Manual vs Automatic Turntables

Audio

THE AUTHORITATIVE MAGAZINE ABOUT HIGH FIDELITY • JUNE 1973 60¢ ® A 23602

A Buyer's Guide to TURNTABLES & RECORD CHANGERS

AUDIO TESTS 13 QUADRAPHONIC HEADPHONES

Check: ☐ CRAFTSMANSHIP
☐ VERSATILITY ☐ SPECIFICATIONS
☐ PERFORMANCE ☐ POWER ☐ FEATURES
☐ CRITICS' REVIEWS ☐ DEALER RECOMMENDATIONS
☐ VALUE ☐ MUSIC REPRODUCTION
☐ PIONEER OWNERS ☐ RELIABILITY ☐ WARRANTY
☐ REPUTATION ☐ SERVICE and you'll reach the inevitable conclusion...

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

Reliability through exhaustive quality control.

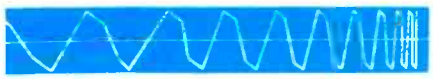
Pioneer builds each receiver as though it was one-of-a-kind. To begin with, we produce virtually every part that goes into our receivers on our own production lines. So we know we're putting in the best there is. Until it's a completed unit, each receiver is continuously checked and inspected every step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

All the versatility you need — plus.

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

Conceptual diagram

Consistent power throughout the bandwidth.



Not This

Consistent power to spare.

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

Great specs + top sound = outstanding performance.

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

Here's a mini spec list:

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

Easy-to-use features increase listening enjoyment.

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

Unanimous acclaim from the experts.

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

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

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

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

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

A Pioneer receiver costs less than you'd imagined.

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

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

U.S. Pioneer Electronics Corp.
178 Commerce Rd., Carlstadt, New Jersey 07072.

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when you want something better

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Audio

JUNE 1973 *Successor to* RADIO *Est. 1917* Vol. 57, No. 6

FEATURE ARTICLES

EQUIPMENT PROFILES

RECORD REVIEWS

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EDITOR *George W. Tillett* PUBLISHER *Jay L. Butler*
ASSOCIATE EDITOR *Edward Tatnall Canby* MARKETING DIRECTOR *Sanford L. Cahn*
ASSISTANT EDITOR *Peggy Bicknell* COVER DESIGN *John Kwasizur*
DESIGN *David Adams* SUBSCRIPTION MANAGER *Jean Davis*
ADVERTISING PRODUCTION *Peggy Bicknell*

CONTRIBUTING EDITORS: *Herman Burstein, Martin Clifford, Leonard Feldman, Martha Sanders Gilmore, Joseph Giovanelli, C. G. McProud, Harry E. Maynard, Alexander Rosner, Sherwood L. Weingarten, Bert Whyte.*

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IMPROVE YOUR HEARING FOR $200.

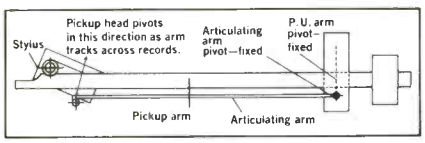
Sometimes high fidelity people lose sight of what it's all about: Sound.

The ultimate test of any piece of high fidelity equipment is what you hear.

That's why, of all the statements made by equipment reviewers about our Garrard Zero 100, the most significant were these:

"Using identical virgin records, and virgin styli in identical good cartridges, the Zero 100 on occasion sounded markedly 'crisper' than other turntables." *Rolling Stone.*

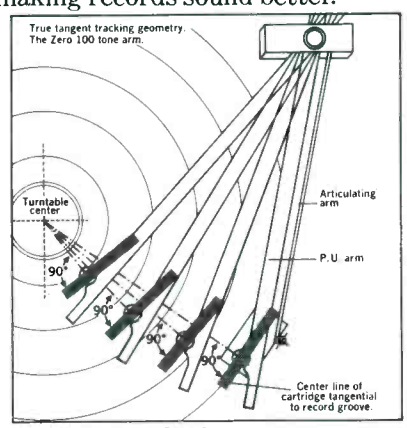
"A listening test proves to bring new life to many records, noticeably reducing distortion on the inner grooves." *Radio Electronics.*



"From about 7 in. diameter to runout, the Zero 100 delivers considerably less distortion and greater definition than with the same pickup mounted in a standard arm. The improvement in sound quality is notably impressive." *Elementary Electronics.*

"The articulated arm of the Zero 100 produced less distortion, and therefore greater definition, on high-level, musically complex passages, from the inner grooves." *Hi-Fi Stereo Buyers' Guide.*

That's what reviewers actually heard when they tested the first automatic turntable with Zero Tracking Error. This is, to our knowledge, the first time a turntable has been given credit for making records sound better.



Cartridges and other components, yes. But never a turntable — until the Zero 100.

By this time you probably know how we achieve Zero Tracking Error. The principle of the articulating arm, continually adjusting the angle of the cartridge so it is always at a 90° tangent to the grooves, is a simple one. But the ingenious engineering and the development of the precision pivots to make the principle work, took several years.

But enough from us. Let's go back to what the reviewers say about the Zero 100.

"It probably is the best arm yet offered as an integral part of an automatic player." *High Fidelity.*

"All of these features combined into one automatic turntable make news, even though some are found on other units. Only in the Zero 100 are they all put together." *Audio.*

When *Audio* talks about "all of these features" they're referring to such things as our magnetic anti-skating, variable speed control, illuminated strobe, viscous-damped cueing, 15° vertical tracking adjustment, patented Garrard Synchro-Lab synchronous motor and our exclusive two-point record support in automatic play.

But all of this gets back to our original point. It is the sound that makes the difference. After all, a $200 record player should give you a really meaningful difference. And the high fidelity experts agree that people who own a Zero 100 will hear better than people who don't.

If you'd like to read the reviews in full detail, we'll send them to you along with a complete brochure on the Zero 100 and the Garrard line. Write to: British Industries Company, Dept. F 13, Westbury, N.Y. 11590.

GARRARD ZERO 100

The only automatic turntable with Zero Tracking Error.

Dist. By British Industries Co., A Division Of Avnet, Inc.
Mfg. By Plessey Ltd.

Check No. 10 on Reader Service Card

coming in July

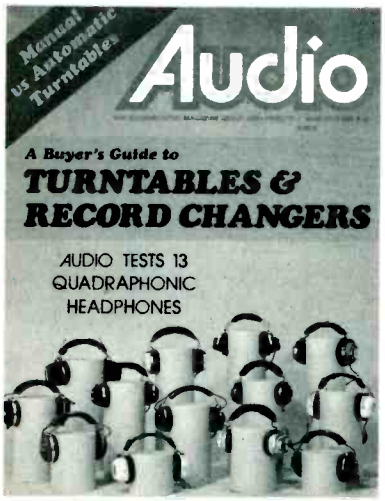
Special Quadraphonics Issue

Progress Report on quadraphonic sound with articles by Len Feldman, Ben Bauer, Harry Maynard.

Equipment Reviews Include:

Panasonic 740 US Tape Recorder

Realistic QTA-790 Receiver



About the cover: This month we present test reports on 13 quadraphonic headphone sets. Certainly this is an area of high fidelity which has undergone a great deal of development in the past several months, witness the fact that many of these headphones were only released during the past year. So far as we know, the field received its initial impetus just 3 years ago in the June, 1970 issue of AUDIO. Our report begins on page 28.

Audioclinic

Joseph Giovanelli

Frequency of a "Click"

Q. What is the frequency of the "click" sound heard when a 1.5 V flashlight battery is temporarily connected to a loudspeaker (as when phasing a system)?—F. Alexander, Maspeth, New York.

A. The voltage applied to a speaker for phasing purposes is, in this case, a DC voltage. This voltage, therefore, has no frequency.

Application of this voltage will cause the speaker's cone to move one quarter of a cycle. When the voltage is removed, the speaker returns to its rest position, completing what could be considered to be the first half of an audio cycle. (This statement assumes that we have a perfect loudspeaker.)

No loudspeaker is perfect. Therefore, when the DC voltage is applied, the speaker's cone will move. Because of its inertia, the cone will move somewhat beyond the point determined by the magnitude of the DC voltage and the strength of the magnetic field surrounding the voice coil. The cone then moves back the other way, attempting to come to an equilibrium. It may move past this proper equilibrium point and, therefore, have to reverse direction once again. The cone will, of course, finally come to its proper rest position. When the voltage is removed, the cone begins to move toward its normal rest position. Again, the inertia of the cone assembly will cause the cone to overshoot that rest position. Once more, therefore, the cone will oscillate around that rest position. The amplitude of these oscillations will be determined by the speaker's damping. The frequency of the oscillations will be determined by the mass of the cone and voice coil assembly, plus the springiness of the suspension of that cone. The suspension, of course, might well include the air trapped within the speaker enclosure.

In addition to the speaker's own resonant frequency, you may also hear frequencies which are determined by resonances within the enclosure which were excited by the sudden movement of the cone.

This cone's sudden movement may also excite resonances in the listening room, giving rise to added sound.

What you hear, then, is a composite sound, not at all related to DC voltage.

Disc Rotation or Groove Displacement

Q. From my calculations, the outer grooves of a 12-inch LP travel at just over 53.8 cm/sec. If I am correct, why is my Shure RM901E rated at 6.2 mv/channel at 5 cm/sec? Even trackability ratings are at speeds of 25 cm/sec and below. Is the output voltage directly in line with increase or decrease of the disc's speed?—Art Cook, Indianapolis, Indiana.

A. There is no direct relationship between disc speed and groove velocity. We are not interested in how much groove material passes under the stylus during one second. We are interested solely in the displacement of the groove. If we could add up the total groove displacement, vertically and horizontally, during one second, the result should be equal to the figures you see on the charts for output voltage versus cm/sec. It is not the amount of material passing under the playback stylus which results in the production of a signal: it is the displacement of the groove by the modulation imposed on it during the cutting process in which we are interested when we specify the parameters for a phonograph cartridge.

Matching a Four-Channel System

Q. I have gone four-channel. I have a JBL amplifier and two JBL speakers. I added the EV 1244X decoder/amplifier and two KLH 32 speakers.

Is that a good match of equipment? I sometimes wonder if I am really hearing four-channel sound.—Charles N. Bailey, Pawtucket, Rhode Island.

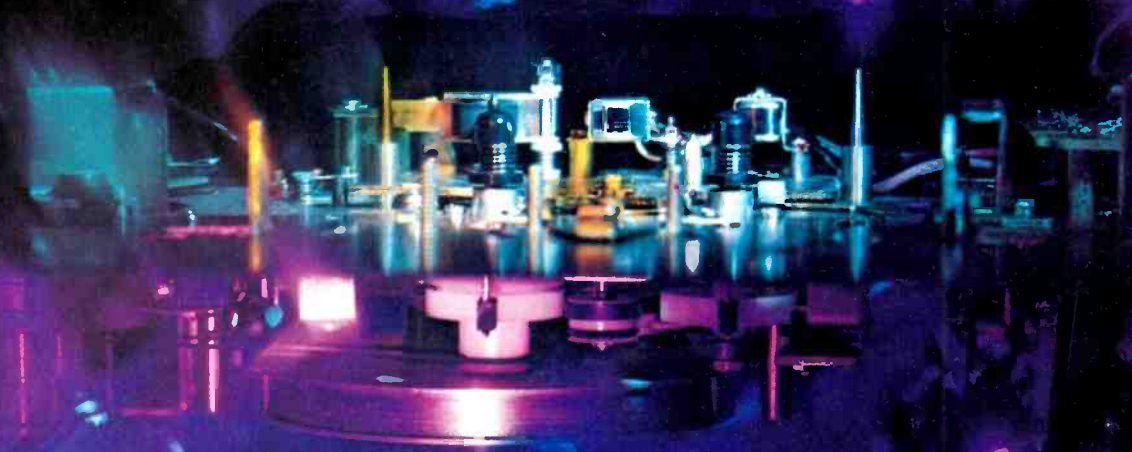
A. I cannot determine from here whether or not you really have a good match between the two brands of speakers you are using. I can say only that I believe that the safest way of matching speakers is to use the same make and model of speaker for all four channels. Not doing so can result in shifting of the image, tied with changes of musical pitch or instrumental textures.

If you do not seem to hear four-channel sound, it may be that you do not have your speakers properly phased. Even if you have the front pair properly phased, and the rear properly phased, it may be that the phase of one pair must be reversed with respect to the phase of the other pair. In other words, you may have to reverse the leads of each speaker in one pair of speakers only.

In addition, check the balance between front and rear channels.

It can also be that your program is not four-channel, and does not have enough difference information to produce the desired spatial effect.

TEAC announces a major achievement in tape technology:



A totally new transport drive system has produced the first cassette deck with record and playback wow and flutter of less than 0.07%!

Measurably better than any other cassette deck in the world.

THE TEAC 450

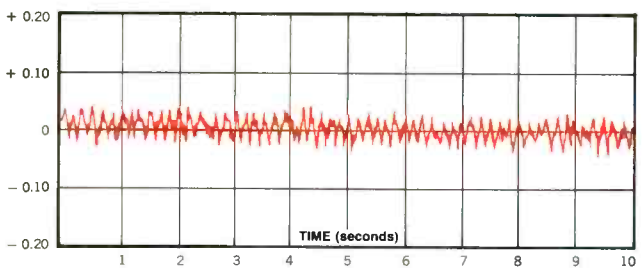
with enhanced Dolby* system. No other cassette deck can touch it.

Here's why it has no peer among cassette decks and why its specs are matched by only a few reel-to-reel decks.

TEAC can now announce a remarkable achievement in sound: a cassette deck with an enhanced Dolby system, and record and playback wow and flutter of *less* than 0.07%! This WRMS measurement is not just an abstract statistic; it is a measurement that assures you a steady, flutter-free sound previously unheard of in cassette decks. This is measurably better than any other cassette deck in existence!

How did we do it? With a hard-headed, uncompromising philosophy of design leadership, and incredible quality control.

The heart of this accomplishment is TEAC's new transport drive system—a system with all new parts and exceptional critical tolerances.



(Actual wow and flutter chart of the 450 shows **WRMS** measurement of considerably less than 0.07%.)

Item: our new clutch

Until now cassette decks had clutches that, because they were mass produced, had variations that created unacceptable variants in tape torque and head-to-tape contact. Our new slip clutch for the supply and take-up reels has been critically machined to give optimum torque—perfect balance of tension between take-up reel and capstan. This helps eliminate another of the causes of wow and flutter, and reduces level fluctuation (drop-outs) to a new low for cassette recording.

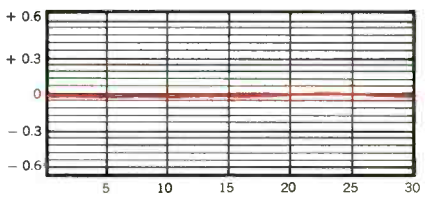
Item: our outer rotor motor

Our hysteresis synchronous motor has the *outside* revolving, rather than the inside—as in a normal motor. The flywheel is exceptionally large (93mm) and has twice the mass of any other TEAC flywheel. This increases the inertia and stability of the transport drive element which pulls the tape.

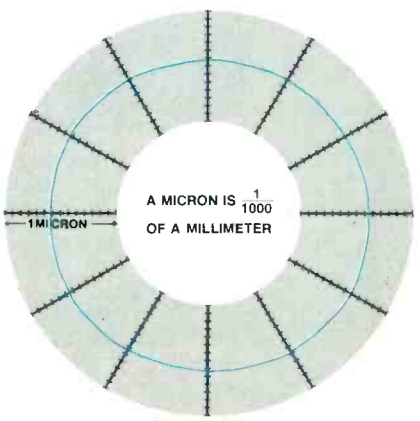
Our outer rotor motor is even dynamically balanced, to be completely free of rotation variation! It drives the capstan flywheel with a professional quality flat belt made of a new synthetic material created for minimum stretch and maximum durability.

Item: our new capstan

A newly designed capstan has a shaft with a diameter of 2.4 mm. The shaft has a critical tolerance of 0.15 microns (the accompanying diagram shows this 0.15 micron tolerance enlarged 4000 times). This perfect roundness allows the tape to be transported at a much steadier rate, smoothing the tape flow and greatly reducing one of the significant components contributing to wow and flutter.



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



(Actual "Roundness" tolerance of the 450 capstan shaft shows enlarged critical tolerance of 0.15 microns.)

CASSETTE DECK

Item: our enhanced Dolby system

TEAC has given Dolby circuitry a significant new flexibility: our exclusive Dolby FM/Copy control. In the past, when recording Dolbyized tapes or Dolbyized FM broadcasts, the high-pitched emphasis of the encoded Dolby signal was heard as you monitored—an inaccurate and disturbing representation of the sound being recorded. The exclusive TEAC Dolby FM/Copy switch decodes the Dolby signal for monitoring, while leaving the recorded encoded Dolby signal undisturbed.

While today there are only a handful of Dolbyized FM stations broadcasting throughout the country, TEAC has created this forward-thinking feature to enhance your enjoyment of their signal.

And for good measure, we've added an automatic output stabilizing network that maintains Dolbyized levels despite changes in the line levels!

So what else is new?

Literally dozens of new exclusive TEAC features—both electronic and mechanical—can be found on the 450. For instance:

Three-level bias and equalization. Flick the two switches and instantly adjust for normal, high output or chromium dioxide tapes. A vital, but neglected feature in other cassette decks.

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

Mic/line mixing. A feature of reel-to-reel decks now found on the 450. Professional slide controls allow you to mix 2 mic inputs and 2 line inputs to create voice and stereo instrumental mixing.

Lighted tape run indicator. A glance at the 450 from across the room tells you the tape is flowing normally.

Two heads. A record-playback head and an erase head of a new material called Permaflux—the lowest distortion head ever made.

Solid-state triggering devices. Solid-state switching and the elimination of relays further enhance reliability.

Signal-to-noise ratio of 60dB. This important rating places the 450 with the finest in reel-to-reel decks. Which translates into superior sound.

LED. A light emitting diode backstops your 2 VU meters by warning you of transient high-level highs, and helps you avoid saturation distortion (about which we've spoken in a previous ad).

What does it all add up to?

A cassette deck that is in a class by itself. A sophistication in tape technology that is exclusive with TEAC.

The TEAC 450 has the flexibility to function as a complete record/playback unit, or as an integrated component in a total system. It is a pace-setter for the industry.

And to top it all, TEAC now offers a two-year warranty on all parts and labor—a warranty that reflects total confidence in our superior TEAC engineering and workmanship.

That 0.07% wow and flutter may be much better than anyone else's cassette deck. But it is only a hint of things to come from TEAC.

Only a hint.

Here are the specs:

Heads
Two, erase and record-playback, 4 track 2 channel stereo.

Motor
Hysteresis synchronous outer-rotor motor

Wow and Flutter
0.07% (wrms)

Frequency Response
30–16,000 Hz (Chromium dioxide tape)

Signal to Noise Ratio
60 dB (with Dolby process)

Dimensions
$6^{15}/_{16}$" (H) x $17^{1}/_{2}$" (W) x $10^{5}/_{8}$" (D)

Features and specifications subject to change without notice

*Dolby is a trademark of Dolby Laboratories, Inc.

TEAC®

The leader. Always has been.

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TEAC offices in principal cities in the United States, Canada, Europe, Mexico and Japan.

Check No. 29 on Reader Service Card

Tape Guide

Herman Burstein

Recording With a Timer

Q. Within the past week a new use for a tape recorder has occurred to me, namely unattended recording of certain radio programs which are broadcast while I am at work and are missed for that reason. In connection with this, I have a question: Should I be concerned that the "Play" button on most cassette recorders needs to be pressed ahead of the time the recording is made, so that the timer will need only to operate a switch to start and stop the recorder? I believe that the "Record" button merely operates a switch, but that the "Play" button presses the capstan against a rubber roller. In this case a flat spot would develop on the rubber tire. I have not bought a cassette machine yet, partially because of this question. Do you know of a way in which this possible source of trouble can be avoided, maybe by choosing a certain machine, or otherwise?—Richard T. Kroll, Ann Arbor, Michigan.

A. You are correct that you may run into the problem of "flatting" the pressure roller in case you preset a tape machine for operation by a timer. I really don't know of a general solution for this problem, and can only say that it depends upon the machine you use. Some tape machines intended for remote control may avert this problem: that is, the pressure roller may not press against the capstan until operation starts. Inquire of the audio store (s) where you plan to purchase a machine as to which ones are suited for operation by a timing device.

Takeup Reel Squeak

Q. I own a Sony tape deck TC 255. I use it in the vertical position and sometimes the takeup reel has a nasty squeak. It is quite loud and annoying. I've taken the unit apart and oiled according to the manufacturer's instructions. The squeak persists. How can I get rid of it?—David Tishler, Lawton, Oklahoma.

A. I have no answer inasmuch as the problem is a peculiarity of one particular brand and model of tape machine, rather than a general problem. I suggest you query Sony.

Footage Counter Use

Q. A problem with my tape deck is that the counter registering footage is way out of line with the actual amount of tape used. How may I correct this problem?—David Tishler, Lawton, Oklahoma.

A. The so-called footage counter does not count feet. It only counts numbers (of turns of the takeup reel), which are indexes to the various portions of a reel. The counter enables one to locate (approximately) any desired part of the reel, provided one has previously noted the corresponding number.

Noise Suppression for 78's

Q. I have quite a large collection of 78 rpm records dating back to 1910. I am attempting to capture them on tape. The results, of course, are scratchy and full of surface noise. Can you point me in the direction of how to do the best that an amateur can, including how to clean the records in the first place?—Robert Dyer, Ridgewood, New Jersey.

A. My preference for cleaning records is simply soap and water. Others have more sophisticated ideas, and you might consult your local record shop in the matter. However, washing will not affect noise, at least not appreciably.

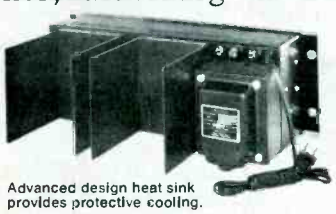
Some fairly good noise suppressors were marketed in the past for amateurs, with prices they could generally afford. You might inquire of your audio dealer whether he knows of any still around. Such devices are available at the professional level, but are quite costly.

The following expedients may help you to reduce noise in copying 78 rpm records onto tape. Record at 3¾ ips, rather than 7½ ips, because treble response, and therefore noise, tends to be less at the reduced tape speed. For further reduction of treble response, increase the bias in your tape machine; of course, if you increase bias enough, you can record at 7½ ips. On the other hand, don't tamper with bias unless you have the facilities for restoring it to the correct level. You may find that you get better results using an elliptical stylus, such as that used for LP's, instead of a 3-mil spherical stylus ordinarily recommended for 78 rpm records.

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

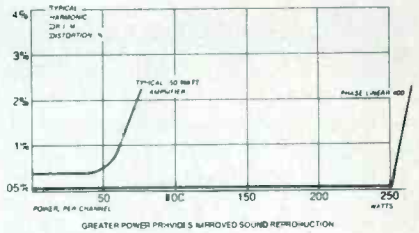
Can you live without a 400 watt amplifier?

Maybe. If you're content to listen to music at a less than realistic level. Or if you don't mind the loss of quality caused by clipping during the more dramatic passages in your favorite records. On the other hand, if you want to listen at a real-life level without distortion, you need *at least* 400 watts of amplifier power. Other things being equal, the more power you have to drive those fine speakers, the more faithful the sound. Julian Hirsch put it this way: "Anyone using a low-efficiency speaker . . . with an amplifier in the 30 to 50 watt class cannot approach realistic listening levels without severe clipping." And *Audio*, after listening to the Phase Linear 400, said, ". . . many people do not realize just how much power is necessary to handle peaks without clipping . . ." *Stereo Review* summed up: "A superb amplifier, furnishing the essential qualities of the (Phase Linear) Model 700 at a much lower price (almost a bargain in today's market)."



Advanced design heat sink provides protective cooling.

At $499.00 why live with anything less than the Phase Linear 400? Ask your dealer for an audition.



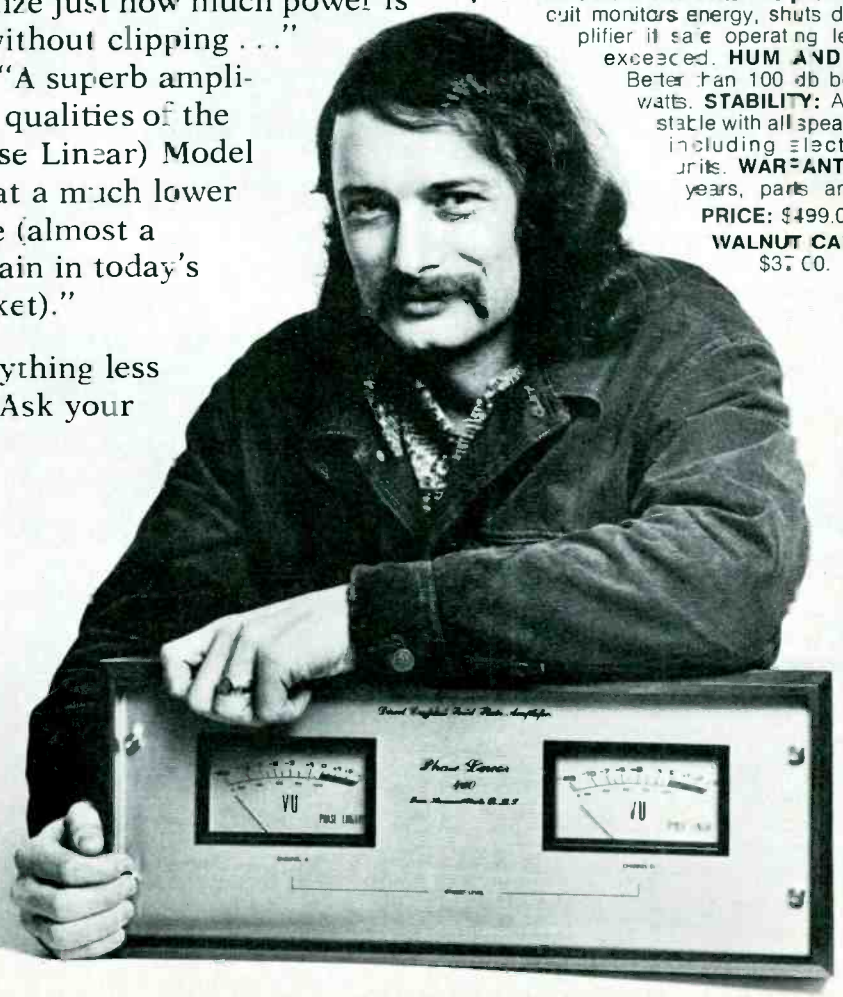
GREATER POWER PROVIDES IMPROVED SOUND REPRODUCTION

Phase Linear 400
400 watts RMS direct coupled solid state stereo power amplifier.

POWER: Greater than 200 watts/channel RMS both channels driven into 8 ohms. Power at clipping typically 250 watts/channel into 8 ohms and 400 watts/channel RMS into 4 ohms. **HARMONIC OR I.M. DISTORTION:** Less than .25%; typically less than .05%. **PROTECTION:** Patented protection circuit monitors energy, shuts down amplifier if safe operating levels are exceeded. **HUM AND NOISE:** Better than 100 db below 200 watts. **STABILITY:** Absolutely stable with all speaker loads including electrostatic units. **WARRANTY:** Three years, parts and labor.

