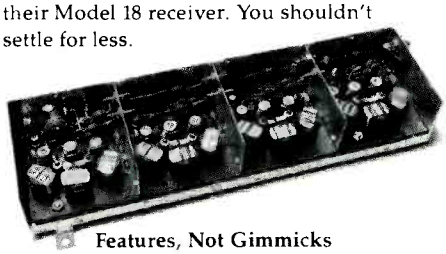
Until this year, the least-expensive Marantz stereo component you could buy cost $300.00. And our FM tuner alone cost $750.00! To own a Marantz, you either had to be moderately wealthy or willing to put beans on the table for awhile. But it was worth it. And a lot of experts thought so, too, because the word soon got around, and the products sold themselves.

**What The Competition Said**

The chief design engineer of a major competitor once said that no one even tries to compete with many of Marantz' sophisticated features; it would be just too expensive. Marantz designs its circuits the same way the aerospace industry designs missiles and jet planes—for utmost performance and reliability.

**Butterworth Filters**

You've probably never heard of Butterworth filters because no one else uses them besides Marantz. And the U.S. Military. Other manufacturers feel they can get by without them. And they can. Because their standards don't have to measure up to Marantz'. Butterworth filters let you hear music more clearly, with less distortion, and, unlike their conventional I.F. coil or filter counterparts, they never need realignment. They help pull in distant FM stations and separate those right next to each other on the dial. Although Butterworths cost more, Marantz designed not one but four of them into their Model 18 receiver. You shouldn't settle for less.



**Features, Not Gimmicks**

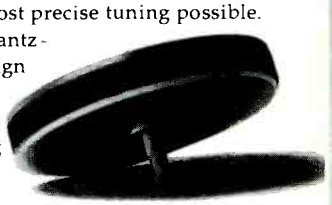
The unique features of a Marantz component are there for only one purpose, to make possible the highest level of listening enjoyment.

That's why we put an oscilloscope in our best components.

An oscilloscope is kind of a TV tube. But instead of the Wednesday Night Movie, it shows you a green wavy line. An electronic picture of the incoming FM radio signal telling you exactly how to rotate your antenna for minimum multipath distortion (ghost signals) and maximum signal strength (clarity) even from the weakest stations.

The "scope" also shows correct stereo phasing: that is, if the broadcasting transmitter or your other equipment is out of phase. And it lets you set up optimum stereo performance and reception to create a solid "wall" of sound.

Marantz also offers a different tuning experience because you rotate the actual tuning flywheel. This results in the smoothest, most precise tuning possible. And this Marantz-exclusive design requires considerably fewer moving parts than conventional systems used by other manufacturers. The benefits? Reduced friction, wear, and service problems. We call this patented feature "Gyro-Touch Tuning."



**Built To Last**

Marantz stereo components aren't built in the ordinary way. For example, instead of just soldering connections together with a soldering iron, Marantz uses a highly sophisticated waveflow soldering machine—the type demanded by the military. The result: perfect, failproof connections every time.

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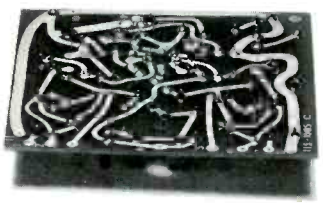
# worth Filters!

Even our printed circuit boards are a special type—glass epoxy—built to rigid



military specifications, ensuring ruggedness and dependability.

**Marantz Power Ratings Are True**

When someone tells you he has a "100-watt amplifier," ask him how the power was rated. Chances are his 100 watts will shrink to about 75 or 50 or perhaps even as few as 25. The reason is that most manufacturers of stereo amplifiers measure power by an inflated "peak power," or "IHF music dynamic power."

Marantz states its power as "RMS continuous power" because Marantz believes this is the only method of measurement that is a true, absolute, scientific indication of how much power your amplifier can put out continuously over the entire audible frequency range.

For example, if Marantz were to use the unscientific conventional method, our Model Sixteen 80-RMS-80 power amplifier could be rated as high as 320 watts per channel!

Moreover, you can depend on Marantz to perform. For example, the Marantz Model 16 can be run all day at its full power rating without distortion (except for neighbors pounding on your wall). That's power. And that's Marantz.

**Marantz Speaks Louder Than Words**

In a way, it's a shame we have to get even semitechnical to explain in words what is best described in the medium of sound. For, after all, Marantz is for the listener. No matter what your choice in music, you want to hear it as closely as possible to the way it was performed.

In spite of what the ads say, you can't really "bring the concert hall into your home." For one thing, your listening room is too small. Its acoustics are different. And a true concert-hall sound level (in decibels) at home would deafen you.

What Marantz does, however, is create components that most closely recreate the sounds exactly as they were played by the musical performers. Components that consistently represent "where it's at" in stereo design. And no one gives you as much—in any price range—as Marantz.

**Every Marantz Is Built The Same Way**

Every Marantz component, regardless of price, is built with the same painstaking craftsmanship and quality materials. That's why Marantz guarantees every instrument for three full years, parts and labor.

**Now In All Price Ranges**

Today, there is a demand for Marantz quality in other than very-high price ranges. A demand made by music-lovers who want the very best, no matter what their budgets. True, you can still invest $2,000.00 in Marantz components, but now we have units starting as low as $199. Though these lower-priced models do not have every unique Marantz feature, the quality of *all* models is the same. Marantz quality.

And quality is what Marantz is all about.

**Hear For Yourself**

So now that you *know* what makes a Marantz a Marantz, *hear* for yourself. Your local dealer will be pleased to give you a demonstration. Then let your ears make up your mind.

marantz®

of the clutch lever, accessible from the side of the machine when it is removed from the cabinet—no need for deck removal. The adjustment is for a compromise tension, avoiding excessive back tension, but not allowing the tape to spill when stopped from FAST FORWARD.

When making these adjustments, the compromise setting must often be borne in mind. Never adjust merely for 'good take-up' or 'effective fast-winding' until the complete sequence of operations has been run through. Tape spillage when the machine is stopped from running at any speed and in any direction is a fault that always gives a clue to clutch maladjustment. (Equally, brakes may be at fault: very often, brake and clutch operations are inter-dependent, as we shall see later).

Slipping-belt types of clutch, the main drive system as in Fig. 9, are usually constructed on the 'one-piece' system, with the different speeds of rotation effected by a change in belt tensioning. A jockey pulley, sometimes more than one, is sprung in against the flat belt by the lever system. The belt itself was part of last month's subject and need not occupy us here. But the jockey pulley or rider on which it rides is very much in our mind. It must be vertical to the belt run, and free to rotate, if so designed. The lever must be free to swivel and any springs used should be checked for correct tensioning. As this kind of action is constantly under changing drive tensions, special care must be taken when checking springs.

Most slipping-belt drives result from a build-up of foreign matter on pulley faces, especially the fast-moving motor pulley. Don't trust your eye: a fine polish may mask what is really a mechanically 'sticky' surface. Clean off all pulley surfaces with alcohol, run them over with cleaning ribbon a few times and ensure they are dry before refitting the belt. More will be said about flat belts and their vagaries when we deal with braking systems.

Safety clutches bother some people. The idea of these devices, usually a form of multi-disc clutch with complex adjustment, is to prevent the pull from exceeding a calculated maximum—to obviate tape damage. Braking forces can be formidable, and thin, double, or triple play tape is vulnerable to such stresses. The safety clutch may consist of a number of coupled discs, usually thin plastic, sprayed with flock or other felt-like finish. Spring tension, not always obvious in application, holds the discs together, and in contact with the clutched surface, and adjustment is for the maximum stress permitted for the tape for which the machine is designed. Then, if the pull exceeds this, because of fault conditions, fierce braking, or other troubles, the safety clutch slips, allowing the spool to decelerate more gently than with a direct clutch action. Like all safety devices, the added complication gives the service man additional problems when it goes wrong and some of these devices are the most difficult to set up.

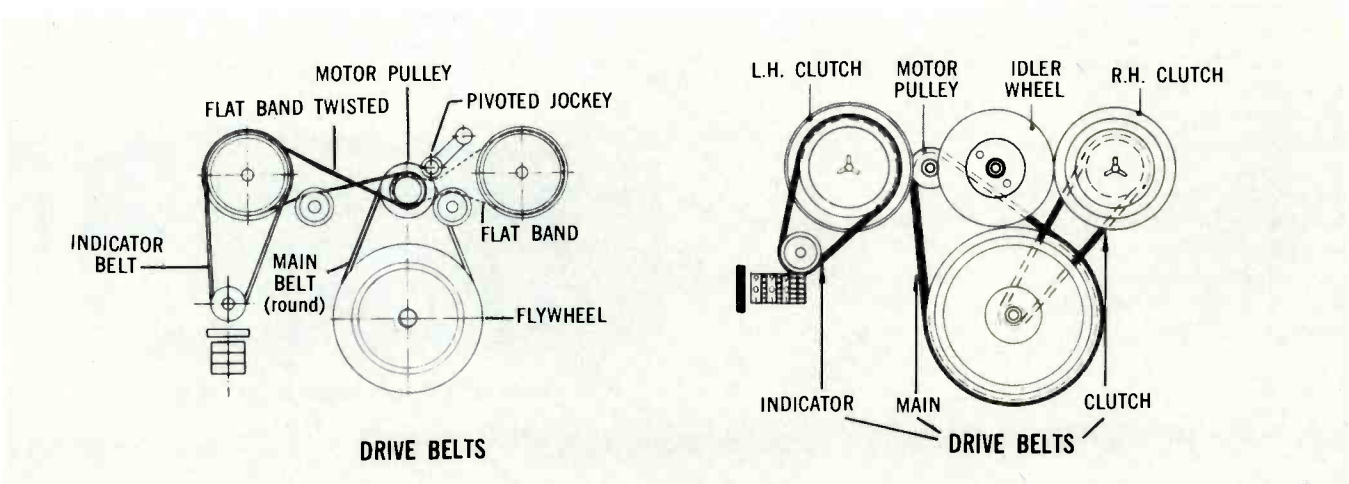
Adjustment is often a tedious business, and will depend on being able to measure the pull of the spooled tape at all weights throughout the spooling operation. To determine the slipping moment of a clutch with a constant braking moment, a spring balance can be used, and a measured pull at a measured distance from the center of the reel (with the pull at right angles) is taken. The moment is force (poonds) x distance between center and point of application (centimetres). The pond is a force equivalent to the pull of a gram weight. For reels up to 7 inches in diameter, readings of 150 to 300 would be normal, and 8½ inch reels would give readings of 200-400, using this scale.

For purely weight-dependent clutches we need a different procedure. Place a reel of minimum diameter with only one or two turns of tape on it on the right turntable. Draw off about 50 cm from the reel and loop it to the hook of a 100-g spring balance. Switch to PLAY and allow the tape to be taken up slowly. Pull as measured should not be less than 20 p for the average domestic machine. Repeat the test with a full reel. Look for a tolerance of from 20-100 p. Check especially for variations of tension during a revolution of the turntable, which would indicate eccentric or worn bearings or spindle trouble.

Use of the correct tape has been stressed already. Oversize tape will tend to retard spooling, undersize tape will wander and cause irregular torque. Tape that is too thin causes greater weight per diameter spooled and affects torque when weight-dependent clutches are used. Æ

**Fig. 8**—Slack clutch drive system with slipping moment via belt from flywheel to lower section of simple weight-dependent clutch.

**Fig. 9**—Clutch action obtained by tensioning of flat-band type of drive belt, using free-rotating jockey pulley on pivoted lever.



# Do something nice for Beethoven this Christmas.

Precision stereophonic sound systems. At your nearest high fidelity specialist.
James B. Lansing Sound, Inc., 3249 Casitas Avenue, Los Angeles 90039

JBL



Check No. 57 on Reader Service Card

# ABZs of Stereo FM

[Conclusion]

LEONARD FELDMAN

## CONVENIENCE FEATURES

Last month we began to analyze a modern stereo FM multiplex decoder circuit as exemplified by the circuitry used by Sony Corporation in their currently available model STR-6040 Stereo Receiver. While we traced the manner in which separate "L" and "R" information is recovered, we skipped over a few circuits which have little to do with this basic recovery process. These additional circuits, present in nearly every modern stereo FM tuner or receiver to a greater or lesser degree, may be termed "Convenience Circuits"—circuits that make stereo listening easier, but do not directly contribute to the quality of sound heard.

### Stereo Indicators

Very soon after the first stereo FM adapters became available in 1961, many manufacturers realized almost simultaneously that it would be a good idea to denote the presence of a stereo station by some visual or aural indicator. Such an indicator was particularly important in those days, because automatic switching circuits (which introduce the decoder circuitry whenever the set is tuned to a stereo station) had not, as yet, been developed. Thus a listener who set the selector switch of his tuner or receiver to monophonic FM had to depend on a station announcer's vocal declaration that the program being heard was transmitted in stereo so that he would switch his selector to "stereo FM." With increasing sophistication of programming, few announcers bothered to mention the fact that they were broadcasting in stereo, and undoubtedly, many stereo programs were listened to in the monophonic mode in those early days.

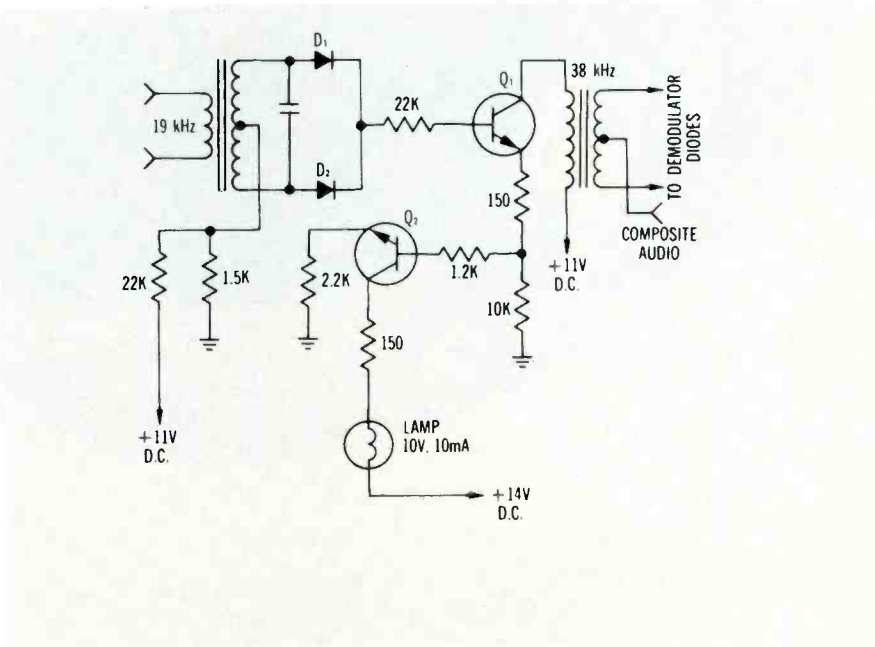
A stereo indicator light is readily incorporated into stereo decoder circuitry. Although many schemes are used, they are all based upon the fact that in the presence of stereo, there must be a 19-kHz pilot signal present and, conversely, this signal is absent when monophonic transmission is used. (We won't dwell upon the fact that even today some careless station operators forget to "turn off" the 19-kHz pilot when reverting to monophonic transmission!). A simple stereo indicator circuit, utilizing a low-current panel-lamp, is shown schematically in Fig. 1. Diodes $D_1$ and $D_2$ act as a full-wave rectifier to convert the incoming 19-kHz amplified signal into 38-kHz pulses. The base of $Q_1$, in the absence of 38-kHz pulses, is normally biased so as to prevent significant conduction of current in $Q_1$. As soon as positive-going 38-kHz pulses appear at the base of $Q_1$, that transistor conducts heavily, causing a positive voltage drop across the 10-ohm resistor in its emitter circuit. This positive voltage is then applied to the base of $Q_2$ which was, up to now, also cut off. Positive voltage at the base of $Q_2$ causes this transistor to conduct, and since the lamp is in series with its collector back to B+, the lamp becomes illuminated.

Refinements of this basic circuit have been made by many manufacturers, each claiming superiority over the others. Basically, the simple circuit of Fig. 1 has certain shortcomings, as it stands. For example, interstation noise, which is basically wide-band (random) noise, contains *all* frequencies, including 19 kHz. If this noise is present in sufficient amounts, the stereo indicator light will become illuminated in the presence of this "off-station" noise. Sophisticated noise-vs-signal sensing circuits have been developed which permit the indicator to become illuminated only in the presence of a true 19-kHz pilot signal.

### Automatic Switching

Mode switching from monophonic reception to stereophonic reception really involves no special circuitry at all, so long as the decoder circuitry doesn't use a local 19-kHz or 38-kHz oscillator to create the required 38-kHz restored sub-carrier for demodulation. In fact, most currently produced stereo decoder circuits have abandoned the "local-oscillator" approach, primarily because of stability and synchronizing problems. It is much easier to take the incoming 19 kHz, double it, amplify the resultant 38-kHz signal and use *it* as the restored sub-carrier directly. By properly biasing the demodulating diodes, the monophonic signal may be fed through them with no increase in distortion. Then, when a switching

Fig. 1—Typical stereo-indicator lamp circuit.



We don't know if you'll ever really need all the precision features and refinements of the new Dual 1219 professional automatic turntable.

For instance, the 1219's tonearm tracks precisely at the 15° stylus angle in single play, just as it does at the center of a stack in the multiple-play mode. (In the single-play mode, the tonearm base lowers to maintain the correct stylus tracking angle with a single record.)

The tonearm suspension is a true ring-in-ring four-point gimbal. The tonearm pivots vertically from an inner concentric ring which, in turn, pivots horizontally from an outer ring. The same principle is used in precision gyroscopes.

The 1219's tonearm is the longest used in any automatic, with an effective length of 8¾". Its horizontal tracking error is the lowest in any automatic: less than one and a half degrees.

And the motor combines high starting torque (for its twelve inch, seven pound platter) with dead-accurate synchronous speed.

But these and other refinements introduced in the 1219 are costly to produce. At $159.50, they may be unnecessary for some music lovers. So Dual also offers two less expensive models. With fewer refinements, but no less precision or reliability.

The new medium-priced Dual 1209, at $119.50, has many of the 1219's advantages. Such as a counter-balance with 0.01-gram click-stops. Separate anti-skating scales for conical and elliptical styli. A single-play spindle that rotates with the record. And a motor that also combines synchronous and high-torque induction features.

The Dual 1212 is still less expensive. But like every Dual, it has such refinements as a silicone-damped cue control, and a pitch control that lets you "tune" any record over a semi-tone range. Though priced at only $79.50, it has been rated by independent testing laboratories as "compatible with the finest amplifiers and speakers, as well as the most compliant cartridges available today."

Which Dual should you buy?

That depends on whether you want more precision than you may ever need. Or merely more precision and more refinements than any other turntables provide. Our full-color brochure and other literature may help you make your decision.

**United Audio** Products, Inc., 120 So. Columbus Ave., Mount Vernon, New York 10553. Dual

# The Dual 1219 has more precision than you may ever need. And there's a lot of the 1219 in every Dual.

signal in the form of amplified 38 kHz is present, the same circuit path may be used to recover separate L and R signals. Thus, the presence or absence of incoming 19 kHz is in itself the necessary "switch." More-sophisticated approaches to this automatic-switching requirement have appeared, however, largely in an attempt to *prevent* stereo decoding on all but adequately strong signals. For example, "threshold" circuits have been developed which sense either noise content or "full limiting" from the i.f. section of the tuner to determine at what signal level the 38-kHz signal should be applied to the demodulators to provide a satisfactory, noise-free stereo program. In addition, most manufacturers still provide a manual "mono" position on their selector switches. This is done because even some sufficiently strong signals may be loaded with "multipath" reflections which render a stereo program unlistenable. Under such circumstances, the listener might prefer hearing the program monophonically, rather than with the distortion caused by the multipath problems.