PRICE: $499.00

WALNUT CABINET: $37.00.



Phase Linear 400

THE POWERFUL DIFFERENCE

PHASE LINEAR CORPORATION
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EDMONDS, WASHINGTON 98020

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Behind The Scenes

Bert Whyte

This column is usually concerned with some specific event or subject . . . something with a central theme. There are occasions however, when there are a number of matters clamoring for attention and I am compelled to deal with them in what might be charitably called a "bits and pieces" column. This present effort is of that genre, so if this is not your "cup of tea", you can always turn to the pithy and pungent comments of our dear Editor, or catch Canby's latest musings, or even read our classified ads . . . a fascinating glimpse into the microcosm of audio exotica.

The hi-fi industry has a number of trade publications, notably "Audio Times" and "High Fidelity Trade News", that at regular intervals surveys business conditions of audio retailers throughout the country. While the surveys of the past few months reflected the overall state of business, there was heavy concentration on the impact of quadraphonic sound and it's contribution to sales. It was interesting to note the diversity of opinions and the experiences of dealers in various sections of the country. In some stores where quadraphonic sound has been enthusiastically accepted and agressively merchandised, it has accounted for as much as one third of total sales. This is the exception rather than the rule, with percentages of sales in most stores appearing to run between 5 to 15 percent. There are also a distressing number of stores in which quadraphonic sound is given the "Bah!-Humbug!" . . . "Who needs it" kind of treatment. They are entitled to their opinion of course, but one rather suspects that type of outlet still offers sharpening services for cactus needles! All kidding aside, the surveys showed that there was a general acceptance of quadraphonic sound as a fact of life, and as a distinct marketable entity. However, there was also universal concern that the quadraphonic disc war was causing much confusion among their customers, fomenting fears of equipment obsolescence.

Well, the dealers can take heart, because their laments have not fallen on deaf ears. I pointed out several months ago that at the Consumer Electronics Show in June, we would almost surely see receivers with built-in SQ, QS and CD-4 facilities. It is now certain that this will be the case, although by no means across the board with the products of all receiver manufacturers. What precipitated this as much as anything, was the signing of the Warner record group to the CD-4 system. Even the most obtuse could see that both the matrix and the discrete camps have plenty of clout, and that co-existence is the order of the day. Obviously the customer is going to pay more for such expanded facilities, and with the fragile inter-national money situation, the rise could be quite considerable. But whatever the ultimate cost of these units, their mere existence can allay the fears of obsolescence. In essence, the ball will be tossed back to the dealer, and it will be up to the dealer to effectively demonstrate all the quadraphonic modes of these new units and turn his customer's apprehensions into sales.

The next item on the agenda will be short and to the point. I get more mail from readers asking where they can purchase pre-recorded open reel tapes, than almost anything else. I have furnished this information before . . . ye Editor has proffered it as well, but here it is again. The King Karol Record Shops in New York specialize in tape in all formats, and operate a mail order service. The Sam Goody shops, have similar service, with not quite the depth of stock. Columbia has not issued any open reel tapes for some time (more's the pity) but catalog items can be obtained in these shops. The open reel situation at RCA is somewhat similar, except that they have made a deal with a company called "Magtec", to issue catalog items (which incidentally will return to the original 7½ ips speed, instead of the 3¾ ips of latter years) as well as new productions, including, it is rumored, quadraphonic tapes. Both of the aforementioned stores carry items from the Ampex Stereo Tapes catalog, but for some time now Ampex has been operating a successful open reel mail order service which is said to offer 24 hour "turnaround" on orders. You can get an Ampex catalog covering 6000 some selections on over one hundred different record labels by sending 50 cents and writing to . . . Ampex Catalog Offer, Box 178, Elk Grove Village, Illinois 60007. Keep those open reels rolling!

Speaking of Ampex Stereo Tapes, it is a pleasure to announce that they have decided to issue quadraphonic open reel tapes. In fact I have the first six productions. From the London catalog there is "Chacksfield Plays Bacharach"; "Annunzio Paolo Mantovani", 25th Anniv. album; "A Salute To Glenn Miller", Ted Heath Orchestra; and a sampler entitled "The Quadraphonic World of Phase 4 Stereo". From Vanguard their by-now-familiar "Surround Stereo" sampler, and from Enoch Light's Project 3 label, "Four-Channel Dynamite".

Admittedly, not much in this batch for the classical buff, but they will be coming along as quadraphonic masters are made available to Ampex. In the meanwhile, this first effort is very well done, with excellent processing, including fairly low hiss levels, although it is obvious that Dolby B noise reduction would be as helpful here as it was in the recent issue of Vanguard "fore and aft" Dolby tapes. London's approach to quadraphonic seems a bit more conservative than the dynamic "free-wheeling" philosophy of recording espoused by Enoch Light. They use surround techniques, obviously mix-downs from 16 track material, but I have a feeling that none of the productions were originally conceived for quadraphonic sound. Nonetheless, their tapes are quite effective, certainly produced with a sharp ear for musical values. On the sampler is a richly sonorous and spectacular excerpt from "Victory At Sea" and a vividly atmospheric arrangement of the "Russian Cavalry Song", with parts of Borodin's "Prince Igor" interpolated into the score. The Glenn Miller tape uses all the old familiar arrangements, which are played almost by rote, but this will not bother those who want a literal re-creation, if not the spirit of the

The ADC-XLM "...in a class by itself."

That's the way Stereo Review described our XLM. High Fidelity headlined their review, "Superb new pickup from ADC" and went on to say, "...must be counted among the state of the art contenders." And Audio echoed them with, "The ADC-XLM appears to be state of the art."

With the critics so lavish in their praise of the XLM, there's hardly any necessity to add anything. Far better to let the experts continue to speak for us.

Frequency response The CBS STR-100 test record showed less than ±1.5dB variation up to 20,000Hz. *Stereo Review*
...response is within ±2dB over the entire range. *Audio*
Frequency response is exceptionally flat. *High Fidelity*

Tracking This is the only cartridge we have seen that is really capable of tracking almost all stereo discs at 0.4 grams. *Stereo Review*
The XLM went through the usual torture test at 0.4 grams (some top models require more than a gram). *High Fidelity*
The XLM is capable of reproducing anything found on a phonograph record. *Audio*

Distortion Distortion readings...are almost without exception better than those for any other model we've tested. *High Fidelity*
The XLM has remarkably low distortion in comparison with others. *Audio*
At 0.6 grams the distortion was low (under 1.5 per cent). *Stereo Review*

Hum and noise The XLM could be instrumental in lowering the input noise from the first stage of a modern transistor amplifier. *Audio*
The cartridge had very good shielding against induced hum. *Stereo Review*

Price This would be a very hard cartridge to surpass at any price. *Stereo Review*
We found it impossible to attribute superior sound to costlier competing models. *High Fidelity*
Priced as it is, it is a real bargain in cartridges. *Audio*

The Pritchard *High Definition* ADC-XLM $50.

ADC **AUDIO DYNAMICS CORPORATION**
Pickett District Road, New Milford, Connecticut 06776

Check No. 48 on Reader Service Card

"Miller Sound". All in all, an auspicious debut for Ampex quadraphonic open reel tapes.

If you are at all serious about tape recording, sooner or later you come to the realization that the two line and mic inputs provided on most tape machines are a decidedly limiting factor. The answer to more mic and line inputs is the use of an accessory mixer. These come in all sorts of sizes, degrees of sophistication and prices. I have used a number of popular mixers over the years, all of which had their virtues, and all of which lacked certain features, which from my viewpoint at least, would have been desirable.

For some time now I have been using a Prokit SM-6A mixer made by Gately Electronics of Havertown, PA. This unit is available as a kit at $299.00, or factory-wired at $499.00. It is well worth the money in the wired version, and if you have the time and the dexterity to put the kit together, it's a real bargain. Being a lazy type cat, I opted for the factory version. If you are tired of lugging equipment on location recordings, the first endearing feature of this mixer is that it measures a mere 17 in. wide, by 3½ in. high. by 9 in. deep, and weighs in at about ten pounds. Small as it is, it is loaded with facilities, many of which are not available on larger and more expensive mixers.

The Prokit will mix up to six signals simultaneously, either line or mic inputs, which are pushbutton selectable on the front panel. Since the SM-6A is a stereo unit, any of the six signals can be assigned to either channel A or B output. Inputs 5 and 6 on the unit can be switched to provide phono preamplification with standard RIAA equalization. Line or mic inputs one through four can be switched to channel A or B, or both . . . the latter point being of particular value to me. Control over each input is via silky-smooth pots, and there is a master pot for each output channel. Two VU meters are provided, which in the factory-wired version are set up so that a "O" VU indication results in a +4dBm output. Additional taps are provided so that a "O" VU indication can be either OdBm or +8dBm. On the rear panel of the Prokit, the mic preamp gain can be switched between 35 or 55 dB on each input, such range covering most dynamic, ribbon, or condenser mics. There is also a switch that can provide a low frequency cut at about 100 Hz on each input. A connection for stacking units in parallel is provided, to gain additional inputs. An accessory EQ-6 equalization kit can be plugged into the rear to provide equalization on all inputs. A headphone jack accepts 600 ohm phones.

The Prokit uses top quality components such as Allen Bradley pots, UTC input transformers, Switch-craft XLR connectors, Centralab push-button switches. Plug-in integrated circuit operational amplifiers are a feature of the unit. Mic input impedance is 150 ohms balanced bridging, line input impedance 100K unbalanced, and the phono preamp is typical 47K unbalanced. Output impedance is less than 50 ohms, and output capability is +20dBm (8 volts) into 600 ohms or higher. Distortion is a very low 0.5 percent at +8dBm (2 volts) and noise is inaudible at –127 dBm on mic channels. Even with the master gain control half-open, the noise is –65dBm.

This "bare bones" description doesn't tell you what a pleasure it is to use this versatile unit. Now I frequently have friends visiting me for listening sessions, and just to titillate them, I play some 15 ips three-channel half-inch master tapes. Inevitably they want copies of these, but most of them do not have half-inch 3 channel machines. Mixing down from 3 to 2 channels before I acquired the Prokit, was a real pain. Other mixers I have used, while of generally excellent quality, usually had an input configuration of 6 mics and but 2 lines. With the Prokit, I simply assign the left channel of my master tape to line input one, channel A output; the right channel of the tape to line input three, channel B output; the center channel of my tape goes to line input two, with both A and B channel outputs. All done by manipulating pushbuttons! Of course, when my friends playback the copy on their two-channel stereo machines, the "hidden" center channel is "reconstituted" and appears between their loudspeakers. Recently I had to make some radio commercials, with source material from a tape machine, from discs, and live voice on mic. No trouble at all with the Prokit. Just plug in everything (including direct pre-amplified phono) push the right combination of buttons, "ride the pots", and the job is done.

Truly, the Prokit is a delight to use and performed flawlessly. If I have a few quibbles, they are that I would like to see either a pilot light showing the unit is on, or illuminated VU meters. (Good thing too, in dim locations.) Also, while it is nice to have master pots on the outputs of the two channels, things would be handier if there was an overall master pot controlling the level of both channels simultaneously. Needless to say, this function would be especially valuable if you were using two Prokits for quadraphonic recording. Enough of nit-picking. Try one, you'll like it!

For $200 you can buy a $200 turntable made by G, D, or M.

For $150 you can buy a $200 turntable made by BSR.

Just look at the specs and features:

Feature	Garrard Zero 100	Dual 1229	Miracord 50H-II	BSR 810
Motor type	synchronous/ induction	synchronous	hysteresis	synchronous
Platter weight	3.5 lb.	7 lb.	6 lb., 5 oz.	7 lb.
Platter diameter	11.5"	12"	12"	12"
Variable pitch	yes	yes	yes	yes
Integral strobe	yes	yes	yes	yes
Stylus setdown adjustment	no	no	no	yes
Stylus overhang adjustment	yes	yes	yes	yes
Cue/pause control	yes	yes	yes	yes
Minimum stylus pressure	0.25 gram	0.25 gram	0.5 gram	0.25 gram
Wow (Stereo Review)	0.1%	0.05%	(not yet tested)	0.03%
Flutter (High Fidelity)	0.07%	(not yet tested)	0.07%	0.05%
Rumble (Stereo Review)	–55.5dB	–56dB	(not yet tested)	–54dB
Price	$199.95	$199.50	$199.50	$149.50

When the engineers at BSR set out to design the 810, they had in mind an automatic turntable that would be as good as, or better than, the finest turntables made by competing manufacturers.

As the comparison above clearly indicates, they met their goal. But, equally important, they produced a turntable that sells for $50 less than other top-of-the-line models. This means that the $50 you don't spend on an 810 can buy you a hi-fi system that is $50 better, or does $50 more. You can get electrostatic head phones instead of dynamics, or a Dolbyized cassette deck instead of an ordinary deck. Or get a pair of microphones, or a mike mixer, or better speakers, or even some new records. With BSR you save, and get the best.

BSR

BSR (USA) Ltd., Blauvelt, N.Y. 10913

Check No. 7 on Reader Service Card

Editor's Review

IHF Standards

At a recent meeting of the IHF Standard committee, we were unanimous in our support for a pink noise sensitivity measurement for loudspeaker sensitivity. This involves the use of one-third octave pink noise, centered on 400Hz and measured with one watt applied signal at a distance of one meter. This measurement will be included in our future tests of loudspeakers.

Don Davis, who is an occasional contributor to AUDIO, recently formed his own company—Synergetic Audio Concepts—which specializes in training audio systems engineers. He will be conducting seminars in 21 cities during the next few months. Courses last for three days and pupils use programmable computers and latest test instrumentation. Details can be had from: Syn-Aud-Con, P.O. Box 1134, Tustin, CA 92680.

On Test

The following receivers are now being tested: Sony 7065, Sansui 2000X, Onkyo 555, KLH 52 and 55. Tuners include the new Pioneer TX 9100 and Dynaco AFM-6. Tape recorders include the Akai GXC-46D and Wollensak 4750 cassette units and the Akai 4000DS and Dokorder 9100 open-reel decks. Among the loudspeakers are the APL 16, Bozak Sonora, Microstatic HF unit, the ESS Heil system and the Magnaplanar. The last named systems have been in the listening room for some weeks now and I really hate to part with them. As the radiation pattern is a doublet, bass is slightly attenuated but overall sound is clean with the kind of transparency associated with the KLH Nines.

Demonstration records

The "Organ Music from Westminster" record mentioned in the April issue (Design Acoustics D-12 review) was made by Robert Fulton and another disc I can recommend is his recording of Robbinsdale Senior High School Symphonic Wind Ensemble, directed by Robert Thompson. Wind instruments are notoriously difficult instruments to record but this particular record is exceptionally clean with excellent dynamic range. The performance is good too—I had trouble in convincing listeners that this is just a High School Band! Mr. Fulton builds his own microphones at a reputed cost of $6000 each and the two used were electrostatic types having a polarising voltage of 6000! Price of the record is $5.95 and it can be obtained from: Romans, 8012 Cedar Avenue, Minneapolis, Minn. 55420.

4 (2) Channels

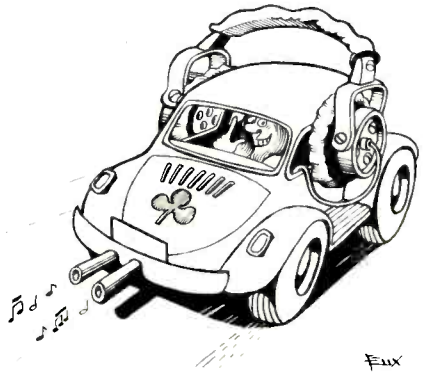
The new Schwann catalog contains a 4-page listing of quadraphonic records and it is suggested that many records sold as two-channel are actually matrix records. In other words, they say—*a four channel compatible record is sold as stereo because many people are not yet ready to accept 4-channel.* Maybe so; in any case it is an interesting thought. See page 28 for the quadraphonic headphone tests. Owing to space limitations, we couldn't print the cassette tape survey this month, but we'll try and find room in the next issue—patience!

Open-Reel

Interested in open-reel tapes? Barclay-Crocker of 11 Stone Street, New York 10004 issue an interesting supplement to their catalogue, called "Reel News." The catalogue itself contains listings of more than 3000 tapes and is well worth the price of one dollar.

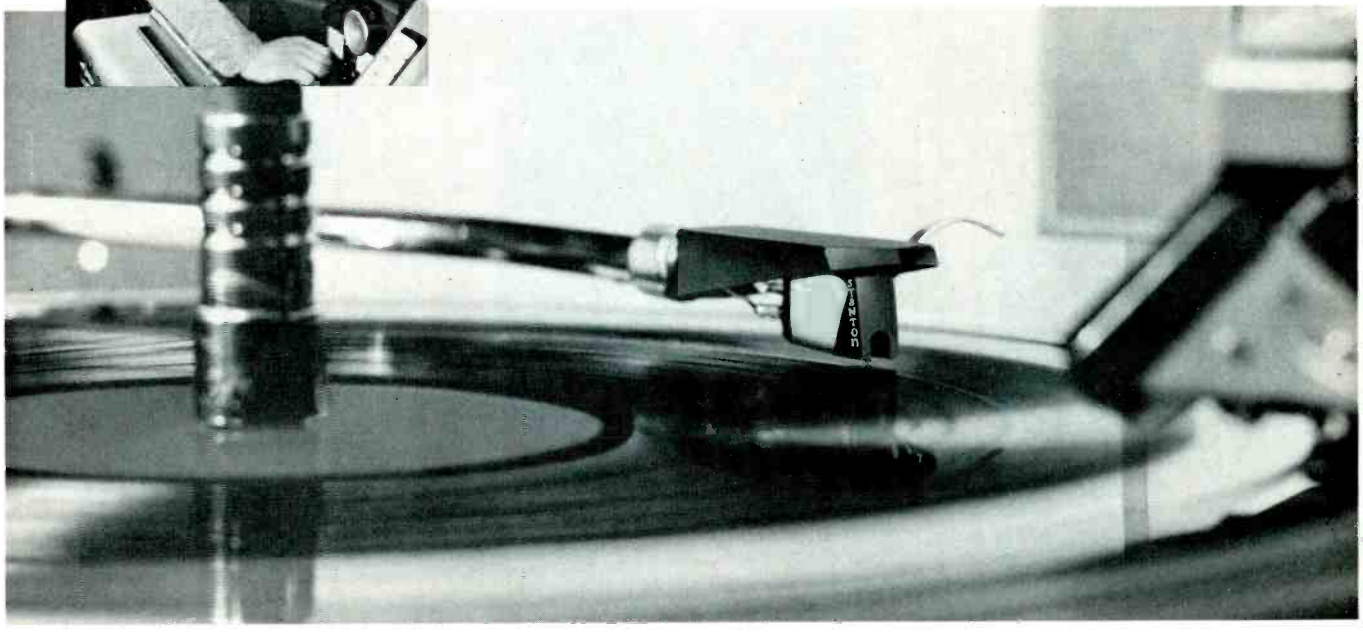
Congratulations

Our best wishes to H.W. Barnard who retires from the "Wireless World's" Editorial Chair this month. And congratulations to Bill Rollins who has just celebrated his 40th year in the loudspeaker business. Bill started his career in 1933 working for Utah at the princely salary of 35¢ an hour. In 1954, he started Oaktron Industries who now make more than 4½ million speakers a year. Finally, to Walter Hullsiek who is the new President of Fisher. He was formerly a top executive with Admiral and more recently, V.P. of corporate development at Amana. Mr. Hullsiek holds a E.E. from the University of Minnesota.



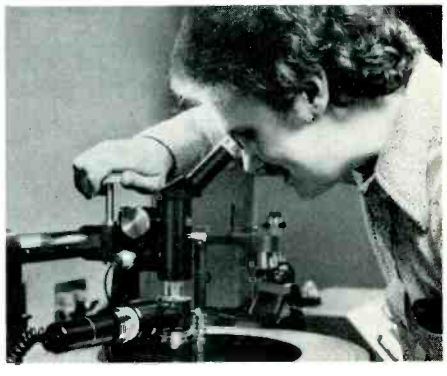
See page 28 for our quadraphonic headphone directory

Stanton.
Benchmark for an Industry.



Stanton's 681 Series is the Calibration Standard to recording engineers such as Robert Ludwig.

Whatever the requirements for recording and playback, Stanton's Series 681 cartridges are the Calibration Standard. And there is a 681 model engineered specifically for each of these critical applications. That's why Stanton is truly the Benchmark for the industry.



The Stanton 681A – For Cutting Head Calibration. With Stanton's Model 681A, cutting heads can be accurately calibrated with the cartridge, for it has been primarily designed as a calibration standard in recording system checkouts. Frequency response is factory calibrated to the most rigid tolerances and the flattest possible response is assured for precise alignment of recording channels.

The Stanton 681EE—for Critical Listening. Stanton's Model 681EE is designed for low-distortion tracking with minimum stylus force, regardless of the recorded velocity or the distance of the groove from the disc center. High compliance, low mass and low pressure assure perfect safety even on irreplaceable records.

All Stanton Calibration Standard cartridges are guaranteed to meet the specifications with exacting limits. Their warranty comes packed with each unit – the calibration test results for that individual cartridge.

For complete information and specifications write Stanton Magnetics, Inc., Terminal Drive, Plainview, L.I., New York.

STANTON

All Stanton cartridges are designed for use with *all* two- and four-channel matrix derived compatible systems.

Check No. 50 on Reader Service Card

What's New in Audio

Sansui Loudspeaker
Model SF-1 is described as a surround-sound, omni-radial system and it uses two 6 inch units with a 2½ inch cone tweeter. One 6 inch speaker faces downwards and the other two co-axially mounted to radiate upwards. Frequency response is quoted at 55 to 20,000 Hz and the system will accept a maximum peak power of 45 watts. Price: $139.95. Dimensions: 22¼ by 14 9/16 inches square.

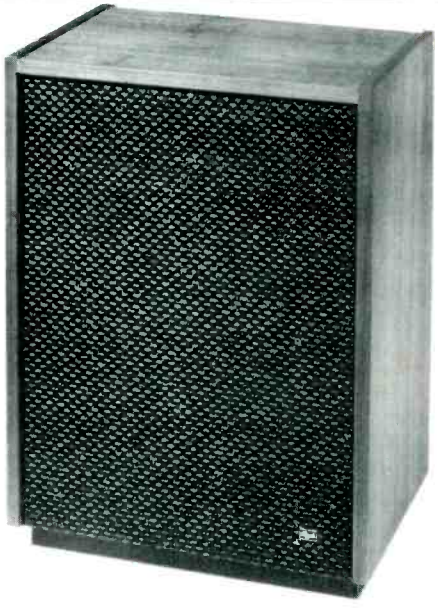
Check No. 65 on Reader Service Card

Hear Muffs
These unusual headphones are not worn over the top of the head but fit around the back of the head to form a kind of soft cushion. They are ideal "bed-phones" and the velour slip-covers are available in a choice of five colors. Price: $29.95.

Check No. 66 on Reader Service Card

Shure V 15 Mk III
This new cartridge from Shure has a stylus with 25% less mass compared with the Mk II. A new laminated core structure is used and the net result is a significant improvement in frequency response and other parameters. Price: $72.50, with biradial or spherical diamond stylus.

Check No. 67 on Reader Service Card



Bozak 401 Loudspeaker System
This new system from Bozak is called the "Rhapsody" and it uses a 12 inch bass unit, a 6 inch mid-range and a dual tweeter unit. A 3-position HF level switch is fitted and the walnut-faced enclosure measures 25¾ inches high, 18 wide by 13¼ inches deep. Price: n/a.

Check No. 70 on Reader Service Card

The 400 millisecond miracle.

Most people seem to take for granted the smooth, effortless way in which a Revox works.

And that is as it should be.

For a great deal of time, effort and sophisticated engineering have gone into translating extremely complex function into lightning quick, responsive operation.

For example, when you press the play button of a Revox, you set in motion a sequence of events that take place with the precision of a rocket launching.

It begins with a gold plated contact strip that moves to close two sections of the transport control circuit board.

Instantaneously, the logic is checked for permissibility. If acceptable, a relay is activated.

Within 15 milliseconds, power is supplied to the pinch roller solenoid, the brake solenoid, the back tension motor, a second relay and, at the same time, the photocell is checked for the presence of tape. If present, Relay One self-holds.

Elapsed time, 25 milliseconds.

At 30 milliseconds, Relay Two closes and puts accelerating tension on the take-up motor.

The logic checks are now complete and power is available to actuate all necessary functions.

From 30 milliseconds to 300 milliseconds, mechanical inertia is being overcome and the motors and solenoids are settling down.

By 300 milliseconds, the brakes have been released, the pinch roller is in contact with the capstan shaft, the tape lifter retracted, the playback muting removed and the motors have come up to operating speed.

At 350 milliseconds power is cut off from Relay Two, which changes over to another set of contacts, releasing the accelerating tension on the take-up motor and completing a circuit through Relay One that, in turn, restores normal tension to the take-up motor.

Total elapsed time, 400 milliseconds. The Revox is now in the play mode.

And it's all happened in a fraction of the time it takes to read this sentence.

The 400 millisecond miracle. **More proof that Revox delivers what all the rest only promise.**

Revox Corporation 155 Michael Drive, Syosset, N.Y. 11791. Calif.: 3637 Cahuenga Blvd. West, Hollywood 90068
England: C.E. Hammond & Co., Ltd., Lamb House, Chiswick, London W4 2PB. Available in Canada.

Check No. 35 on Reader Service Card

automatic or manual turntables which one to buy?

Joe Lesly*

As soon as you decide you'd like to buy components, the next step probably depends on whether you know someone who's knowledgeable about high fidelity. If you do, the rest is easy. You just follow the advice that's offered. But if you don't, and try to learn by yourself, you must be prepared to learn more than you want to know. Just flip through some of the pages in this particular issue, for example, and see how many ways of playing records there are. That is, how many makes and models of record playing equipment are available. All you really want to know is: Which one best suits my purpose?

As the writer is associated with one of the manufacturers, it would be easy for us to tell you. But that wouldn't be fair to you or the editors. Nor would it be as interesting a challenge to us as the task we've undertaken: to be as objective as our human frailty will allow.

Now, back to your question: Which one to buy? To decide that, you should know what to look for. And to know what to look for, you should pause to consider some fundamentals, obvious as they may be, about what happens from the time you place a record on the platter and the time you return it to its jacket.

After a record is placed on the platter, the next thing that happens is the movement of the tonearm from its resting post to the lead-in groove. What you have to decide is whether you want the tonearm to move by hand or whether you prefer to move a switch and let it all happen automatically.

That choice brings us all the way back to the tired old subject of record changer vs. manual turntable. We won't get into that one again, other than to point out that this question has long since become one of convenience, not quality.

Actually, it's more than a simple question of convenience. If you've recently handled a tonearm set to track at one gram, you may well have felt uneasy about it. One gram feels like no weight at all, and it's no easy matter to handle it with confidence. What's more, one-gram tracking means there's a very fragile suspension between the body of the cartridge and the tiny diamond tip at the end.