An interesting little circuit that acts to restrict automatic stereo switching (and, coincidentally, false stereo indicator lighting) is shown in Fig. 2. This circuit, used in the new low-cost Sony STR-6040 receiver, is fed high-frequency noise via coupling capacitor $C_1$. The value of this capacitor is so low (62 pF) that it will pass primarily high-frequency noise. The noise is amplified by $Q_3$ to drive rectifiers $D_1$ and $D_2$. In the presence of interstation noise, the d.c. output of $D_1$ and $D_2$ is fed back to the base of $Q_3$, driving it into conduction. This, in turn, shorts the frequency doubler to ground, preventing further amplification of the 38-kHz signal. Both stereo demodulation and stereo-indicator-lamp operation are therefore cancelled.

When a proper stereo signal is received, the signal-to-noise ratio increases, reducing the noise signal at the base of $Q_3$ which then cuts off, permitting the stereo indicator and demodulator circuits to function normally.

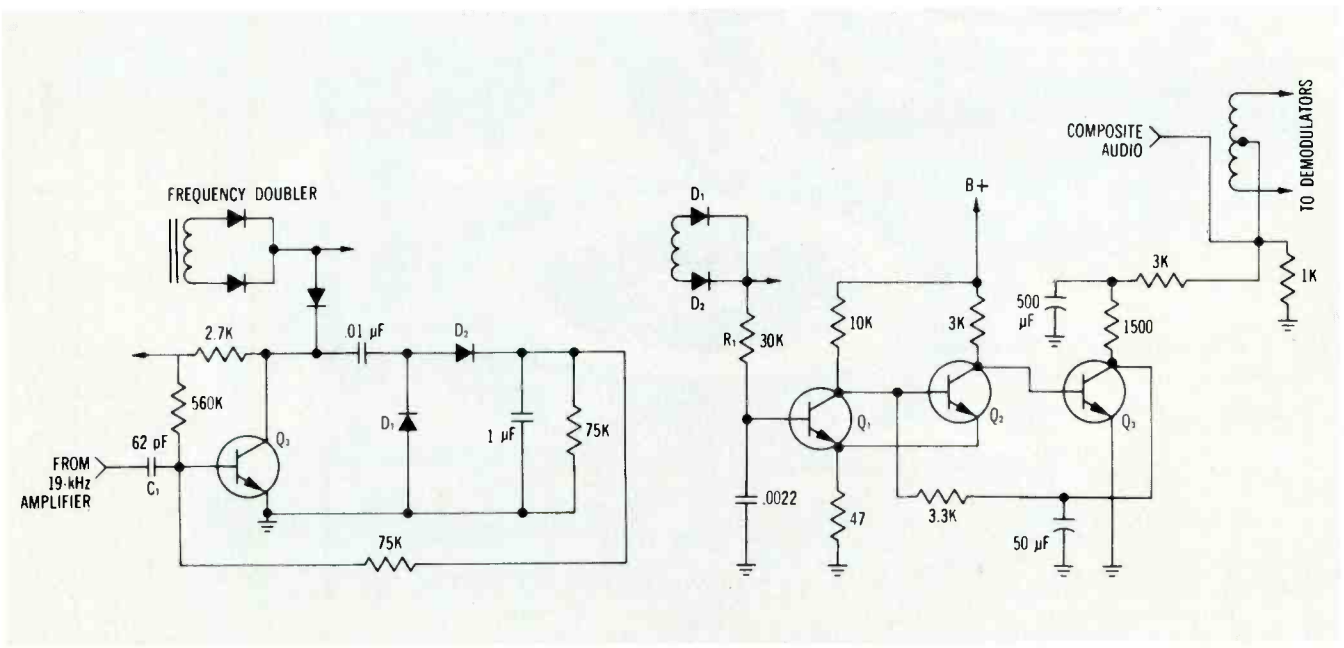
A more elaborate d.c. coupled, three-stage mode switch used by Sony Corporation in their Model 6120 (basic circuitry of which was analyzed last month) is shown in Fig. 3. When a stereo signal is received, the d.c. component of the signal developed by the 38-kHz doubler diodes ($D_1$, $D_2$) is coupled through $R_1$ to turn on $Q_1$. This, in turn, turns off $Q_2$ and turns on $Q_3$. When $Q_3$ is saturated, the forward bias normally applied to the demodulating diodes (not shown) is removed by the shorting action of $Q_3$ and the demodulator then operates in the stereo multiplex mode.

Though not shown in Fig. 3, these same stages of d.c. amplification are used to provide yet another "convenience feature" in this receiver. In one of its selector switch settings, this receiver will pass *only* stereo broadcasts on to the stereo amplifier section. In other words, the user simply sets the mode switch to STEREO ONLY, and as he scans the tuning dial, only those stations then broadcasting stereophonically will be heard at all. In this case, $Q_3$ of Fig. 3 drives a relay (not shown), normally used in its interstation muting circuitry, but in this case, doing double-duty to mute all but stereo signals. There is really no end to the number of circuits which ingenious design engineers can come up with, for basically, the stereo broadcasting system itself provides a very handy "logic-binary" in the form of a "yes-no," depending upon the presence or absence of 19 kHz in the incoming composite signal.

For the last few months we have covered some of the techniques and theory involved in stereo FM broadcasting and reception. Stereo FM has been with us for less than a decade, but its popularity as a high-fidelity program source keeps growing. There are new, exciting prospects for this medium, including 4-channel stereo broadcast over a single FM station. AE

**Fig. 2**—Automatic switching circuit sensitive to noise.

**Fig. 3**—A mode-switching circuit used in Sony STR-6120.



# The world's fastest bookshelf speaker.

That's not a joke. The new **Rectilinear X** is at least four times faster off the line than its closest competition. And you're not reading a drag-racing magazine.

But let's begin at the beginning.

A few months ago, we announced the **Rectilinear X** (that's a ten, not an ex) as the world's first high-fidelity loudspeaker. We explained that it was the first speaker system to pass a signal more or less unaltered, in the same sense as a minimally acceptable amplifier. (We didn't say, as a few people seemed to interpret us, that our new $199 bookshelf speaker made all costlier systems obsolete. There will probably always be a need for larger, more expensive speakers for reasons of power, efficiency, versatility, special acoustical problems, etc. But not accuracy.)

What we want to point out in this ad is the specific reason for the superior accuracy of the **Rectilinear X** as a listening device.

Not the frequency response, although it happens to be beautifully flat and smooth. Nor the absence of harmonic distortion, although the 10-inch woofer with its one-inch linear travel won't distort a 50 Hz signal at 10 watts any more than a medium-priced stereo receiver. Nor even the transient response, although the exceptionally low-mass tweeter follows steep wave fronts with great alacrity.

No. The truth is that all of today's top speakers have reasonably smooth frequency response, low harmonic distortion and good transient response. And it would be utterly impossible to predict their individual sound quality or their relative ranking from these data alone.

However, as we have discovered, there *is* a measurable quantity that corresponds very closely to audible differences in speaker performance. *Time delay distortion.*

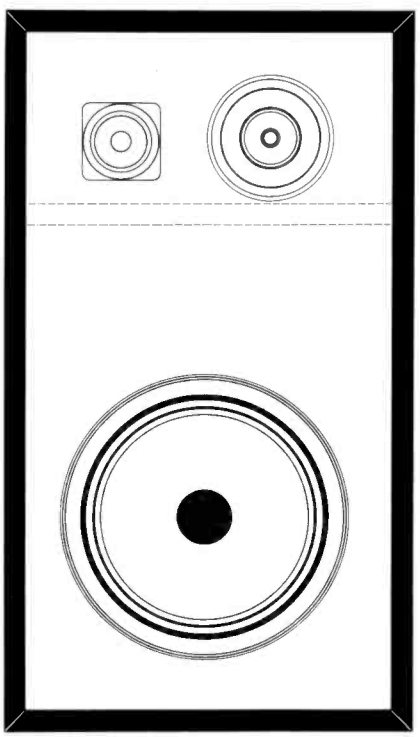
In our introductory advertising, we referred to this much-neglected criterion by the more specialized mathematical term of envelope delay distortion, a concept with many ramifications in network theory. A sophisticated explanation would require a very involved discussion of loudspeaker phase response as distinct from amplitude response, but the basic idea is quite simple.

Sound waves travel through air at the rate of approximately 1135 feet per second (at room temperature). Therefore, if you're sitting let us say 11⅓ feet from a speaker, you'd expect a signal to reach your ear one one-hundredth of a second (10 milliseconds) after the amplifier feeds it to the speaker terminals.

Not so. It will reach your ear more slowly.

It seems that speakers don't speak the instant they receive a command from the amplifier. Between the entry of the electrical signal and the exit of sound, there's a time delay. Not just a slowdown of the rate at which pressure amplitude builds up (i. e., transient response), but an actual moment of silence. Dead silence.

What's more, the length of this moment is frequency dependent. Generally speaking, lower frequencies are delayed longer than higher frequencies. Which means that the low and high frequency components of a signal that enter a speaker at the same instant don't arrive at your ear at the same instant. There's a smearing effect. This accounts, in part, for the gutsy, canned sound of some popular speakers, which many people like although its bears no resemblance to live music.



Now, time delay distortion is least audible at low frequencies and becomes more and more obvious going up into the midrange. Woofers, with their massive moving parts and complex networks, are the worst offenders, so it becomes important to keep them out of the midrange. The only speaker system that goes all the way in this respect is the **Rectilinear X.**

Although the specially designed 10-inch woofer has remarkably little time delay to begin with, it's crossed over at 100 Hz to a 5-inch midrange driver with phenomenally low time delay distortion. Thus the entire midfrequency band has the benefit of minimum time delay. And you can hear it.

At 500 Hz, for example, the **Rectilinear X** has a time delay of less than 0.2 millisecond. By comparison, the top-of-the-line model of the most famous name in bookshelf speakers has a delay of approximately 0.8 millisecond at the same frequency, mainly because most of the output is still coming from the woofer. The **Rectilinear X** is literally faster off the start line.

Since no other speaker system cuts off the woofer at 100 Hz, and no moving-coil speaker is faster in the lower midrange than our 5-inch driver, the **Rectilinear X** is the world's speed king

At which point we can't resist borrowing a phrase from the underground. "Speed kills." Our competition.

(For further information, see your audio dealer or write directly to Rectilinear Research Corporation, 30 Main Street, Brooklyn, N. Y. 11201.)

**Rectilinear X**

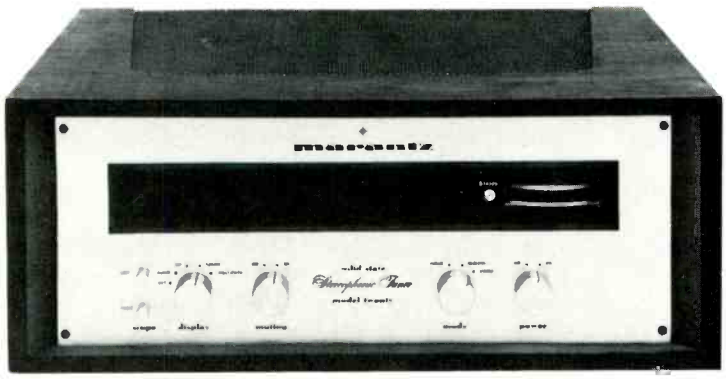
# Equipment Profiles

*This Month:*

- Marantz Model 20 Stereo FM Tuner
- Astrocom/Marlux Model 407 Stereo Tape Deck
- Dual Model 1219 Automatic Turntable
- Pioneer Model CS-66 Speaker System
- Sansui Model 4000 Stereo FM/AM Receiver
- JBL Model C60 "Sovereign I" Speaker System

## Marantz Model Twenty Stereo FM Tuner

Fig. 1



**MANUFACTURER'S SPECIFICATIONS:**

**IHF Sensitivity:** 2.8 μV or better. **Quieting Slope (S/N Ratio):** 70 dB at 50 μV. **Output Level:** 1 V. rms. **Total Harmonic Distortion:** 0.15% max @ 400 Hz, 100% modulation. **I.F. Bandwidth:** 3 dB @ 230 kHz; 80 dB @ 880 KHz. **Frequency Response:** 75 μsec. de-emphasis, ±0.5 dB. **Multiplex Stereo Separation:** 40 dB @ 20 Hz, 45 dB @ 1000 Hz, 35 dB @ 10,000 Hz, 30 dB @ 15,000 Hz. **38-kHz Supression:** 60 dB. **67-kHz Supression:** 65 dB. **Total Spurious Rejection:** Better than 90 dB. **Image Rejection:** 60 dB. **Dimensions:** 15⅜" W x 6⅛" H x 14⅛" D. **Weight:** 25 pounds. **Price:** $495.00 (optional walnut cabinet, $29.50).

With the introduction of the new Marantz solid-state "Model 20" Stereo FM Tuner, that company has completed the slow transition from vacuum-tube equipment to "all" solid-state products. The "all" is in quotes because the now-famous cathode-ray tube used in the oscilloscope display of this model, its predecessor (the Model 10B), and the Model 18 receiver is, by all definitions, a vacuum tube and does require a high-voltage power supply not required for the balance of the circuitry.

A few revealing comparisons are in order between this new tuner and the all-vacuum tube Model 10B ($750.00), which it most likely supplants in the Marantz line. For one thing, the price has come down by more than $250.00! If performance is equal or better, this would certainly prove that transistorization does, finally, lead to more economical designs at no sacrifice in performance. Weight, too, has gone down. The new Model 20 tips the scales at 25 pounds against 36 pounds for the famous 10B! Published distortion figures (fully met, as we shall see presently) are actually lower (in both mono and stereo modes), while IHF sensitivity is stated as 2.8 μV as opposed to the 2.0 μV claimed for the 10B. In fact, our unit measured a bit better than 2.5 μV, so that the oft-published statement "or better" really takes on significance in the case of the Marantz Twenty!

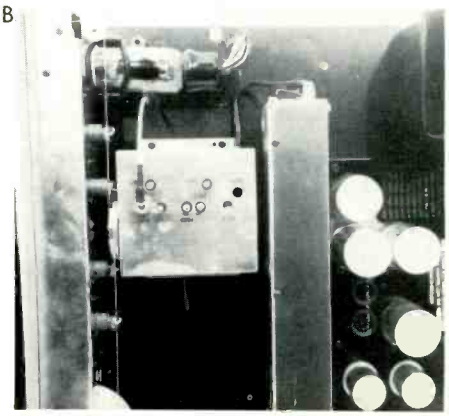
Styling, to our way of thinking, is actually better on the Model 20, featuring the same "gyro-touch" tuning control (a horizonatally mounted, heavy flywheel—the serrated edge of which the user actually spins with a fingertip) used in the Model 18 receiver reviewed previously in AUDIO, June 1968. The heavy (almost ⅜-in. thick), gold-anodized aluminum front panel, metal-turned knobs and black-framed dial glass area all provide a simple elegance of appearance in keeping with traditional Marantz design concepts. As shown in Fig. 1, there are four major controls besides the tuning-flywheel previously mentioned. Starting at the left, the first of these is a "scope-display" function switch, with positions for external use of the scope for examining audio of other sound sources, an audio position for examining the tuner's audio output, an OFF position (which correctly presumes that the user may, at times, want to listen to the tuner *without* having to stare at the scope traces, however fascinating they may be), a tuning position for accurate center-of-channel selection and a "multipath" position enabling the user to judge the degree of multipath interference and adjust his antenna for its minimization.

The next control is simply a muting on-off switch. This is followed by a mode switch featuring mono, stereo and "hi-blend" positions. This last position mixes left and right channels at just the high-frequency end of the audio spectrum, thereby reducing noise encountered with weak signal stereo transmissions by out-of-phase noise can-

Fig. 2A—Rear-panel view of Marantz Model 20. Fig. 2B—Section of top of chassis shows fully shielded i.f. module and the r.f. front end (below the scope display tube).

A

B



cellation. The last control at the right of the panel is the power on-off switch.

A pair of smaller controls located at the extreme left of the panel, below the scope display, are simply horizontal and vertical positioning controls for the 'scope display.

The rear of this tuner, shown in Fig. 2A( features an elevated antenna terminal strip with connections for either 75- or 300-ohm cable. An attenuator switch is also located on this raised structure, though in all our experiments we never found it necessary to activate this attenuator because of any overload problems. It is conceivable, however, that someone located within a stone's throw of the FM transmitter tower might find this feature useful. On the other hand, inadvertent activation of the attenuator might erroneously suggest poor sensitivity of the particular receiver. Output level controls (factory adjusted to provide precisely 1 volt rms from each channel output), dual output jacks for each channel, external 'scope input jacks, a line fuse, and an unswitched, unfused convenience outlet complete the back-panel layout.

## Circuitry

The Marantz Model 20's circuitry follows techniques previously developed by that company in the Model 18 receiver. The passive front end, a completely sealed and shielded unit shown in Fig. 2B adjacent to the 'scope tube, feeds four stages of i. f. amplification which employ a modified Butterworth-type filter between each of the stages rather than transformer coupling. This system provides sharper cut-off slopes and a phase-linear response, an important requirement for good stereo separation in the circuits to follow. Four limiter amplifiers follow, and this section of the tuner also contains the unique photoelectrically operated muting circuits. Conventional but extremely linear discriminator FM demodulation is used. The multiplex decoder section has carefully tailored phase-correcting networks, a highly effective SCA rejection filter and such additional niceties as electronically triggered photo-electric stereo switching and interchannel muting. A dual line amplifier provides the necessary low impedance outputs for the tuner by using emitter-follower circuits. Vertical and horizontal amplifiers for the scope display are also solid-state, as is the well-regulated power supply. In all, we counted 73 solid-state devices—30 bi-polar transistors, 7 FET's, 3 Zener diodes and 33 other diodes—in this beautifully designed and well-executed layout.

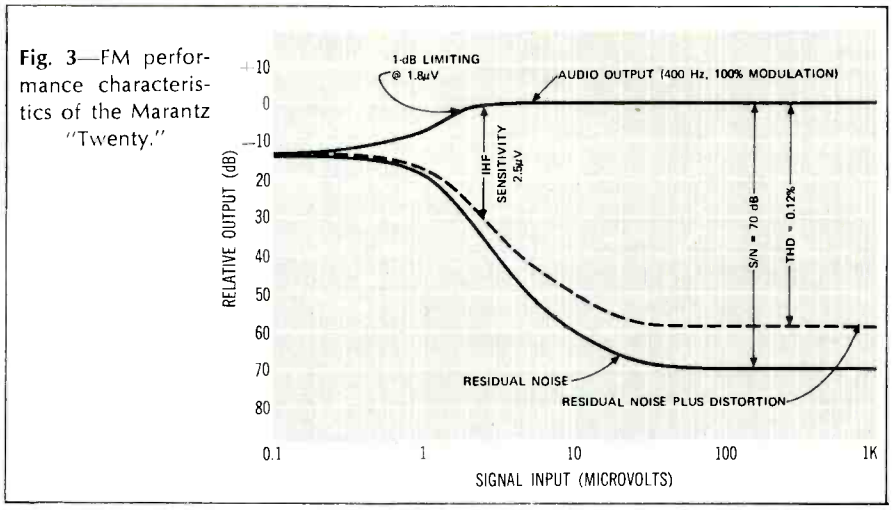



**Fig. 3**—FM performance characteristics of the Marantz "Twenty."

## Measurements

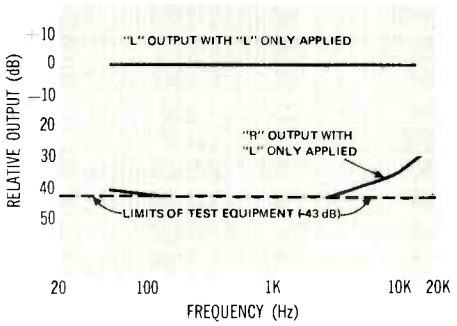
The most important measurements relating to the performance of the Model 20 are shown, graphically, in Fig. 3. Note that IHF sensitivity exceeded claims, measuring 2.5 μV. Total Harmonic Distortion (THD) measured a very minute 0.12%, which is lower than the 0.15% claimed. S/N was 70 dB, a number usually associated with amplifier performance, but seldom achieved in tuner design. Full ("1-dB") limiting was attained with a mere 1.8 μV signal input. The manner in which the S/N approaches its ultimate 70 dB value is extremely significant here. Unlike many products which attain their best signal-to-noise figure gradually, with increasing signal strength (often not reaching the final figure until a signal strength of 50 or even 100 μV is applied), this tuner's residual noise takes a mighty dip above 3 μV, reaching a S/N figure of 60 dB at only 10 μV input. This fact alone renders normally "noisy" stations (deep-fringe) readily usable and totally listenable. It is this characteristic, perhaps more than just a good IHF sensitivity figure, which really makes the difference to the end user.

Figure 4 plots stereo FM separation, It was particularly remarkable at the high end, where it is extremely difficult to maintain high figures of separation. Extra care and phase-correction circuits, as noted, make the difference here. As has happened with other Marantz equipment reviewed here, the claim of −45 dB stereo FM separation at 1000 Hz could not be fully substantiated—because our test equipment was only capable of producing a test signal having a "built in" separation capability of 43 dB! From all appearances of the curve of Fig. 4 (made up of those points which we *were* able to measure), it is obvious that this amazing separation figure (at mid-band) is not only achieved, but probably exceeded.

Another important fact about this stereo circuitry is that the THD in stereo mode is as good as it is in mono: 0.12%! Most manufacturers omit this important specification and, for some unknown reason, so did Marantz. They certainly need not have.

As a matter of record, automatic switchover to stereo (about the smoothest we've encountered) takes place at a signal strength of approximately 5 to 10 microvolts.

**Fig. 4**—Stereo FM separation of the Marantz "Twenty" FM tuner.



## Performance

The Marantz Model 20 performs exactly the way a super-tuner should. To begin with, calibration is absolutely "on the button" from 88 to 108 MHz. In logging stations, we found 43 acceptable ones with just an indoor dipole. With an outdoor 6-element Yagi (at a distance of about 20 miles from the center of New York City), the number of usable stations increased to 52. Eighteen satisfactory stereo transmissions were recorded. With the muting control activated, some of the weaker stations "disappeared," reducing the number to 32 (indoor dipole again). Since muting is defeated at very low signal strengths, this only proves that some of the "satisfactory" signals thus lost must have been received at signal strengths of 10 $\mu$V or lower—and yet they were quite listenable.

Tuning to center of channel using the 'scope display feature is certainly the most foolproof method ever conceived. When that little vertical trace is centered from left to right on the face of the 1" cathode ray tube you *know* you're perfectly tuned in. By switching the scope display switch to the "multipath" position, it becomes possible to orient your antenna for the least multipath disturbance. This is particularly important in stereo listening, and we found it necessary to reorient our antennas (both the indoor and outdoor) on fully *half* of the stereo stations received. As the reorientation is accomplished, observing the patterns on the scope, we heard a significant improvement in separation and noted a distinct reduction in distortion (particularly at the high end of the audio spectrum).

Satisfied that we were properly tuned in and oriented in the right direction, we proceeded to use still another function of the 'scope display —observation of the audio itself, displayed on the horizontal and vertical axes of the scope face. A "left only" signal will cause vertical movement of the scope trace, while a "right only" signal causes side-to-side motion of the trace. Monophonic transmission, therefore, causes the trace to move diagonally from lower left to upper right, while stereo material having a great deal of separation causes the trace to appear just about everywhere at once, creating a visual display that is both fascinating and highly informative. We will not here publicly chastise the several stations we observed that clearly were supposed to be broadcasting in stereo (the stereo light was lit, in no uncertain terms) and in fact were using monophonic recorded material. Happily, we caught no stations with their "stereo out of phase"—but had there been any, this multi-purpose scope display would have picked it up and denoted it in unmistakable manner.

Even if this worthy tuner didn't have a 'scope, its absolute clarity of reception, its selectivity, its craftsman-like construction and obvious durability, and use of the very best component parts would make it a worthwhile investment for those who really want FM reception in their homes as near to perfection as the present state-of-the art permits—and have $495.00 (plus $29.50 for the walnut cabinet if one plans to place the tuner "in the open") they're willing to part with to achieve these ends. We're delighted to say that the tuner is worth every cent of it.

**Check No. 62 on Reader Service Card**

## Astrocom/Marlux Model 407 Stereo Tape Deck

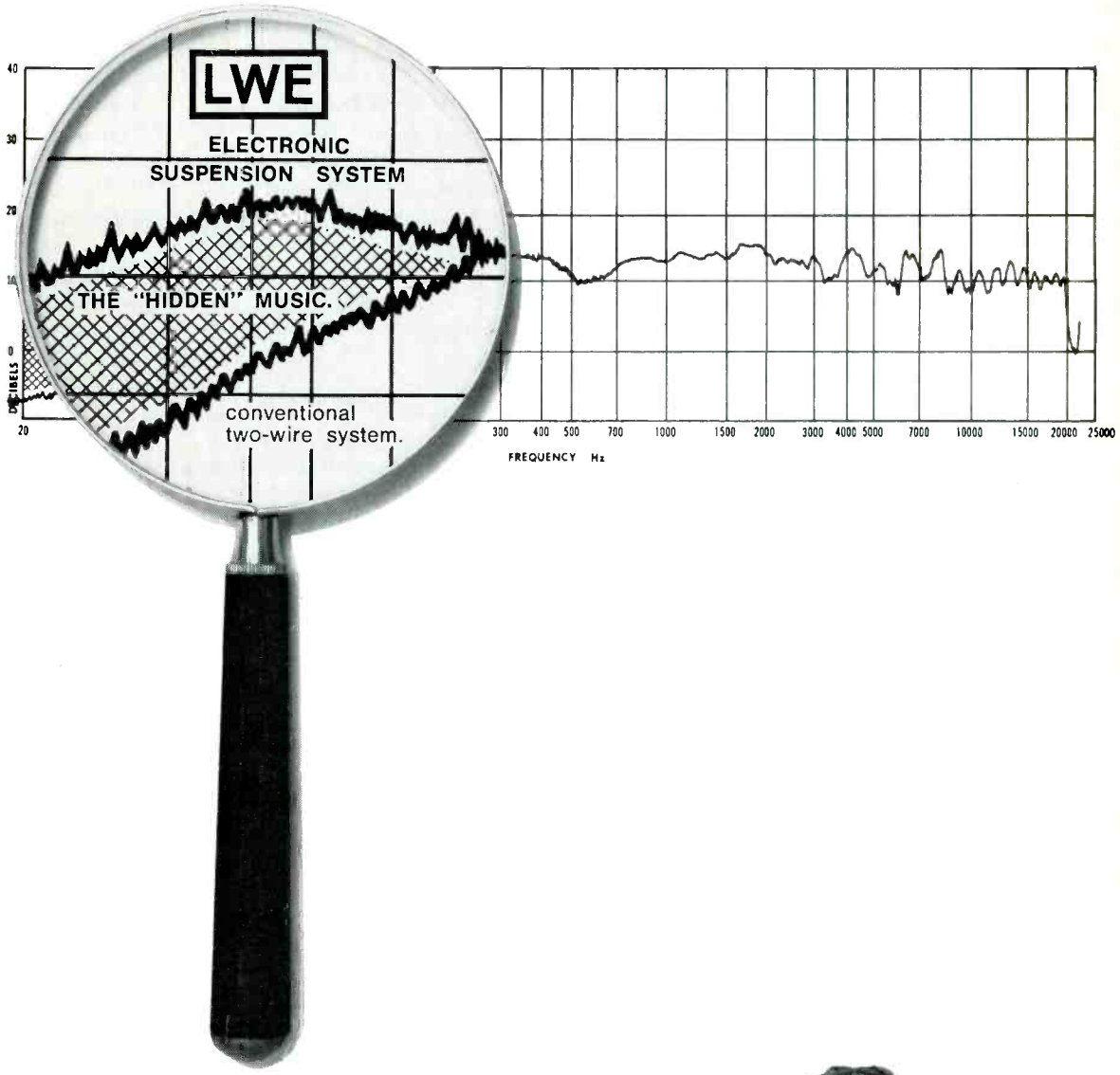
**MANUFACTURER'S SPECIFICATIONS:**

**Tape Speeds:** 7½ and 3¾ ips. **Reel Size:** 7" or smaller. **Recording System:** ¼-track stereo or mono. **Magnetic Heads:** Four—1 erase, 1 record, 1 forward, 1 reverse play. **Level Indicators:** Two calibrated VU meters. **Motors:** Three-motor system; 1 for supply reel, 1 for take-up reel, 1 hysteresis synchronous motor for capstan drive. **Frequency Response:** 30-20,000 Hz @ 7.5 ips; 40-16,000 Hz @ 3¾ ips. **Total Harmonic Distortion:** Under 1% @ 1 kHz @ 0 VU; under 3% @ 1 kHz @ +6 VU. **Crosstalk:** Better than 45 dB. **Equalization:** NAB. **Bias Oscillator Frequency:** 85 kHz. **Input:** Line/high impedance (100k ohms), Microphone/10k ohms unbalanced. **Output:** Low impedance unbalanced—150 ohms. **Mixing:** Two line and 2 microphone; independent level controls permit mix. **Signal-To-Noise Ratio:** Better than 50 dB. **Rewind or Fast-Forward Time:** Less than 60 seconds for 1200 ft. **Weight:** 40 lbs. **Dimensions:** 21" W x 14½" H x 10½" D. **Price:** $379.95.

Every once in a while we come across a product which so clearly stands out in its class that we must evaluate it relative to much more expensive equipment, otherwise only superlatives would be found on this page. The fact is that Astrocom/Marlux has produced a terrific tape deck whose performance and features put it right alongside the top 4-track tape decks. Neither esoteric operating principles nor new devices are responsible for this achievement. Instead, we have good straightforward engineering, well implemented, and obvious care in manufacturing.

The Model 407 is an automatic reversing, two-speed, three-motor, four-head, four-track deck which means you play it through your stereo sys-

# THE CASE OF THE MYSTERIOUS HIDDEN MUSIC...




**. . . and how it was solved by an LWE Electronic Suspension speaker.**

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**THE SOLUTION:** We discovered that most of this "hidden" music is in the bass range below 100 Hz. This is where the response of conventional speakers drops off rapidly — except for resonant peaks which produce only an artifical boomy sound. ☐ The above chart shows the frequency response of a standard LWE I Speaker* — with and without Electronic Suspension. Here's the evidence that proved Electronic Suspension produces a smoother, non-resonant response extending below 20 Hz. — far superior to that of any conventional two-wire speaker.

**THE MORAL:** LWE outperforms any comparable priced speaker on the market today. Prices range from $75 (LWE Instant Kit) to $550 (LWE (I). Hear LWE at your dealer or write today for LWE's "Sound of Excellence" brochure.


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*LWE I is a 3-way system in oiled walnut with 15" woofer and horn tweeter, $250. Optional base, $12.00.

**Check No. 65 on Reader Service Card**

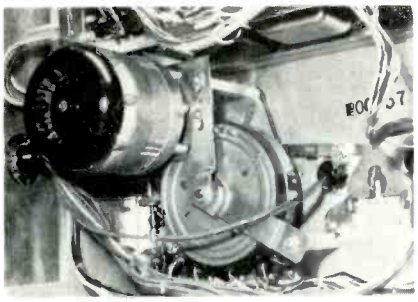

**Fig. 2**—Rear view of exposed chassis shows capstan/flywheel and capstan motor.

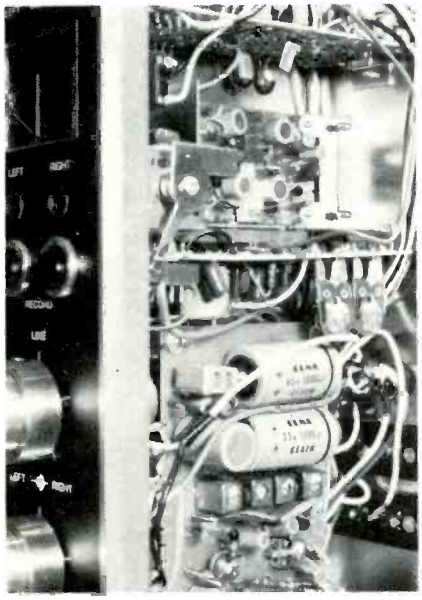

**Fig. 3**—Electronics chassis with side cover removed. Controls and VU meters can be seen at left.

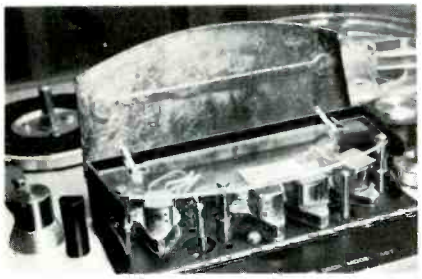

**Fig. 4**—Tape head assembly with top cover snapped open reveals tape path from the supply compliance arm and flutter filter to the capstan and pinch roller. Note the lucite sub-cover over the four tape heads.

tem. (It plays back in both directions, records in one direction.) It is automatic in the sense that if you stick on a piece of sensing foil at the end of the tape, the deck will reverse motion and the second playback head will read the tape on its way back. Two tracks forward, and two tracks in reverse. The switchover takes place when the aluminum foil travels across two closely spaced sensing posts. A massive 3/16-in. cast plate acts as the backbone of the deck. To provide effective tape motion, the Astrocom 407 uses a dynamically balanced, heavy capstan flywheel which is driven by a hysteresis synchronous motor through a neoprene belt. The supply and take-up turntables are each controlled by their own motors. A flywheeled impedance roller in conjunction with a compliance arm effectively isolate the tape from the supply pack. All controls are solenoid actuated by a logical grouping of five push buttons that have a real good feel to them.

Another compliance arm on the take-up-reel side takes up the slack and guides the tape onto the take-up reel. When the tape runs out or breaks, the spring-loaded arm returns to rest, actuating a switch which stops the machine. All motors, including the capstan, are stationary at all times except when the tape is in motion. This means a standing start in all modes, a good feature. The tape motion is excellent—even with very thin tape. A STOP command causes a rapid, gentle stop. Two tape tensions, selectable by a push switch, are provided. The lower tension is used when using very thin tape, such as the 3600-foot triple play.

The head assembly is mounted on a thick plate, and the heads are covered by a lucite plate which keeps bungling fingers away from the delicate head contacts, as well as preventing accidental jarring of the carefully aligned heads and guides, yet allowing clear view for cleaning and demagnetization. A hinged lid comes down on top of the plastic when in normal operation. Interspersed between the four heads are three stationary machined guides and two tape lifters. The guides see to it that the tape is properly centered on the heads. (Rolling guides would have been the last touch.) The tape lifters pull the tape away from the heads during fast forward and fast rewind. The playback heads are well shielded and easy to clean. Threading and editing are straightforward. Thus, it is apparent that this machine was designed with an operator in mind who is interested in complete control over his machine and wants to know what is happening at all times. Good human engineering is evident here—something that is too often left out of home machines.

The unit, mass produced in Japan, is uncluttered, and should be relatively easy to service due to its modular construction. All major components are plug-in. The electronics are contained in a separate chassis that can be unplugged from the deck, or even mounted in a different position relative to the deck.

## Performance

The first requirement, that of good tape motion, is met with distinction by this modestly priced deck. The result shows up in wow-and-flutter measurements, which yielded figures of .07% at 7½ ips and 0.15% at 3¾ ips. The frequency of the flutter is such that it was inaudible, even at 3¾ ips.

Rewind time is very fast—45 seconds for 1200 feet of tape.

Good design, standard components, neat and well planned wiring, and attention to shielding and routing detail are responsible for the outstanding recording/playback performance of this unit. Specifically, the signal-to-noise ratio, often traded for wide frequency response in lesser machines, has not been sacrificed here. We measured a signal-to-noise figure of 55 and 53 dB for left and right channels, respectively, for playback, referred to

**Fig. 5**—At the right bottom side of the front panel are the tape motion pushbutton controls, capstan, pinch roller and take-up compliance arm, as pictured here.


**Fig. 6**—At the left-bottom side of the front panel are the tape speed and tension controls, with the reverse-sensing post and flutter filter above them.

0 VU of the standard Ampex alignment tape, or 71.5 dB NAB-weighted. For record/playback, also referred to 0 VU, which is the 1%-distortion point of the tape, we measured 51 dB in either channel and speed, or 60.5 dB NAB-weighted. Referred to the 3%-distortion point specified by some manufacturers, the signal-to-noise ratio would then be 7 dB better all around. Notable is the relative absence of hiss in recording, partially due to the unusually low distortion of the 84 kHz bias oscillator. A total harmonic distortion of 0.35% out of the oscillator was measured.

Playback frequency response as shown here is excellent, being ± 1.5 dB between 50 and 15 kHz at 7½ ips. In the important range of 500 to 15 kHz, it is ± 0.5 dB. Matching between left and right channels is within 0.5 dB, which is also excellent. The same data apply for the reverse tape motion against the reverse play head, which came to within 0.5 dB of the forward head in every respect. Record/play frequency response, as illustrated, is also excellent, being ± 2 dB between 50 and 15,000 Hz. At 3¾ ips, the record/play response was ± 2 dB 50-12,000 Hz. The machine came factory

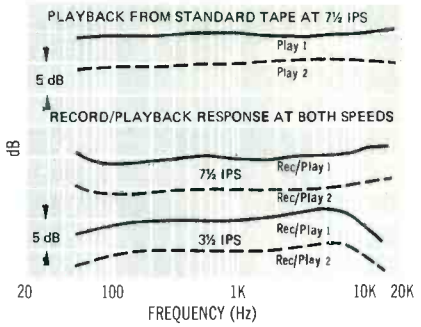


**Fig. 7**—Play response at 7½ ips and record/play response at both speeds.

equalized for Audiotape "Formula 15" tape, so we ran our tests using that tape. Crosstalk between channels is better than the specified 45 dB, and thus fine.

Input sensitivity for full record level is 0.1 volt and 0.45 millivolts for the line and mike inputs respectively. The output from the deck at 0 VU is 0.75 volts. The VU meters are unusually accurate, track well, and are easy to read. They indicate a fixed play level as well as the record level. In sum, the machine met or exceeded all its specifications.

Making recordings with this machine is easy. Because of the simple threading and positive control of tape motion, the recorder gets under way in short order. The speed change is electrical—not mechanical—and a 4-digit tape counter aids in locating portions of the tape. In monitoring off the play head while recording from an FM tuner, we could hardly tell between input and output—the ultimate test of a tape recorder. We say hardly, because there's always a couple of dB of noise that is added to a quiet source when recording. The solenoid-operated pushbuttons performed beautifully. One can activate reverse play while the unit is in the fast forward mode by a feather touch of a button, for example. And it's all done quickly and gently, without tape breaking or spilling.

The tape deck, which is housed in an oiled-walnut cabinet, can be used either vertically or horizontally. Individual test data accompany each machine. To our knowledge, Astrocom is the only manufacturer of home tape machines who furnishes such data—an innovation worth imitating by other manufacturers. The Astrocom/Marlux Model 407 is certainly a lot of tape machine for the money. It would make a fine addition to any good-quality stereo system, bar none.

**Check No. 64 on Reader Service Card**

## Dual Model 1219 Automatic Turntable

**Fig. 1**

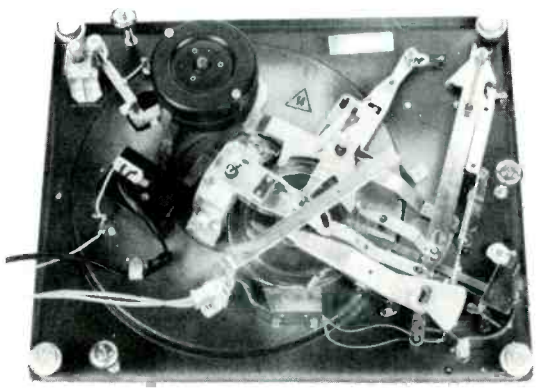

**Fig. 2**—Underside of the Dual 1219 indicates a neat, uncluttered mechanism. Phono jacks are on a bracket for attachment to the output leads, and a separate plug accommodates the 117-volt supply and the chassis ground connection.