So even if you don't really need a "changer" per se, you may well need the security of an automatic start. (And stop, for that matter.) Fortunately, most manual turntables are provided with a "cueing" device that takes care of the set-down and lift-off function, leaving you only the job of moving the tonearm to and from the record. Plus, of course, remembering to set the cueing lever for the action needed. And finally, hoping that anyone else in your family who uses your system will also remember, and use it properly.

OK. One way or another, the tonearm has descended to the rotating record, and the diamond stylus is now in the groove. You can now walk away and enjoy the music for the next twenty minutes or so. But to be sure you're enjoying the same music every time you play the same record, you want to be sure that the stylus and the record are getting along together just fine.

You know, of course, that the diamond stylus is the hardest substance on earth, and that the vinyl record is anything but. In fact, a crude but homey comparison might be something like dragging a rounded end of a stick along the surface of a bowl of jello. The parallel object of that little example would be to avoid breaking the thin skin of the jello.

In principle, what you hope will happen to your record is: nothing. The stylus will move this way and that way, very obligingly, as the contours of the record groove direct. And, of course, their "directions" occur at a rate of something up to fifteen thousand a second.

For "nothing" to happen, the tonearm holding your cartridge should 1) be precisely balanced, 2) have the correct stylus pressure applied to meet the stylus compliance requirements and 3) apply that pressure equally on both walls of the stereo groove. (Not every one agrees with the importance of that last criterion, which refers to anti-skating, but their ranks have noticeably thinned as more has become known about the need for balanced tracking.)

Just one other thought for you about the actual action of a record in play. Quickly now, what makes the tonearm move across the record from lead-in groove to run-out groove? Did the answer come to you right away? Many people have never given it any thought. Answer: pressure of the outer wall of the record groove as the groove spirals inward.

Another quick question: What resists that inward movement of the tonearm? Answer: the friction of the bearings in the tonearm pivots. When you consider that the stylus might be riding in the groove with perhaps one gram of pressure, it does not require much friction in the pivot to unbalance the tracking on the two walls and even cause occasional skipping. And worse, permanent damage to the recorded material in the groove.

If all this seems academic to you and more than you want to know, take a moment right now and add up the money you've already spent on records, and the money you're likely to spend

*Vice president, Ries, Cappiello, Colwell, Inc. (*agents for Dual*)

All quadraphonic systems are not created equal...Sansui has created the QS vario matrix.

QRX-6500

Here at last is the development that once and for all will lay to rest the dispute over discrete vs. encoded recordings. The Sansui vario matrix—a technological extension of the QS Regular Matrix—provides unbelievable front-to-back separation, to a degree never before possible with matrix recordings—separation so great that engineers have hailed it as the "discrete matrix."

Two new units in the Sansui four-channel lineup—the QRX-6500 and the QRX-3500 contain this outstanding new decoder. These full-featured four-channel receivers have high power output (280 watts and 180 watts IHF), superb FM sensitivity, and are loaded with special features to make quadraphonic listening a totally trouble-free and fulfilling experience.

QRX-3500

The new decoder includes a position for Phase Matrix recordings, and both "Hall" and "Surround" positions for the QS Regular Matrix and for the synthesizer section, for accurate decoding of any current matrix as well as creating enhanced 4-channel sound from two-channel recordings.

Other special features include a sound-field rotation switch, linear balance controls for front/rear and for left/right, and the capability to drive up to 10 speakers —all front-panel switch-selected.

Treat your ears to a demonstration today at your nearest Sansui dealer. Your listening will never be the same again.

QS REGULAR MATRIX

Sansui

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in the future. Chances are you've already spent more on records than on all your other components combined. Assuming we're in agreement on that score, we can now turn to the question of evaluating the record playing equipment available at the typical audio dealer.

Unlike receivers and speakers, whose insides are effectively sealed, record players are accessible to the eye and hand. Most elements of their design, materials and workmanship are exposed, either above or below.

As you look up and down the shelves, you'll see a sampling of the products described in this magazine, ranging from very low-priced to fairly high-priced record changers and automatic and manual turntables. It's fair and accurate to say that price and quality go together, and we think it's clear that we hope you will put quality first and not short-change yourself or your records with false economy. After all, damage or premature wear on a record is permanent.

With the salesman's permission, you should operate each prospective turntable a few times, using whatever start and stop switches are provided, and using the cueing device on those units which have them. Note how smoothly and quietly everything works (or doesn't).

Now pay attention to the various tonearm settings: for balance, tracking pressure and anti-skating. Again, if the salesman allows, you should place all the settings back to neutral and unbalance the tonearm. Then start all over again, just as you would in your own home. Balance the tonearm with the weight of the cartridge. Apply tracking force, then anti-skating. Just performing these functions will give you a sense of how well the machine is made.

You might now pay attention to some of the features and refinements that each model offers. Although the "experts" might disagree on the importance of each, the more seriously minded turntable manufacturers prefer to include refinements that they consider necessary. For example, some models have two settings for anti-skating: one for conical styli, the other for elliptical styli. This refinement recognizes the fact that the narrower tracing edge of the elliptical stylus penetrates slightly deeper into the groove wall, resulting in more frictional pull and hence more skating. So the "elliptical" calibration applies a bit more anti-skating than the equivalent "conical" calibration.

One refinement the better record changers have adopted from single-play units is a single-play spindle that fits snugly into the platter and rotates with it. This type of spindle centers the record more precisely and helps reduce wow and flutter. Also, it certainly makes good sense for a spindle to rotate with the record instead of presenting potential resistance which can enlarge center holes and increase eccentricity.

When you operate the cueing lever, pay particular attention to the way the tonearm responds. The better cueing systems are damped, so the tonearm floats down at a constant slow rate of speed no matter how fast you move the lever. And the best systems also damp the tonearm on the way up, so it won't bounce. If you don't think you will really use the cueing feature much, consider the problem when you're listening to a record when the phone rings. Without cueing, you have the choice of turning the record off or paying little attention to it. With cueing, you can lift the tonearm off the record, then resume where you left off when the call is over.

So much for the tonearm. Now for the platter and what makes it go around. Lower priced models have a stamped steel platter. Higher priced ones have nonferrous cast platters. The highest-priced ones also have cast platters which are dynamically balanced. In addition, all things being equal, the heavier the platter the better its flywheel action in smoothing out the fluctuations of the motor itself.

Any acceptable record changer has

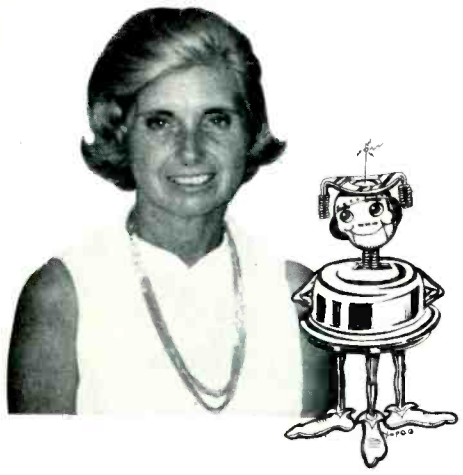
a four-pole motor, as the two-pole motor belongs to the "toy" category. But there are differences among four-pole motors. The better ones are able to resist line voltage changes and thus maintain speed constancy, which is the special virtue of the synchronous motor. The best of the conventional motors is the type which is both inductive and synchronous. These motors use their induction elements to provide the torque required to get the platter up to speed quickly, then the synchronous element takes over to lock the speed into the 60H frequency of the AC power line.

A new kind of motor has recently appeared in a very few of the highest-priced single-play turntables. This motor is electronic and is energized by a regulated DC power supply. Its particular advantage is its low rotational speed which reduces vibration (hence rumble). Even electronic motors differ from each other, as the best of them not only rotate at low speed, but at the exact speed required for the record, 33⅓ or 45 rpm. Thus, these motors don't require any speed-reduction system, such as friction-idler or rim-belt, and can drive the platter directly. Be forewarned that such motors come with turntables priced at over $300.

One useful feature associated with motors and drive systems is a variable speed control. Since records are made to rotate at certain fixed speeds, whether 33⅓ or 45 rpm, you may wonder why the platter shouldn't always rotate at these speeds and let it go at that. For one thing, your taste may lead you to prefer a certain record that's pitched slightly higher or slightly lower. If you ever want to play a live instrument along with a record, you'll find it easier to tune the record to a piano, for example, than vice versa. And camera buffs also find this feature useful in timing a recording to a length of film.

In case you haven't noticed the absence of any comment about wow, flutter and rumble, we'll mention them right now. All record players have some wow and flutter measurements below 0.1%. And rumble (weighted) should be below 50 dB. But it will take a very good ear to detect either one unless they are grossly evident, and any record player good enough to be submitted for published test reports, such as in Audio, will be adequately quiet.

At this point, we hope we haven't told you more about record players than you really want to know. And if you remember nothing else, please remember that only one component handles your precious records. You want that component to be a very good one. AE



Happy 25th Birthday, Transistor!

Audrey Anders

Though I am aware that your publication is slanted toward those more conversant with such terms as "Sensitivity ± 60 dB re 1 mW/10 microbars," I still feel that it is neither sterile nor purely pedantic. Having heart, you have not relegated us, the nontechnics, to merely the Sony ads or cartoons by Cork. For instance, in Leonard Feldman's article on buying watts, I might become irretrievably lost in his charts and graphs, but I am certainly appreciative of attenuator switches, and personally I think program indicator lights would add to the decor, if not the performance of amplifiers.

I, the quintessense of the non-technical layman, have lived with transistors for a number of years now, since their very inception and birth some twenty-five years ago. Being the wife of an electrical engineer associated with its parent company, Bell Telephone Laboratories, I had heard its virtues extolled at cocktail parties, in taxicabs and across various dinner tables around the world. During these soporific dialogues I had generally amused myself by planning the next day's menu, wondering if I had put the cat out, or by simply falling asleep.

Though I had long been aware of the transistor, I had little interest in it, and certainly no intrinsic care for it, until my high school son, in a term paper, lifted it out of its sea of electronic anonymity and gave it life. I remember coming across this paper on his desk.

"Transistors," said the title page, "by Bob Anders—Period Three." An innate maternal interest, rather than a propensity for transistors, caused me to flip the title page and proceed to the introduction.

"To my knowledge," said my son, "the transistor is known to the average person only as a little gadget that goes in pocket radios and other assorted electronic devices."

"How true," I agreed.

"It is unfortunate that this ignorance exists," he continues, "but there are valid reasons behind it. The transistor has an unpretentious appearance. It is small, usually measuring no more than a fraction of a square inch. The actual functioning part of the transistor, minus the casing, sometimes approaches microscopic dimensions." I had heard that it was tiny.

"Perhaps the major reason for this lack of understanding of the transistor," he said, "is that it has no attention getting devices. It doesn't generate light like Edison's lamp; it doesn't ring like Bell's telephone; it doesn't go 'bang' like a Chinese firecracker."

"How interesting," I thought.

"The transistor," he explained, "is a little creature whose habitat is usually inside some sort of box, hidden away from the view of the vast multitude. There he is forced to live lonely and unknown amidst forests of capacitors and rivers of tin."

"How very sad," I mused.

"Usually the only one who ever talks to him is an upset technician or a local transformer that merely hums. After years of such isolated existence, it is surprising that the transistor does not simply give a little 'FSST' and die, an unsung hero. Instead, he seems never to weary of his task, and lives on and on."

I was beginning not only to know the transistor, but to have care and compassion for it.

"But his story is not completely tragic," continued my son. "While the transistor is never seen nor heard, he has the uncanny ability to make other things so that they can be seen and heard."

"Magnanimous indeed," I noted.

"By himself," he said, "the transistor is a nobody, a mere clustering of expensive molecules occupying space, but put him with a bunch of other nobodys like resistors and he becomes a real somebody, one of the greatest somebodys of our time!" How wonderful!

"Ever since 1948, when the first tiny transistor was born, men have been using the characteristics of this little guy to make such things as computers, radars, micro-mini radios and all sorts of electronic miracles. Each day, millions of tiny transistors are at work on telephone conversations all over the country."

"The transistor becomes even greater," he extolled, "when you find that he has fathered many new and great inventions. The whole space program could not have come about had it not been for transistors. The transistor may be just a little nobody, but his significance will brighten our way of life for years to come."

By not the transistor was becoming a friend. He not only made my pocket radio smaller, my stereo more efficient, but I even felt his presence in my telephone conversations.

Bob went on to explain some of the basic transistor functions, sometimes approaching pedantry, but not so much that he lost sight of me, the layman.

"It is not," he said, "that these functions could not be accomplished before the coming of the transistor; they could, but only through the use of bulky devices called vacuum tubes. Unfortunately, these tubes were limited by many physical properties. They were subject to heat, cold, impact forces, vibration, space limitations and amount of usage. They required separate circuitry to supply their cathodes with enough energy to cause the release of electrons. These cathodes required warm-up time. The transistor, however, surmounts these handicaps. He has no cathodes to warm up. He needs little external energy to operate and operates at low voltages in most circuits. The transistor gives off very

Why you should buy the best turntable you can afford.

Chances are you've already put more money into your record collection than into the rest of your entire component system.

That's reason enough to make sure that nothing happens to your records when you play them.

Remember, records are made of soft vinyl, and they're played with a diamond-tipped stylus. And there's nothing harder on this earth than a diamond.

If that stylus can't respond easily and freely to all the contours of the record groove, there's trouble. Especially with the sharp and fragile curves which produce the high frequencies. Instead of going around these peaks, the stylus will simply lop them off. And with those little bits of vinyl go the high notes, your record and your investment.

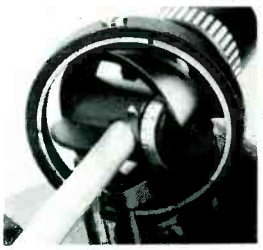
There's still more to consider. The record must rotate at precisely the right speed, or pitch will be off. The motor must be quiet and free of vibration, or rumble will be added to the music.

In short, the turntable should neither add sounds to a record, nor take any away. And that's the kind of turntable you should want. To get that kind of turntable, we suggest you ask someone you know and trust who really knows components. A friend. A record reviewer. An audio engineer, or a good audio dealer.

And if you'd like to read more about turntables, we'll send you two booklets that someone else wrote. One tells you what to look for in turntables. The other tells you what independent test labs have reported about the Duals they've evaluated.

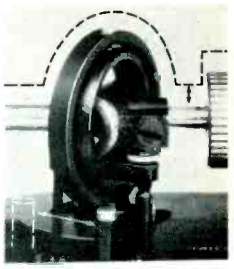
We'll leave it to you to decide if you can afford anything less than a Dual.

How Dual protects your records.



The tonearms of the Dual 1218 and 1229 are mounted in gyroscopic gimbals, the best known scientific means for balancing a precision instrument that must remain balanced in all planes of motion.

Unlike conventional tonearms, the 1218 and 1229 track records at the original cutting angle. The 1229 tonearm parallels single records; moves up to parallel, changer stack. In the 1218, a similar adjustment is provided in the cartridge housing.



In all Dual models, stylus pressure is applied around the pivot, maintaining perfect dynamic balance of the tonearm.

For perfect tracking balance in each wall of the stereo groove, separate anti-skating calibrations for conical and elliptical styli are provided on all Duals.

Dual 1214, $109.50

Dual 1215S, $125.00

Dual 1218, $169.50

Dual 1229, $225.00

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little heat: he is small and can be placed in much smaller places than could the vacuum tube. He is such a speedy little fellow that he is operating the instant a voltage is applied and the circuit closed."

Bob went on to explain and draw pictures of such things as amplification, modulation, demodulation, oscillation and various shaping of wave forms. Under the heading of "Modulation and Demodulation," he explained: "In this function the transistor acts as an exciter. Much as a ferocious dragon excites a fair maiden, so does a transistor excite an electrical current."

Though I was no longer a fair maiden and had never suffered encounters with fiery dragons, this had meaning for me. It even had heart and soul.

On the final page of his essay, Bob stated: "From here on in transistor characteristics become specialized and very complicated, involving much math. You will encounter such monsters as silicon controlled rectifiers and field effect transistors."

I scare easily where technological terms are concerned, and I could see that anything deeper, even with Bob's supportive analogies, would likely take me in over my head. Still, he had given me a basic understanding of the transistor, and for those interested in continuing he made reference to the books in his bibliography.

Bob is now finishing his sophomore year in college, is headed toward a scientific career and is doubtless immersed in things murkier than silicon controlled rectifiers or field effect transistors. It is my fervent hope, though, that he will continue to find feeling among the charts and graphs, and warmth even in cold, inflexible fact. Thus he will help to bridge that eternal ocean which seems to forever flow between men of science and those of us who tend to conceptualize a valence bond as something that goes over draperies, and impure germanium as an ill-formed flower.

Since I am constantly exposed to trade journals and electronic magazines, I have known since the first incipient days of the new year that this is the twenty-fifth anniversary of the transistor. I might once have noted this as simply one more banality from another culture; but due to that high school term paper I am now quite conscious of that little nobody hidden away in my household electronics, and I am appreciative of those who gave him birth. It is even with a certain empathy that I can now say, "Happy twenty-fifth birthday, transistor, and best wishes for many, many more."

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A New Idea for Measuring Wow and Flutter

Robert E. Berglas*

Before describing the system I have worked out for an accurate measurement of Wow and Flutter using digital counting techniques, some attention should be given to the weaknesses inherent in existing methods.

Present methods do not lend themselves to a central criterion of scientific investigation: namely, reproducibility of data. Given the art as it exists, published results are more a function of the particular test instruments, than the actual matter under review. Printed Wow and Flutter specs simply cannot be reproduced unless the manufacturer's set-up is known (and his test equipment happens also to be on the user's bench).

Recognizing this embarrassing fact of engineering life, the industry has attempted to bring some method to this madness by hitting upon a mind-boggling variety of "weightings" and *a priori* suffixes. In sum, these are equations which lop off equipment eccentricities and, unfortunately, "fudge" results.

To be more specific, consider for a moment the numerical manner researchers devised for specifying degree of speed variation—of course, the cause of Wow and Flutter. The unit of measurement became RMS percentage of speed variations. And, yet, the RMS notion is no more than a convenience—a) to transform a periodically changing quantity into a steady quantity, and, b) a convenient average value that subverts more than it explains.

Fundamentally, Wow and Flutter is *frequency modulated* (FM) program material; and the RMS concept is, at heart, amplitude modulation (AM) of an AC voltage. It simply will not do to transform peak-to-peak voltages into "peak-to-peak percentage speed error." It may be convenient, but it is also a fudge beyond the definitions we are working with.

Another inproportionate conversion takes place within existing Wow and Flutter meters—i.e., the conversion of AC to DC (to drive the meter). The DC voltage in these instruments is generated by a "detector." The problem here is the same as was for the RMS concept—namely, that this is *not* "detection" in the true sense. Detection refers to the recovery of amplitude modulation from an RF envelope. Wow and Flutter components, however, change the *frequency* of the incoming signal, and converting to DC is inappropriate and not proportional. In the process of making the meter happy, investigators have fundamentally confused AM with FM.

A New Digital Wow and Flutter Method

Analog devices such as meters are fine for measuring voltages; but they just cannot contend with rapid fluctuations in frequency.

With recent advances in digital IC propriety devices, we have at our command, and for the first time, accurate and precise systems for frequency determination. Indeed, my friends at Texas Instruments developed their remarkable TTL digital IC line largely for counting purposes, where, often, the input would be variations in frequency.

The new digital method for measuring Wow and Flutter that is described here, is made at once simple and incredibly accurate by pressing into service the latest generation of Frequency Counters, built around TTL logic. With this instrument and a suitable stable test signal, frequency modulated variations in turntable and tape recording gear can be measured with repeatability and authority. The procedure described is simple, easy to perform, and, to tell the truth, a remarkable experience for the investigator.

Wow and Flutter components will frequency modulate a test signal, and if we monitor resulting output tones with a Frequency Counter, we will not see displacements from the standard input signal.

Anticipation and an understanding of the phenomenon serves to prepare one for the actual procedure. Wow and Flutter give off specific frequency variations: Wow is known to affect frequencies under 6Hz; while Flutter exists in a higher range, up to 250Hz. Further, these frequencies modulate very often both above and below the test signal (known as positive and negative speed variations).

Let us say we have a 1000Hz test signal, either on a record (say, the CBS BTR-150, or the one put out by Stereo Review), or recorded on a test tape. Moreover, let x equal a possible wow component of 6Hz or less; and y equal flutter existing at up to 250Hz. Then, if we monitor the playback on either a turntable or tape machine, we will get the following interesting phenomena:

Wow . . . . $1000 \pm x$;
and
Flutter . . . . $1000 \pm y$;

The readout usually starts off, obviously, with the 1000Hz reference. But, then, with transients which repeat themselves with periodicity, the modulated compromise is flashed out as the instrument is toggled by variations in count. We can now calculate the true percentage of speed variation, manifest as percent FM:

$$\frac{(1000 \pm x) - x}{(1000 \pm x) + x} \times 100$$

Flutter determination is similar.

Choice of Frequency Counter

The Heath Company today puts out some of the most advanced and inviting Frequency Counters on the market. They are designed around TI's TTL logic IC's, and a first generation Schlumberger unit was used by the author.

(Continued on page 80)

*University of California

If they danced in the recording studio, what will they do at home?

We've gone about the serious business of designing the best possible loudspeaker for professional studio monitor use. With computers and anechoic chambers and all the rest. And, having gained a basic new insight into bass speaker performance, we've come up with what looks like a winner. The Sentry III.

We've run all the curves that prove, in a most scientific, sober fashion, that the system is really quite good. We've got polar graphs, and frequency response curves, distortion measurements, total power output curves, power handling test results, and SPL data galore.

But what happens when we demonstrate the Sentry III? Leading engineers (whose names we hesitate to divulge — but they are top men) leap about in their control rooms DANCING for heaven's sake! Snapping their fingers and feeling the sound, and reveling in the sensory pleasure of a clean first octave. And last octave too, for that matter.

And they run from one side of the studio to the other trying to find holes in the distribution of the highs . . . and they can't . . . and they LAUGH! It's very unseemly (but secretly quite gratifying). So we try to thrust our good numbers and graphs at these serious engineers, but they'd rather listen and compare and switch speakers. And make rude remarks about their old monitors.

Perhaps you, as a serious-minded music lover will stand still long enough to heed our technical story. And appreciate that the very same sonic virtues that intoxicated these recording engineers have an honest place in your home. Especially when your goal is music reproduction at or near original concert levels.

In fact, several recording engineers have ordered Sentry III speakers for *their own* living rooms. Some with the accessory equalizer that extends response to 28 Hz.

Please write for our technical explanation of the Sentry III. You'll also get the select list of dealers who have been entrusted to demonstrate this remarkable speaker. Pay one of them a visit . . . and bring your dancing shoes.

The New SENTRY™ III Monitor Loudspeaker

a Gulton COMPANY

Electro-Voice®

SENTRY III Frequency Response, 40-18,000 Hz ± 3 dB; Sound Pressure on axis at 4' with 50 watt input, 113 dB; Dispersion, 120° horizontal, 60° vertical; Size, 28½W x 20½D x 34½H; Weight, 156 lbs. $600.00 suggested resale net. SEQ active equalizer extends response to 28 Hz ± 3 dB, $60.00.

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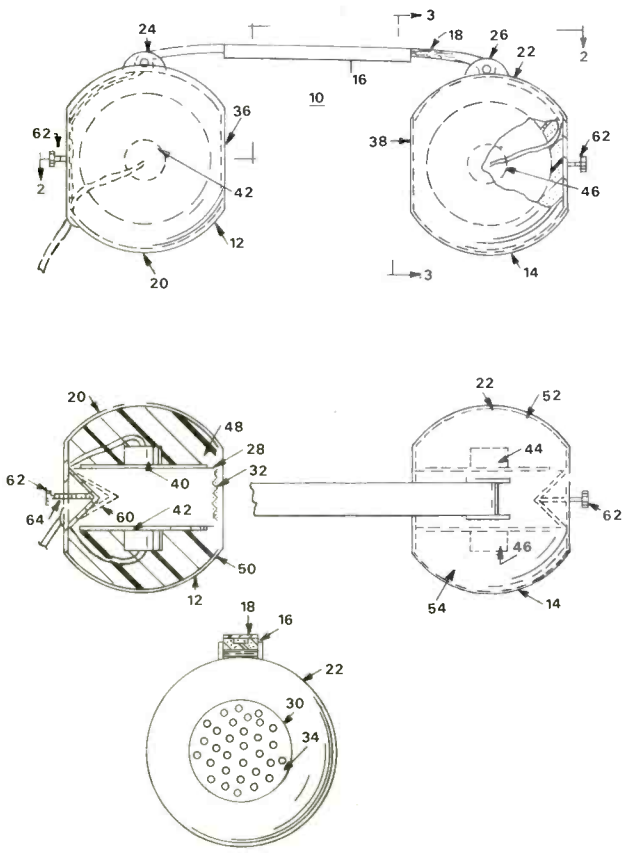
ELECTRO-VOICE, INC., Dept. 634A, 602 Cecil St., Buchanan, Michigan 49107

Quadraphonic Headphones

As far as we know, the first quadraphonic headphones were described in these pages in June 1970, by one Jon Fixler. Figure 1 shows the original patent specifications. The front and rear units are mounted back to back with the sound coming from the same opening. Another tape was shown with the two transducers mounted side by side. Well, ever since then experts and would-be experts have been arguing about the concept. Some say 4-channel headphones cannot possibly work; some say, well, if they do work the effect is purely psychological. It's all in the mind . . . Others, particularly those who make them, are full of enthusiasm and we hear about "breathtaking realism", "the ultimate in fidelity" and so on. Howard Souther, of Koss is more cautious. He says, "Even with two-channel headphones, what the listener hears is something larger, more dramatic than real life. We never claimed that we could reproduce sounds from the rear but we create a three-dimensional effect to fool the brain which picks up auditory clues and recreates reality." He went on to say, ". . . every acoustical engineer knows that the head must be free to move to pin point the sounds behind the listener." This is true: If you cover one ear you can still locate sounds from the rear but not very accurately. Location is performed by time, amplitude and phase differences *between* the two ears as well as by the 'shadow effect' caused by the head itself. All this information is applied to the brain which functions like a computer to signal the sound location.



If sounds were fed to both ears via four closely spaced transducers, would there be enough separation to fool the brain? We decided to find out by a series of tests and so we assembled a listening panel of five with the 14 headphones now available. Our signal sources consisted of a sine-square wave generator, white noise and a Pioneer 4000 quadraphonic receiver and a Sony 277/4 tape deck. The 4000 has switched positions for SQ matrix, Regular matrix and discrete. The SQ matrix is a semi-logic type and so a Fisher 504 receiver which has a non-logic SQ matrix was also used.

Test 1. Sine wave signals ranging from 400 Hz to 8 kHz were applied to the front and rear of one side of the headphones. With all phones it was not possible to tell which transducer the sound was coming from. In other words, the score was no better than 50% accurate.

Test 2. As above, but repeated with square waves. The score was slightly better at 60%. Not considered conclusive.

Test 3. This one gave us some positive results. We used a white noise signal and the score increased to an average of 75% with the Clark, JVC, Lafayette, Realistic and Mura receiving the highest marks. The phones were reversed with the same results in most cases.

Test 4. Similar to Test 3, but repeated with all four channels in operation. Results were substantially the same. It would seem that the differentiation is due to the asymetrical shape of the ear—the signal from the front transducer going down the ear canal and the rear signal passing across the ear with consequent minute frequency and phase changes.