**MANUFACTURER'S SPECIFICATIONS:**

**Speeds:** 33⅓, 45, 78 rpm. **Motor Type:** Hysteresis-synchronous. **Platter Diameter:** 12". **Platter Weight:** 7 lbs. **Wow and Flutter:** .05%. **Max. Tracking Error** 1.5 deg. **Max. Stack Records:** 6. **Arm Resonance:** 8 to 14 Hz. **Change Cycle** (at 33⅓ rpm): 13 secs. **Cartridge Weight Range:** 1 to 12 gms. **Dimensions:** 14¾" x 12" x 5" above motor board and 3" below. **Weight:** 15½ lbs. **Price:** $159.50.

The 1219, introduced recently, is full of features which make the unit a joy to use and a fine instrument for playing records. It is provided with nearly every refinement one could imagine—pitch control, single-lever operation, adjustable arm height, dial adjustment for stylus force, separate calibration on the skating-force adjustment for conical and elliptical styli, arm-lift lever, single-play and multiple-play mode selection, rotating single-record spindle, adjustable overhang, and a counterbalance with click-stops representing .01-gram changes

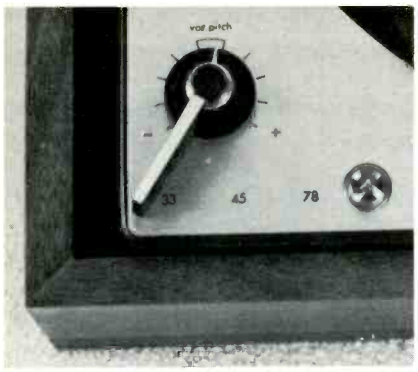

Fig. 3—At the left-front corner of the chassis is the speed-control lever, with the vernier speed control under it to provide a 6 per cent speed variation.

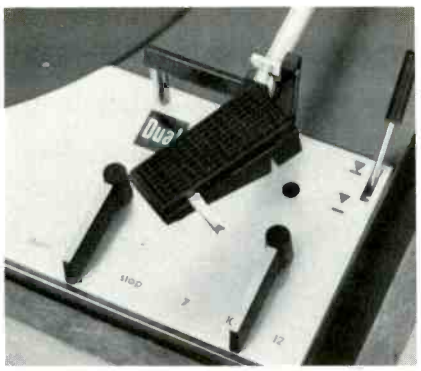

Fig. 4—The right front corner of the chassis mounts all operating controls—Master Operating Lever at left, and record size selector at right. Above is the Cue Control Lever, which raises and lowers the stylus to the record when the turntable is switched to the single-play mode.

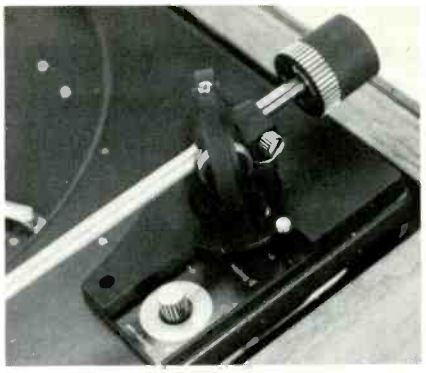

Fig. 5— Skating force is set for either conical or elliptical styli by the dial on the platform. The arm base is raised or lowered—for single- or multiple-play—by the lever under the pivot assembly, setting the vertical tracking angle to 15° for the former and 15° for the middle-of-the stack record for the latter.

in balance weight. At $159.50 (plus walnut-finished base and dust cover) it is one of the highest priced automatic turntables on the market.

For manual operation, the single-record spindle is inserted in the turntable platter, a record placed on the turntable, and the arm lifted from its rest and placed anywhere desired on the record, or just placed over the record and the cue-control lever used to lower the stylus to the record with viscous-damped gentleness. Or if you want to start at the beginning of the record, you can move the Master Operating Lever to the START position, and the device does it all for you—lifts the arm, moves it to the proper radius as set by the three-position Record Size Selector (7, 10, or 12 in.), and lowers the arm—still gently. To stop the play, you can lift the arm and return it to its rest, which will stop the motor quickly, or you may move the operating lever to STOP, and the machine will go through a cycle and return to the arm to the rest, switch off the motor, and lower the arm to the rest—which takes a little longer.

Setting up the turntable requires first mounting the cartridge on the removeable platform in the head of the arm. Then the counterbalance is set roughly to the balance position and locked in place by a thumbscrew. Fine balancing is done then by rotating the balance weight. The .01-gram click stops make it easy to get a perfect balance. The stylus force is then set by a dial at the arm pivot point, and the anti-skating adjustment made to the same number as the stylus-force setting. If you are using an elliptical stylus, you use the black scale; the red scale is for conical styli. In either case, the dial is set to the same number as the stylus force. For purists, there is a table in the instructions for the correct settings for conical styli of different radii than the usual 0.7 mils.

If you are playing a single record manually, you will set the mode selector at the base of the arm at "s.p." (single play), which moves the base vertically so that tracking is at the preferred 15-deg. vertical angle; for a stack of six records the arm is raised ¼ in by moving the lever to "m.p." (multiple play), which gives the 15-deg. angle for the middle records, and is the best compromise for a whole stack.

At the left front of the motor board is a lever for selecting the desired speed—33⅓, 45, or 78 rpm. Around its base is a dial which permits a vernier adjustment for faster or slower speed.

The hysteresis-synchronous motor runs at 1800 rpm, and is not affected by voltage over a range from 80 to 150 volts. It is, of course, affected by the line frequency, as is any synchronous motor, but line frequencies are well controlled throughout the country these days, so you may be sure of a constant speed. The vernier control operates by raising or lowering the idler wheel slightly, and its contact with the tapered motor shaft provides the speed variation. Each of the three steps on the motor shaft is similarly tapered, and when once set for the exact speed on one step, the speed is exact on the other two. The high torque of the motor brings the platter up to speed in less than half a revolution (at 33⅓).

The arm is pivoted in the center of a ring for vertical motion, and the ring is similarly pivoted inside another ring for lateral motion, with the whole resembling a gimbal in operation. All bearings are of the low-friction pivot type. The effective length of the arm from pivots to stylus is 8¾ in., which results in the low tracking error of not more than 1.5 deg. The head is a magnesium structure with a waffle-like open construction to reduce weight which still retaining strength. The cartridge holder is locked to the head by a simple lever, and the necessary four contacts are made when the holder is placed in the head. The cartridge mounting holes are slots so the proper stylus position can be achieved. A plastic gauge is provided so the tip of the stylus may be set exactly. The gauge slips over the cartridge holder with the cartridge mounted, and the stylus is positioned at the tip of a "V" in the gauge.

## Performance

The 1219 met its excellent specifications. Wow and flutter measured .05 per cent in the 6-to-250-Hz range (it was closer to 0.15 in the range below 6 Hz, but down this far is of no real interest). Arm resonance is specified as falling between 8 and 14 Hz, with the range the result of different car-

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tridge weights, and it measured 11 Hz with the cartridge we used. The range of the vernier control was measured against a 1000-Hz tone, and verified as a 6 per cent range. Motor speed remained constant over the range from 80 to 150 volts, with no apparent variation whatsoever. With a variable-frequency source, however, the speed varied—as expected—in proportion to the frequency.

Rumble measured 43 dB below a peak stylus velocity of 5.0 cm/sec at 100 Hz, unweighted, while the weighted measurement (using the standard "A" weighting network) was −61 dB. This certainly puts this turntable in the upper classes of automatic units. All of the rumble appeared to be in the range below 100 Hz, as would be expected.

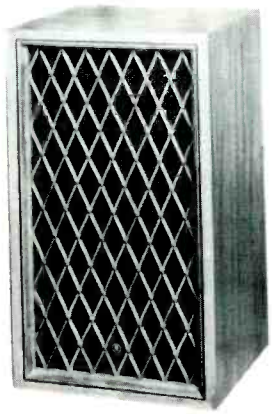
While it would appear that there are many adjustments and controls, it must be pointed out that the majority of these are one-time settings, and once they are made, the 1219 is as simple to operate as any automatic could be. The instruction book tells all there is to know about operating the unit, but many people do not read such manuals thoroughly. If one does he will learn that the cue control is deactivated when the mode selector is in the "multiple play" position. Also, if one changes the selector from multiple play to single play, but does not change the single-play spindle to the automatic-play spindle, the record drop mechanism will not operate. Either one of the above operating oversights might lead an uninformed user to believe the unit is defective when it isn't.

The 1219 proved itself to be a great turntable in every respect. Whether or not the advantages of exact settings for vertical tracking and for anti-skating can be identified by the average listener, it must be admitted that measurements show that there are improvements—in the first case, in the reduction of distortion, and in the second, in reduced wear on the record grooves, particularly on the side of the groove nearest the center of the record. Any improvement in record playing equipment that adds even a tiny bit of reduction in the distortion or reduces record wear is worth incorporating in the equipment, and in the Dual 1219, it is done as admirably and as completely as we've seen to date.



## Pioneer Model CS-66 3-way Loudspeaker System

Fig. 1



**MANUFACTURER'S SPECIFICATIONS:**
**Enclosure Type:** Acoustic (Sealed). **Loudspeaker Components:** Woofer: 10 in.; Mid-range: 6½ in.; Tweeter: Cone Type. **Impedance:** 8 ohms. **Frequency Response:** 35 Hz to 20,000 Hz. **Maximum Power Input:** 40 watts. **Dimensions:** 12 3/16" W x 22" H x 11 7/16" D. **Weight:** 29 lbs. **Price:** $109.00.

Another entry in the growing list of medium-priced "bookshelf" speaker systems is this attractively styled unit from Pioneer Electronic (U.S.A.) Corp. Anyone who has concluded that every "book-shelf" system looks like every other one will be pleasantly surprised by the "wood-grille" effect developed by Pioneer for this and several other of its speaker systems for 1970. As shown in Fig. 1, actual wood strips (walnut) are used to fabricate the diamond-pattern front grille or latticework, taking the enclosure out of the "run-of-the-mill" class and into the realm of modern or contemporary furniture. The surfaces of the cabinet are superbly finished, and while the term "oiled walnut" may apply in terms of color, much more than the usual once-over-lightly with linseed oil went into this finishing process.

Whenever possible, we like to examine the "contents" of a new speaker enclosure. In this case, removal of twelve wood screws enabled us to move the precision fitting, gasketted back panel, disclosing layer upon layer of sound absorbing material, filling the volume of space not occupied by the speaker elements themselves. These consist of a semi-soft-suspension ten-in. woofer equipped with a fairly heavy permanent magnet, a closed-basket 6½-in. mid-range element and a closed-basket cone-type tweeter of approximately 3½-in. diameter. Crossover components are mounted to the inside of the back panel and consist of 6 dB/octave networks between woofer and mid-range elements (at a measured frequency of approximately 1800 Hz) and full 18 dB/octave L-C networks between mid-range and tweeter (at a frequency of approximately 7000 Hz).

A three-position, fixed-step attenuator switch controls the relative level of the tweeter only. The amount of control thus obtained is minimal, measuring about two or three dB per position at 10 kHz.

### Measurements

The impedance characteristics of this speaker system are extremely smooth, as shown in the plot of Fig. 2. Other than a normal moderate rise at the resonant frequency (around 85 Hz), the impedance stays pretty close to the desired nominal figure of 8 ohms, never going below the safe limit of 4 ohms. Thus, this system may be considered safe for use with any solid-state amplifier having a four ohm "lower limit" of operational safety.

Our free-air frequency response measurements indicate extremely smooth response from about 80 Hz to 15,000 Hz, over which portion of the spectrum the measured output on-axis never deviated from a nominal

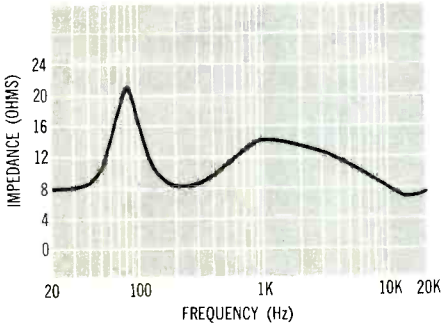



Fig. 2—Impedance characteristics of the Pioneer Model CS-66 loudspeaker system.

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reference by more than ± 4 dB. Response was down about 10 dB at 50 Hz, but even at this sub-resonant frequency there was little or no evidence of doubling at moderate (10-watt input) levels. By 30 Hz, however, doubling was evident, even at low power levels, a situation not uncommon for speakers of this basic construction and woofer diameters. Output may be deemed useful and relatively undistorted from 40 Hz to 18,000 Hz, which is quite remarkable for a system of this size and price. The closest "flat" frequency response was obtained with the treble attenuator switch in the highest or INCREASE position.

An interesting specification given by the manufacturer is "sensitivity," stated as 98 dB/watt. Of itself, this specification is incomplete unless one states distance from the speaker surface at which the 98-dB level was measured. Still, we commend Pioneer for stating *anything* about this important parameter, which we prefer to think of as the efficiency of the reproducing system. Our own measurements of efficiency, based strictly upon the speaker system's ability to provide room-filling sound, indicated that amplifiers in the moderate power class (15 to 20 watts rms per channel) will provide sufficient power to these speaker systems in moderately large listening areas.

### Listening Tests

The most striking virtue of the CS-66 speaker system, when subjected to critical listening tests, is the richness and penetration of the mid-range tones. Instrumental definition is, therefore, excellent. Both middles and highs have a fine directional dispersion, with no discernible loss of highs up to thirty degrees of axis and, at worst, about 10 dB of attenuation at angles of about 60 degrees off-axis. As for the extreme highs, there was no raspiness or unpleasantness associated with their reproduction and little or no intermodulation distortion was detected in the spectral region where this effect is usually most noticeable.

The bass region, while seemingly free of distortion at normal listening levels, seemed to lack any real "bottom"—a deficiency which was more noticeable when material containing musical energy below 80 Hz (and even down to 50 Hz) was auditioned. Transient response was good. Balance between the three loudspeaker elements and their cross-over networks was very smooth, with virtually no distortion or attenuation or over-emphasis present at the crossover frequencies. Speaker-cone recovery was also good, with no muddiness attributable to hangover in evidence.

Actually, the system seemed to behave more like a classical "infinite baffle" than a so-called "acoustic suspension" system. As such, its relatively small size (in terms of a "true" infinite baffle enclosure) may account for the loss of that bottom half-octave or so, that we would have liked to have. By way of compensation it must be mentioned, though, that what bass there is, is "honest." No "one note boom" for these systems.

In summing up, the Pioneer CS-66 Speaker System ranks high in its class —basically the medium-to-modest price class. It is good enough to form the primary listening pair for those planning a stereo system of medium power. And for those who have a system with enough reserve power to consider a secondary listening area, these bookshelf units won't eat up much power from your amplifier and *will* provide a "secondary" listening location with high-quality sound.

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## Sansui 4000 Stereo FM/AM Receiver

Fig. 1

**MANUFACTURER'S SPECIFICATIONS:**

**TUNER SECTION (FM) IHF Sensitivity:** 1.8 μV. **S/N Ratio:** Greater than 60 dB. **Capture Ratio:** 1 dB. **THD** (Mono): under 0.6%. **Selectivity:** better than 40 dB @ 98 MHz. **Image Rejection:** better than 90 dB. **I.F. Rejection:** better than 95 dB. **Spurious Response Rejection:** better than 90 dB. **FM Stereo Separation:** better than 35 dB @ 400 Hz (AM). **Sensitivity:** 20 μV @ 1 MHz. **AMPLIFIER SECTION: Total IHF Music Power:** 160 Watts @ 4-ohms; 120 Watts @ 8 ohms. **RMS Power/Channel:** 65 Watts @ 4 ohms; 45 Watts @ 8 ohms. **THD:** under 0.8% at rated output. **IM:** 0.8% at rated output. **Power Bandwidth:** 20 to 30,000 Hz. **Frequency Response:** 20 to 40,000 Hz ±1 dB. **Hum and Noise:** Phono, better than 70 dB; Aux, better than 70 dB. **Input Sensitivities:** Phonos: 2.5 mV; AUX: 150 mV; Tape Monitor: 170 mV. **Tone Control Range:** Bass: ±13 dB @ 50 Hz; Treble: ±11 dB @ 10,000 Hz. **GENERAL: Dimensions:** 17¾" W x 5¼" H x 13¼" D. **Price:** $379.95 (includes metal case; optional wood cabinet, $22.50).

Never one to skimp on control functions, the Sansui Electric Company has really out-done itself in designing this new, powerful, top-of-the-line solid-state receiver. In power-handling capacity, it is outranked only by the company's model 5000. In FM performance and sensitivity, it is just about tops in its receiver class. But the most pleasant thing about the Model 4000 is the very liberal application of control features—if you are a control fancier!

Examining the front panel layout in Fig. 1 and "reading" the lower portion of this handsome gold-anodized and black panel, we come first upon the "push-push" power switch, followed by the usual stereo headphone jack. while most present-day receivers are equipped with speaker selector switches (usually enabling the use of two sets of stereo speakers systems separately or together), this next control, a speaker selector, provides for selection of *three* sets of stereo speakers—a logical move, since, as we shall see presently, the powerful pair of amplifiers can certainly drive two sets of speaker systems adequately. Care is

taken to avoid driving all three sets simultaneously (lest they be of the 8-ohm variety, which would lead to net impedances in parallel of a less-than-safe 4-ohm limit), so that the switch positions are A, B, C, A+B, A+C, but never A+B+C. There is also an "OFF" position for use when private headphone listening only is desired.

Low-and High-Filter switches in the form of push-push-to-release buttons come next, followed by friction-coupled, dual-concentric bass and treble controls. Channels can be tonally compensated together or separately (by defeating the clutch action) as desired. Master volume control and balance control come next, followed by another four push-buttons which control "loudness" compensation, reverse of stereo channels (haven't seen that one lately), mono-stereo switch, and tape monitor. The right-most control is the main selector switch and has positions for a pair of phono inputs, AM, FM Mono, FM Auto (Stereo) and Aux.

The upper portion of the panel is starkly black—until power is applied. In the radio positions, the long dial area becomes uniformly illuminated in green numerals and logging scale. The two tuning meters become similarly illuminated and, wonder of wonders, if you're listening to AM, the dial pointer *itself* is softly illuminated in a light orange color. Switch to FM, however, and the dial pointer now glows *red*.

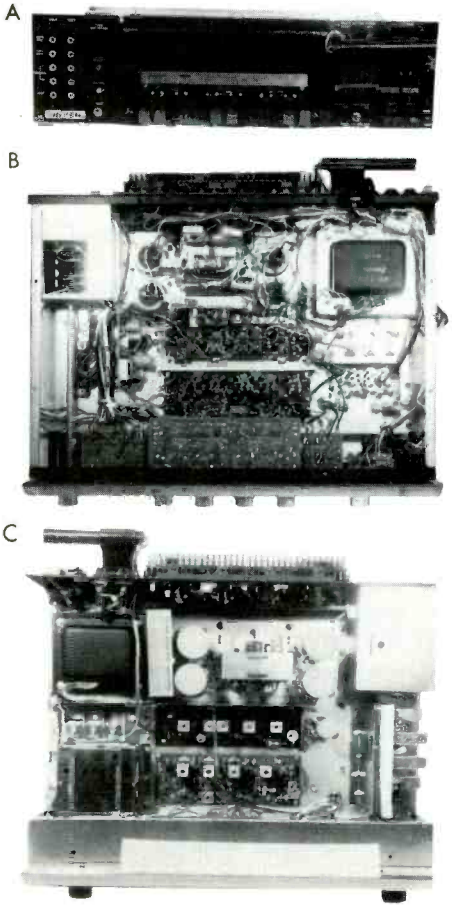
The FM dial scale is absolutely linear. That is, the distance between 88 and 90 MHz exactly equals the distance between 106 and 108 MHz, a marvelous feature in our opinion, and one that is not as easy to achieve as might first appear. The two meters already referred to are signal strength (used in both AM and FM tuning) and center of channel (for FM tuning). They are highly effective and, more importantly, highly accurate and well coordinated. Above the tuning scale itself, located at about 89 MHz, the words *FM STEREO* light up whenever stereo transmission is tuned in. Switching to any of the non-radio positions causes the entire dial area to be darkened once more, except for tastefully illuminated words which appear in the dark area, denoting "Phono 1," "Phono 2" or "AUX." The operating manual advises that the word "Protector" would flash on if the output transistor circuitry were ever subjected to excessive current flow, but, happily, we never observed this phenomenon during the course of our tests. To the right of the dial glass area are located a muting defeat switch and an MPX Noise Cancellor (to be actuated when noisy, fringe area stereo reception is obtained). A large tuning knob coupled to a very effective flywheel completes the front-panel layout.

The rear-panel layout of the Sansui 4000 is pictured in Fig. 2. At the left are the usual input and output jacks, plus a DIN Tape Recorder socket (for direct connection to many foreign-brand tape recorders), an output level adjust (to cut overall gain of the amplifier if it is to be used with high-efficiency speaker systems), and a muting threshold adjustment.

By far the cleverest innovation for speaker and antenna connection is that found on the Sansui 4000. Instead of the usual screw-terminals, barrier-strip terminals, or even knurled-or thumb-screw terminal posts, there are a series of spring-loaded plastic push-buttons which resemble a miniature piano keyboard. When each button is momentarily depressed, a small hole is exposed. The hole is just the right size for the neatly stripped ends of stranded wire cable to be inserted. The key is then released, and the wire is tenaciously held by spring action. No screwdriver required *and* not the slightest possibility of a short-circuit caused by exposed and loose strands of wire. To avoid phasing confusion, positive "keys" are colored red, while common, or negative keys are colored black. Since provision exists for the connection of six loudspeaker systems (three stereo pairs), there are twelve such "keys" for speaker connection, as well as six more for FM and AM antenna connections.

In the case of FM antenna connection, pairs of keys are provided for 72- or 300-ohm use (no links to remove, shorts to make, or jumpers to confuse and short out). Speaker line fuses, a power line fuse, switched and unswitched convenience outlets and a built-in ferrite AM antenna, plus convenient "ground" post terminals (a pair) complete the back-panel layout. There's no doubt that you could hook up six speakers with this arrangement in less time than it takes to hook up a single pair with more conventional terminal-strip methods.

**Fig. 2A**—Rear-panel layout of Sansui 4000 receiver. Fig. 2B and 2C—Bottom and top views.




## Circuitry

The top and bottom views of the Sansui 4000 chassis shown in Fig. 2 disclose the neat, modular circuit board construction of this well-laid-out receiver. No less than 11 circuit boards (some of them of the plug-in variety) plus a minimum of neatly harnessed interwiring and a fully shielded FM front end contain the 44 bi-polar transistors, 1 Field-Effect Transistor (FET), 4 integrated circuits (ICs), 28 diodes, 2 Zener (regulating) diodes and 2 silicon-controlled rectifiers.

The massive power transformer, by the way, has taps which enable using this instrument with power sources as low as 100 VAC, all the way up to 250 VAC. When purchased in the United States, however, there is nothing to do here, for the units are supplied for direct connection to 117 VAC. The one FET mentioned is used as an r.f. amplifier in the FM front end, which is equipped with three additional tran-

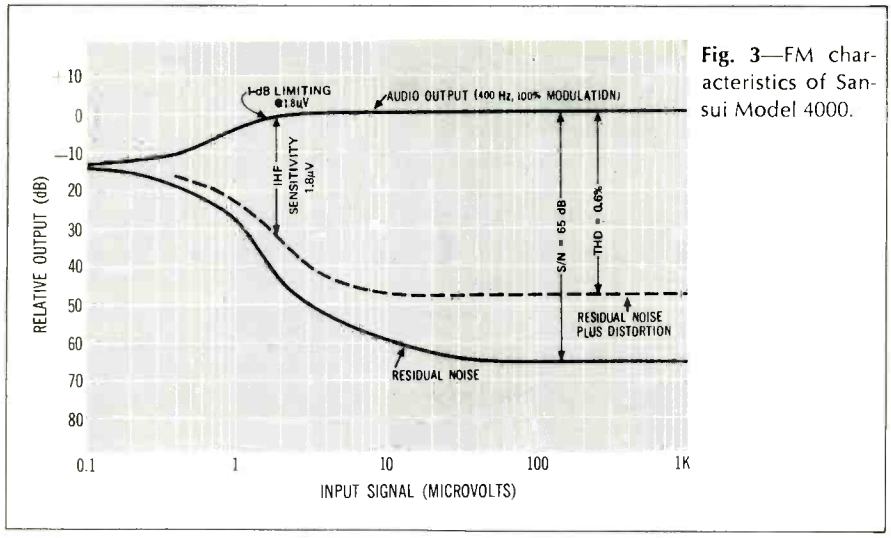



**Fig. 3**—FM characteristics of Sansui Model 4000.

sistors. The four ICs mentioned provide the gain and limiting in the FM i.f. strip.

The AM circuit is conventional and adequate in performance, but seemed to be a bit deficient in bandwidth compared to some of the AM circuits now found in better-grade solid-state receivers. All audio modules, from preamplifier through output stages, were excellently conceived, engineered and produced, particular attention being paid to the use of precise parts for such functions as equalization and tone control. Tracking of volume controls was found to be accurate to at least −60 dB (within 2 dB). The output "protector" circuit is a current, rather than a heat-sensing device. As such, it would be expected to act more rapidly and more effectively in protecting the output transistors from damage.

## Measurements

Figure 3 presents some of the more important FM performance characteristics in graphic form. IHF sensitivity exactly equalled the 1.8 μV claimed. S/N measured 65 dB, bettering the 60 dB claimed. Total harmonic distortion (THD) equalled the 0.6% claimed, and did as well in stereo mode, for which no specification was given by the manufacturer. Notice that quieting and limiting are extremely "fast," such that the "1-dB limiting point" is reached at slightly less than 2 μV. At the same signal strength, noise has already receded to 45 dB below full output. The claimed 1-dB capture-ratio figure was actually reached at a signal input of only 50 μV, and was somewhat better than specified at higher input signal levels.

As shown in Fig. 4, stereo FM separation was excellent at mid-band and low end, but was somewhat deficient at the more difficult high end, dropping to 20 dB at 15 kHz, the end of the usable audio spectrum.

Audio performance, too, was excellent, with 0.8% distortion reached at 50 watts continuous power (rms) per channel, instead of 45 watts as claimed (see curve of Fig. 5). Like many solid-state amplifiers, however, distortion seemed to rise at low power levels as well as high. At no point, however, did it exceed 0.5% at lower power levels. In this respect, IM characteristics, also displayed in Fig. 5, were actually better, staying at an insignificant 0.2% all the way up to 40 watts and reaching the predicted 0.8% at about 48 watts per channel.

Tone-control range, loudness action (at −30 dB from top volume), and low and high filter curves are all displayed in the graphs of Fig. 6, while power bandwidth is shown in Fig. 7. We found the power bandwidth a bit better at the low end (15 Hz) than stated by the manufacturer, and exactly equal to claims at the high end.

Typical square-wave responses taken at 100 Hz and 10,000 Hz are shown in the photos of Fig. 7, while Fig. 8 demonstrates symmetrical clipping when the amplifier is subjected to overload.

Both in measurement and in listening, we found the action of the low and high filters excessive, cutting out too much program material too "early" because of their 6 dB per octave (rather than 12 dB) construction. Loudness control action was, for a change, useful, thanks to the presence of the additional *gain* control for presetting levels to match our speaker systems. This feature enabled us to set up the master volume in such a way that when it was at 9 o'clock the level was truly *low* and was enhanced by

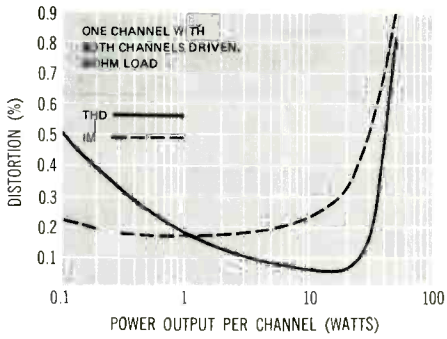



**Fig. 5**—Total harmonic distortion and intermodulation distortion.

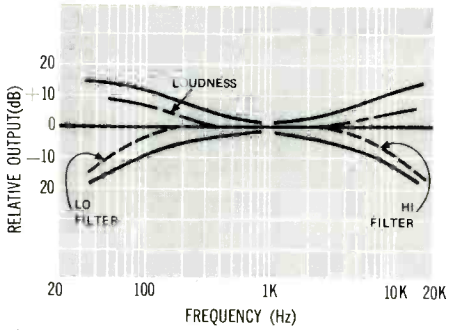



**Fig. 6**—Tone, filter, and loudness-compensation characteristics.

**Fig. 4**—Stereo FM separation.

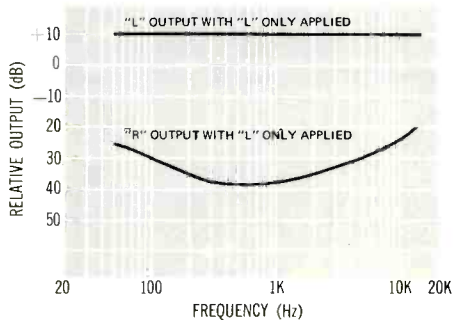
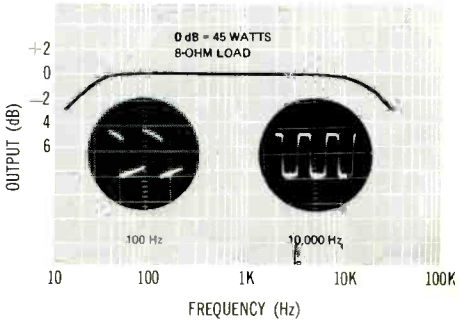



**Fig. 7**—Power bandwidth and square-wave response.

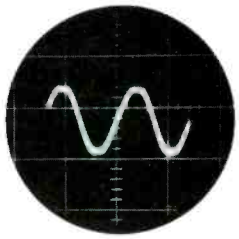


the use of loudness contouring. Most receivers only have a single point at which to adjust level—namely the volume control. Levels are often quite loud when the control is one-quarter way open, so that use of loudness controls over-exaggerates the bass when such accentuation is hardly required. Unfortunately, the instruction manual fails to take advantage of this desirable feature, and mentions level setting only in relation to speaker efficiency.

## Performance

With an indoor di-pole on "first floor level" we pulled in 42 "listenable" FM signals, 15 of them in stereo. Changing to a well-oriented outdoor FM antenna increased the "yield" to 52, as good as we ever get in our location (which has excellent reception). Some of the weaker stations which we have identified in the past were noticeably quieter with this receiver, due in large part to the steepness of the quieting slope, discussed earlier. The signal-strength meter had been calibrated by us during our signal generator tests (it

Fig. 8—When driven beyond ratings, the Sansui 4000 receiver exhibits perfectly symmetrical clipping—evidence of good circuit design.



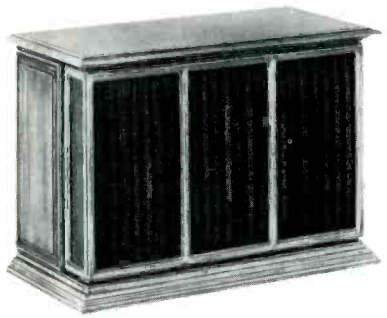
is useful as a strength indicator up to about 100 $\mu$V), and anything received at better than 10 microvolts was so quiet as to be indistinguishable from signals of 100 or even 1000 $\mu$V strength. This, to us, is the mark of a fine FM tuner section, all other things being equal.

We purposely hooked up *two* sets of stereo speaker systems (in the same room) to test the power capability of this rugged unit (and to prepare for four-channel stereo which looms). Both sets of speakers were acoustic-suspension, low-efficiency types, but the Model 4000 didn't seem to mind at all, putting out dynamic levels exceeding anything likely to be demanded of it under normal listening circumstances. As mentioned earlier, this hook-up resulted in four-ohm impedance across each set of speaker outputs, and yet, the "protector" light never came on at all. Despite the profusion of front panel controls, handling was extremely easy and we felt at home with the equipment after about five minutes—a measure of the excellent control layout or "human engineering," if you please. We could detect no dips or peaks in response with tone controls set flat, nor were any measured by instrumentation. Hum and noise in Phono were all but inaudible, and equalization seemed perfect.

In all, if you favor "total control"—control not unlike that obtained with more expensive separate tuner, preamp, amplifier components, $379.95 seems like a very modest price for this receiver. And a handsome, metal, black wrap-around enclosure is included in the price (an optional wood cabinet costs $22.50).

Check No. 72 on Reader Service Card

## JBL Model C60 "Sovereign I" Speaker System



**MANUFACTURER'S SPECIFICATIONS:**
**Speaker Complement:** LE15A woofer, PR15 passive radiator, LE85 compression driver, HL91 acoustic lens/horn, and LX5 crossover network. **Crossover Frequency:** 500 Hz. **Dimensions:** 26½" high x 40" wide x 20" deep. **Finish:** Country oak or Golden oak. **Price:** $717.

The C60 "Sovereign I" is an impressive system visually and aurally. Only one step below JBL's top-of-the-line "Paragon" system, the Sovereign/S7R speaker system (another version uses the S8R speaker system which has the same high end as the Paragon) is housed in a handsome hand-finished enclosure. The front panel, which supports the rich, pleated fabric grille, comes straight off with a pull, to reveal the fronts of the speakers. The LE15A woofer is located in the lower left corner, next to the PR15 passive radiator at its right. The HL91 acoustic lens can be seen in the center, on top.

The LE15 is a 15-in. bass driver with a 4-in. edgewound copper-ribbon coil. Its free-air resonance, according to the specifications, is 20 Hz. The flux density in the voice-coil gap is 9500 gauss, with a total flux of 450,000 maxwells, accounting for its high efficiency. Above 500 Hz, an LE85 compression-type driver operates through a five-octave range. Sound from the diaphragm, driven by a 1¾-in. edgewound aluminum ribbon voice coil, is conducted to a heavy cast-aluminum exponential horn and slant-plate acoustic lens. The JBL L91 lens operates with sound waves in the same manner as a divergent optical lens acts with light waves, the object being to spread the high frequencies. The lens does this by slowing down a portion of the advancing sound wavefront as it passes through the lens. The result is wide dispersion of highs in the horizontal plane. The lens employs eleven plates set at an angle of 38 deg., and spaced 0.25 in. center to center. The curvature of the lenses is calculated to spread sound evenly through a 120-deg. lateral angle, but restricted to approximately 40 deg. in the vertical plane.

The LX5 crossover network includes reactive components and acts at 12 dB/octave. A three-position switch allows the intensity of the high-frequency driver to be balanced to the "liveness" of the listening environment. The attenuation circuit uses a tapped autotransformer rather than resistive pads so that coupling between amplifier and transducer is not affected by the setting of the control.

The last component of the system is the PR15 passive radiator. This is a 15-in. speaker *without a driver*. It's designed so that it reinforces the regular 15-in. speaker in the lower bass region. Like a port, the passive radiator operates in phase with the driving loudspeaker over a certain frequency range—from perhaps 20 to 100 Hz. Below its effective range, the passive radiator is out of phase with the driving speaker. Above its useful range, the passive radiator does not move at all; it is said to act as an acoustically opaque barrier between the inside and the outside of the speaker system.

The original design criteria for this system's performance were: 1. Usable frequency range from below 30 Hz to beyond the upper limits of human hearing. 2. Uniform response on the basis of total radiated acoustic power (not on-axis measurement alone) from about 40 to 15,000 Hz. 3. Uniform coverage over a 120-deg. horizontal angle through the full frequency range of the system. 4. The ability to radiate one acoustic watt with negligible distortion through the range from 40 to 15,000 Hz. 5. Sufficient sensitivity to meet the above goals when driven by a high-quality 40- or 50-watt amplifier.

These criteria are difficult to achieve, but our examination indicates that the C60 Sovereign I succeeds in meeting these objectives. In driving the speaker with JBL's model SE400S "Energizer" power amplifier, we noted excellent dispersion at all frequencies and a clear, forward-sounding quality which added presence to most recorded material (there was a 4-dB peak between 6 and 7 kHz, on axis).

The speaker system was especially successful in reproducing very clean source material, such as original or second-generation tapes. On this type of material, we could advance the tweeter level control to maximum without creating an unbalance. On records and pre-recorded tapes that exhibited distortion in the high end, we were forced to cut back to the minimum position, which is closest to flat response. A word about flat response: JBL's Sovereign I frequency response is uniform within a few dB on the basis of total radiated acoustic power, rather than on-axis measurements alone. This means that if the speaker's dispersion is good (which it is) and the listening room is toward the live side (it can be), the speaker system will sound overbright *even though it measures flat!* The interesting thing is that it only sounds overbright with poor source material. But in a room that tends to be acoustically dead or sound-absorbent, as many living rooms are, an even distribution of highs is necessary. It is here where the high-frequency energy, dispersed evenly, significantly contributes toward realism of reproduction in the room. This is only one reason why measurements alone are not the final answer in evaluating speakers.

The low-frequency response of the Sovereign I started to roll off rapidly below 40 Hz and was audible until about 27 Hz.

The Sovereign I is a medium-to-high-efficiency loudspeaker system. Fifty watts of audio power from an amplifier was all that we found necessary to produce clear sound at very high listening levels. Most speakers could not reproduce these levels even with unrestricted available power. But aside from the Sovereign I's ability to play loudly (therefore effortlessly at lower levels), we liked its transient response, especially when driven by the JBL SE400S Energizer. The bass was crisp and solid. This system should be excellent for use in a large, plushly appointed room where its big sound, large size, and attractive appearance can be best appreciated.

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# SUBJECT INDEX/1969

# AUDIO MUSIC REVIEW



# THE BRAHMS REQUIEM!

**Edward Tatnall Canby**

Several generations of young Americans, by now, singing in school and college choirs, in community and church get-togethers, are scarcely able to think of this venerable, century-old piece without an attached exclamation point. It is the supreme choral experience for thousands of singing beginners, coming as it usually does at the most impressionable of musical ages, the teens and twenties—nor has pop music ever interfered, for that is a wholly different scene. "Social singing," one might call the Requiem, a kind of disciplined togetherness for which pop in all its forms offers no counterpart.

There are actually *two* great experiences for the young choral singer (and the older one who lives on through life, renewing those experiences). The Requiem and the Mass. *The* Mass—the Bach B Minor. The Mass is breathtaking in majesty. To find one's self an actual part of that music, helping to create the vast work with one's own personal voice, is an awesome thing. It was the Mass that made me transfer from one famous college to another even more famous: at the second, the Freshmen were singing the Bach Mass with a first-line symphony orchestra and I could not bear to miss it. Next year, they did it once again, and I was one of the hundreds on the stage of the great symphony auditorium. I was 19.

The Requiem sings itself. It is the kind of music that makes pipsqueak voices sound warm and friendly, and makes angels out of all the others. This astonishing vocal music draws the singer straight out of himself, herself; shy souls find themselves emoting like actors; astonishing lyric powers are disclosed in the mere flow of air over very ordinary vocal chords, as though some instant vocal pill had developed a great Instrument overnight. Above all, it's *easy* to sing the Requiem (once the notes are learned, of course)—you seem to sing twice as loud, twice as high, twice as long as ever you thought you could. Such a flattering thing to self esteem!

(How different is Beethoven. That curmudgeon of a composer knew nothing about choral voices and was deaf to boot. To sing the Ninth Symphony is an exciting and frustrating experience. Many segments are nearly unsingable, but worse is the frustration of *not being heard,* even when one gives until it hurts. The famous line of high Fs for the chorus basses reduces most non-pros to an agony of tortured throats and strained muscles—yet it sounds weak and ineffectual out in the audience. Even the great Bach had his choral weakness, the unfortunate fact that he was an organist, and an organ does not need to take breaths. Bach wrote pages of continuous chorus notes, minutes at a time, without a break. To this day, singers simply leave out a few notes every so often, to replenish the air supply.)