Test 5. The final test—probably the most important one—took a considerable amount of time (and

produced a near-mutiny from the panel). It involved listening to various musical selections from 4-channel tapes, SQ, Sansui and EV discs which were transferred to tape for convenience.

Using the rear channels only, the sound image appeared between the ears in the center of the head. Adding the front channels widened the image, moving it forward with an increase in bass response. Obviously, results were very much dependent on source material. Four-channel tapes, expecially Enoch Light's Project 3, gave the best results, although we were not unanimous on this point. Some items sounded better with the Fisher non-logic decoder as the sudden shifts with the Pioneer logic proved somewhat disconcerting. The 14 units varied considerably in overall sound quality but all were considered superior in the 4-channel mode. There was a much greater impression of depth and spaciousness hard to define—in some cases the impact was quite startling. The sound image produced by two-channel headphones is quite different to that given by two loudspeakers—one reason is that both ears hear both loudspeakers. In the same way, 4-channel headphone sound is not what you hear from four loudspeakers. You may like it or you may not. Rock lovers seem to enjoy the excitement, the stunning impact of a group playing away in their heads, but if your musical tastes lie in other directions, listen before you buy. Incidentally, we found the sound to be more natural with a slight blending of the front channels. Some receivers have a control for this purpose—but make certain that it operates only on the front channels.

For the second part of the tests, the headphones were passed to C. G. McProud who carried out measurements using an acoustic coupler. We must emphasize that the curves shown are relative as the artificial ear or coupler does not duplicate the characteristics of the human ear. Several standards are in use and a IEEE committee is trying hard to establish more accurate standards that will find international acceptance.

How they were measured

All the response curves were measured in the same manner. Each was fed from a 12-watt amplifier—solid-state—in series with a 100-ohm resistor to simulate the typical headphone jacks in a receiver. The signal voltage was set at 3.0 at 1000 Hz, and the swept a.f. signal was provided by a Bruel & Kjaer QR-2009 record, sweeping from 20 to 20,000 Hz in a period of 50 seconds.

The phones were placed on an artificial ear (a shop-made one, and not necessarily "absolute" but still comparative) into which was mounted an AKG C-451E condenser microphone with an omnidirectional cartridge. Its output was fed into the condenser microphone jack of a Justi-Meter III and the response recorded over the sweep-frequency range. Each pair of phones was subjected to four cycles—left front, left rear, right front, and right rear. The reference on the chart recorder was set at center scale for all phones except the Mura, which was somewhat lower in sensitivity at 1000 Hz compared to its overall loudness.

Sound pressure level (SPL) was measured at 1000 Hz in comparison to another pair of phones which had a sensitivity of 92 dB when fed with the standard 3-volt signal. Isolation has been measured in the past by feeding a 400-Hz square wave into the amplifier, reproducing the output on a loudspeaker and measuring the output without the phones on the artificial ear and comparing it with the output with the phones in place on the ear. For all the phones in this group, the isolation was better than 20 dB, so no figures are presented for each separate pair.

The Mura phones mentioned indicated a lower SPL than most of the others. Observation of the response curve will show that 1000 Hz is considerably lower than the overall sound level, which accounts for the lower-than-average figure for SPL.

All curves were run at the "slow" writing speed, which is 12 dB/sec. At the "fast" position—approximately 40 dB/sec, the variations are not unlike those from loudspeaker response curves run in a room—with lots of sharp peaks and valleys.

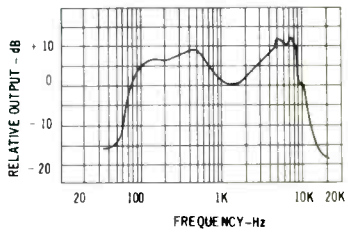
In some cases, level differences between left and right phones could have been corrected with the controls on the phones themselves, but differences between front and rear provided for no adjustment.

Clark/4CH-A Four-Channel Phones

SPL: 74 dB, Isolation: 13 dB

These phones are the most unusual in appearance, consisting of very wide black plastic cups, horizontal in shape and measuring 4¼ in. wide by 2¾ in. high and 2¼ in. deep. These are fitted with exceptionally soft molded foam cushions 5¼ by 3½ inches, and curved to fit the side of the user's head. Weight is 23 oz. Sensitivity is lower than most, and isolation is somewhat less than the other models tested, probably due to the plastic cups which were especially sensitive to touch. The headband is metal, readily adjustable, and covered with a foam-filled vinyl pad, making the phones comfortable to wear. The round coiled cord, in black, extends to 12 feet, and is fitted with a white stereo plug for the front units, and a red stereo plug for the rear. Overall sound was smooth with better apparent front/rear separation than most.

The small unit shown with the phones is a decoder, Model DC-2A so 4-channel sound can be had from a normal two-channel input. It consists of a plastic box measuring 2¼ inches wide by 2¼ long and 1¼ deep with two stereo jacks mounted on it, one labeled front and the other rear. An 18 inch cord is attached with a single stereo plug at the end. Insertion loss is negligible as the matrix is a passive arrangement using two hybrid transformers. Mixing ratio is said to be 0.7:1. In practise, the results were very similar to those given by the Pioneer regular matrix. A slight blending of the front channels was preferred with some program material. Price: headset, $80; with decoder, $95.



JVC Model 5944 4-Channel, 2-Channel Compatible Headphones

SPL: Front, 82 dB, rear 79 dB.

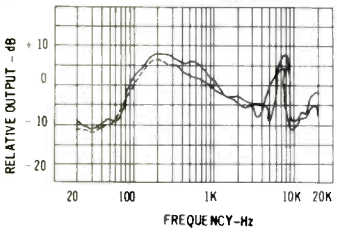
These phones specifically indicate that there are two separate transducers, and they are placed in a horizontal position, so the headset appears to be broad, as compared to most in which there are two transducers in each cup, but externally the phones appear identical with conventional stereo models.

Nominal input is 1 mW; maximum is 100 mW. Diaphragms are 1½" in diameter, with ¾" voice coils. The two transducers are tilted slightly together at an angle of 145 deg. The headband is well padded with black vinyl covering over foam. Adjustment screws retain the sliding cup bails. The cups are glossy

plastic in a dark gray—almost black—with foam-filled vinyl pads measuring 5 in. wide by 3½ in. high. Weight is 19 oz. The phones are equipped with a 6-ft. 7-in. straight cord with two plugs, each with a small plastic tag to indicate "Ch. 1 (L) and Ch. 3 (R)" or "Ch. 2 (L) and Ch. 4 (R)" for front and rear signals respectively.

For listening to 2-channel (conventional stereo) either plug may be inserted into the headphone jack, or an optional twin cord (TWC-1) may be used to parallel the front and back units to provide the same volume at a lower level and with consequent lesser distortion.

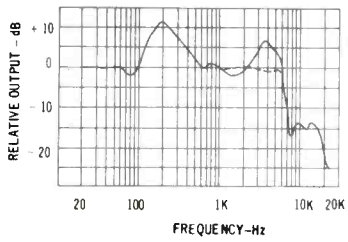
Each cup has a slide switch which is marked "Phase Norm/Rev," which enables some interesting effects to be obtained. In some cases the reverse phase position seemed to widen the stereo image, in others it had the impression of constricting it. For instance, SQ records sounded better with the controls in the normal position, but ordinary records played via SQ matrix, sounded better with the phase reversed. Price: $49.95.



Koss KO/747Q 4-Channel Quadraphone

SPL: Front, 99 dB; rear, 95 dB.

Similar to several other Koss phones is the KO/747Q, which has a brown plastic headband cover with foam padding, and with brown plastic earcups and brown vinyl fluid-filled pads measuring 4¼" x 3¾". Weight is 22 oz. Each cup has a rotary-type disc volume control, and the left cup is fitted with a rocker switch for 4-channel or 2-channel listening, the two elements in each cup being paralleled in the 2-channel position. A double 10-foot coiled cord is provided with the usual two stereo plugs, one black for the front channels and the other gray for the rear. Price: $55.00. Channel matching was within 2 dB except between 3 and 6 kHz.

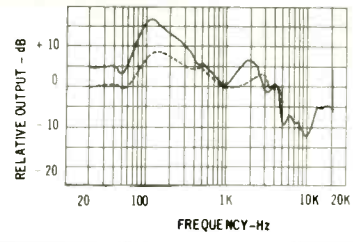


Koss K/6LCQ 4-Channel Quadraphone

SPL: 92 dB.

These phones are somewhat less expensive than the K2+2 described previously, possibly because of the absence of the plastic carrying case as one reason. They have a brown plastic headband cover, foam padded. The cups are brown plastic, with foam-filled cushions measuring 4¼" x 3¾". Weight is 22 oz. Each cup is provided with individual balancing slide-type controls which permit balancing front and rear and right to left for optimum listening pleasure. In addition, the left cup has a rocker switch labeled 4-chan and 2-chan. In the 2-chan position, the driver units are paralleled to double the radiating area for increased bass-range efficiency. The left channel showed a rise from 400 Hz down, increasing to +5 dB at 100 Hz. Overall sound was smooth and easy to listen to.

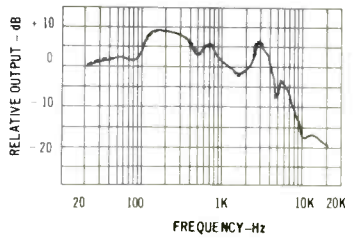
A 12-foot coiled cord is provided, emanating from the left earcup (as usual), and two stereo plugs—one black for front in 4-channel listening or for the input for stereo, and the other gray for the rear channel when listening to four channels. Price: $39.95.



Koss PRO-50

SPL: 98 dB. Channel matching very close.

Stepping up again in the price range is the PRO-50. A brown plastic headband cover is foam padded and, of course adjustable. The cups are brown plastic, with liquid-filled vinyl pads 4½" high by 3½" wide. The left cup is fitted with a 4-chan/2-chan rocker switch, and individual volume controls on the two cups permit adjustment. These controls take the form of serrated disks labeled 0 to 10 and permit balancing the outputs of the two phones. The phones are fitted with a 12-foot coiled cord with two stereo plugs—black for front and gray for rear. For stereo listening, the rocker switch is flipped to the "2" position, and only the black plug is used. Channel matching was very close and sound was well balanced. The volume controls were judged easier to use than other types. Weight is 22 oz. Price: $70.00



Koss K2+2 Four-Channel Dynamic "Quadraphones"

SPL: front, 93 dB: rear, 96 dB

Koss was undoubtedly the original high-fidelity headphone manufacturer, if we are to exclude some professional units such as RCA's MI-3453 or some Western Electric models from the early sound moving picture days. And Koss

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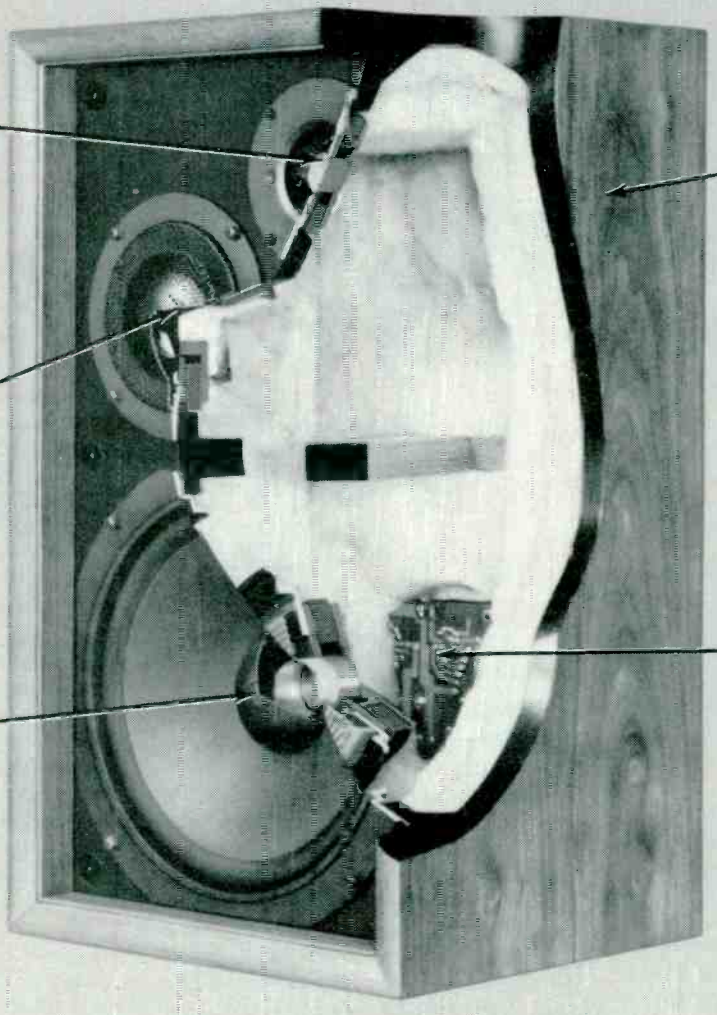

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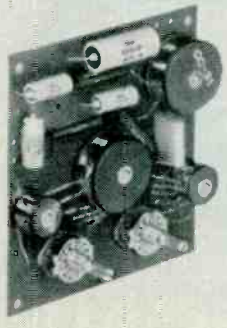

Close-up View of 3/Way Intergrated Crossover Network

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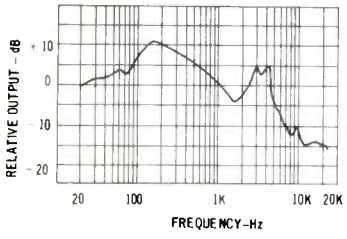
probably has more models than anyone else. The K2+2 combines two transducers—dynamic, of course—in each cup, and in addition provides volume controls in the cups to control the front-unit level—a convenience for four-channel listening. In addition, there is a "4-Chan/2-Chan" switch which parallels the front and rear units in both phones for conventional stereo listening. These phones have a black plastic headband cover, well padded with foam. Cups are black plastic, with metal trim, and the fluid-filled ear cushions for user comfort. These pads measure 3½" wide by 4½" high. A small knob on the bottom of each cup controls the front unit volume, and the 2/4 switch is a rocker type on the left cup. The double coiled cord extends to 10 feet, and a black plug is used for the front—channels 1 and 3—and a gray plug for the rear—channels 2 and 4.

The Koss K2+2 phones are packed in an attractive plastic case 14" x 10" x 6", with foam padding inside, die-cut to accommodate the phones and hold them securely in the case. Weight is 22 oz. Price $85.00.

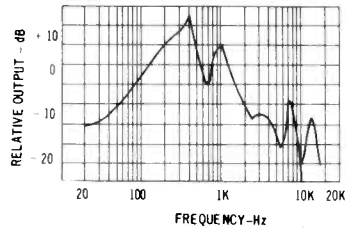
Channel matching was very close and overall sound was one of the smoothest of those tested.



Lafayette F-4400 Four Channel Stereo Headphones

SPL: 88dB, single flat steel adjustable headband, covered with foam-filled black vinyl pad. Horizontally mounted separate transducers in gray plastic cups 5¼ x 3½ in., with ample permanently attached foam-filled black vinyl-covered pads. Sound emanates from small arcuate openings near the ends of a solid plastic diffuser, thus directing the sound from further to the front and rear than in most types. Small slide switch on left phone converts from four-channel operation to two-channel for conventional stereo listening. Cord is parallel flat type, 9½ ft. long, terminating in two molded stereo plugs—black for front and gray for rear, with designation molded in the bodies of the plugs in addition. Weight is 28 oz.

According to the leaflet enclosed with the phones, a special built-in frequency dividing/phase shifting network will produce a 4-channel effect from a 2-channel source when the mode switch on the phones is set to "2-CH". We found it certainly gave a more spacious kind of sound but it was generally considered inferior to a regular matrix decoder. Price: $39.95.



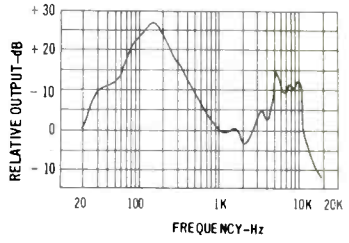
MURA QP-300 Quadrasonic Headphones

SPL: 67 dB.

With a brown vinyl covered pair of bands, the Mura QP-300 offers a different method of tightening the pressure against the ears. The cups are of brown plastic, with lighter brown foam-filled pads. The cups are deeper than usual, measuring 4" x 3¾" at the pads, but with a depth of 4 inches over the pads. The cups are vented at two sides on the rear with louver-like openings as part of the acoustic circuit. Weight is xx oz.

Two units are used for each channel, that's right—a total of eight! The low frequency transducers are loaded by a pressure plate and slots conduct the sound to openings placed near the treble units mounted on each side. Overall sound was a little too bass-heavy for most of the panel but balance could be restored by judicious use of the tone controls.

The phones are fitted with a flat cord 7 feet long, and are packed in a vinyl zippered case 10 in. square by 4 in. high, lined with blue felt and sufficient padding to make an effective carrying case. Price: $49.95.

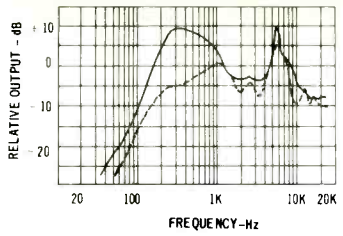


Teledyne Ph-220 4-Channel Headphone

SPL: 79 dB.

This is another "side-by-side" unit similar to the JVC and the Mura models. However, in the Teledyne, the transducers are mounted in a straight line. The brown vinyl-covered foam-filled pad has extendable gold-finished metal bands slotted to accommodate the thumbscrews which secure the phones at the desired position. The light buff earcups are fitted with brown vinyl foam-filled pads 4¼ x 3¾ in., the former dimension being width.

These phones have an eight-foot flat cord with two stereo plugs and black plastic indicators for front and rear. Also furnished with the phones is a twin connector consisting of a stereo plug attached to two stereo jacks for paralleling the front and rear units for stereo listening. The Teledyne PH-220 is sold by Olson Radio Corporation. The left channel had a reduced response below 1000 Hz. Apparent separation was one of the best. Weight is 22 oz. Price: $44.98.

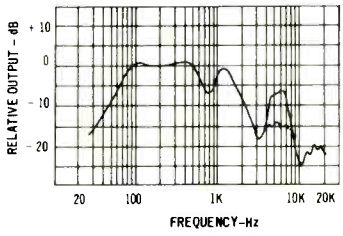


Stanton "Dynaphase Sixty-Five/Four C"

SPL: 95 dB.

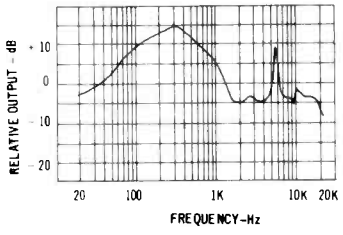
Differing from the general run of headphones is the Stanton 65/4C model (to abbreviate). It has a black vinyl foam-filled headband cover, with adjustable bails to the two blue cups with chromed and plastic nameplates on the back of each. The ear cushions are large (4¼ x 4¼ inches) and foam filled with considerable depth so the overall depth of the cup and pads is 3 inches. A single round cord extends from the left cup for 24 inches where it enters a plastic switch box 1¼ x 1¾ x 1 in. to accommodate a slide switch labeled 4-chan and stereo, paralleling the units in the stereo position. A double coiled cord extends from the switch box and extends to 9 ft., terminating in two stereo plugs—one blue for the front and one black for the rear. These plugs are 1 in. wide x 2⅛ in. long, and might present a problem if the headphone jacks are close together on the receiver. Weight is 19 oz.

A number of accessories are available optionally to provide for separate volume and tone controls for the two phones (four circuits)—two being required for four-channel listening. Also available as an option is a 25-foot extension coil cord. Overall sound was smooth with good balance. Styling and finish was one of the best tested. Price: $64.95.



Realistic NOVA 44 Stereo/4-Channel Headphone

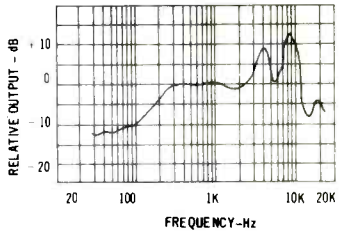
Radio Shack's entry into the stereo/4-channel field is this NOVA 44 model, which appears to be similar to the JVC, in that the two transducers are mounted side by side, thus making the earcups wider than high. A soft foam-filled vinyl headband cover—black in color—matches the black plastic cups and the black vinyl foam-filled cushions which measure 4¼" wide by 3¾" high. The units are again mounted at an angle—as in the JVC—but in the Nova the angle is close to 90 deg. The coiled black cord will extend to 15 feet, and is fitted with two molded plugs into which the "F" and "R" are molded with a square shank. Weight is 24 oz. Bass response was judged rather too predominant but this could be corrected by the tone controls. Price $39.95. (The Radio Shack Catalog Number is 33-1016.)



Superex QT-4 Four-Channel Stereo-phone

SPL: Front, 80 dB

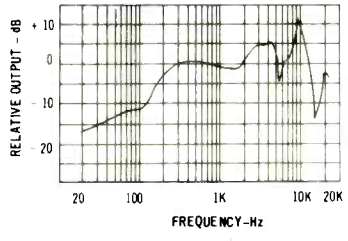
With its vinyl-covered dual wire headband and adjustable slides, the Superex QT-4 is the first of this company's entry into 4-channel phones. The cups are of off-white plastic, with vinyl covered foam-filled pads, measuring 4⅜ x 4⅛ inches. Four identical and matched units are mounted in the phones, with a coiled black cord which extends to 15 feet. Two stereo plugs terminate the cord—one with a red identifying sleeve on the cord where it enters the plug to indicate the rear channels. Weight is 16 oz. Overall sound was smooth but lacking in bass. Balance could be obtained by using the bass tone controls. Price: $65.00



Superex QT-4B Quad-Tette Four-Channel Stereophones

SPL: 80 dB.

These phones are similar to the QT-4, but in addition to this similarity they are fitted with a tiny slide switch on the left phone to permit paralleling the front and rear units for conventional stereo listening. Weight is 16 oz. Frequency response was found to be similar to the QT-4's and most of the panel preferred to use some bass lift. Price: $50.00.



AUDIO ETC

Edward Tatnall Canby

The CD-4 Cartridge

A great truth seems to have been intruding itself, these last months, upon my observant consciousness. I haven't cultivated it—the thing just grows of its own accord. It is that the future health of the LP disc, and in particular the idea of four channels on disc, depends beyond all other factors on the phono cartridge.

Off all things! And as if we hadn't already brought that particular mechanical/electrical transducer to an absolutely extraordinary level of performance in the long quarter century during which the modern magnetic pickup has been on the market. That performance is already far beyond anything most of us would have imagined in the ripe old days of mono, some fifteen-odd years back, at the time stereo first loomed. In fact, at that time there was much engineering grumbling as to the disastrous effect of stereo upon the elegant simplicity of the mono cartridge, then at a very advanced stage of development.

It is the engineer's privilege, of course, to grouse about the very problems which he will soon brilliantly solve. They do it every time. A kind of protective coloration, in case things don't work out. So the mono cartridge men, grumbling hard, went to work on stereo and look what they've done. Year after year, they have gone right on improving the unimprovable. And though the remaining area for advancement would seem to get smaller and smaller, somehow it doesn't; the designers just push things out a bit further in various impossible directions. Crazy and wonderful, with absolutely no reservations on my part. I can only admire.

I am not wandering in vague generalities here. These thoughts are occasioned by recently converging factors, new and revolutionary, within the parameters of the still-potent disc format. I refer, of course, to the CD-4 "discrete" quadraphonic system and its radical new cartridge requirements. Just the thought of them has been enough to jolt the entire cartridge industry. And not without results, CD-4 or no.

It has been conventional, for instance, to measure our components according to that linguistically pleasing formula *20 to 20 KHz* that being a stylized realization of more or less realistic hi-fi needs in terms of frequency range. I have before me an individual cartridge run, for example, performed on an Audio-technica cartridge now in my phono system, which reads as a virtually flat line between those two points. At each end there is a vertical drop to zero, *clonck*. But the specs on the cartridge suggest something a bit different: the cartridge response is listed as "*5 - 45000*", if you will forgive the old-fashioned cycles. No cloncks.

Our measuring equipment, industry-wide, has taken on the 20 - 20K convention as a matter of convenience, and even art, in virtually every common display including this familiar cartridge "run", pen traced, and the assorted scope trace patterns. At 20KHz the measurements just quit. They don't tail off or fade away; they stop. The pen drops to zero. The scope trace repeats itself in a bright 20K line and goes no further. But, you see, now we are up against a drastic changeover, and CD-4 has set it off, with a vengeance! The spark that sets the fire, the straw on the camel's back? Take your choice.

It's not as though these measurements couldn't go right on out, if we so desired. It is simply that there hasn't been much of a reason to do so in the hi-fi audio measurement area. For my non-engineer mind the reasons are, well . . . reasonable. We don't communicate much of importance above 10KHz and we can't hear at all when you get up to 20KHz. True, we do need to get a ways into the supersonic, even so, since what goes on up there, mechanically and electrically, is related to effective sound propagation lower down. So—take 20KHz as a convenient round figure, safely into the supersonic but not *extremely* supersonic. That's about it.

Suddenly, with CD-4, we have a drastic need to go higher, much higher, and for a new reason—a specific carrier signal, two of them in every groove, set down at the extraordinary high level of 30 KHz as a mean. Not extraordinary in general sonic terms nor in electrical, but in a standard LP record groove—*very* extraordinary. Enough to set the jitters and titillations going all over the place. How to manage it? That is—how to play such a groove? (We'll forego discussion of the problems in cutting the same, via slow-speed turntables.) Specifically, if I have picked up the proper info, we are here directly involved in the crucial matter of resonances (so vital in the bass area when it comes to loudspeakers), and in the means whereby cartridge makers have coped with that extremely delicate and difficult factor in cartridge system response. For it seems that the resonance basically determines the response extent, no matter how many good tricks you invent to cope with the same.

Non-engineer readers should understand that, generally speaking, a point of resonance is not only a point of distortion—overly easy and exaggerated response—but also a point of no extension. For it is a physical characteristic of all sorts of resonances that frequency response, whatever it is, drops off sharply beyond resonance in a tell-tale descent. It graphs like a ski slope, fast. Elementary, Herr Watson, he said. But most extraordinarily vital right now.

Yes, cartridge resonances may be damped, flattened down, in many ingenious ways, (as in loudspeakers), often combining electrical and mechanical factors so as to cancel out and arrive as net flat, if you see what I mean. Then the response is good and the drop-off is at least non-catastrophic. But alas, it is still there. There is no hump beforehand but the drop drops, just the same. We can manipulate the resonance point very nicely, pushing it higher and higher via more and more delicate mechanical components: but you know where *that* leads. Especially for people like me who are all thumbs. The devil and the

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With the Sony SQD-2020, you can enjoy 4-channel reproduction from SQ records or SQ broadcasts at their very best. Or from matrix records or broadcasts, other than SQ. Or from discrete sources. You can play regular stereo in stereo, or with quadraphonic enhancement.

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deep, blue sea.

Thus the upper resonance point has always been a main concern in cartridge design, as refinements in the mechanics have pushed it gradually upwards, eventually off the scale into supersonic inaudibility. There, it would seem to have been quite safe—for you couldn't hear it. For awhile, the state-of-the-art cartridges had resonances around 15KHz which, flattened out, gave excellent sound with minimal peaking right up to that high point, already beyond plenty of ears. In recent generations of stereo cartridge that resonance has gone even higher, tending to center near 20KHz, and the nearly flat, or flattened, response has been pulled all the way out to this level before the inevitable drop-off. Adequate, to put it mildly! Adequate, that is, for all standard LP/45 discs including every variety of matrix quadraphonic, since these are contained within the standard LP frequency spread.

The new Shure V-15 Type III cartridge, announced to the press early last spring via a most interesting seminar held at Shure's home base near Chicago, is an advanced fourth generation transducer (if we count Type II and Type II Improved, with altered stylus assembly, as two generations) which beautifully sums up this whole era of steady refinement and development in the subtleties of cartridge designing. I am purposely limiting myself to one factor—there are plenty more which, in fact, go into creating the resonance and helping to flatten it down. This super-refined model boasts many new "highs" in performance, most notably its extraordinary tracking ability, beyond any of its notable predecessors. But let me note merely the wider, flatter extended frequency response in the Type III.

The original V-15 had a resonance at about 15KHz, with good, if not totally flat, response up to that point, then falling off. (Something is left, as you go further up, but the "slope" is fast, down to nothing.) The Type II Improved, with improved stylus, brought this figure up to 20KHz with even better flatness, out to that super-hi point. It is a lovely cartridge. The new Type III makes use of a laminated magnetic structure and new extremely light (but strong) stylus mass to extend the resonance to 23KHz, with an astonishingly flat response straight out to this point. Putting aside the Shure "trackability" which, I assure you, is of the greatest interest and importance, you can understand that in just this one respect of flat extended frequency response we have in Type III a splendid and consistent degree of improvement over the earlier high-quality cartridges in this particular line of development. What more could one ask.

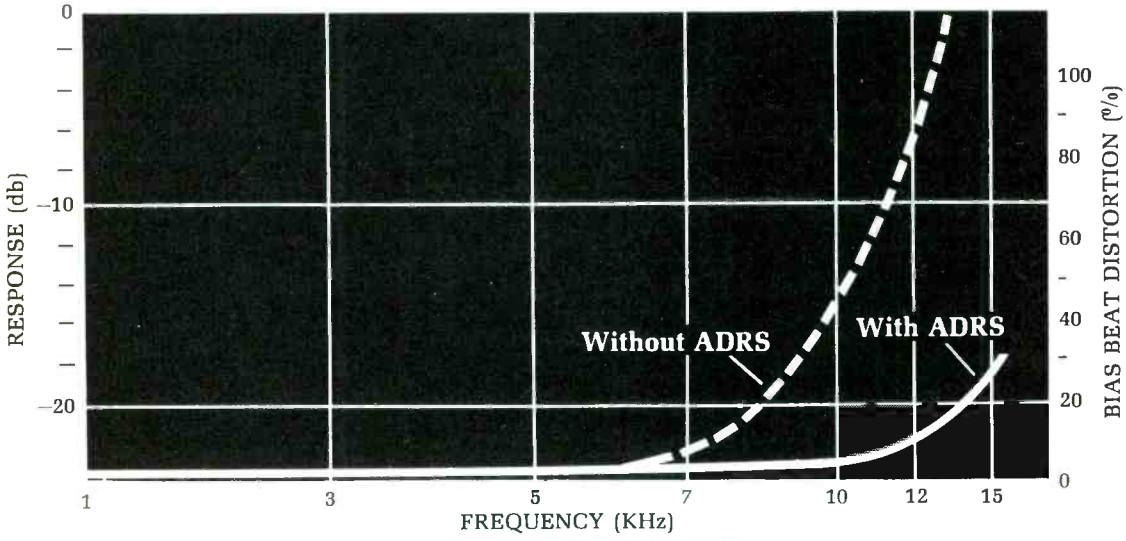
Well, it's so simple. Indeed, I went out to Chicago just to enlighten myself on this very matter. You see, the CD-4 quadraphonic disc requires an even wider frequency response, out well beyond 30KHz and *flat at that point*, if four-channel "discrete" sound is to be reproduced with optimumly low distortion and separation.

Flat is the key word. The cartridge that plays the CD-4 disc must reproduce a frequency modulated signal, two of them, one on each face of the groove, that is based on a 30KHz carrier, mechanically inscribed in the groove and to be traced by the cartridge. Since FM signals vary up and down in frequency to each side of the central "norm" where the carrier, so to speak, is at rest when no signal is modulated, the cartridge must reproduce *both* sides, above as well as below, and reproduce them *equally*. You cannot do that on a ski-like downslope! The upper side will be weaker, lower in level, than the down side.

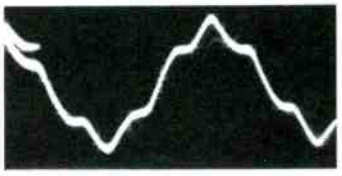
Now if this super-hi pair of signals

ADRS*

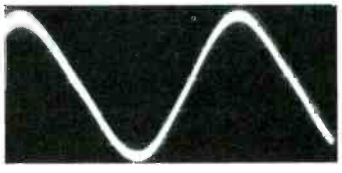
The curve that bent the Cassette Market out of shape.



You are looking at a distortion measurement curve. It compares high-frequency distortion found in other cassette decks to the exclusive new AKAI cassette line equipped with ADRS. The results are extraordinary. ADRS eliminates almost all distortion above 8,000 Hz. And only AKAI combines ADRS and GX** Heads with Dolby to give you the most perfect cassette recording in the world today.



Without ADR System



ADR System

Illustrated at left are the actual output curves of a 13KHz signal from a Dolby equipped cassette deck without ADRS, and a comparable curve from a new AKAI GXC-46D cassette deck with ADRS, GX Head and Dolby. The clear, undistorted signal is a pleasure to behold. And an even greater pleasure to hear.

*Automatic Distortion Reduction System
**Glass and Crystal Ferrite Head

GXC-65D

Invert-O-Matic - Automatic Continuous Reverse - Mechanism guaranteed two full years . . . parts and labor

GXC-46D

Why settle for second best in cassette decks?

Only AKAI offers you ADRS, GX Heads and Dolby at a price no more than you would pay for decks equipped with Dolby alone. See . . . and most of all hear . . . our revolutionary new GXC-46D and GXC-65D. Your ears will make up your mind for you.

AKAI™

AKAI America, Ltd. / P. O. Box 55055, Los Angeles, California 90055

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were of the normal, ordinary sort, the drop-off in the higher side would be no more than that, like a bit of supersonic tone control, a roll-off in response but nothing worse. All, of course quite inaudible, but let that pass. What we have, however, is a new sort of signal (at least for commercial discs), an FM modulation of a pair of mechanically inscribed carrier waves, right in the groove. As in FM tuners, therefore, a simple but devastating phenomenon takes over in the demodulating of those signals. An *unequal* reproduction of the FM carrier swing, above and below the central frequency (I am using my own lay language, unofficial) results in plain, old fashioned distortion of the resulting audio signal. Ugly, unpleasant sound. And because the CD-4 system matrixes—whoops, I'd better say "electrically mixes"—its four discrete channels for recording, then unmixes them again in the reproduction, that distortion will end up in *all four* quadraphonic channels. Ugh. Not good.

So your CD-4-capable cartridge, then, must (a) be able to pick up *something* at 30KHz (many don't) or there will be no quadraphonics at all. Just, shall I say, duophonics, out of four speakers. And even more vital, (b) the cartridge response must be reasonably *flat*, not sloped, in that high area, from below to *well above* 30KHz. Otherwise, distortion.

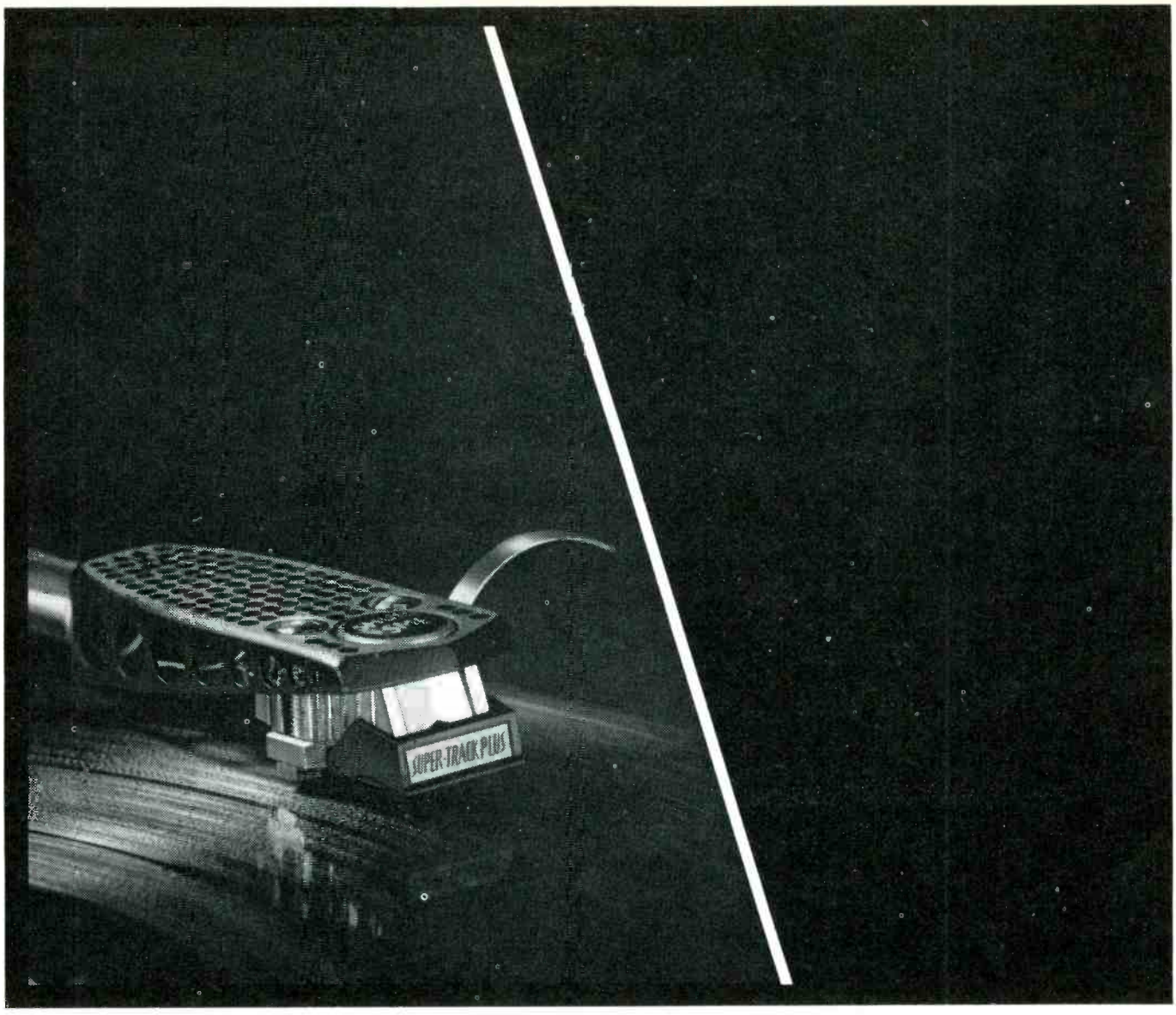
As a matter of fact, better no response at all. You can play a CD-4 record in stereo with any cartridge, of course. It ignores the carrier signals. They don't register (though they may perhaps invoke complications in your stylus motion—that is a moot point). You can play your cheap standard cartridge through a CD-4 demodulator and get quite a pleasant sound, *providing* the cartridge is totally insensitive at 30KHz. The regular pair of groove signals comes through and is nicely distributed in, as I say, four-way duophonic stereo. No 30KHz response, no distortion!

But if your cartridge has *some* response on the lower side of 30KHz, and *less* response on the upper side, then you will have yourself a problem. A dose of muddy sound, together with the discrete four-way separation. So it goes, as well as I can gather, a rank non-engineer.

We may now bounce back to the new cartridges and their present and future characteristics. First, you are asking *me* whether all this really matters. I.e., will there be lots and lots of interesting CD-4 discs around to get played by our cartridges?

I know no more than the next "expert" but I can put it safely this way. There is not the slightest chance that the CD-4 disc, from RCA and other companies, will *not* be available in the near future. (Nice double negative.) Nobody has to play them, but many will want to, and in full four-way "discrete" sound. Whether the long-absent decoding equipment will also be around in force, soon, is another story but let that pass, too. We're talking about cartridges. Any way you look at it, CD-4 *is* now a factor and *will be*, conservatively speaking, at least in the nearby future. (Some say it is dead already; others say it is on the verge of triumph. I say merely that it is *here*.) And so we will need new cartridges, in all ranges of excellence and cost, developed or modified to meet the new requirements. Even the junkiest record player that claims to play discrete discs in quadraphony will have to cope *somehow* with that elusive little pair of super-signals in the new groove walls.

Now you are asking *me* what Shure had in mind in respect to its V-15 Type III, which I am "shure" is going to prove to be one of the best top-of-the-line American made cartridges. I will have you know that I am not on the



anything II could do III can do better!

Several years ago, we decided that our next challenge would be to go beyond the best there was. Our computers told us we had taken the existing cartridge structure and stylus assembly of the V-15 Type II Improved as far as we could, and that hereafter, any improvement in one performance parameter would be at the expense of performance in some other parameter.

Therefore, over the past several years, a wholly new *laminated cartridge* structure has been developed, as was an entirely new stylus assembly with a 25% reduction in effective stylus mass! These developments have resulted in optimum trackability at light tracking forces (¾-1¼ grams), a truly flat, unaccented frequency response, and more extended dynamic range than was possible even with the Type II Improved, without sacrificing output level!

If you like its sound today, you will like it even more as time goes on. In fact, to go back to any other cartridge after living with the Type III for a short while is simply unthinkable, so notable is its neutral, uncolored sound. You must hear it. $72.50.

INTRODUCING THE NEW

SHURE V-15 TYPE III

Super-Track "Plus" Phono Cartridge

Shure Brothers Inc. • 222 Hartrey Ave. • Evanston, Ill. 60204

In Canada: A. C. Simmonds & Sons Ltd.,

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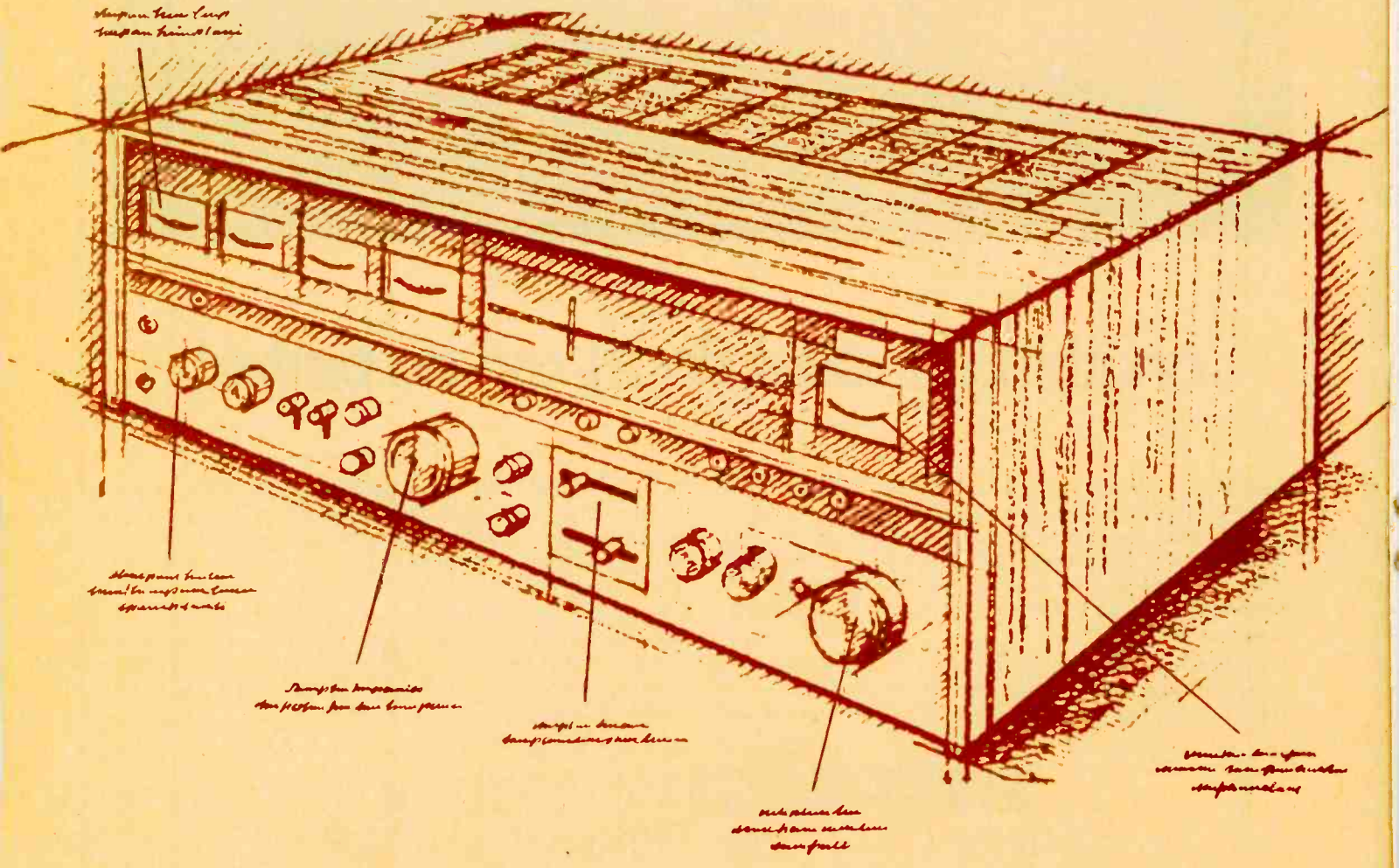
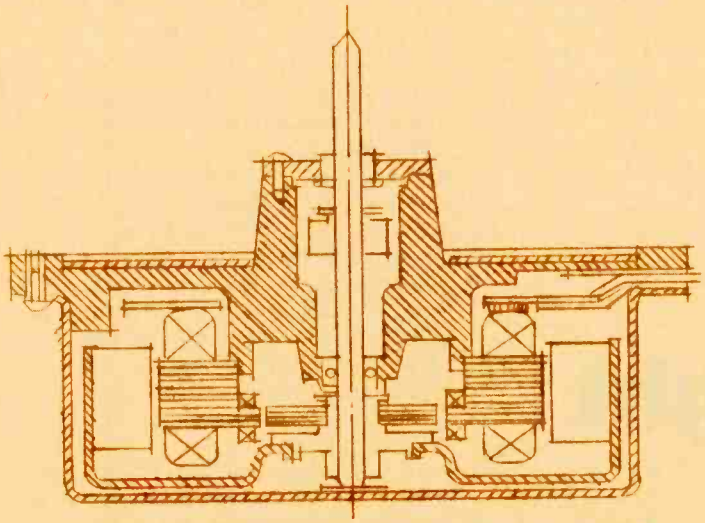
Introducing a new word in the Hi-Fi vocabulary:

Technics (tek·neeks') *n.* a new concept in components.



A concept that focuses the research, experience and skill of an electronics giant on the creation, design and production of components. A total commitment to audio componentry without peer.

The research has already produced over 23,000 patents. Firsts like: direct drive motors, Hot Pressed Ferrite heads, HiZNR resistors, automatic reversing micromotors, Exicon X-Ray television and new kinds of miniature fiber optics.



CROSS SECTION OF DIRECT DRIVE MOTOR

Experience has taught us to be extra finicky about the parts we use. So we design and make virtually every part of every component ourselves. From the newest type of monolithic I.C.'s to our own exclusive four-pole MOS FET. From the epoxy resin coils in our multiplex sections. To the precision controls on the front panel.

We have learned the virtue of being totally unmerciful in test procedures. All designs are put through tortures like baking, freezing, drenching, shock, extreme stresses and prolonged humidity. Because any unit that can survive that kind of punishment is capable of years of faithful service under normal conditions.

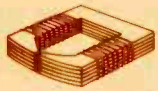
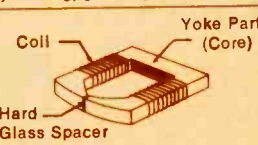
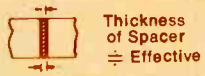
We also know that there is no substitute for all-out quality control. Each subassembly is checked visually and electronically as it is put together. And checked again as it joins the main assembly. Every complete unit undergoes 50 performance checks, involving 170 different test points and measuring things like IHF sensitivity and power output. Sixty additional tests assure perfect appearance and proper operation.

All our units have earned the coveted listing for safety of Underwriters Laboratories®.

The Technics concept has already taken shape. In a line of discrete 4-channel receivers. Direct drive turntables. Dolbyized™ cassette decks. And reel-to-reel recorders. That are ready for delivery today.

So, now that we've been formally introduced, why don't we get to know each other.

COMPARISON OF PERMALLOY AND HPF HEAD

	Permalloy Head	HPF Head
Material	Alloy of Ni, Mo and Fe	Powder of MnO, ZnO and Fe_2O_3
Manufacturing Method	Punching by a press	Sintering at a high temperature under high pressure
Core	Piles of metals	Precision made block, produced by cutting, grinding and polishing.
Shape		
Finished Gap	Gap Spacer (BeCu) 	Gap Spacer (Hard Glass) 
Electric Loss	Big	Small (⅓ of the permalloy)
Hardness	130 ~ 140 HV	630 ~ 700 HV (5 times harder)
Life	about 1,000 hours	about 200,000 hours

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Technics
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Shure staff, and cannot speak for Shure. I will also say, on the side, that Shure really has me baffled. The Type III, by their own specs and charts, is way down at 30KHz and sloping off like a ski jump, too. I do not see how it can be expected to play a CD-4 disc quadraphonically, though it should do an absolutely superb job on any other type of disc, whatever. So that is that, for all to see and hear. Why?

Strictly on my own, I would suggest several speculative possibilities (and I have not consulted Shure, aside from the company's own amply provided seminar and publicity material).

1. Perhaps Shure has deliberately put the CD-4 disc aside as unlikely to be an important factor in the market for their Type III cartridge. Possible. Reasonable from some points of view. CBS and Sony would agree. This viewpoint may be right. Or it may be wrong. My own feeling, cautiously, is to disagree.

2. On the other hand, perhaps Shure has ready some modifications of its V-15 Type III which could quickly extend its range to accomodate the 30KHz carriers with top quality (flat) response? Could be! But they have not said so. Somehow, with all those problems of resonance and the known exhibits of Shure's V-15s to date, moving up from 15KHz to a high of 23KHz through such beautifully calculated refinements in all parameters—and especially in trackability—I wonder whether a sudden big jump, say flat out to 40 or 45KHz before rolling off, would so quickly be possible? But this is really beyond my competence even for guessing. And if possible, why wait? Why bother to make two Type III models when one would do? *Dunt esk*, as Archie the cockroach used to say.

3. This third possibility seems most unlikely. Perhaps Shure, like many big companies, is so immersed in its own dynamic work that it doesn't accurately evaluate what is going on outside. After all, research on the Type III must have begun years back, before the CD-4 disc was announced. Maybe, just maybe, that methodical development has simply gone forward without fail, all the way to its triumphant conclusion, without any influence at all via this new need for a 45KHz response? Could be. But I don't believe it.

So I really am baffled. What would *you* do, if in mid-development of a splendid cartridge like this Type III a sudden new emergency declared itself? Give up, in the face of CD-4, and start all over again? Modify your design, perhaps with considerable anguish and compromise, to accomodate the new possibility? Develop alternative models, one with CD-4 capability and another (very likely a better cartridge under the circumstances) without?

Believe me, these are tough questions involving very difficult technical decisions, and all the cartridge makers are having to go through the process. I do not think any of us, at least outside the cartridge engineer's own domain (and maybe not even there), can know just what has been in Shure's mind. My best guess, is sheer honesty and integrity. I should suppose that Shure was unwilling to compromise a superb design, so carefully matured over the years, by any sort of sudden, drastic alteration. I would have to agree. To find out for yourself how it is, just go out and look and listen to this Type III cartridge, and compare its performance with that of its own predecessors in the line. Not even CD-4 should be allowed to get in the way of *this* beauty. Maybe it's as simple as that.

It remains, then, to look around briefly elsewhere—not everywhere, since this is not a cartridge survey. A year and more ago, for instance, I witnessed a Stanton Magnetics demo at which the slogan, if I remember, was some-

(Continued on page 69)

Albeit an expensive bargain, but a bargain nevertheless. For the Model Fifty-Four is without question the finest stereo receiver we have ever made. Indeed, it may well be the finest stereo receiver *anyone* has ever made. And if that wasn't enough, the Fifty-Four is also an absolutely incredible four-channel receiver. With 60 watts (RMS) per side in the two channel mode and 25 watts (RMS) per side in the four-channel mode, the Fifty-Four is an extraordinary power package. It's considerably more compact and sleeker than competitive models, yet it will outperform the biggest and bulkiest of them with ease.

And it's so very easy to use.

All the controls are clearly indicated and conveniently located on the front panel. You can change from one format to another—two channel, Stereo 4, SQ, etc.—with the simple flip of a switch. In addition, there's a neat "joy stick" for absolutely perfect balance control.

The Fifty-Four also features an exclusive automatic power control circuit (patent pending) that turns the receiver on and off to coincide with the operation of your automatic turntable.

All in all, we think the Fifty-Four is quite in a class by itself.

But don't take our word for it. Not for $525.† Go listen for yourself. And if the price still seems a bit rich, consider this: Buy the Fifty-Four and you'll never have to buy another receiver again.

Now *that's* a bargain!

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

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

The new KLH-Model Fifty-Four Stereophonic/Quadraphonic Dual Function Receiver. Our $525 bargain.