The Brahms Requiem marked that composer's complete maturity and the beginning of his true fame. It came at the high noon of German Romanticism, when the earlier bombast and witchery had mellowed down and grown eloquent and comfortable, yet music was still naive, uncomplicated, sincere. It was a splendid moment. Later Brahms is far more introverted and more complex in harmony, rhythm, and structure. Early Brahms, the youthful sort, tends to be brash and noisy, or longwindedly poetic. The Requiem, Opus 45 (he went on well beyond 100) splits the difference to perfection. It is totally sincere, even in its few places of naive exaggeration and mildly corny drama—as in the two monumental fugues (how the singers love them!), one based on a continuous D major pedal tone that never stops sounding from beginning to end. The music is built on the loveliest of texts, chosen poignantly by Brahms himself, and this is one of those rare pieces that is graced by an English translation that sings almost more beautifully than the original German. It should, being almost word-for-word bible; but the words fit the music as though the two had been made together. "*Behold, all flesh is as the grass.*" ("Ahz the grahss," we sang in our young sophistication.) "*For lo, the grass withereth . . .*" ("Don't sing 'swithereth,' I can hear our chorus director shouting.) To this day I cannot see or hear a word of these gentle, timeless phrases about death without hearing the music that goes with them.

Above all else, the Requiem singers know that *they* come first and sound out best, ahead of the orchestra, which plays the most limpid of tactful accompaniments, never intruding, and ahead of the two soloists, soprano and bass, whose music is entwined with the chorus as in no other work. The chorus is all and sounds all.

It was perhaps the last work of its kind. For in the nineteenth century, the honorable tradition of music composed first of all *for the performers* was all but dead. Only in chamber music, in the string quartet and the Lied, did the old idea of music for the players' sake persist. Oddly, the chief critic of our leading newspaper wrote a few years back that the Brahms Requiem was welcome in a local performance because it was so little known and obscure—or words to that effect. I was so astonished that I wrote a letter to the paper. How different are our various musical worlds, and how exclusive! The music critic lives for performance of a professional sort. The Brahms Requiem is a different breed of music, in spite of its solo parts and full orchestral backing.

RCA has just released a new American recording of the Requiem, done with the Boston Symphony Orchestra

and the New England Conservatory Chorus under Erich Leinsdorf, with Sherrill Milnes as the baritone and Montserrat Caballe as the high soprano. It is a curious version, this, for the performers are strictly professional—but the chorus, even so, is youthful, mostly students. The professional ideals of our American musical establishment clash with the simple sincerity of the Requiem, intended for high-level amateur singing as practiced in Germany. The music gets through even so. To my way of thinking, it simply carries the chorus along with it, for not even the toughened professional music student can resist the Brahms appeal to the singer himself. Far from it.

The chorus in this recording is robust, muscular, full of big voices and not a few clashing wobbles, all in the best American pro tradition. There is much virtuoso loud and soft singing (most amateurs sing all on one dynamic level), obviously nurtured by the choral director, more of it than the music requires though by a hair. The choral work is accurate and businesslike, the high notes are taken operatically in perfect production where the amateurs shriek), the big fugues, for once, are orderly and, so to speak, legible, where many an amateur performance of them ends in a rout. Without a doubt the chorus is the best element in this recording.

As for the BSO, that famous orchestra plays the coolest, most letter-perfect Brahms you can imagine. Somehow, Herr Leinsdorf manages to make almost every movement, not plod, but merely glide. Like a slow waltz, or a desultory march. Very little warmth, alas, and a grievous lack of dramatic contrast and melodic shaping, though all the louds and softs are just where they belong. Leinsdorf must have found it all too tame. Not even a sincere and earnest baritone and a good-to-excellent soprano can redress the balance. It is the professional chorus (not necessarily all vocal students, of course) which keeps the Requiem afloat and alive.

Technical note: RCA has done a superbly modern job of recording the large forces, with a perfect balance between chorus and orchestra (very hard to achieve) and the two soloists at stage distance, for once not played up as "features." Rightly, both are occasionally drowned out by the surrounding music. Exactly as it should be. This is stereo at it best.

**Brahms: A German Requiem, Op. 45.** Montserrat Caballe, Sherrill Milnes, N. E. Conservatory Chorus, Boston Symphony, Leinsdorf.
**Brahms: Four Serious Songs, Op. 121.** Sherrill Milnes; Erich Leinsdorf, pf. **RCA LSC 7054 stereo (two discs)** ($11.96).

# Classical Records

**Edward Tatnall Canby**

## Unusual Gift Items

**Mendelssohn: Die Erste Walpurgisnacht; Overture to Son and Stranger.** Chookasian, Haefliger, Prey, Michalski, Musica Aeterna Chorus and Orchestra, Waldman.
**Decca DL 710164 stereo** ($5.98)

The enterprising Frederic Waldman of New York is off again into unusual repertory for his Musical Aeterna series. The fiery Mendelssohn cantata, a sort of choral witches' sabbath in the early-Romantic manner (as of the Symphonie Fantastique of Berlioz, or Weber's Die Freischutz) pits Druids and Christians, the Druids putting on wild midnight rites, the Christians terrified out of their wits. A tough piece to make sense out of in performance today, since Mendelssohn's idea of a terrifying spiritual orgy is not only tame in the music, as we hear it, but very long—the chorus tends to run out of steam with all the repetition. The slower, calmer surrounding scenes are much easier to implement.

All things considered, Waldman gets a pretty fiery performance out of his somewhat leather-voiced pro chorus. They have the power, though there is a certain Met Opera sound to the Druidic shrieks that is not quite convincing. But the singing is accurate and disciplined throughout, the orchestra is impeccable and the soloists are good. There is, however, another recording of the music, a mono reissue from Everest and Leipzig, that hits the spinechilling Walpurgisnacht spirit better than any

non-German chorus is likely to manage. Not as good a recorded sound, nor as disciplined singing, but the effect is nevertheless more powerful, to a degree. Why not try both discs?

The little overture to a privately performed work called Son and Stranger (done at the Mendelssohn home before some hundreds of guests) is a typically buzzing, light bodied bit, pleasantly familiar in style but too reminiscent of "A Midsummer Night's Dream" and such for any lasting value.

*Performance:* B+ *Sound:* B

**Schumann: Piano Concerto in A Minor; Mendelssohn: Piano Concerto No. 1 in G Minor.** Rudolph Serkin; Philadelphia Orchestra, Ormandy.
**Columbia MS 7185 stereo** ($5.98)

You'd never know the Philly had signed up with RCA these days. Columbia is releasing and re-releasing positively scads of Philadelphia recordings, perhaps to cash in before it is too late, perhaps (just perhaps) with a certain relish viz a viz the Enemy who won the battle. Fortunately, the musical consumer need not worry—it's all to his good.

These two, I assume, are re-couplings of the same performances that appear on several earlier Columbia discs, this being standard and legitimate policy these days, if endlessly confusing to the reviewers. (The Serkin-Schumann is on two other releases.) This record is worth its cash for the Schumann alone, which is really superb even in the face of some twenty competitors. Serkin still can bring together that almost naive enthusiasm and sincerity and the enormously professional piano techniques that must somehow be combined in this great work—Ormandy, as ever, is the perfect accompanying conductor, supplying all the accuracy needed, borrowing straight out of Serkin's own excitement.

The noisy Mendelssohn is pretty hard to take even with an extraordinary dose of Serkin fervor; like so much Mendelssohn (for our ears, anyhow) it tends to drone on and on, sort of glassy-eyed in its never-relaxing intensity, just full of too, too many notes. But nobody else is going to do you much better than Serkin. This one, apparently the earlier recording, seems to have a bit of tape flutter in the slower piano music of the middle movement.

*Performances:* A *Sound:* B–

**Jennie Tourel sings Offenbach (Highlights from La Vie Parisienne, Tales of Hoffmann, La Perichole.)** Columbia Symphony, Abravanel, Morel.
**Odyssey 32 16 0351 mono** ($2.98)

Once a Tourel fan, always one. Jennie Tourel in her prime had one of those bewitching voices that could "act" any style, any language as though born to it. Her Russian songs were fantastic, her Mahler marvelous, and as for her French—from Ravel to Offenbach—it is just delightful. These


famous recordings, once two different 78 albums if I am right, date from 1947 and 1952 and it is a credit to Columbia that both are excellent hi fi, the later and, presumably taped, opus hardly different from that of 1947, no doubt originally recorded on 16-inch lacquers. Only a tiny trace of metal in the voice will show up to the *very* discerning ear in the 1947 recordings.

The two orchestral suites with soprano (mezzo) solo are arrangements, "La Vie Parisienne" taken from various operas. The Tales of Hoffman is represented by the familiar Barcarolle —a duet, as all will remember who have heard it. Miss Tourel sings both parts, and manages to be a light soprano and a much throatier contralto simultaneously, thanks to overdubbing. This must be one of the earliest examples outside of pop music, always remembering the famed Bach Concerto for Two Violins on RCA Victor —was it Heifetz and Heifetz?

*Performance:* A– *Sound:* B–

**Karl Weigl: Eight Songs with String Quartet; Three Songs for Alto and String Quartet No. 5.** Patricia Brooks, sop., Betty Allen, mezzo, Iowa Quartet.
**CRI 242 SD stereo** ($5.95).

Karl Weigl, a Viennese WW II refugee who died in New York in 1949, is a musician's composer in a curious way. He is revered far and wide among compositorial pros including Big Names Everybody Knows, but his music, characteristically, is seldom heard except in contemporary composers' concerts. The reason is opposite to what you may think. His music is not too "modern" but, rather, too old fashioned. At first hearing you might think it something dragged up from the later '90s instead of music actually composed a half century later. Weigl is a kind of gentler, smaller-scaled Richard Strauss, who similarly went on composing well-made music in a manner long since abandoned by others.

The 1934 Quartet sounds for the casual ear an expert mixture of early Mahler, Dvorak, very early Schoenberg and even a bit of Debussy. Might date it offhand as progressive 1908. Nice, even so. And the Songs are beautiful, no two ways about it. They seem even earlier, partly due to the limpidly clear melodic lines, in the Viennese *lied* tradition of Schubert, Brahms, Wolf, all faded elegance and gentility, full of the familiar Romantic nature worship—of birds, trees, the rain pouring down, golden twilight, clouds, sun, mountains . . . and more birds.

I think I can guess why, aside from their craftsmanship, these Weigl works are so revered by our older moderns. He, alone, managed somehow to hang onto the Old Days, that long Austrian twilight that ended abruptly in 1914; he alone could still realize it in heartwarmingly professional music right on into the post WW II years.

Splendid singing by Brooks and Allen, though Brooks is a more wobbly soprano than the famed Elizabeth Schumann, who first sang the music, and Allen's huge mezzo is not precise enough here to match her excellent ear.

*Performance:* A– *Sound:* A–

**Orff: Catulli Carmina.** Roger Wagner Chorale, Anna Marie Biggs, sop., Robert Mazzarella, ten.
**Angel S 36023 stereo** ($5.98)

This is the "other" Orff piece—the more famous one being Carmina Burana. Like most of Orff, it projects in the same strikingly effective manner, and is both as brilliant and basically as superficial as the similar—and highly popular—Burana music. Orff is all rhythm and color, on virtually static harmonies repeated ad infinitum, with clashing gongs and bells and what-not to provide the stunning brilliance of impact. No question about its virtuosity. But to what end? Pleasure in the listening, surely!

"Catulli" makes use of a scurrilously lusty Latin text, evidently "framed" by Orff himself on the style of the old Roman, Catullus. Angel, alas, has had a case of cold feet. The text is nowhere in sight, though it is shouted and moaned and stuttered and groaned at you for two whole sides of vocal communication. Angel shouldn't have. Orff's special trick here is to repeat key words in his Latin lines at high speed in a sort of hypnotic chant fashion "carmina-carmina-carmina-carmina-carmina." It helps a great deal if we have at least an idea what all this high-speed stuttering is about, Angel is studiously vague. It's not *that* bad, Angel! Other record companies have dared. It would be especially nice to know what the Angel-West Coast tenor, Robert Mazzarella, moans so expressively about, in his super-Caruso fashion.

The Roger Wagner performance is predictably pro, highly accurate and energetic but a bit on the smooth Hollywood side. Maybe that's the best way.

*Performance:* B *Sound:* A–

**Carl Maria von Weber: Hightlights from Oberon.** Thomas, Bjoner, Koth, Plumacher, Brauer; Bamberg Symphony, Schuchter.
**Vanguard Cardinal VCS 10063 stereo** ($3.50).

Weber's opera music is quite unique and a special treat in recorded form; for most of its "action" is built into the music itself, whereas the visual and plot elements are today nearly

incomprehensible in staged form. Oberon was the last of his works, produced in England in 1826 with an English text; but it remains a German Romantic opera in spite of a few minor borrowings from Shakespeare's "Midsummer Night's Dream." The combination of an early-Wagner vastness of scale and the Romantic urgency of the music with so much that comes straight from Mozart, so soon before, is unbeatable in the listening. The famed Weber tunefulness, mostly known today in the overtures and a few concerti, are wonderfully seductive in vocal form.

Unfortunately this is an opera in "Singspiel" style with quantities of spoken text and non-singing parts. So are such diverse operas as "Carmen," "The Magic Flute," and "Fidelio," but evidently the best way out of the problem here is a straight set of musical highlights. Here, they are made unusually interesting via a musical patch technique that joins the various items into a continuously flowing whole. It works, even though the items are not always in their original order. Excellent accompanying notes keep us straight as to what plot elements are involved.

The "great singers" in Vanguard's roster are not as great as the plug makes out, but all are musically intelligent and know the tradition; the principals, notably the soprano Ingrid Bjoner, are excellent. A very worthwhile exploration of an operatic milestone.

*Performance:* B+ *Sound:* B+

**Schumann, Brahms Gypsy Songs (and other songs for choral ensemble).** Gachinger Kantorei, Martin Galling, piano, Helmuth Rilling, conductor.
**Nonesuch H 71228 stereo** ($2.98)

Strange that the Brahms Liebeslieder, both series, are known and widely loved but the very similar Gypsy Songs (Zigeunerlieder) for voices and a single piano, are very seldom heard. They have all the qualities of the Love Songs with an additional touch of gypsy wildness that makes for colorful effects. Wonderful music of its sort! And the only effective way to perform these and the other similar works is with a small chorus as here—not big solo voices, as is too often the case. This long record includes the Zigeunerlieder of Opus 103, eleven songs complete, plus three (non-gypsy) early works, Op. 31, in the mellow and lovely early-Brahms manner and six more of the sort, opus 112, much later and more complex. Schumann is barely edged in at the beginning with a three-minute gypsy work for chorus and piano.

The Gachinger singers are very much on their toes and Martin Galling makes a dynamic Brahms pianist; but Helmuth Rilling, the conductor, sets extremely fast tempi for too many of the short works, forcing a too-rapid change of harmonies and losing many small details in spite of the excellent chorus work. When he finally slows down, for a few numbers, things go very beautifully. The tenor section, always featured in Brahms choral music, is particularly nice, rich and eloquent but beautifully blended. Most amateur tenors squawk like chickens when faced with Brahms; too many pros bellow in Caruso style, all wrong for the music. The Germans, of course, *should* know how to do the thing right!

*Performance:* B+ *Sound:* B

**The Art of Harold Gomberg (Britten: Fantasy Quartet; Six Metamorphoses for solo oboe. Mozart: Quartet in F for oboe and strings K. 370).**
**Vanguard Cardinal VCS 10064 stereo** ($3.50)

Like the oboe? Here's an old-line player of the warm and romantic sort, solo oboe these many years with the New York Philharmonic, whose knowledge of the near-modern oboe is outstanding. There's none of the Baroque—now so popular—in this man's way of playing. But if you will listen to a different kind of music, two kinds, you'll see how good he is. The singing Gomberg tone, the perfect breath control and phrasing, will remind old-timers of the famed Goosens sound of a generation ago.

The Britten Fantasy is an early work but most precociously colorful; the six Metamorphoses make an extraordinarily rich fare out of the oboe all by itself. As for the familar Mozart Oboe Quartet, it has rarely been so

expressively and tastefully recorded. An excellent oboe record of interest to any listener.

*Performance:* A− *Sound:* B+

**Emanuel Feuermann—Dvorak Cello Concerto Op. 104; Brahms Cello Sonata No. 1 Op. 38.** Berlin State Opera Orch., Taube, Theo van der Pas, piano. **Parnassus 1 mono** ($5.25) mail: 130 Arnold St. Staten Island, N.Y. 10301)

For many musical ears Emanuel Feuermann, who died young in 1942, easily ranks with the famed Casals as one of the great cellists, though the two are so different as scarcely to be compared. Thanks to his celebrity recordings with Heifetz and Rubinstein for RCA Victor, Feuermann is still in the LP catalogue. These two very early recordings, however, are resurrected from the original 78s by a new small company, the records apparently dating from the extreme early 1930s. The LP transfer is done happily without high-end roll-off, the sound is smooth and very low on stylus-groove distortion and there is evidence of good and careful engineering throughout. Good job, and much easier on the ears than some of the more hoked up 78 copyings.

The Dvorak Concerto is a joy and an aural oddity, too, for today's ears. The sound is so dead in respect to room acoustics that at first you will think it is an acoustic recording, though it soon is evident that a good sized symphony orchestra is involved, behind the forward-placed solo cello. There is a curious ringing sound to the violins, in my memory very characteristic of ultra-early electrical recording. I suspect that this dates from the beginning of the 1930-1933 period allotted by the record notes—for it did not take the engineers long to discover the usefulness of large hall liveness when microphones were used. Even though the cello is placed close-up, the musical balance turns out to be highly communicative here, once the ear adjusts to the odd sound, and the tone colors—left intact as recorded—come through remarkably well. The cello is beautifully taken down, the upper notes singing gloriously, the bottom tones in natural proportion, without boominess. Definitely, Feuermann was a splendid musician and virtuoso! Those who enjoy Janos Starker today (he contributes a forword) will find Feuermann of the same superbly accurate school. Though the orchestra is a bit sloppy by today's (tape edited) standards, its excellent spirit is more important. The performance is fresher, more genuine than any likely version today, when such music seems increasingly old fashioned.

The Brahms Sonata is less satisfactory for two familiar technical reasons. First, the cello is loud and close, the piano is far off in the background, which is ruinous to a work that particularly features brilliant piano writing. In many passages the cello saws loudly at unimportant passagework while the energetic Dutch pianist is lost in the distance. Second, in once-familiar style the cello is miked to bring out an enormous, boomy bass which will rattle the china in your living room every time a low note appears—which is often in this work. Oddly, the boom bass is entirely missing in the Dvorak. The extra bass is

accentuated by a corresponding lack of bass in the piano.

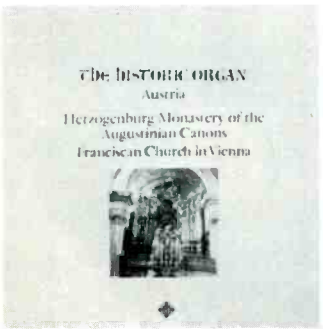
Don't be discouraged! The LP is worth the cost for the Dvorak alone.

*Performance:* B+ *Sound:* C

**The Historic Organ—Austria. Herzogenburg Monastery; Franciscan Church in Vienna.** Herbert Tachezi, organist.
**Telefunken (Das Alte Werk) SAWT 9527 stereo** ($5.95)

For those who like Baroque organ and who marvel at the sound of instruments still so potent after hundreds of years of use this series of exploratory recordings continues of great interest and charm. The recent explorations into the Swiss Valais hinterland, where all sorts of ancient instruments still play, often, pumped up by hand, now gives way to a more sophisticated array of organ sound from old Austria, two instruments, one of them large and sumptuous, out of the mid-18th century, the other smaller and a lot older.

The Herzogenburg organ is one of the most ample in sound I've heard,




its volume somewhat lost in the large reverberation of the Baroque monastery church. Under the fingers of a perceptive and imaginative organist, this instrument makes an impressive impact in mid-Baroque music by such as Froberger, Pachelbel, Johann Kaspar Ferdinand Fischer (what a name!), and lesser worthies—Krieger, Speth. The Franciscan organ is a hundred years older and an historic treasure, disassembled and hidden away from bombing during WW II, then returned to its ancient site. It has the characteristic twangy brilliance of the older instruments, with great clarity of definition in a somewhat dead and close-up space. It also is charmingly out of tune, and whether this was necessary or merely circumstantial I do not know. More of the same kind of music, two Kriegers, Pachelbel, Froberger, and Kerll.