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Turntable Directory

BSR 710/X

Garrard SL-95

Dual 1229

Automatic Turntables

SPEEDS
A-33, 45, 78
B-33, 45
C-33 only
D-16, 33, 45, 78
E-16, 33, 45
F-Cont. variable

MANUFACTURER	MODEL	Speeds (see letter code)	Platter diameter, in.	Wow and flutter at 33⅓, %	Rumble (NAB) dB	Max. tracking error, deg.	Pivot-stylus dist., in.	Arm type	Cart. weight range, gms.	Arm resonance, Hz	Max. stack records	Change cycle at 33⅓, secs	Clearance below board, in.	Clearance above board, in.	Overall W x D, in.	Overall height, in.	Weight, lbs.	Price	SPECIAL FEATURES
BSR MCDONALD	710/X	B	12	0.15	-55		8.56	Bal. & Spg.	0-4		6		3	4½	17 5/16x 14 9/16	8¾	19	204.80	With wal. base, dust cover, Shure M-91E cart.; sync. mtr.; vics. cueing.
	810/X	B	12	0.05	-55	0.5	8½	Bal.	0-4	7	6	14	4½	3	17⅛x15	9¼	32	239.95	With wal. base, cover, Shure M91ED cart.; sync. mtr.; visc. cueing.
	610/X	A	11	0.12	-40	0.75	7½	Bal.	0-6	15	8	7	3	4	15¼x14⅛	7¼	17	130.45	With wal. base, cover, Shure M93E cart., sync. mtr.; visc. cueing.
	510A/X	A	11	0.12	-40	0.75	7½	Bal.	0-6	15	8	7	3	4	15¼x14⅛	7¼	14	80.00	With base, cover, Shure M75 cart.; sync. mtr.; cueing.
	310/X	A	11	0.15	-38	1.0	7½	Spg.	0-9	20	7	7	3	4	15¼x14⅛	7¼	12	105.45	With base, cover, Shure M75 cart.; sync. mtr.; vics. cueing.
BRAUN	PS 600	A	12	0.07	-45	2	8½	Bal. & Spg.	0-4	8	10				17¼x12⅞	7⅞	27	299.95	Oil-hydrl. susp.; brushless d.c. mtr.; ill. strobe; with base, cover
DUAL	1229	A	12	0.04	-55	0.3	8¾	Bal. & Spg.	1-12	8-14	6	13	3	5	14¾x12	8	19	225.00	Gimbal susp.; adjust. vert. track. angle; 6% pitch contl.; sync. mtr.; cueing, ill. strobe.
	1218	A	10⅝	0.06	-45	0.5	8¼	Bal. & Spg.	1-12	8-14	6	11	2⅝	5	13x10¾	7⅝	14	169.50	As above less strobe
	1215 S	A	10⅝	0.08	-45	0.5	8¼	Bal. & Spg.	1-8	8-14	6	11	2⅝	5	13x10¾	7⅝	13	125.00	Pitch contl.; damped cueing; sep. anti-skate for con. & ellip. styli.
	1214	A	10⅝	0.08	-45	0.5	8¼	Bal. & Spg.	1-8	8-14	6	11	2⅝	5	13x10¾	7⅝	13	109.50	Pitch contl., damped cueing, built-in anti-skate
GARRARD (BIC)	Zero 100	B	11½	0.06/ 0.025			7½	Bal.	0-15	8	6	10	3	4⅜	15¼x14⅛	6½	12	199.95	Zero tang. track. arm; ill. strobe, var. spd.; mag. anti-skat.; visc. damp. arm.
	SL-95B	A	11½	0.07/ 0.025		0.75	8¼	Bal.	0-15	8	6	10	3	4⅜	16x14½	7⅜	11	149.95	Vics. damp. arm; 2-pt. disc support; oversize platter; anti-skat.; slide-in cart. clip.
	SL-72B	A	10½	0.08/ 0.025		0.75	7½	Bal.	0-15	8	6	10	3	4⅜	15¾x14½	7⅜	10½	109.95	Visc. damp. arm; anti-skating; cart. clip.
	SL-65B	D	10½	0.09/ 0.025		0.85	7½	Bal.	0-18	10	8	12	2⅛	4	15¼x13⅛	6⅞	9	84.95	As above.
	SL-55B	D	10½	0.12/ 0.025		0.85	7½	Bal. & Spg.	0-12	12	8	12	2⅛	4	15¾x13⅛	6⅞	9	64.95	As above.
	40B	D	10½	0.14/ 0.03		0.85	7½	Bal. & Spg.	0-12	12	8	12	2⅛	4	15¾x13⅛	6⅞	9	49.95	Visc. damp. cueing; cart. clip; tubular tone arm; super-sens. trip.

JVC 5203

Miracord 770H

PE 3012

AUTOMATIC TURNTABLES

SPEEDS
A-33, 45, 78
B-33, 45
C-33 only
D-16, 33, 45, 78
E-16, 33, 45
F-Cont. variable

MANUFACTURER	MODEL	Speeds (see letter code)	Platter diameter, in.	Wow and flutter at 33⅓, %	Rumble (NAB) dB	Max. tracking error, deg.	Pivot-stylus dist., in.	Arm type	Cart. weight range, gms.	Arm resonance, Hz	Max. stack records	Change cycle at 33⅓, secs	Clearance below board, in.	Clearance above board, in.	Overall W x D, in.	Overall height, in.	Weight, lbs.	Price	SPECIAL FEATURES
GLENBURN CO.	1100	D	10	0.2	-36	1.5	8	Spg.	5-15	10	8	7	2	3⅞	13¼x11¼	6	7	54.50	Supplied with base, dust cover and integrated ceramic cartridge/diamond needle
	1130	D	11	0.15	-36	1.5	8	Spg.	5-15	10	8	7	2	3⅞	13¼x11¼	6	8½	64.50	Supplied with base, dust cover and integrated ceramic cartridge with high compliance stylus/diamond needle
JVC	VC-5203	D	11	0.1	-45		8	Bal. & Spg.			6	10			16⅜x14¼	7¼	13⅛	89.95	With mag. cart., base, cover.
	4VC-5244	B	11	0.1	-45		8	Bal. & Spg.			6	10			15¾x17¼	7⅞	19	199.95	CD-4 4 chan. demodulator built in; with base, cover, mag. cart.
MGA	ST-10	D	11	0.2							8				17⅛x14⅜	7½		69.96	
	ST-123	D	10⅛	0.2							6				15⅛x13⅜	7½		49.95	
MIRACORD (BENJAMIN)	50H-11	A	12	0.06/ 0.02	40			Bal. & Spg.		8	10		3¾	5⅝	18½x14½	10	18	225.00	
	770H	A		0.05/ 0.01	42	0.5° in.		Bal. & Spg.							14⅛x12½			265.00	
	650	D	10⅜	0.07/ 0.03	39	0.5° in.	7⅛	Bal. & Spg.	0-11	10	10	12	2⅝	5⅝	13⅜x11⅝	9	17	149.50	
	660H	D	10⅜	0.06/ 0.025	39	0.5° in.	7⅛	Bal. & Spg.	0-11	10	10	12	2⅝	5⅝	13⅜x11⅝	7	17	175.00	Hys. sync. mtr.; overhang adj.; calibra. marker.
	625	D		0.07/ 0.03	38										13⅜x11⅝			119.95	
PE (IMPRO)	3060	A	10⅜	0.08	59	0.5	8¼	Bal. & Spg.	1-10		6	13	2½	4	13x10½	6½	10½	169.95	Sep. anti-skat. for con. & ellip.; sync. mtr.; gimbal arm; track angle adjust.
	3015	A	10⅜	0.12	58	0.5	8¼	Bal. & Spg.	3-15		6	13	2½	4	13x10½	6½	9½	129.95	Fail safe stylus contl.; pitch contl.; rotat. single play spindle; damp.
	3012	A	10⅜	0.15	56	0.5	8¼	Spg.	3-15		6	13	2½	4	13x10½	6½	9½	89.95	cueing, anti-skating. As above, less anti-skating.
RADIO SHACK	45	D	11⅞	0.1	50	0.6	7¼	Bal. & Spg.	3-4	12	6	12			16¾x14¼	4¼	20	149.95	Tracks ¾ to 6 gms.; with base and cart.
	40A	D	11⅞	0.1	50	0.6	7¼	Bal. & Spg.	5-7	12	6	12			16¾x14¼	4¼	20	109.50	Tracks 1 to 6 gms.; with base and cart.
	36	D	11	0.18	29			Bal. & Spg.			6				15¼x13¼	6½	10½	79.50	Tracks from 2 gms.; with base and cart.
	24A	D	11	0.18	29			Bal. & Spg.			6				15¼x13¼	6½	8	64.50	Tracks from 2 gms.; with base and cart.
SANYO	TP 80SA	B	11½	0.1				Bal.							18½x15	7¼	22	under 155.00	
V-M	1555	B	11¾	0.3		1.5	9½	Bal. & Spg.	3-9	11	6	15	5½	5½	17x13	5½	18	179.95	Belt-drive sync. mtr.; with cart.; wal. base, cover.
	1542	D	11	0.3		5	7⅛	Spg.			6	9		6	14½x13½	6	10½	89.95	4-pole sync. mtr.; with cart., wal. base, cover.

Empire 598 II

JVC VL-5

Lenco L75A

Manual Turntables and Tone Arms

SPEEDS
A-33, 45, 78
B-33, 45
C-33 only
D-16, 33, 45, 78
E-16, 33, 45
F-Cont. variable

TURNTABLES													TONE ARMS											
MANUFACTURER	MODEL	Speeds (see letter code)	Wow and flutter at 33⅓ %	Rumble (M&B) dB	Motor type	Platter diameter, in.	Platter weight, lbs.	Drive	Arm mounting provision	Dimensions, W x D x H, in.	Weight, lbs.	MODEL	Overall length, in.	Pivot-stylus dist., in.	Vertical bearing	Lateral bearing	Stylus force method	Max. tracking error, deg.	Cart. weight range, gms.	Arm resonance, Hz	Stylus force range, gms.	Weight, if sep., oz.	Price	SPECIAL FEATURES
ACOUSTIC RESEARCH	XA	B	0.1	35	24-p sync.	11¾	4	Belt	Integ.	16¾x12¾ x5¼	13½		12	9	Cone	Ball	Bal.	0.35/in.	10 15	0.8			87.00	With cover, base, stylus force gauge, oil, overhang gauge. XA Univ. similar but 120 or 220 V, 50 or 60 Hz.
AUDIO RESEARCH												TA 1	12	8.5	Ball	Ball	Bal. & Spg	2	3 15	8	0.6		175.00	Oil hydrl. susp.; intermed. chassis; ill. strobe; auto off; with base and cover.
BRAUN	PS 500	D	0.09	45	Hys.	12	7	Belt	Integ.	17x12½ x6¾	28			8¾	Ball	Ball	Bal. & Spg	2		8	0-5		269.50	Oil hydrl. susp.; intermed. chassis; ill. strobe; auto off; with base and cover.
DECCA (PAOLI)												Int	11½	9	unipivot		Bal		3 20	14	½-4		117.50	Viscous damp.; adj. mag. anti-skating.
EMT (GOTHAM)	928	A	0.02	65	Sync.	12	7½	Belt	Integ.	10x18 x3½	31		12			Ball	Bal. & Spg	0.83	7 19	8	0.5		899.00	Includes pre amps
	930	A	0.02	64	Hys. Sync.	12	31	Idler	Integ.	15½x19¼	51		12			Ball	Bal. & Spg	0.83	7 19	8	0.5		1570.00	Includes pre-amps.
EMPIRE	598 II	A	0.01	55	Hys.	12	7	Belt	Integ.	17½x15⅛ x8	30	990	12	9	Ball	Ball	Bal. & Spg	0.7	5 15	6	0.6	20	349.95	With Empire 1000 Zex cart.
JVC	VL-8	B	0.05	60	Servo	12	4	Belt	Integ.	19⅝x16¼ x7½	22		13	10	Ball	Ball	Bal.	0.94	5 20	7	0.4		249.95	CD-4 ready
	VL-5	B	0.1	50	Sync.	12	2	Belt	Integ.	18½x14½ x7⅜	15		12	9	Pivot	Ball	Static Bal		5 25	10	0.3		99.95	CD-4 ready; arm lifts up at end of record.
LENCO (BENJAMIN)	L 85	B	0.08	63	Sync.	12½		Belt	Integ.	18¼x14⅜ x3	30												249.50	
	L 75A	D&F	0.06	38	Sync.	12		Belt	Integ.	17½x13¼ x6	32												149.50	Incl. dust cover & base
	B-52	D	0.12	37	Sync.	11¾		Belt	Integ.	14¼x11¼ x5¼													89.50	
PHILIPS	GA 212	B	0.06	38	DC Servo	12	2¼	Belt	Integ.	15½x13½ x5½	10½		10¾	9		Ball	Bal	1/6	5-17	7	⅛-5		164.50	
	GA 308	B	0.2	38	Sync.	10	2¼	Belt	Integ.	14½x12 x5½	11½		10	8½		Ball	Bal	1/5	5 12	2-3	2-3		99.50	
PIONEER	PL 61	B	0.05	55	DC Servo	12¼	4	Belt	Integ.		24												299.95	
	PL 41 DC	B	0.08	52	Hys.	12		Belt	Integ.	19⅞x16⅞ x7⅛	28												239.95	
	PLA-35	B	0.1	47	Sync.	12		Belt	Integ.	18⅛x16⅜ x7¼	20												140.95	
	PL-12AC	B	0.12	45	Sync.	12		Belt	Integ.	17x13½ x6	13												99.95	
RABCO	ST-4	B	0.08	32	Sync.	11⅜	5	Belt	Integ.	15x18 x5	15												159.00	
												SL 8E	14	7	Cone	Cone	Bal	0.16	4 18	10	0-4	48	169.50	
REK-O-KUT	B 12 T1	A	0.02	40	Hys.	12	5¼	Idler	Hole for 12 in. arm	15½x15¾ x6	16												194.50	
	CVS 12	F	0.09	35	Hys.	11¾	4¼	Idler	Hole for 12 in. arm	15x16 x5	15												169.50	
												S-320	12	9	Ball	Ball	Spg	1		9-12	0-6.5		54.95	
												S-260	15¾	11⅞	Ball	Ball	Spg	1		9-12	0-6.5		64.95	
												S 410	12	10⅛	Ball	Ball	Bal	1¼		10	½-2½		69.95	

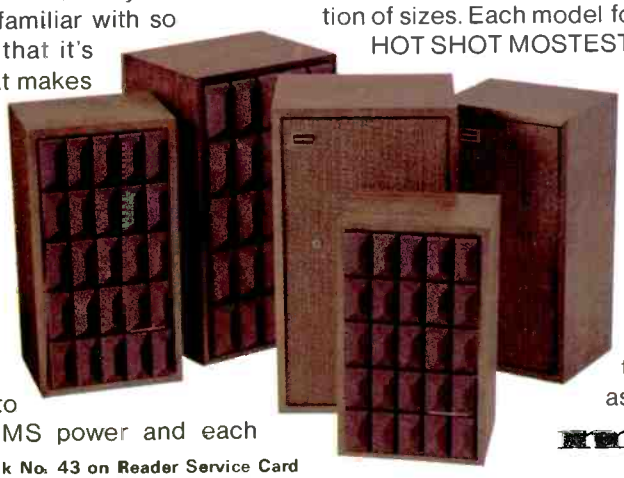
(Continued on page 55)

A Marantz speaker system breaks up that old gang of yours.

Separation of sound is a true test of a speaker system. And to put Marantz—or any speaker—to the test you should listen to something you are already familiar with so you'll be able to hear for yourself that it's the speaker and not the recording that makes the difference. Oh, what a difference Marantz makes! What you thought were two oboes are now clearly an oboe and a flute and that barbershop quartet...well, they're really a quintet.

Let's face it: ALL speakers claim to be the very A-1 HOT SHOT MOSTEST BEST.

But the proof is in the listening. And that's where Marantz speakers come in. Each model is engineered to handle a plethora of continuous RMS power and each employs a long excursion woofer and a tweeter with fantastic off-axis response. And Marantz offers you a wide selection of sizes. Each model for the money is truly the very A-1 HOT SHOT MOSTEST BEST.



However, keep this in mind. Marantz speaker systems are built by the makers of the most respected stereo and 4-channel equipment in the world. The same quality that goes into Marantz receivers and amplifiers goes into the entire line of Marantz speaker systems.

To find out how much better they sound, listen. That's all we ask. Listen.

marantz®
We sound better.

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advertising index

(Continued from page 48)

Sansui SR 2050E

Technics by Panasonic SP-10

Thorens TS 125B

MANUAL TURNTABLES AND TONE ARMS

SPEEDS
A-33, 45, 78
B-33, 45
C-33 only
D-16, 33, 45, 78
E-16, 33, 45
F-Cont. variable

TURNTABLES												TONE ARMS											
MANUFACTURER	MODEL	Speeds (see letter code)	Wow and flutter at 33⅓, %	Rumble (NAB) dB	Motor type	Platter diameter, in.	Platter weight, lbs.	Drive	Arm mounting provision	Dimensions, W x D x H, in.	Weight, lbs.	MODEL	Overall length, in.	Vertical bearing	Lateral bearing	Stylus force method	Max. tracking error, deg.	Cart. weight range, gms.	Arm resonance, Hz.	Stylus force range, gms.	Weight, if sep., oz.	Price	SPECIAL FEATURES
SME (SHURE)												SME 3009 Impr.		9	Knife Edge	Ball	Bal.		4-9		0-1.5		135.00	
												SME 3009/S2 Impr.		9	Knife Edge	Ball	Bal.		4-9		0-1.5		147.00	Detachable Shell
SANSUI	2050 C	B	0.07	40	Sync.	12	2.9	Belt	Integ.	17½x13⅜ x7½	26		8¾		Knife	Knife	Bal.	1½					169.95	Damped cueing; with base, cover, auto. off & cartridge.
	1050 C	B	0.07	40	Sync.	12	2.9	Belt	Integ.	17¾x13¾ x7½	21½		8¾		Knife	Knife	Bal.	1½					139.95	Damped cueing; with base, cover & cartridge
SONY	PS-5520	B	0.1	43	Hys	12	2⅛	Belt	Integ.	17¾x15½ x6⅛	19		11½	8½	Pivot	Ball	Bal.						139.50	
												PUA-237	13⅜	9⅜	Ball	Ball	Bal.			9			85.00	
												PUA 286	15⅝	11¼	Ball	Ball	Bal.			8			99.50	
SOUND SYSTEMS INT'L.	PS-5520	B	0.1	43	Hys.	12	2⅛	Belt	Integ.	17¾x15½ x6⅛	18½		11½	8½		Ball	Bal.	3	4-14		0-3		139.50	
TECHNICS BY PONASONIC	SP-10	B	0.03	65	D.C	12	6	Direct	Indep.	14x14 x4	20												369.95	Electronically controlled motor speed; illuminated strobe; damped cueing; independent variable control for each speed.
	SL-1100A	B	0.03	65	D.C	12	4.4	Direct	Integ.	25x15 x5	28			9¼	Ball		Bal.	1.75	2-9.5	10	0.5		319.95	Electronically controlled motor speed; illuminated strobe; damped cueing; independent variable speed controls for each speed.
	SL-1200	B	0.03	65	D.C	13	3.86	Direct	Integ.	16 5/64x13 57/64 x7 1/2				8 31/32		Ball	Bal.	2.0	2-9.5	10	0.4		269.95	Electronically controlled motor speed; illuminated strobe; damped cueing; independent variable control for each speed.
THORENS (ELPA)	TE-125 AB Mk II	B	0.08	48	Sync.	12	8½	Belt	Integ.	18x14 x5	32												375.00	
	TD-125 B	E	0.08	48	Sync.	12	8½	Belt	Mount. board	18x14 x5	32												275.00	
	TD-160C	B	0.09	37	Sync.	12	8½	Belt	Integ.	17x13½ x7⅜	16½												200.00	
TOSHIBA	SR 40E	B	0.1		Ind	12		Belt	Integ.	18⅜x7⅞ x15 5/16	22												199.95 with IC cartridge	
	SR-50	B	0.09		D.C. Servo	12		Belt	Integ.	22x15⅜ x7½	26½												399.95 with P.E. cartridge	
	SR-80	B	0.1		Hys. Sync.	12⅜		Belt	Integ.	19 1/16x15 13/16 x7⅞	17⅜												299.95 with electric cartridge	
V-M	1579	B	0.3		Sync.	11¾	2	Belt	Integ.	17x13 x5	12		12	9½	Flex. memb.	Cone	Bal. & Spg.	1.5	3-9	11	0.4		99.95	

Equipment Profiles

Lafayette LR-4000 4-Channel SQ Receiver

MANUFACTURER'S SPECIFICATIONS:

FM Tuner Section:

IHF Sensitivity: 1.65 uV. S/N Ratio: 70 dB. THD (Mono): 0.1%.

Capture Ratio: 1.5 dB. Image rejection: 75 dB. **Selectivity:** 60 dB. **Cross-Modulation Index:** 90 dB. **Stereo Separation** (400 Hz): 40 dB.

AM Tuner Section:

Sensitivity: 15 uV/meter. S/N Ratio: 45 dB. **Image Rejection:** 68 dB. **Selectivity:** 50 dB. **Frequency Response:** To 4500 Hz ± 6 dB.

Amplifier Section:

Continuous Power Output: 164 watts (41 watts/channel) at 8 ohms; 228 watts (57 watts/channel) at 4 ohms. THD: .07% at 1 watt; 1.0% at rated output. **Power Bandwidth:** 15 to 70,000 Hz. **Frequency Response:** 20-20000Hz. **Input Sensitivities:** Aux 1, 2: 225 mV; MAG: 4 mV; CER: 140 mV; **TAPE PLAY** (2 and 4 Ch.) 500 mV; Mic: 6 mV. Maximum Inputs: Aux 1 & 2: 5V; MAG: 90 mV; CER: 3 V; TAPE PLAY: 10 V; MIC: 150 mV. Hum and Noise: AUX 1 & 2: -75 dB. MAG: -65 dB; TAPE PLAY: -83 dB; CER: -60 dB; MIC: -70 dB. **Tape Out Level:** 450 mV (for rated input).

Matrix Decoder Section:

SQ Phase Shift Characteristics: 90° ± 10° from 50 Hz to 20,000 Hz. Decoder Channel Separation (with Logic, SQ position): LF to RF: 22 dB; LF to LB: 20 dB; RF to RB: 20 dB; LF to RB: 20 dB; RF to LB: 20 dB; CF to CB: 14 dB; LB to RB: 16 dB.

General Specifications:

Dimensions: 21" w x 5¼" h x 15¾" d. **Net Weight:** 30 lbs. **Retail Price:** $499.95 (including walnut enclosure).

The Lafayette LR-4000 Receiver is the first four-channel all-in-one receiver to include so-called "full logic" in its built-in SQ decoder circuitry. The exact nature of "full logic" in a matrix decoder will be discussed later, but its presence in a receiver suggests that the initial success of CBS's SQ matrix system will be further consolidated as more and more equipment manufacturers develop better and better circuitry to show up this particular matrix system to best advantage.

Considered strictly as a four channel receiver, this top-of-the line entry from Lafayette has much to commend it. The front panel dimensions suggest that there is a lot of receiver behind all those controls, switches and lights, and there is. The upper portion of the panel contains blacked-out plastic which becomes illuminated when power is applied. Five push-buttons to the left of the dial area select signal sources. The central, tuner button simply selects tuner section and it is necessary to use a second, TUNER MODE control, located below the meters, to choose AM, FM or an MPX FILTER position when noisy stereo FM transmissions are encountered. Illuminated words corresponding to the button depressed appear under the dial scale, but we wish that the buttons themselves were either illuminated or more legibly marked. Set against the "blacked out" plastic it is virtually impossible to read the designations in normal living room ambient lighting. Below the push-button selectors are a signal strength and center-of-channel tuning meter while to the right of the dial scale is a good sized tuning knob (flywheel coupled) as well as main and remote speaker push buttons and the main power on-off button. Additional indicators in the dial area denote the presence of stereo FM transmission as well as the fact that a tape monitor or speaker button has been depressed. These latter two lights are a great idea and no doubt will save Lafayette from many a consumer complaint when users forget that they are in the "monitor" position (or have failed to press *either* of the two speaker buttons) and therefore think the set is inoperative!

The lower portion of the panel contains a stereo microphone jack and a stereo tape-out jack for easy access by a "visiting" tape recorder. The TUNER MODE Switch, already described, comes next, followed by a function switch with positions for two-channel operation, a pair of "regular" matrix positions called "composer A" and "composer B", the SQ decode position, a discrete four-channel position and a "reverse" position which flips front channels to the rear and vice versa. The master volume control consists of a pair of concentrically mounted knobs, one for rear volume adjustment, the other for front channels. Balance controls for front and rear channels are similarly arranged on a single shaft. Three sets of tone controls (bass, mid-range and treble) also provide separate tonal adjustment of front and rear channels, but these three are friction-held, so that both sections operate together when turned, unless one is deliberately restrained from rotating. Six more push buttons appear at the lower right of the panel. These are of the push-to-make, push-to-break type and operate such features as a pair of tape monitoring systems (one is two-channel, the other will accommodate four-channel tape machines both "in and out"), stereo mono switching, loudness compensation, high frequency filtering and the interstation muting circuit for FM. At the extreme right of the panel are front and rear headphone

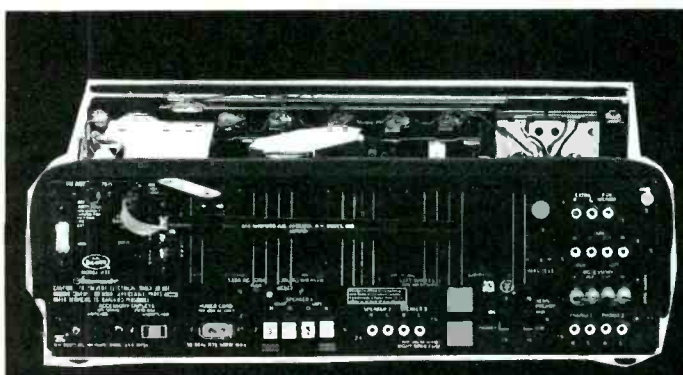


Fig. 1—Rear panel view

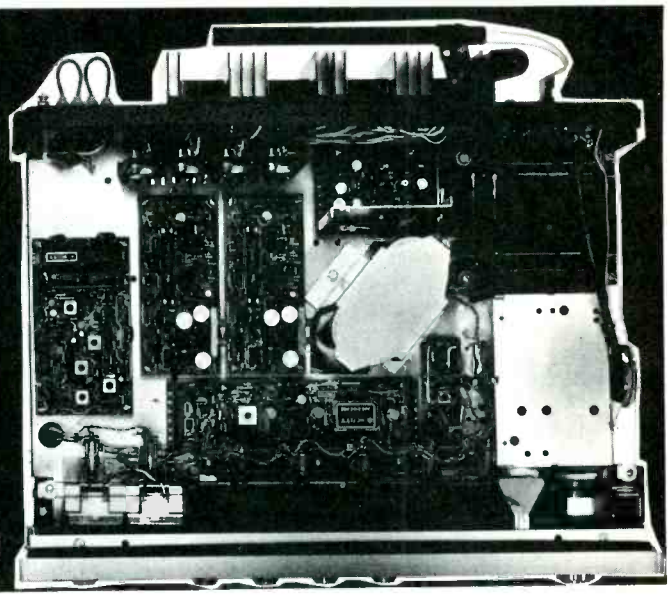


Fig. 2—Inside view

jacks which can be used singly for conventional stereo headphones or together for the new quadraphonic phones equipped with two plugs.

A diagram of the rear panel is shown in Fig. 1. Protective output fuses are provided for each of the amplifier outputs, and there is a power line fuse as well. Screw-terminal barrier strips are used for "main" speaker system connections, while remote speakers, if desired, are connected by means of phono-tip plugs. There are, therefore, enough connections for two full four-channel systems in two locations. An antenna terminal strip permits connection of both FM and AM external antennas, and for FM antenna connection, a shorting link must be opened to disconnect the receiver's own internal antenna (which consists of a small capacitor connected to one side of the power line—which we promptly disconnected!). There are enough input jacks for discrete sources of four-channel programming, either at the AUX inputs or at the tape-monitor playback inputs. Phono inputs are limited to a stereo pair as are the other tape monitor in and out jack pairs. A slide switch alters phono input sensitivity and equalization to accommodate magnetic or ceramic cartridges. An FM detector output jack is also provided for possible future use if a system of discrete four channel FM broadcasting is approved. The usual ferrite bar antenna and a pair of AC convenience outlets (one switched, one unswitched) complete the rear panel layout.