*Performance:* A− *Sound:* B+

**Prokofieff: Piano Concerto No. 5; Weill: Music from "The Threepenny Opera."** John Browning, pf., Boston Symphony, Leinsdorf.
**RCA LSC 3121 stereo** ($5.98)

An interesting "period piece," this record, with two very different works from the 1930 era at the turn of the Great Depression. Both still sound very much of the twenties; but where the music of the early part of that gaudy time tended to sound naughty and a bit simple minded, by the later years it had again become both more serious and more complex—even if still full of those tell-tale clankings and clatterings like a noisy cafeteria at lunch hour. That was the prevailing style—from Prokofieff to Weill.

The Prokofieff Concerto came at the tail end of his long Western period, before his return to the Soviet Union and such subsequently mellifluous music as "Peter and the Wolf," "Romeo and Juliet," and the well known Symphony No. 5. Like most of his piano-and-orchestra music, the Concerto is immensely "busy" and complex—the piano scarcely stops for a moment—yet with disconcertingly sudden cadence-endings as plain as an old hymn tune. In two seconds you'll know we are still technically in the twenties, though the date was 1932. All rattly clanks and clatters, the Prokofieff tunefulness carefully hidden (for it was still too soon to write an old fashioned tune straight out). John Browning's skilled piano is recorded in RCA's 1940 style, close-up with the orchestra remarkably distant behind him. Shows him off, but the music would be easier to absorb if the piano weren't so close.

The suite from the familiar 1928 "Threepenny Opera" is in the original small-band semi-jazz orchestration, with the song parts taken over by solo instruments, and RCA has reduced the reverb to a suitably intimate level on this side. The performance is certainly good humored and affectionate but somehow it still sounds like the Boston Symphony—these impeccable players don't really know how to unbutton in a 1928 fashion. Curious mike balance, with the all-important banjo and the clop-clop of the wood blocks somehow much too faint. I enjoyed it a lot, but I'd prefer the oldie 78 versions any day, fi or no fi, or any version with the irreplaceable Lotte Lenya, whose voice *is* Kurt Weill.

*Performance:* B *Sound:* B−

## Piano for Christmas


**Prokofieff: Sonata No. 6 in A, Op. 82; Haydn: Sonata No. 6 in C; Chopin: Four Mazurkas.** Aleksander Slobodyanik, piano.
**Melodiya Angel SR 40109 stereo** ($5.98)

The jaundiced critic tends to look out of the corner of his eye at the newest youthful pianist, who has won this prize and that—there are so many, and they are so tough. But this one is different. I found him astonishingly wise and musical for his age, 25. He not only hears what he plays, but hears it in good style, knows each kind of music for its own best meaning, puts it over with brilliant but on the whole modest technique—modest in manner. As always with the best pianists, we feel that he is playing the music for itself, not for himself.

The big, wandering middle-period Prokofieff sonata gets the brilliance and show it needs, but never an inappropriate brassy hardness. The Haydn is lovely. On a big piano he plays "small" with the utmost naturalness, a beautifully balanced and expressive Haydn without the self-conscious miniaturism of Horowitz's famed renditions. And his Chopin rolls out liltingly, without bombast and in a disarmingly light fashion,

just as Chopin ideally should always be played. The piano is one of those European-style instruments, somewhat woody in tone (for our Steinway ears), the pedal is laid on fairly heavily, as is often the way with younger pianists now. The recording brings all this out most agreeably.

*Performances:* A− *Sound:* B

**Rafael Orozco—Chopin: The Complete Preludes.**
**Seraphim S 60093** ($2.49)

Here's another of those new young piano powerhouses, prize-winning as always. This one, my ear says, has a few things to learn about Chopin, unless of course you insist that one can play Chopin in all sorts of ways and his is as good as any.

Maybe so—but what seems to me to be sadly missing, in contrast to the informed Chopin players of the past, is any sense of gradation, between melody and accompaniment, between the terraces of tone out of which virtually every Chopin piece is built. Orozco plays the accompaniment loud, he plays the melody loud. OK—so be it. But I find the whole rather dull, though his technique is, naturally, up to any speed requirements of the music. If you think you don't agree, try it for yourself!

*Performance:* C+ *Sound:* B

**Beethoven: Sonatas No. 14 Op. 27, No. 2 "Moonlight"; No. 12 in A Flat Op. 26; No. 25 in G Op. 79.** Bruce Hungerford, piano.
**Vanguard Cardinal VCS 10056 stereo** ($3.50)

Bruce Hungerford's Beethoven at first may startle those older listeners who are used to the old fashioned fiery-poetical approach to that composer. He plays his fast movements forthrightly and with power—and a beat like a Brandenburg Concerto. No poetic pauses, no sweat on the brow, no flying mane of hair, so to speak (whether gray or beatle style!). This is the middle generation of piano playing, midway between the old Romantics and the brand new super-Romantic youngsters, who tend to outdo the oldsters in total keyboard pathos. This is the steely generation. But the man is excellent.

At first I didn't think so. That hard beat is not easy to take. But it very quickly becomes evident that, within his own conception of style, this man plays highly communicative Beethoven. Just have to adjust to it. Then you will find that he knows the music and knows what he is doing, not merely in finger terms but in harmony, shape, musical lines, and all the rest of the things that make sense out of piano music, not merely notes.

Very little pedal—that goes with his generation's style. A dry tone, rather spare. Only those hesitations and pauses that are clearly written into the score. All this quite opposite to the young style of today—which pedals like mad, weeps over every note (while hanging onto it for dear life) and plays up each expressive detail en route! All in all, Bruce Hungerford may be a wholesome relief from the "now" pianists, casting no aspersions, of course—they are good, too, the best of them. Just different.

*Performance:* B+ *Sound:* B

**Aldo Ciccolini—Piano Music of Chabrier.**
**Angel S 36627 stereo** ($5.98)

Wow—what a record! One lives and learns. Like most of us who know the name Chabrier, I had a fixed notion of the familiar "Espana" rhapsody of 1883 (the first of the great French orchestral evocations of Spanish atmosphere) as a rather gentle, perfumed piece, a bit tame to our hardened modern ears though full of gracious melody. Somehow, when this record began to play, I sensed that "Espana" would appear even though I hadn't even looked at the contents. It did!

The wonderfully amusing notes on the record jacket explain. It seems that Chabrier was, actually, a highly individualistic bull in a china shop, a self-taught musician, a fabulously powerful pianist who made a "fireworks of torn strings, hammers in pieces, and broken keys" of the then-frail (relatively) pianos to be found in the elegant salons of Paris. Aldo Ciccolini must have surely studied up his Chabrier, for this is just how he plays the French music. It is no "salon music" in today's sense—far from it! Loud and demanding, though always gracious and of an interestingly colorful harmony, it was the modern music of the day in France and influenced a passel of younger Frenchmen from Ravel to Les Six, the nose-thumbing revolutionaries of the post WW I period.

Ciccolini in his mid forties, is a superbly communicative pianist, one of those who transcend his instrument and make you forget it in favor of what it says—marvelous for the amateur listener, who should be forever grateful to such artists as this. Such a lively, bouyant personality! Chabrier lives again, in gorgeous stereo. And when "Espana," in piano transcription, finally does appear on side 2 it just about blows the roof off. I'll never hear it the same again.

*Performance:* A *Sound:* A–

**Piano Music of Stravinsky.** Beveridge Webster.
**Dover HCR ST 7288/85 (two discs) stereo** ($5.00)

Here again is superb piano communication, making for the easiest possible enjoyable listening. Though he plays much else for Dover, Webster is obviously a Stravinsky "natural" and in fact is a long-time friend of the composer and performer of his music. This beautifully recorded album, one of the finest piano discs in a technical sense I ever hope to hear, covers almost all of the composer's music for single piano, with a piano version of Petrushka thrown in. It all comes out wonderfully persuasive, with that steady Stravinsky beat always present but never dogmatic, with superb phrasing and intelligent dynamics. There are the ragtime pieces of 1918, composed after a look at printed jazz scores—Stravinsky had never heard the real thing—the lovely Sonata of 1924, already Bach-like in stucture, the amusing Circus Polka, written for an elephant ballet, a set of easy pieces, for children, called The Five Fingers, four Etudes, a Tango, a Serenade in A.

*Performance:* A *Sound:* A

**Rachmaninoff: Etudes-Tableaux, Op. 33 and Op. 39.** Beveridge Webster, piano. **Piano Music of Berg, Schoenberg, and Webern. (Berg: Sonata Op. 1. Schoenberg, Three Pieces Op. 11, Six Little Pieces Op. 19, Five Pieces Op. 23. Webern: Variations Op. 27.)** Beveridge Webster, piano.
**Dover HCR 7285** ($2.50)


Dover's able all-purpose pianist offers two interesting but tough records here to expand your understanding of the piano's wide repertory. The Rachmaninoff is mainly interesting for its plentitude of notes and pianistic show-off and the soporific impact of the music after five or ten minutes. Orchestral Rachmaninoff is pretty long-winded but at least it is colorful and has "big tunes" periodically. These smaller pieces (speaking relatively) like so much Rachmaninoff start out bravely, sincerely, and end up boring. Just too many notes, say-

ing nothing very important or very new. Even Beveridge Webster can't do much about it.

No wonder the Prelude in C Sharp Minor is famous. At least it is concise.

The piano pieces of the famous Viennese three, Berg, Schoenberg, and Webern, are very much the property of the young pianist-musicians today, Peter Serkin, Glenn Gould, and the like. Beveridge Webster, in his 60s, plays these difficult works with an interestingly different approach. Where Gould, Serkin *et al.* project them with almost self-conscious intensity, via much sweating of the brow, Webster is both more objective and more accurately Romantic, as of the *fin de siecle* period from which these men took off, towards the development of Viennese serial music. If you are interested in the whys and hows of such music, Webster's comprehensive introduction and the excellent and detailed notes by Eric Salzman will take you a long way towards satisfaction. Good Xmas gift for a home pianist.

*Performance:* B+ *Sound:* B–

**Gieseking plays Debussy (Preludes, books I and II, Children's Corner, Suite Bergamesque).**
**Odyssey 32 36 0021 (3 discs) mono** ($8.95)

A three-disc reissue of a well known early Columbia LP series, recorded back in 1952, this is a fine bargain with its updated quiet background, plus of course the low price, well below the original. The sound is modern though in mono to rate near-contemporary. The only fly in the Odyssey ointment is the parallel series of Gieseking recordings of the same Debussy music still available on Angel, those discs first released on LP (according to my records) in 1954.

I have compared the original Giesekings on Angel with the new Odyssey; definitely they are not the same recordings, and differ quite noticeably in interpretative detail. The Odyssey Suite Bergamesque, for example, is slower than the Angel version, with seemingly more pedal and a wide range of dynamics. The Odyssey recording is a bigger, harder, brighter piano sound, tending to a metallic edge in the louder notes and somewhat percussive in a few tones. Angel's sound is much smoother, with a solid 78-style bass and light treble, and is recorded in a deader surround, more intimately. There are no undue percussives.

Both sets are, of course, top-quality Debussy, for there has never been a greater Debussy pianist than Gieseking (unless the American George Copeland). I prefer the Angel version for its cleaner articulation, its milder sound, its leaner, lighter technique. Was the Angel (EMI) series made earlier than Columbia-Odyssey? I would guess so, in spite of the later LP release date.

The original Angel LP discs are full of ticks and pops, as was common in the mid-fifties. Newer pressings, as now available, should be much cleaner.

Alas, you'll have to pay more for Angel than Odyssey. That's fate. Maybe Angel will now release their Gieseking on Seraphim, to restore the balance of payments?

*Performances:* A– *Sound:* B–

# Light Listening

SHERWOOD L. WEINGARTEN

## The Philly "Pops" Debut

Necessity, notorious as the proverbial matriarch of invention, has given birth to a brilliant infant, the *Philadelphia Orchestra Pops*, and an equally lustrous initial recording by the 110-member ensemble, DEBUT! (RCA Red Seal, LSC-3106).

The embryo was conceived when RCA discovered the impending death of a contract and, with it, its association with the "Boston Pops." Because it was losing the Beantown boys and Arthur Fiedler to another label, a gap-filler was needed. Voila! Philadelphia's place in the musical pop-classical sun.

The recording, made in Philadelphia's Academy of Music (where the orchestra normally performs under the baton of Eugene Ormandy), also spotlights the talent of Henry Mancini, who composed and arranged all the numbers on the disc, and who conducts the Pops. Mancini, a 45-year-old Cleveland native who has won three Oscars, 17 Grammy awards, four gold LPs and a gold single (for "Theme from 'Romeo and Juliet' "), says of these semi-classical excursions "I wouldn't call this truly serious music; it's in a pop serious vein." But whatever label is attached, the result rates superlatives.

Side One is taken up with the three-segment "autobiographical suite" that represents impressions of Mancini's teenage years in Aliquippa, Pa., 20 miles from Pittsburgh. The first part of "Beaver Valley—'37" is entitled "The River," and it offers a pastoral sound with simplicity the keynote. The 5:34 section begins with a lonesome piano and then showcases the flute artistry of Murray Panitz; strings are lush, then pizzicato, then are joined by the exciting clarinet of Anthony Gigliotti and bells. The whole thing sweeps up the audiophile in an awareness of nature's beauty.

The middle sequence, "Black Snow" (5:55), is a sharp contrast, what Mancini calls "kind of a protest number" against pollution. A gloomy factor (the entire Extract is meant to paint a musical portrait of snow being dirtied by cinders from surrounding steel mills) is quickly introduced by the timpani of Gerald Carlyss. The heavy sound, however, is lightened somewhat by solo spurts by Louis Rosenblatt's English horn, John de Lancie's oboe, Mason Jones' French horn, and the full string section. A touch of what seems an Eastern influence creeps in, too, making the overall effect one of contemporary counterpoint with Americana.

Finally, Mancini utilizes the full power of the orchestra on "The Sons of Italy" (4:28), which is mainly a tarentella full of zest and reflective of the days when folks gathered in a hall for laughter, music—and probably more than a swig of vino. A clarinet solo starts it off; a fully-stringed portion quickly makes its presence felt, and then a clarinet riff (the melody at this point is reminiscent of "The Sorcerer's Apprentice") and trumpet brighten things just before the richness of the full orchestration inundates the audiophile with sound. Soloists include de Lancie, Anthony Gigliotti (B-flat clarinet), Donald Montanaro (E-flat clarinet), Bernard Garfield (bassoon) and Gilbert Johnson (trumpet). All are superb.

Not incidentally, the stereo on the disc, which was recorded in its entirety in 7 hours, is marvelous.

On the second side of the vinyl, Mancini, who started playing piano at age 12 and who began in show business with the Glenn Miller-Tex Beneke Orchestra, conducts six brief pieces "basically conceived," he says, "to feature what is known as the Philadelphia Sound." The numbers give various sections of the ensemble a chance to shine, but the strings win the lion's share of work in the musical grab bag.

Mancini, who was catapulted to fame by his jazz scores for the "Peter Gunn" video series, starts with "Dream of a Lifetime," which sometimes resembles background music for soap opera. The mood ballad (featuring William Smith on piano and Marcel Farago on harpsichord) is pleasant enough, but lacks the bite needed to stimulate a listener much. It originally was written for the Academy Award television show, and is now used in Kodak commercials. Easily more exciting is "Strings on Fire!" with lovely highs *and* lows, a piece that starts and ends with crescendos, tapering off midway into musical swirls that

Henry Mancini and The Philadelphia Orchestra Pops.

wrap the armchair aural aficionado in fantasy.

"Cameo for Violin" in an all-too-pithy masterwork, the beauty of which is gently shouted by Norman Carol, virtuoso violinist and concertmaster. "Drummers Delight" is march-tempo, band-like at start and finish, but with a total sound at the midpoint (after an interlude with flutes) that will shake the plasterboard of suburban homes. "The Ballerina's Dream" returns to the heavy use of strings, and introduces a new instrument (played by Panitz), the G piccolo. "Speedy Gonzales" closes the LP at breakneck speed. A Latin rhythm races wildly in the background as the tune, originally written for the late, unlamented "Mr. Lucky" TV epic, joyously proclaims the zesty wonder of life (on one hand) and romance (on the other). All in all, doctor, mother and child are doing fine.

### Kenton's "Hair" a Winner

Stan Kenton has come up with the best derivative LP from the tribal love-rock musical, HAIR (Capitol, ST-305)—and possibly the best "big band" contemporary-pop LP of the year. Making full use of 30 musicians and the arrangements of Ralph Carmichael, Kenton's jazz-pop interpretations leave little to be desired. It's an album that can be heard repeatedly, each time allowing the audiophile to find something new and more pleasurable.

Kenton leads the orchestra and plays piano on the disc, which contains 10 tracks crammed with some of the best stereo hi-fi sound (instrumentally, that is) in ages. And, as has been true with Kenton outfits for a couple of decades, the leader surrounds himself with imaginative, talented soloists.

"Aquarius" starts it off with a frenzy, the alto flute of Bud Shank (somewhat thorny in concept) tempering the wildness of the tune just enough. Piercing horns add spice, and the chorus is not a negative factor. "Walking in Space" follows, its electronics-produced sounds injecting a weird, out-of-this-world aura that plays, almost as a counterpoint, against the all-too-mundane hard jazz riffs of Shank's alto sax and a rock interlude. The changes of tempo make it a fascinating listening experience (and a fairly good test track for stereo system performance). "Frank Mills" provides good choral work by a six-girl ensemble, though there is nothing exceptional about the soft, mostly unison voices. "I Got Life," with vocal chorus, has a challenging drum pedal spot. "Colored Spade" offers big band jazz at its avant-garde best, with Coltrane-like riffs by trombone, alto and baritone sax, and trumpet.

"Where Do I Go," which initiates the flip side, is a routine vocal showcasing a men's sextet. But the background instrumentation, with tempo changes again quickly evident, it superb. "Hare Krishna (Be-in)" fails in part, mostly because it is cluttered musically. The melodic "Easy to Be Heard," on the other hand, is pure excitement. A zesty trumpet by Bud Brisbois (a la Maynard Ferguson) shrieks while Kenton's piano and Jimmy Zito's flugelhorn stick close to the melody. The rest of the band goes rhythmically wild, but the overriding flute does its best to quench the musical pyrotechnics. It's the best band sound, and probably the best cut. "Good Morning Sunshine" has a winning melody with pleasant chorus and big-band backing.

* * *

### More Spins

Movie soundtracks have matured, at least to the point where they now offer variety instead of boredom. Case in point: Columbia's THE APRIL FOOLS (OS 3340), part of the "masterworks" series. The background score, written by 24-year-old Marvin Hamlish, is for the most part a throwback to the days when sound tracks were bland, redundant, and dreary; but there is little of his work here ("Peter's Pad" and "I Remember the Rain" fall in the category, but "The Safari Club," with its heavy Afro-Latin beat, bird noises, variety of percussion, and superimposed dialogue, is anything but ordinary).

Guest artists immeasurably aid the LP and, surprisingly, the brief bits of dialogue (mainly by Jack Lemmon and Catherine Deneuve) that separate the musical cuts do not intrude. The title tune, a Bacharach-David com-

position, appears thrice, once from the soundtrack itself (pleasant but not extraordinary) and twice (at the beginning and end of the album) as recorded gaily by Percy Faith's orchestra and chorus specifically for the disc. Highlights also include "La La La," a quasi-rock piece with heavy rhythm work provided by the percussion of Mongo Santamaria (plus chorus); "Wake Up," shoutin' soul by the Chambers Brothers; "Sugar Kite," softrock a la the Mamas and Papas by a vocal group called California, and "Flame," the hardest possible rock (with the usual muffled lyrics by Robert John) with driving beat and bleating brass.

* * *

Marlene Ver Planck, who previously limited her work to commercials, is starred on THE HAPPY FEELING (M-114), an album released by a new company, Mounted Records. Most of the 11 tracks are easily forgotten, but a few are worth attention. The singer, who often approaches a whisper in her vocalizing, is best on romantic ballads, but also shows she has a way with jazz ("Mission Impossible," for example has her spotlighted via wordless riffs in which she uses her high-pitched voice as an instrument).