For all the circuitry contained in the LR-4000, examination of the inside of the chassis discloses a very orderly arrangement of circuit boards and neatly harnessed interconnection wiring. Eight printed circuit modules are used, with identical boards used for each stereo amplifier pair of output channels, as can be seen in the top view of Fig. 2. Interestingly, the schematic diagram supplied with the receiver fully discloses all circuitry *except* that contained in the two circuit boards relating to the SQ decoder and its associated logic circuitry. Evidently, the information obtained by Lafayette from its licensor, CBS, is still of a proprietary nature and the manufacturer has no desire to share it with competition that may not have taken a license with CBS. As for the other portions of the circuitry, in reading the general description as supplied in the instruction manual we were dismayed by two statements—neither of which belongs in a receiver of this fine quality. First, Lafayette still insists upon quoting power on a ± 1 dB basis (bringing the power rating up to 250 watts at 8 ohms or 360 watts when driving four ohm loads). The rest of the industry has long since abandoned this childish practice which doesn't fool a single knowledgeable audiophile (and it is to be presumed that anyone investing $500 in a four-channel receiver is not a babe-in-the-woods). Then, in describing the tuner section, reference is made to a new "phase-lock" circuit which is said to ensure good stereo FM separation and low distortion. Now, it so happens that a new, popular circuit known as a "phase lock *loop*" is being used in ultra sophisticated tuner products these days. What it does is ensure crystal-tuned tuning accuracy. The equipment being reviewed here does NOT contain a phase lock loop circuit. What the authors of the manual must mean is that an attempt has been made to maintain good, linear phase response throughout the IF and detector systems of the FM circuitry which does, indeed, insure good stereo FM separation and lowered distortion. The fact is, that this receiver DOES have unusually good stereo separation and very low FM distortion, as is evident from our measurements which will be discussed shortly. To create a phrase such as "phase lock" circuitry which, at first glance sounds so much like "phase lock loop" circuitry (which is quite another thing) is *just not cricket* and the copywriters ought to be ashamed!

Output circuits use capacitor coupled complementary symmetry and the coupling capacitors are 2200 mfd units. Voltage at the high side of each pair is 64 volts. All other, lower supply voltages are well regulated electronically, with a zener diode used as a reference for the stable and critical tuner voltages. A dual-gate MOS-FET is used as an RF amplifier for FM, while a single IC takes care of the entire AM circuitry. IC's are also used as amplifiers and limiters in the FM-IF section. Tone control circuitry is of the preferred feedback type and low-level preamplifiers use discrete transistors selected for their low-noise characteristics. To give you an idea of just how much circuitry is needed for a four-channel receiver of this class, the unit contains 1 dual gate MOSFET, 10 FET's, 8 IC's and 89 transistors!

Electrical Measurements

Figure 3 represents the monophonic quieting and distortion characteristic of the LR-4000. IHF sensitivity was measured as 1.8 uV and, more importantly, the steepness of the quieting characteristic is as good as we have ever seen, reaching 50 dB of S/N with an input signal of only 2.5 uV. Ultimate S/N reached an incredible 75 dB—this sets a new record for ultimate quieting in FM since we've been using our new FM Generator. Distortion, too, is quite impressive at just

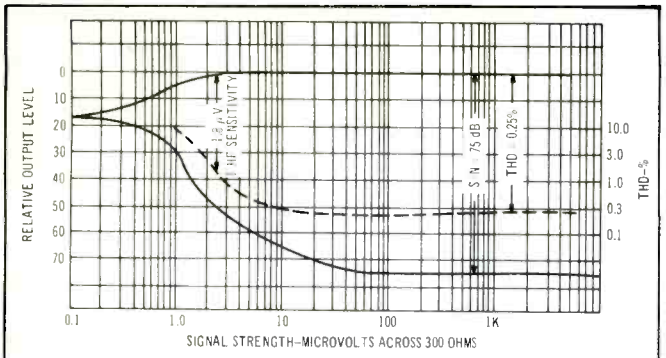


Fig. 3—Mono FM characteristics

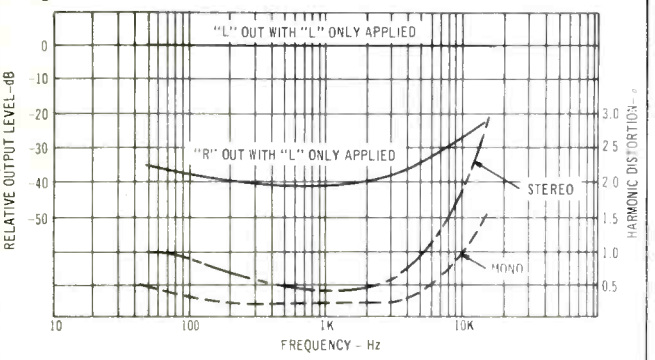


Fig. 4—Stereo separation and THD vs frequency

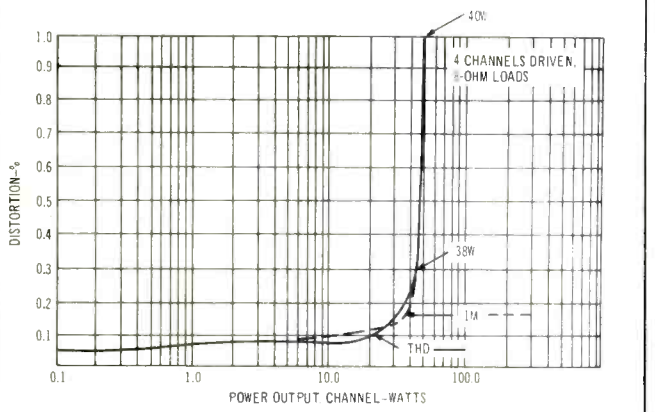


Fig. 5—THD and IM characteristics

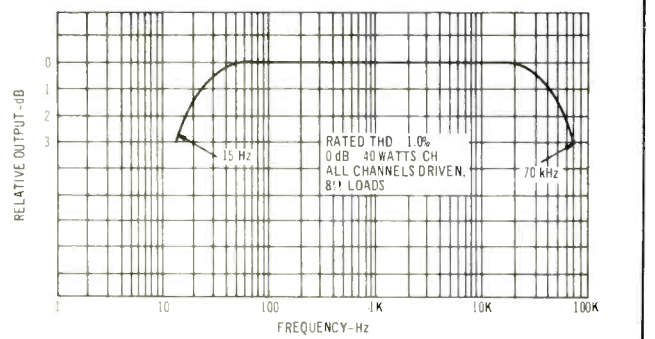


Fig. 6—Power bandwidth

under 0.25%, though it falls somewhat short of the 0.1% claimed in the published specs.

Figure 4 confirms Lafayette's claims of 40 dB stereo FM separation at mid-frequencies and also displays separation at other frequencies. At the low end, separation is maintained above 35 dB and even at 10 kHz, separation is still a bit above 27 dB. Monophonic THD remains well under 0.5% at

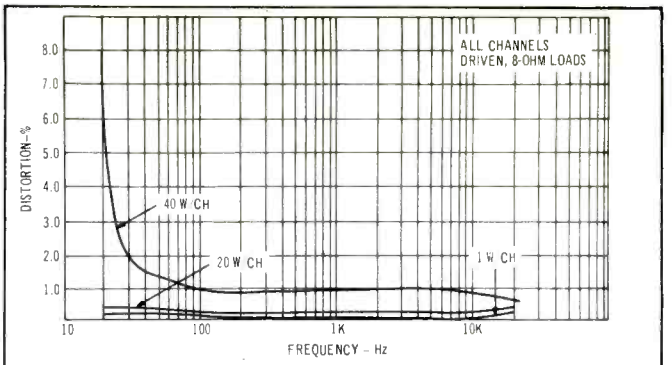


Fig. 7—Distortion vs frequency

all frequencies from 50 Hz to 6 kHz and is acceptably low all the way to 15 kHz. Mid-frequency stereo distortion stays below the 0.5% mark and crests at 1.0% at the low end. As usual, high frequency distortion in stereo appears to be high (maximum 3.0%) but it should be recalled that some of the components read are really "beats" and not actual harmonic distortion.

The power amplifiers produced 40 watts per channel at rated THD (1.0%) with all four channels driven. That's as close to the 41 watts claimed as anyone can measure accurately and we wonder why Lafayette insisted upon pushing the claim for that extra watt. 160 total continuous watts for four channels would seem to be quite enough for *anyone* in a home environment. THD levels at all power levels under 20 watts per channel are well below the 0.1% figure—and that applies all the way down to low, low listening levels of 0.1 watts. Interestingly, the IM characteristic follows the THD characteristic almost point for point, reaching the 1% limit at exactly 40 watts per channel. These results are plotted graphically in Fig. 5, while Fig. 6 confirms the power bandwidth claims from 15 Hz to 70 kHz.

While the four amplifiers, operating simultaneously, are not quite capable of producing full output at 20 Hz with less than 1.0% distortion, at 30 Hz THD has decreased to just under 2% per channel, again with all channels being driven fully. As can be seen in Fig. 7, operation at 20 watts per channel (half power) and 1 watt per channel results in THD readings which are essentially 0.2% and 0.1% across virtually the entire audio spectrum from 20 Hz to 20 kHz.

Figure 8 illustrates the tone control range, filter and loudness compensation characteristics of the LR-4000 and all published specifications concerning these features are confirmed.

Additional measurements made but not shown graphically include a confirmation of the 1.5 dB capture ratio (we actually measured a bit better—1.3 dB) and an alternate channel selectivity of 60 dB. Image rejection was measured as 80 dB, better than the 75 dB claimed, while spurious response rejection measured a bit better than 90 dB.

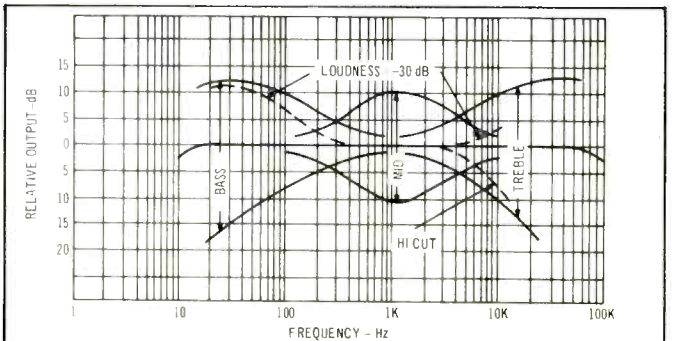


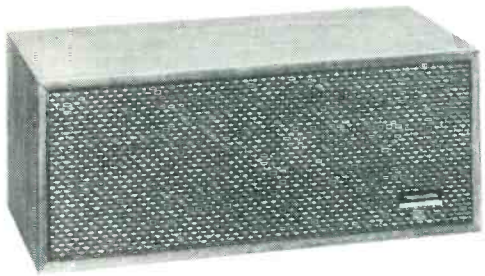
Fig. 8—Tone control, loudness and filter characteristics

"Looking for Extension Speakers that Really Sound Good? Radio Shack Has Them!"

Arthur Fiedler

Conductor of the Boston Pops Orchestra and recording artist for Polydor and RCA-Victor.

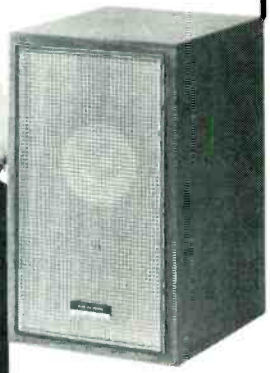
Solo-1. A long-running hit because its BIG sound rivals more expensive speakers! Ultra-high compliance; tuned, vented-duct type enclosure. 50-14,000 Hz, oiled walnut cabinet. **$24.50 Each**



Solo-4. A bookshelf system that's a perfect "add-on" for 4-channel sound or as a handy extension pair! 100-12,500 Hz. Rear-loaded, reflex-type enclosure. **$15.00 Each**

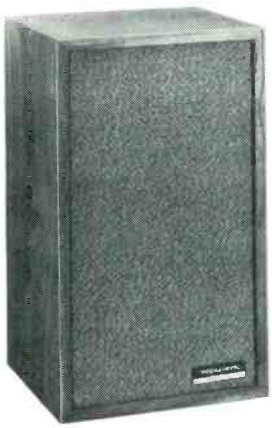
Deluxe Wall Baffle Speaker. Mount anywhere in home or office. Has its own up-front volume control, 40-15,000 Hz response! **$24.95 Each**

8" Outdoor Speaker. Hear your favorite music on patio, porch or at poolside. Carrying handle, easy hookup. **$17.95 Each**

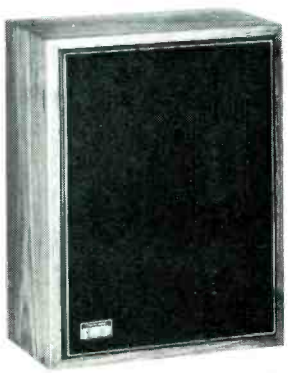


Solo-103. Its secret of great sound is unrestricted cone excursion — first time ever in a 4" speaker! 30-17,000 Hz response! 9-3/4 x 8 x 6-5/8". **$17.50 Each**

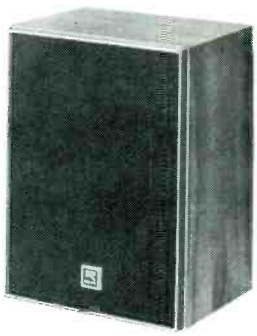
Solo-5. Our lowest price full-range speaker adds "new life" to your phono console or small stereo. Has a wide-response 5" speaker, easy hookup with plug-in jacks or screw terminals. **$9.95 Each**



Minimus-2. Get the sound and range of a "big speaker" system at the size and price of an "add-on"! The "little" 7 x 8 x 14" oiled walnut cabinet has a 6" acoustic-suspension woofer and tweeter with control, 20-20,000 Hz. **$42.95 Each**



MC-500. It's the best $30 sound around and you can use it in the tightest stereo set-ups! Combines an air-loaded, acoustic-suspension 5" woofer with a 2" high-frequency tweeter for an amazing 40-20,000 Hz response. **$30.00 Each**



Minimus-0.5. Makes your transistor radio or portable recorder sound like it cost twice as much! Only 4-3/4 x 6-5/8 x 4-1/2", but its oiled walnut case makes it look like the big ones! **$11.95 Each**

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Four Channel Decoder Characteristics

As yet, no reliable test record has been produced with which to measure the separation characteristics of SQ decoders (with or without logic built in). Because of the complexity of the composite signals which constitute the matrixed L-total and R-total inputs from an SQ record, it would be rather difficult to simulate such composite signals using ordinary signal generators. At very least, a professional SQ encoder would be required, and these are only available to recording studios and broadcast stations at the present time. How about a good test record, CBS, to make a reviewer's life a little easier—now that SQ equipment abounds? In the meantime, our tests had to be confined to musical listening—using a variety of SQ records that we had previously auditioned on both "simple" matrix SQ decoders and front-back logic SQ decoders. There's no doubt about it, the "double" logic does a much better job. A good deal of the ambiguity of instrument placement is gone and, in the case of this particular logic circuit, gain-shifting or "breathing" is rarely perceived. We are familiar with the basic approaches to SQ logic circuitry, but certainly wish Lafayette had seen fit to fill in those blank spaces in the schematic diagram. Suffice it to say that while we cannot confirm the various channel-to-channel separation figures quoted in the published specs, we certainly found separation and localization of sounds to be better than in any previous auditioning of the SQ matrix system. It is so good, in fact, that one tends to question again the need for two competing four-channel disc systems—matrix and "discrete."

We used the LR-4000 with our newly acquired open-reel four-channel recorder and found some of the control features to be most useful. In particular, we liked the dual master-volume and dual-balance arrangement and found ourselves able to manipulate these controls properly after just a few moments of practice. We were able to do such things as decoding SQ FM stereo broadcasts and recording the four resultant channels on discrete tape for subsequent playback in "discrete" fashion.

As noted in the instruction manual, the additional "matrix decode" formats identified as "Composer A" and "Composer B" are useful for non-SQ matrixed four channel records as well as for simulating four-channel sound from conventional stereo records. We found that the Composer "B" position works best with classical stereo records, while the Composer "A" position seems more effective with pop recordings, surrounding the listener with music from all directions.

Considering the LR-4000's performance in areas unrelated to quadraphonic sound, we found that FM reception was excellent. We logged 54 usable signals, using an outdoor moderately priced Yagi antenna (5-element array), of which some 24 were in stereo. To obtain these results, however, we had to defeat the interstation mute control, which cuts out signals below 6 or 7 microvolts. A receiver as sensitive as this one (and having such excellent quieting characteristics) should have had its mute threshold adjusted somewhat lower—to about 3 microvolts or so. Otherwise, a customer adjustment of mute threshold should have been provided.

The 4-millivolt sensitivity established for magnetic cartridges seemed a bit on the low side, in that we had to push the volume control up a bit higher than usual, but there was still enough reserve left to make this comment relatively unimportant. Sound from both phono and radio was clean and tight. What's more, low level listening was actually noticeably superior than on some other receivers we've checked recently—a direct consequence of the lack of crossover distortion in the output circuits evidenced by the extremely low distortion readings obtained at low power output levels.

About the only thing the LR-4000 *can't* do (that some other quadraphonic receivers *can*) is parallel or "boot-strap" pairs of output channels for higher-powered operation in stereo. In other words, in the case of the LR-4000 when the selector is switched to "two channel", the rear speakers simply duplicate the material heard from the front speakers. We suspect, however, that anyone interested in the LR-4000 will be buying it for immediate four-channel use and, under those circumstances, even if he should occasionally want to turn down the rear speakers and listen to ordinary stereo programming, the eighty continuous watts still available for two 8-ohm channels seems like enough for just about any situation that might arise.

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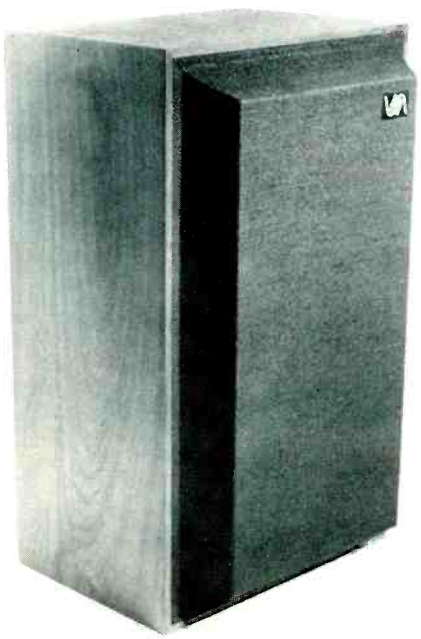


The Microstatic Full-Range Loudspeaker

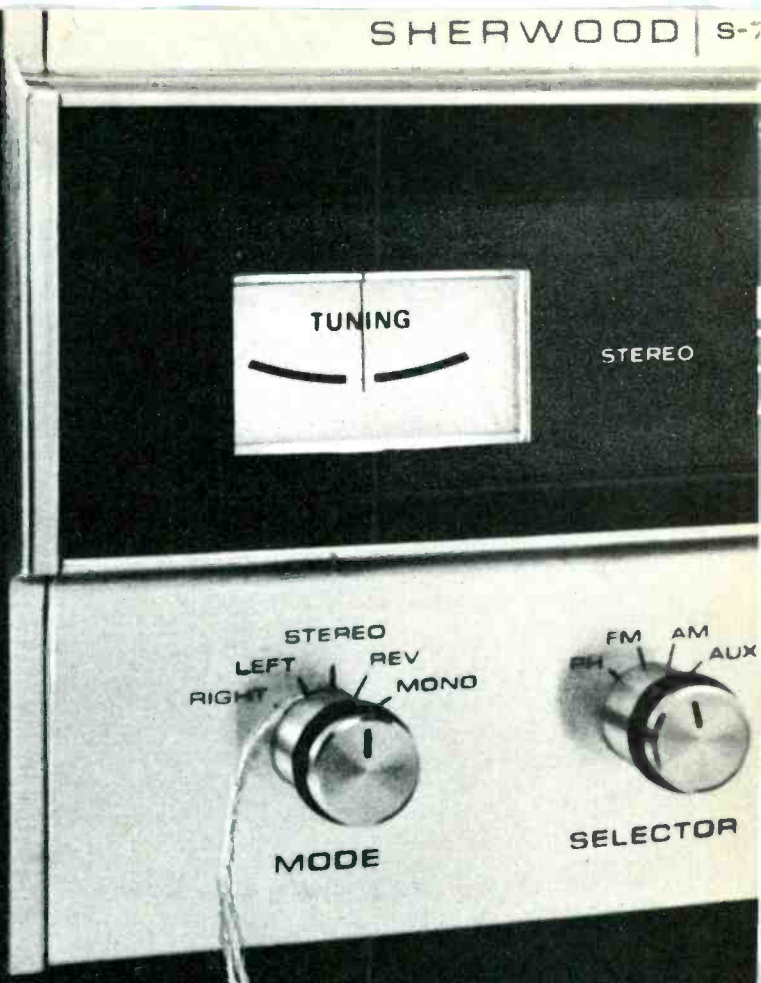
Manufacturer's Specifications:
Bass unit: 10 inch. **Treble:** Five cone types in a multiple array. **Crossover:** Mechanical, 1700 Hz. **Enclosure:** Air-suspension. **Cabinet:** Walnut vinyl. **Grille:** Black cloth, functional or decorative styles. **Dimensions:** 25½ by 15 by 12½ inches deep. **Price:** $149.50.

The first ads for the Microstatic speaker system showed a bunch of five tweeters and a bass unit all bulging out of the grille cloth—looking rather ugly. The caption read "If this design is right, then all the others must be wrong." Since then, Microstatic have had second thoughts and they now offer another design where the speakers are modestly hidden by an extended grille cloth. But the basic concept is unchanged and the treble units are still mounted *outside* the baffle in a cross formation—a *semi-decahedron* array according to the leaflet. The original model is still available for those who believe the functional design is more aesthetically satisfying. Two of the tweeters have 1¾ inch cones and three are 1¼ inch. All have closed backs and the object of the configuration is to give a wide dispersion. Two level controls are provided, one adjusting on-axis response and the other controlling the input to the angled units.

The bass unit has a four-layer 1½ inch voice coil and the response rolls off smoothly enough to avoid using a crossover series inductor. Crossover point is about 1700 Hz. The

It shouldn't matter where a receiver is made. Especially one that has been as highly acclaimed as the Sherwood S-7900A, (AM/FM) and Sherwood S-8900A (FM only).

Except that with the dollar devaluation and the fluctuations of foreign currencies, you will notice that our competitors are increasing their prices. Making these receivers even better values.



The S8900A still $429.95.

The S7900A still $459.95.

- Direct coupled output circuitry with electronic relay protection.
- Front panel four channel provision, (doubles as a second tape monitor).
- Four gang tuning capacitor.
- Solid state Ceramic FM IF Filtering.
- Exclusive FM Inter-channel/side-band hush.
- Built-in Dynaquad 4 channel matrix circuit.
- Power Output (IHF): 280 watts total. RMS, (both channels driven) 60 watts x 2 @ 8 ohms, 20-20,000 Hz. @ 0.3% T.H.D.
- FM Sensitivity (IHF) 1.7 uv (—30d noise & dist.)
- Capture Ratio: 1.9 db.
- Alternate-Channel Selectivity 65 db.
- Stereo Separation: 40 db. @ 1KHz.

Sherwood
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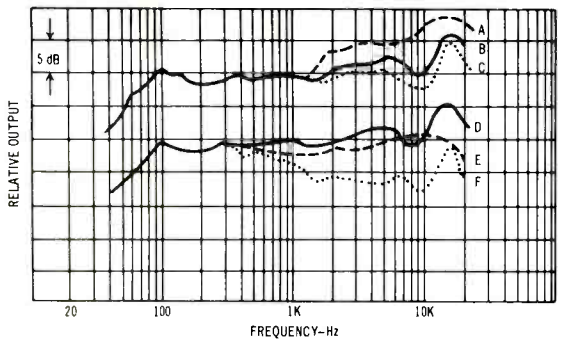


Fig. 1—Frequency response measured with one-third octave pink noise.

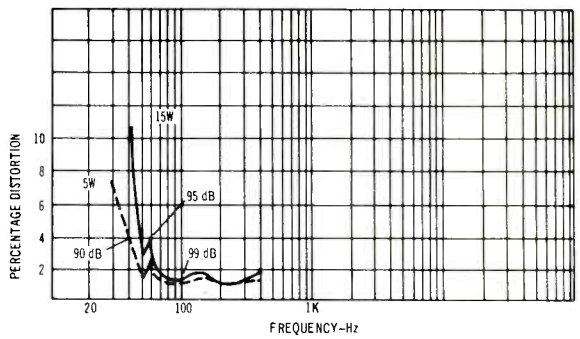


Fig. 2—Low frequency distortion and some SPL figures.

enclosure is sealed and system resonance is commendably low at 49 Hz.

Measurements

Figure 1 shows the response measured with one-third octave pink noise. B was taken on axis with A and C taken with the HF level control at minimum and maximum. The lower curve was measured with both controls in the normal position. D was taken on-axis, E at 30 degrees and F at 60 degrees. Figure 2 shows the THD at low frequencies with some SPL measurements and Figure 3 gives the impedance characteristics. Lowest point was just under 7 ohms, rising to nearly 20 ohms at 2 kHz. Tone-burst responses at 100, 500 and 5 kHz are shown in Figure 4. The system could handle 81 watts continuous power at 40 Hz without distress and 152 watts at 100 Hz. White noise tests showed very low coloration.

Listening Tests

Sensitivity of the Microstatic was slightly above average and so we used a Marantz 2010 for some of the tests. This is an inexpensive receiver rated at some 12 watts per channel and having a better than average FM section. It was quite adequate for a medium-size room, but we changed over to a Citation 12 amplifier combination with Citation 15 tuner in a much larger room. Best position for the speaker was away from the room corners, about 18 inches up from the floor. Bass was solid and well-defined and high frequency dispersion was excellent. We preferred both controls at maximum positions and with the systems angled slightly inwards, the stereo image was excellent with no sign of 20 foot violins and "Jolly Green Giant" voices. At $149.50, the Microstatics are excellent value for the money. Indeed, they compare very favorably with a pair of $250. systems we used for comparison.

Check No. 79 on Reader Service Card *T.A., G.W.T.*

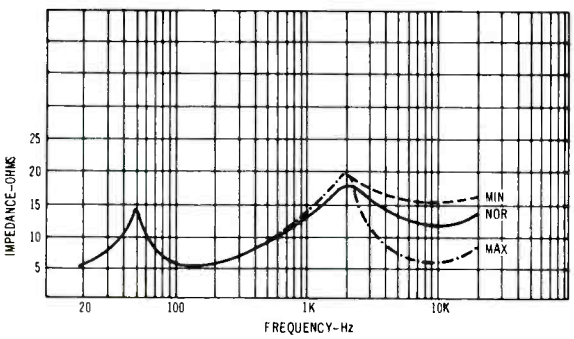


Fig. 3—Impedance characteristics.