Best of the slower tunes are "I Can Dream," a moody arrangement played in slower tempo than is usually heard; "The More I See You," with Sinatra-type phraseology and one Ella-like jazz riff); "Wave," on which the thrush caresses the lyrics in front of satiny bossa nova strains, and "A Little Love Should Rub Off On Us," pleasantness personified.

For a first attempt, it's okay. Let's hear more so we can make a better judgment, though.

### The Franklin Sisters

Franklin, Franklin, and Franklin. The three soul sisters, with a little effort, could become America's greatest triple-play combination since Tinkers, Evers, and Chance.

Aretha, who in 1968 earned more gold records than any female artist in history, retained her crown this year by cutting smash singles such as "Chain of Fools," "See Saw," "I Say a Little Prayer" and "The House That Jack Built." But now she's being pressed by her younger sister, Erma, and the baby in the family, Carolyn.

Erma has come up with a long-awaited album, SOUL SISTER (Brunswick, BL 754147), that showcases her big voice against a backdrop of jazz and soul, always tempered with a hint of the gospel music in which the family is rooted. Although her voice is not as booming as either of her sisters (Erma screams a lot less), and her style is not as well honed, as easily identifiable or polished as Aretha's, Erma offers a sound that promises a successful future. And she's smart enough to escape the narrow soul bag in which many black singers imprison themselves.

"Light My Fire," for instance, is an exciting tune that becomes even more exciting by Erma's subdued vocal meshing neatly with the superb jazz background in the big band tradition; contrasting, "For Once in My Life" is given a production number treatment and is sung at breakneck speed (so fast, in fact, the lyrics at times become muffled).

"Baby I Love You" is a good contemporary swinger that floods the mind with images of moptops with jerking bodies; "Saving My Love for You," a hit single for Erma, contains a heavy beat despite its ballad flavor; "Change My Thoughts From You" accents boogaloo rhythms, and "Son of a Preacher Man" is wilder than most other renditions. "Hold On, I'm Coming," an Issac Hayes melody, comes closest to sounding like Aretha, for it's a staccato rocker that emphasizes the shoutin' brand of soul. And two original compositions by Erma also shine, "You've Been Cancelled," featuring a superb horn background that combines with organ antics and a jumpin' rhythm section, and "Can't See My Way."

The 11-band disc is not unmarred, however. "By the Time I Get to Phoenix," the Jim Webb winner, eliminates the country air but doesn't make it as soul (the strings help not, and the accompanying sound often overrides the vocal). In addition, Erma's voice frequently is clouded (throughout the LP) as if she's too far back from the microphone.

* * *

Meanwhile, Carolyn, youngest at 25, is not over-awed by the stardom of Aretha or Erma. "I can't think of anything better than having sisters that famous," she says. "It's great as long as I just keep on being Carolyn." Soul is her mainstay, too, but her first album is almost pop in concept. BABY DYNAMITE! (RCA, LSP-4160) utilizes slicker arrangements than discs by Aretha or Erma, something that gets in the way of her vocals on some flip side tunes. "Alone," for example, finds an electric guitar predominating at times; at others, the brass overshadows Carolyn *and* the background gospel voices, especially at the tail of the tune (where noise, instead of music, seems the result).

"I Don't Want to Lose You" is the other side of the coin (and the record), however, for it is a total success. An original by Carolyn, whose voice is deepest of the sisters Franklin, the tune spotlights an introduction that might be termed gospel-soul, and then turns into soft rock that defies further pigeonholing. The appeal, in fact, is so universal the number became her first single (backed by another song included on the LP, "Boxer," a rocker highlighted by a bleating horn reminiscent of the high-pitched blastoffs of Maynard Ferguson).

Carolyn, who for five years trained, directed, and led Aretha's background singers (and traveled with her sister on tour), has had more formal training than any of the Franklin fillies of soul. She majored in music theory and harmony at the University of Southern Cal, capping an education that began (like Aretha's and Erma's) in the choir. She composed some of Aretha's best songs, "Ain't No Way," "Baby, Baby, Baby" (in collaboration with Erma) and "Ain't Nobody Gonna Turn Me Round," and she wrote Erma's best-known tune, "Don't Wait Too Long."

The liner notes for her LP were written by her father, Charles LeVaughn Franklin, a Detroit Baptist preacher responsible for indoctrinating all three in gospel music. But the best summation in the notes is a quote from Aretha: "This is my sister Carolyn, and she is ready !!!"

How ready is evident by the first half of the album. The pert thrush (five feet one, boyish haircut and impish smile) starts with "Reality," a rock sound backed by full orchestra-

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tion (stressing brass). Following is "It's True I'm Gonna Miss You," a melody that changes tempo several times (it starts slowly, shifts to a sequence that is almost pure gospel in tone, one that features wild screeches in the background, and again slows up). "What 'Cha Gonna Do" is a frenzied piece that packs as much motion as possible into two minutes and thirty-five seconds.

Side Two includes the best soul sound, "On a Back Street," a bluesy, moderately-paced winner, and the worst cut, "What Now My Love," a too-long (4:05) attempt to be different (pop shadings, odd phraseology and Afro rhythms merge to make the listening adjustment difficult).

* * *

And while Carolyn and Erma struggle to reach the summit, Aretha momentarily rests there, a recent anthology acting as tribute to her talent. ARETHA'S GOLD (Atlantic, SD 8227) packages 14 hits and offers a variety of moods (the emphasis on foot-stompin' dance tunes).

The first side includes the Otis Redding classic, "Respect," which starts with volcanic intensity and keeps it up as Aretha's voice streams from the left channel and the background combo pours from the right; "(You Make Me Feel Like) A Natural Woman," a heavy-beated bluesy tune sung with a smile in her voice (and aided by strings); Don Covay's "Chain of Fools," a mad, mad, mad world of blues lyrics and up-tempo, perspiration-inducing vocal gyrations, and "Dr. Feelgood," a number written by Aretha and Ted White that has a mournful melody but "up" words.

On the second side are "Think," another tune by Aretha and White, a rocker that preaches freedom and makes the listener wish it weren't over so quickly (2:15); Sam Cooke's "You Send Me," an update of the hit from the '50s; "I Say a Little Prayer," the Bacharach-David smash that is rougher in tone than the Dionne Warwick version but equally vibrant, and "See Saw," a joint composition by Covay and Steve Cropper that features imaginative work on the electric guitar.

Aretha. Carolyn. Erma. The acronym is ACE, tops for those who prefer soul-itary confinement by their turntables.

# Tape Reviews

**BERT WHYTE**

**A Wagner Festival:** Carlos Paita conducting the New Philharmonic Orch. Ampex/London L75035 **open reel, 7½ ips** ($7.95)

Carlos Paita is a young Argentinian conductor who is totally unknown to me, but is evidently well-regarded by London, since they have given him the benefit of a Phase-Four production with the glossy New Philharmonia Orchestra. This Wagnerian program is fairly ambitious for a fledgling recording conductor, but Mr. Paita carries it off with all the aplomb of a veteran. The "Flying Dutchman" overture under his baton has a great deal of propulsive energy, and it is rather obvious that he has modeled his performance after the style of Toscanini. Unfortunately, he gets a bit carried away, stumbles over his rapid pace, and inner detail suffers. Still . . . it is exciting and in a few more years of tempering in the concert halls of the world, his may be a talent that commands our attention. His prelude to Act 1 of Die Meistersinger is more conventional and straightforward, nonetheless he does a fine job with dynamics and orchestral balances. The most impressive part of Mr. Paita's debut is his impassioned reading of the Prelude and Liebestod from "Tristan und Isolde." He lacks the control of Stokowski's memorable performances, nor do his strings have the ripe lushness so characteristic of a Stokowski recording, yet his reading is very sensuous and he handles the dynamic nuances of the score in convincing fashion. All in all, Carlos Paita acquits himself quite well, and aided and abetted by some of the best "non-gimmicky" Phase-Four sound I have heard from London, his recording can stand up to much of his competition. This tape has the widest dynamics I have noted on the Phase-Four series, along with nice spacious acoustics, good orchestral definition, low tape hiss, and no audible print-through or crosstalk. My only quibble is that the bass end, especially the percussion, could have been a bit cleaner and more prominent.

**Prokofieff: Symphony #5.** Herbert von Karajan cond. the Berlin Philharmonic Orch.
Ampex/DGG, DGC9040
**open reel, 7½ ips** ($9.95)

The ubiquitous von Karajan essays some Prokofieff, with some almost predictable results. His performance is taut, precise, almost clinically detailed. But he certainly can get the Berliners to play for him! This is supercharged playing with great string work, superb ensemble work. The acoustic perspective is broad, yet instrumental definition is good. Internal balances just right, as was directionality and center fill. The sound was generally very clean and the tape displays wide dynamics. There is an odd thing however. Near the end of the first movement there are several huge cymbal clashes, which, if anything, seem to be out of dynamic proportion. Also, percussion in the first movement could have used a bit more weight and clarity. On the other hand, in the second movement, the tympani are sharp and the heavy bass drum has considerable impact. All in all, an exciting performance, very well recorded.

**Rossini—Sonatas for Strings # 1, 2, 3, 6**
Herbert von Karajan conducting the Berlin Philharmonic
Ampex/DGG, DGC9041 **open reel, 7½ ips** ($9.95)

It is always interesting to hear unfamiliar music from a familiar composer, especially as in this case, it is chamber music for strings from Rossini, whom we always identify with opera. These sonatas are rather formally constructed works, certainly more cerebral and less emotional than the composer's operas. They will not have a broad appeal to other than chamber music buffs and students of strings, but I have an idea that is precisely why von Karajan chose to record these pieces. As a vehicle to extol the beauty and brilliance of the Berlin string sections and to display the conductorial talents of von Karajan vis-a-vis strings . . . it couldn't be bettered. The lush richness of the strings and their differing but distinctive timbres are cleanly and clearly apparent in this splendid recording. The balances between the various sections are nigh perfect and the acoustic perspective wisely chosen for a nice spacious sound with good presence. Hiss, print-through, and crosstalk were negligible.

**The Best of the Don Cossacks**—Ampex/DGG L6554 **open reel, 7½ ips** ($7.95)

Serge Jaroff and his Don Cossacks go on and on . . . and although their act has become highly stylized, listening to them is still a fascinating experience. I remember making a binaural recording of them in 1952 at a girls school in suburban Chicago, and a comparison of that recording with this DGG tape reveals that they are essentially unchanged. Of course a great part of the Cossack program is visual and someday will be a natural for SelectraVision or EVR or some sort of audio-visual medium. Their wild dancing and jumping are something you have to see to believe. In the meanwhile the strictly audio part is quite entertaining. In several of their traditional Russian numbers the contrast between the subterranean basses and the amazingly high-pitched falsetto of several of the soloists is striking. The program is pretty much a potpourri of the songs that have long been associated with the Cossacks . . . "Dark Eyes," "The Volga Boatmen," "Stenka Razin," "Two Guitars," and others in the same mold. The recording is excellent, very nicely balanced, with the voices in a fairly spacious acoustic environment, with good forward projection for maximum articulation and presence. Low hiss level and no audible print-through or crosstalk were welcome bonuses.

**Rachmaninoff—The 24 Preludes**
Constance Keene, piano
Ampex/World Series F2006 **open reel, 3¾ ips** ($24.95)

A major undertaking by Constance Keene and brilliantly executed. In fact the cover of the album displays a statement by Artur Rubinstein proclaiming her virtuosity in this recording. So who am I to argue with the gallant "elder stateman of the keyboard?" A quick listen to these "pianist's pieces" reveals her technical mastery and the panache with which she imbues her performances. For the most part this slow-speed tape is of good quality . . . piano transients are clean and sharp in a moderately close-up recording. However there are sections with some high-level distortion where the piano sounds fuzzy, and too clangorous.

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(Continued from page 79)

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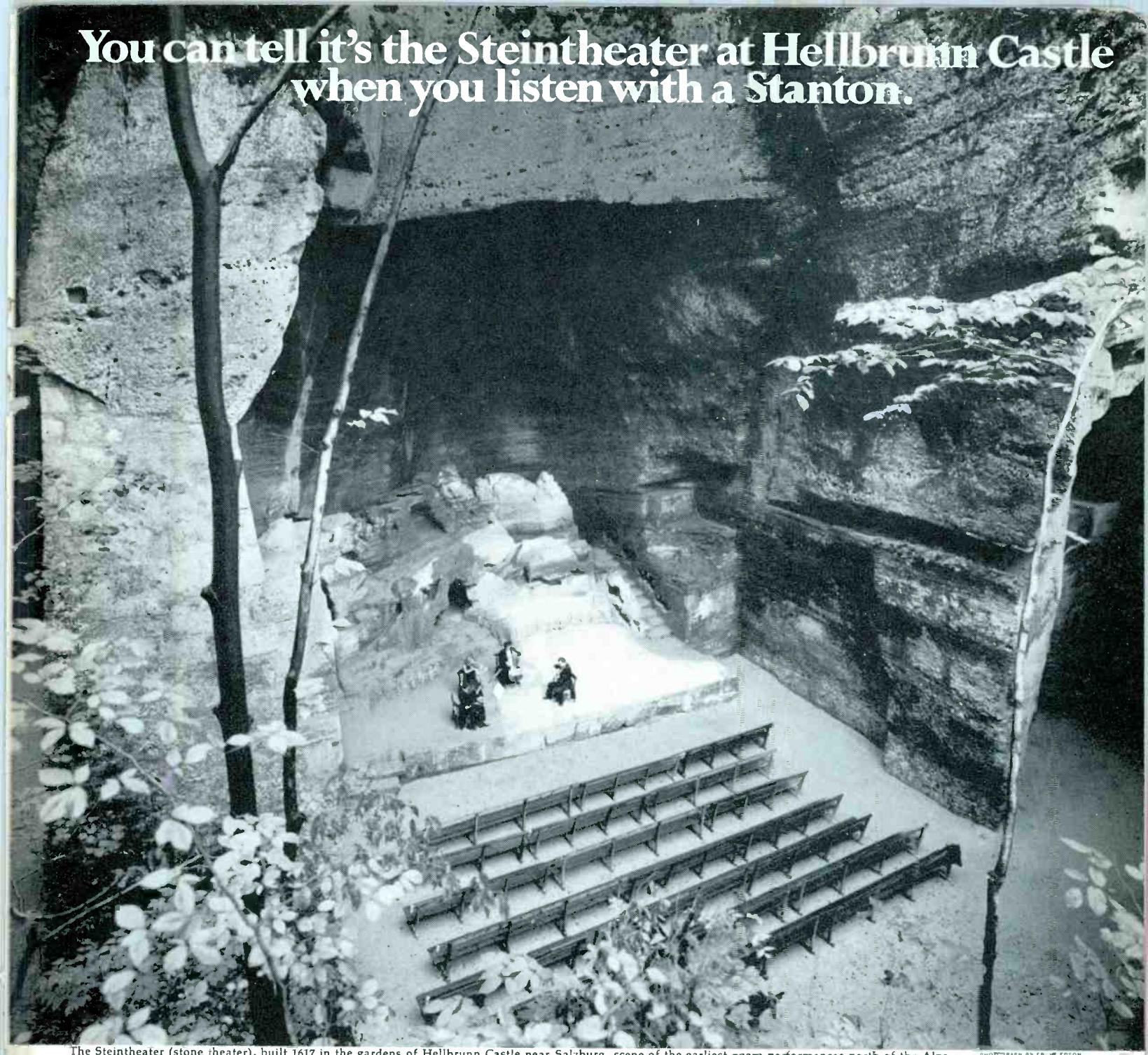

The Steintheater (stone theater), built 1617 in the gardens of Hellbrunn Castle near Salzburg, scene of the earliest opera performances north of the Alps. PHOTOGRAPH BY FRANCE EDSON

The ultimate test of a stereo cartridge isn't the sound of the music.

It's the sound of the hall.

Many of today's smoother, better-tracking cartridges can reproduce instrumental and vocal timbres with considerable naturalism. But something is often missing. That nice, undistorted sound seems to be coming from the speakers, or from nowhere in particular, rather than from the concert hall or opera stage.

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The acoustical characteristics that distinguish one hall from another, or any hall from your listening room, represent the subtlest frequency and phase components of the recorded waveform. They end up as extremely fine undulations of the record groove, even finer than the higher harmonics of most instruments.

When a cartridge reproduces these undulations with the utmost precision, you can hear the specific acoustics of the Steintheater at Hellbrunn Castle, or of any other hall. If it doesn't, you can't.

The Stanton does.

**"The tracking was excellent and distinctly better in this respect than any other cartridge we have tested . . . The frequency response of the Stanton 681EE was the flattest of the cartridges tested, within ±1 dB over most of the audio range."**
**Hirsch-Houck Laboratories, HiFi/Stereo Review, July, 1968.**

**The specifications.*** Frequency response, from 10 Hz to 10kHz, ±½ dB. From 10kHz to 20kHz, individually calibrated. Nominal output, 0.7mV/cm/sec. Nominal channel separation, 35dB. Load resistance, 47K ohms. Cable capacitance, 275 pF. DC resistance, 1K ohms. Inductance, 500mH. Stylus tip, .0002" x .0009" elliptical. Tracking force, ¾ to 1½ gm. Cartridge weight, 5.5 gm. Brush weight (self-supporting), 1 gm. *Each Stanton 681 is tested and measured against the laboratory standard for frequency response, channel separation, output, etc. The results are written by hand on the specifications enclosed with every cartridge. The 681EE, with elliptical stylus and the "Longhair" brush that cleans record grooves before they reach the stylus, costs $60. The 681T, identical but with interchangeable elliptical and conical styli both included, costs $75.

For free literature, write to Stanton Magnetics, Inc., Plainview, L.I., N.Y. 11803.

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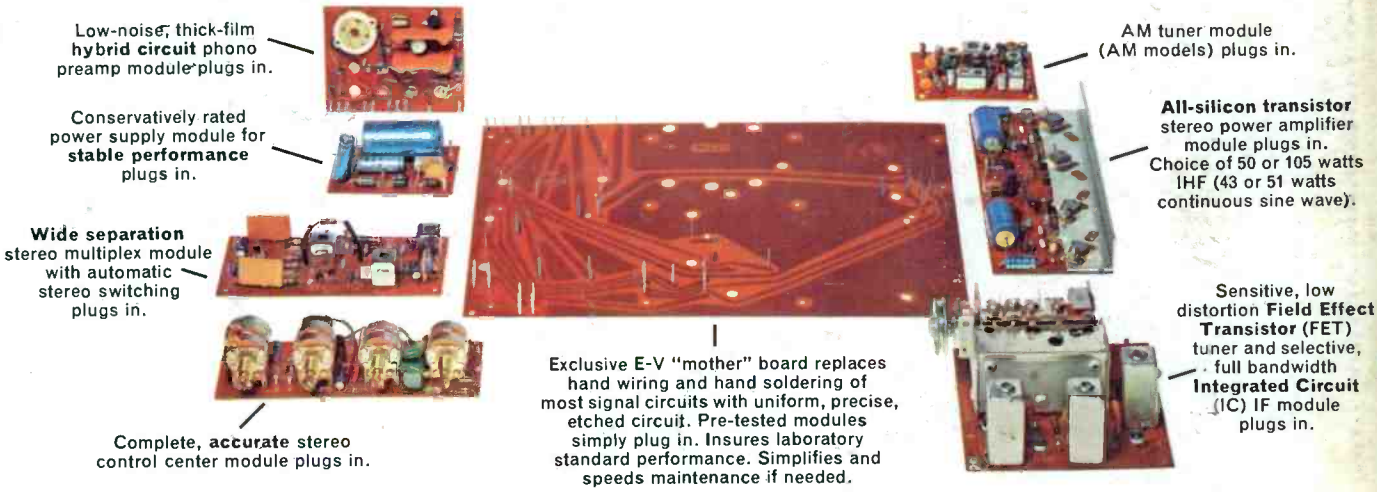


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