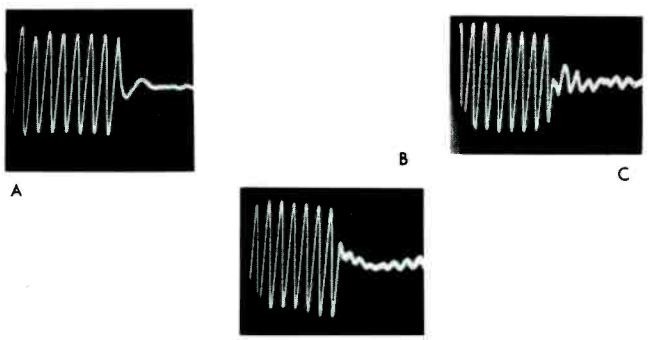
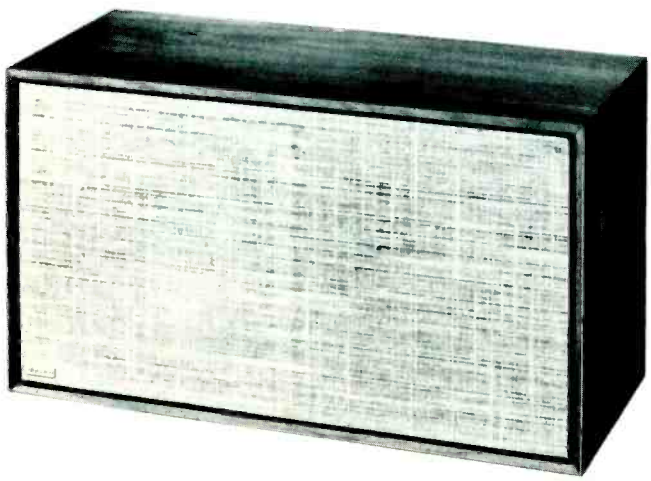


Fig. 4—Tone-burst responses. A was taken at 100 Hz, B at 500 Hz and C at 5 kHz.



The Dynaco A-35 Loudspeaker System

MANUFACTURER'S SPECIFICATIONS:

Bass Speaker: 10 inch. **Treble**: 1½ inch dome. **Crossover**: 1800 Hz. **Cabinet**: Oiled walnut finish. **Dimensions**: 12½ by 22 by 10 inches deep. **Price**: $120.

The Dyna 35 uses very similar speakers to the popular A-25 but the cabinet is somewhat larger. High frequencies of the 25 tended to roll off slightly from about 2,500 and the overall sound was smooth but a trifle distant; this was especially noticeable at low volume levels. The 35 has a more linear response and the sound quality is more "forward" but just as smooth. The larger cabinet has enabled the bass to be extended almost another octave. System resonance is about 55 Hz and the enclosure is sealed. The smaller air volume of the 25 made it necessary to use a resistance-loaded port to get a reasonable bass response.

The 35 actually uses two compartments, one venting to the other. Dynaco calls this "dual spectrum damping" claiming that it provides critical damping at resonance plus the low

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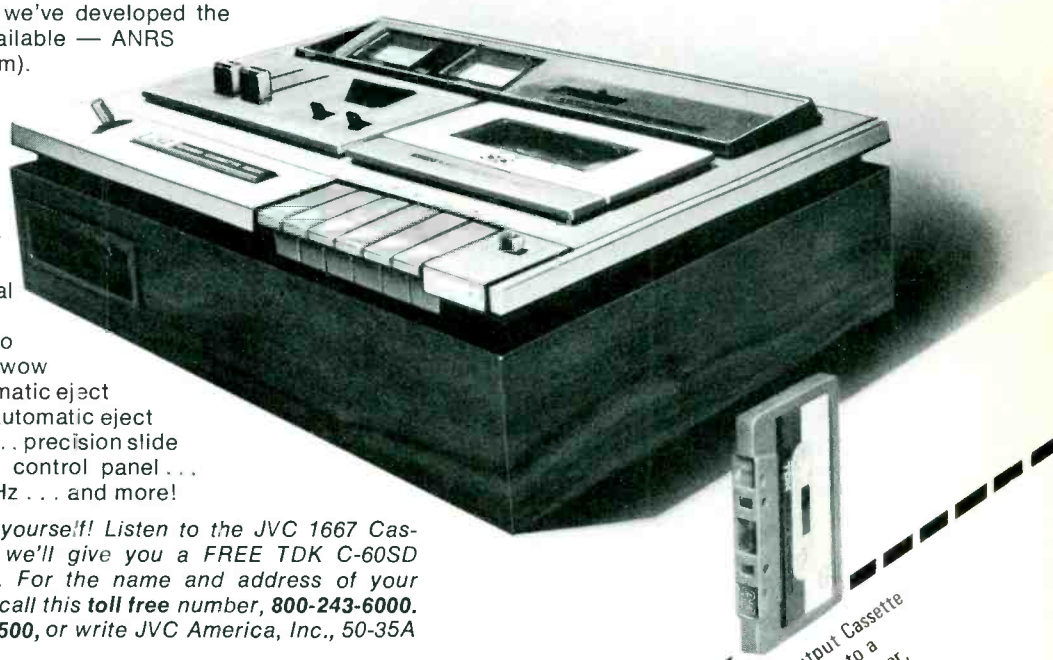

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1013-C

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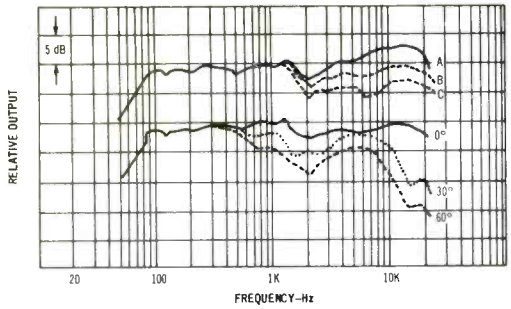


Fig. 1—Response measured with one-third octave pink noise. B was taken with the high frequency control in the normal position; A and C at maximum and minimum respectively.

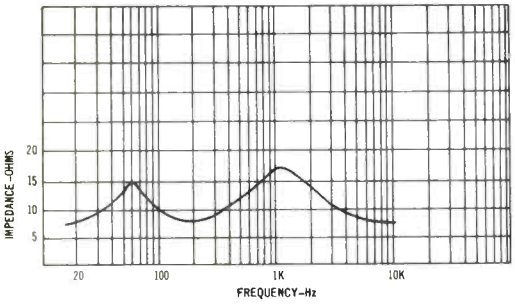


Fig. 2—Impedance characteristics.

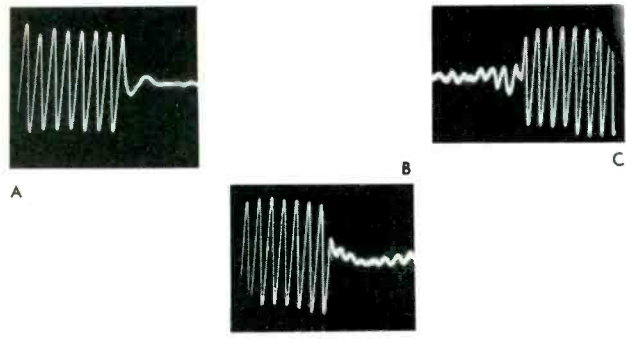


Fig. 3—Tone-burst responses. A is 100 Hz; B is 500 Hz; C is 5 KHz.

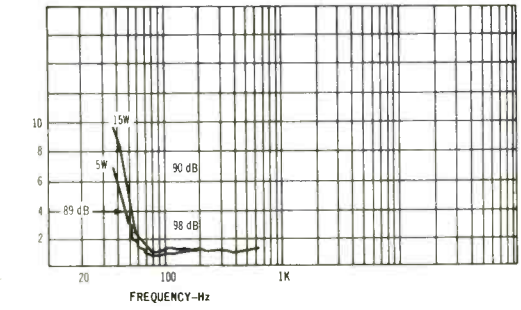


Fig. 4—Low frequency distortion and some SPL measurements.

distortion benefits of the sealed enclosure at the very low frequencies.

A 5-position high frequency control is provided at the rear and there is provision for wall mounting. Cabinet finish is walnut and the beige linen grille cloth is replaceable.

Measurements

Figure 1 shows the frequency response taken with one-third octave pink noise. B is taken with the high frequency control in the normal position and A and C at maximum and minimum respectively. Dispersion at 30 and 60 degrees is shown in the lower curve. Apart from the tiny dip at 1800 Hz, the response is sensibly flat. The impedance characteristics are shown in Figure 2 and it will be seen that the lowest point is 8 ohms. This falls to 7 ohms with the treble control at maximum. Tone burst responses at 100 Hz, 500 Hz and 5 kHz are given in Figure 3. Figure 4 shows low frequency distortion and SPL measurements for inputs of 5 and 15 watts. The system would handle a continuous power of 62.5 watts at 40 Hz without distress and 120 watts at 70 and 100 Hz. White noise tests showed a very low coloration.

Listening Tests

If we had to describe the performance of the A-35 in one word, that word would be "unobtrusive". A loudspeaker is not a musical instrument, it should reporduce what is applied to it without adding or taking away. Some designers opt for a "warm sound" by having a broad peak in the 80 to 200 Hz region; others prefer the "West Coast Sound" which involves a peak or series of peaks in the 2 to 6 kHz range to give "presence". In a dealer's showroom, they can make very impressive sounds with the appropriate program material, but the buyer will invariably be disappointed when he gets them home. In contrast, what is called the "New England" sound is neutral with a minimum of coloration. Now, the Dynaco speakers are made in Denmark—a long way from Boston, Mass., but they could certainly fall into this neutral sound category—in fact, many European speakers do.

Sensitivity of the A-35 is about average and we found a power of 20 watts per channel adequate for our listening room. We used a Pioneer 8000A 4-Channel receiver for some of the tests with two A-10's at the rear. This combination worked beautifully—although it would be even better with two 25's or 35's at the rear. Summing up: the A-35 joins the top six bookshelf systems in this price range. *T.A., G.W.T.*

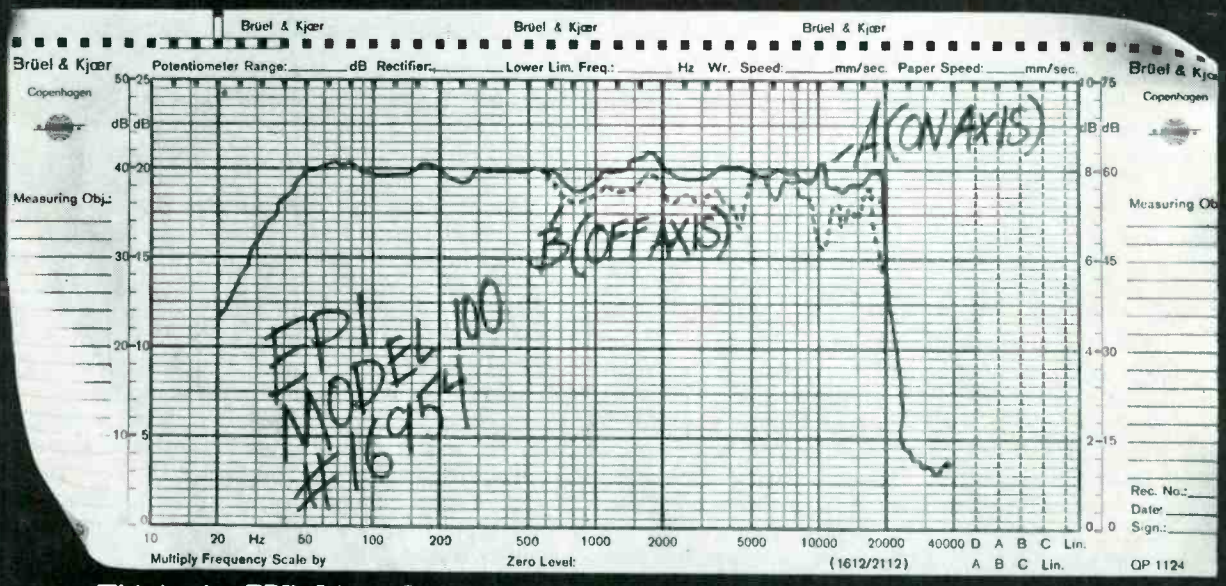
Check No. 78 on Reader Service Card

TEAC Model AT-100 Stereo FM Tuner

MANUFACTURER'S SPECIFICATIONS:

IHF Sensitivity: 2.0 uV. **S/N Ratio**: Better than 70 dB. **THD (Mono)**: less than 0.5%. **Selectivity**: Better than 65 dB. **Capture Ratio**: below 1.5 dB. **Image Rejection**: Better than 90 dB. **IF Rejection**: Better than 90 dB. **AM Suppression**: Better than 50 dB. **19 and 38 kHz suppression**: better than 55 dB. **Frequency Response**: 50—15,000 Hz ± 1 dB. **Stereo FM separation**: 1000 Hz: Better than 40 dB; 100—10,000 Hz: Better than 30 dB; 50—15,000 Hz: better than

EPI'S LINEAR SOUND. YOU HAVE TO SEE IT TO BELIEVE IT.



This is what EPI's Linear Sound looks like.

Everybody talks about linear sound.

But only EPI has EPI's Linear Sound. And there's a difference.

CURVE "A"

See the curve marked "A" on our linear response graph? We recorded curve "A" in the usual manner, placing our microphone (a B&K Model 4133) directly in front of our EPI speaker.

That's a remarkable thing, that curve "A". From way down on the bass end all the way up to the high treble end, it's practically a straight line.

What you see is what you hear: a pure, uncolored, natural sound from top to bottom. With no artificial boosting of the bass to impress the innocent. And all the nuances and overtones at the treble end that, on ordinary speakers, just fade away.

CURVE "B"

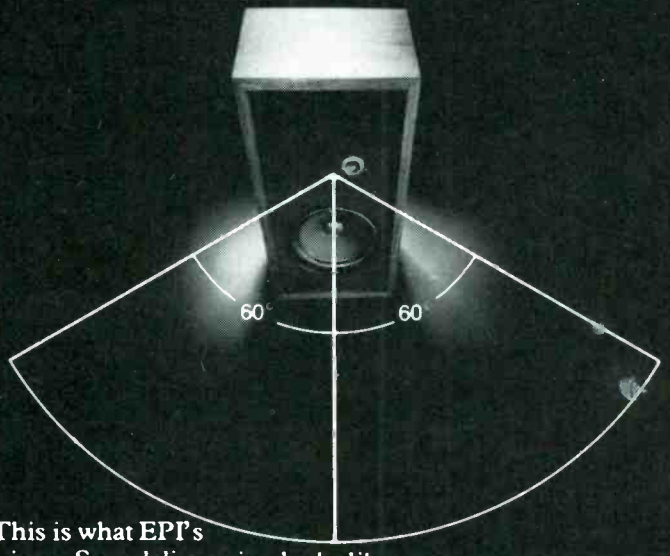
Now look at curve "B", and you'll see something even more remarkable: another virtually straight line.

What's remarkable about this is that curve "B" was recorded by placing our mike at a point 60 degrees off axis. So EPI's speakers disperse Linear Sound not just straight ahead, but in all directions, and at all frequencies.

In fact, up to 15KHz, the off-axis dispersion is down only an average of 3db. This is the result of EPI's unique one-inch linear air spring tweeter.

What does that mean?

It means that when you're listening to music, you can sit anywhere in the room, and you'll be hearing that big, full, natural sound you've just seen on our graph.



This is what EPI's Linear Sound dispersion looks like.

EPI's Linear Sound. It comes out of eight great speakers, from $55 to $1000, made only by Epicure Products Inc., Newburyport, Mass. 01950.

THE LINEAR SOUND OF EPI.

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Fig. 1—Rear panel view.

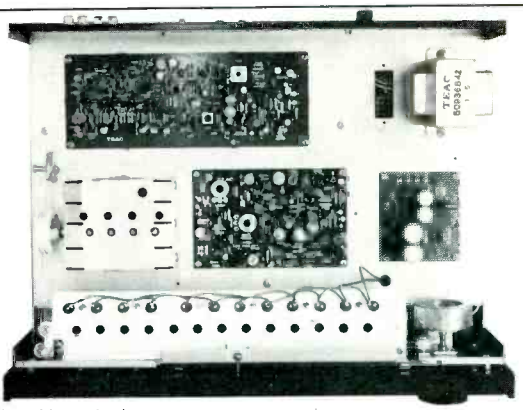


Fig. 2—Chassis layout.

20 dB. **Rated Output**: Fixed: 1.0 V.; Variable: 1.0 V. **Power Consumption**: 16 watts at 117 V. AC. **Dimensions**: 5-9/16" H. x 16-3/16" W. x 13" D. **Weight**: 16½ lbs. **Retail Price**: $229.50.

In the course of testing and reviewing new components for AUDIO, we sometimes come across a product which surprises us, in terms of its previously unheralded performance. The TEAC AT-100 Stereo FM Tuner turned out to be such a product. Among its many virtues were an altogether outstanding signal-to-noise ratio, which measured an incredible 78 dB (a new record in tuner S/N measurements for us) and stereo separation of over 35 dB at 10 kHz.

The light gold and black front panel includes a large, long picture-framed dial-scale and meter area which occupies most of the top section of the front panel. A large, flywheel-coupled tuning knob is located to the right of this dial area. The dial scale itself is linear and, in addition to markings for every MHz from 88 to 108, there is a linear 0-100 logging scale. This area, including the center-tune and signal strength meters, becomes illuminated in a soft blue color when power is applied to the unit. Along the bottom section of the panel are three slim-handled toggle switches. The left-most of these determines stereo or mono mode, and adjacent to the stereo setting is a tiny red-jewelled light which illuminates when a stereo station is tuned in. Towards the lower right are a pair of toggle switches which turn muting on and off and introduce a hi-blend circuit to reduce noise when weak-signal stereo stations are encountered. At the extreme lower right, directly under the tuning knob, is a power push-push button.

The rear panel (Fig. 1) contains an unswitched convenience AC outlet, a fuseholder and two pairs of output jacks. The first pair provides full-level outputs at all times while the second pair is controlled by a slotted level control so that output can be varied from zero to something over 1 volt r.m.s. to suit the needs of associated amplifying equipment. Four screw terminals at the right of the rear panel accommodate 75-ohm or 300-ohm transmission lines from antenna as well as a system ground connection, if required.

Figure 2 discloses the uncluttered chassis layout. The sealed four-gang front end is manufactured by Alpse, one of the better suppliers of high-quality FM-RF equipment in Japan. Other well laid-out printed circuit modules include the i.f.-muting board, a stereo multiplex decoder board and a separate power supply module. All of these modules are fully screened on their top surfaces with schematic part number designations so that a serviceman equipped with a schematic diagram would have no trouble locating a given component. Unfortunately, the operating instruction manual does not include a schematic diagram, so our evaluation of the tuner is based strictly on performance. Visual observation disclosed that there are no integrated circuits used and semiconductor complement includes 25 transistors and 29 diodes altogether.

Performance Measurements

Major monophonic performance characteristics are plotted in Fig. 3. IHF sensitivity was measured as 1.8 microvolts, as opposed to the 2.0 microvolts claimed by Teac. More important, our new criterion of "microvolts required for 50 dB S/N" was a remarkably low 2.9 microvolts—about the best we have ever measured. At that very low signal input level, THD is already well under 1.0% for 100% modulation. At 10 microvolts of input signal, S/N had already reached 66 dB—a value that would have been quite respectable even at 1000 microvolts of signal strength. With increasing signal strength, residual noise just kept getting lower and lower until, at about 100 microvolts, the "ultimate" reading of 78 dB was obtained. Few broadcast stations in our area maintain this kind of S/N to begin with, so that it may be fairly stated that dynamic range of this fine tuner will be limited strictly by station practice and capability!

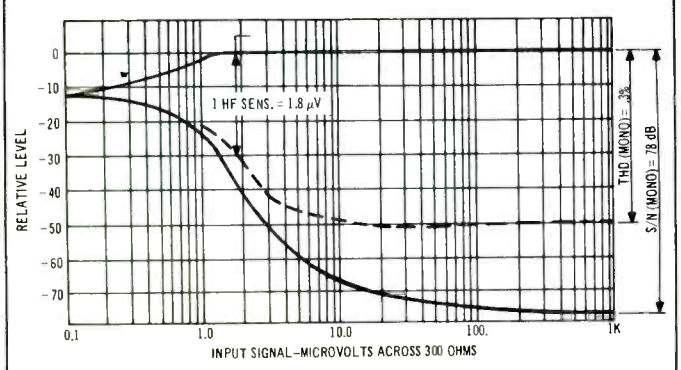


Fig. 3—Monophonic performance characteristics.

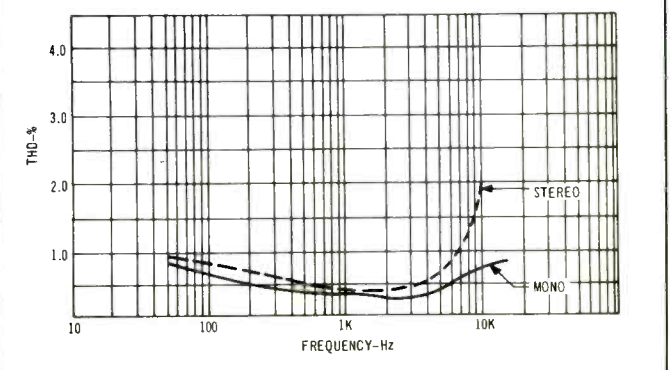


Fig. 4—THD for both mono and stereo.

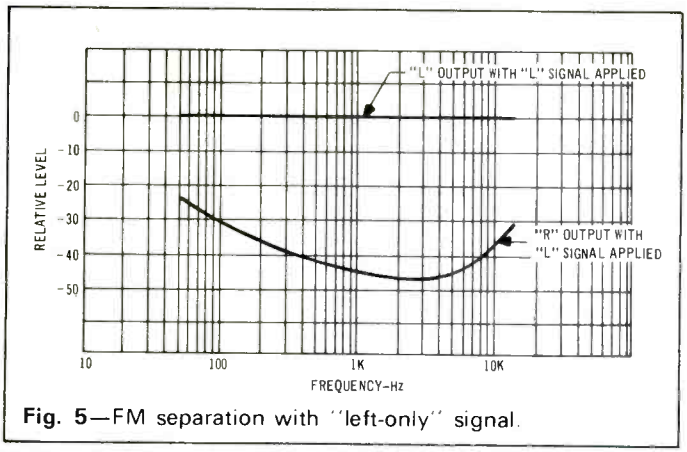


Fig. 5—FM separation with "left-only" signal.

From about 30 microvolts and above, THD in mono (at 1000 Hz, 100% modulation) was a low, low 0.3% (Teac only claims 0.5%) and, although our plot does not go beyond 1000 uV, signal levels of 50,000 uV and higher did not cause this low THD figure to rise, indicating a lack of front-end overload problems.

Figure 4 shows THD for both mono and stereo operation at all frequencies of interest. In monophonic operation, harmonic distortion never exceeds 0.8% throughout the audio range while for stereo, THD remains below 1.0% from 50 Hz to 7 kHz. The 2% reading shown at 10 kHz is the result of minute "beats" rather than actual harmonic distortion and, as such, is not to be taken as significantly as might be the case for actual THD.

Figure 5 shows stereo FM separation when a "left-only" signal is applied. In making our measurements, both channels were checked but the results were so close to being identical that a dual plot was not deemed necessary. At 1000 Hz, separation was measured as 43.5 dB (against the 40 dB claimed) and at somewhat higher frequencies we actually measured separation of as high as 47 dB. Note that at 8 kHz, where most sets are considered to be doing well if they can maintain 30 dB of separation, the Teac AT-100 still exhibits 40 dB of separation. Separation at the extreme low end tends to fall off, however, reaching 30 dB at 100 Hz and decreasing to about 25 dB at the lower limit of 50 Hz.

As noted earlier, the Teac AT-100 is equipped with a "high-blend" switch. Activating this circuit causes cross-blending of high-frequency noise from left to right outputs and vice versa. Since the noise output of a multiplex decoder circuit is basically out of phase from one channel to the other, the result is a partial cancellation of the increased noise normally noted when tuned to a weak stereo station signal. The switch would normally not be used under reasonably strong signal conditions, but we did find that Teac has gone a bit too far in its choice of components for this cross-blend circuit. Although frequency response is not affected, separation suffers a bit too heavily when the switch is used, decreasing to 12 dB at 1000 Hz and even less at higher frequencies.

Other important measurements confirmed but not shown in curves include a measured capture ratio of 1.3 dB (a bit better than the 1.5 dB claimed), alternate channel selectivity of 68 dB (again, better than the 65 dB claimed), spurious response and image rejection in excess of 90 dB (as claimed) and IF rejection of at least 95 dB (better than claimed). Frequency response in mono was within 0.5 dB from 50 Hz to 15 kHz and within 1.0 dB over the same range for stereo. AM suppression was measured as 53 dB while audio output level for 100% modulation was 1.6 volts r.m.s.—somewhat higher than claimed.

Listening Tests

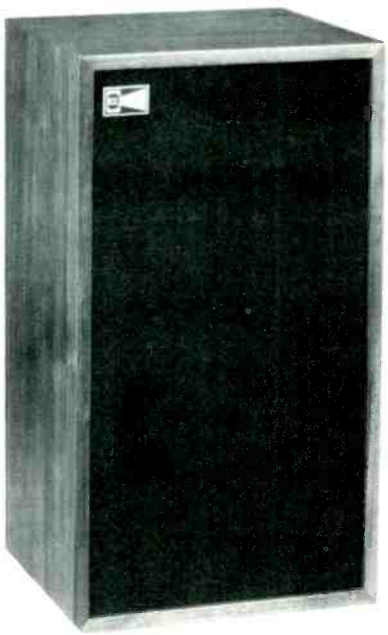
We have been using the TEAC AT-100 tuner for more than a week of listening and, concentrating on a few of the better stations in our area (the very few), have not been able to fault its performance in any way. There is no measurable drift and the center-tune indication of the tuning meter corresponds perfectly with actual center-of-channel tuning. One noteworthy effect we encountered is the relatively minor difference between the noise level of a stereo station in stereo versus the same station in mono mode. In most cases there *was* no difference, whereas in our location and with our particular antenna array we usually can detect a noticeable increase in background noise level when switching from mono to stereo. The very steep quieting characteristic is surely responsible for this welcome improvement. We logged some 48 usable stations, of which 25 were stereo broadcasting, and found it necessary to use the "high-blend" control for only three of the latter.

There are many costlier tuners on the market these days, some with digital read-outs, some with signal-seeking automatic tuning, some with oscilloscope displays and even programmable logic circuitry. These features will surely appeal to some users, but if you are looking for top FM and stereo FM performance with no extra frills and at relatively low cost, the TEAC AT-100 tuner is certainly worth considering.

Check No. 84 on Reader Service Card

Leonard Feldman

The Rogersound RSL 28 Loudspeaker System



MANUFACTURER'S SPECIFICATIONS

System: Two-way, air-suspension. **Bass unit**: 8 inch. **Treble**: 2½ inch. **Impedance**: 8 ohms. **Frequency range**: 40 to 20 kHz. **Shipping weight**: 15 lbs. **Dimensions**: 18 inches high, 9¾ wide by 8½ inches deep.

The Rogersound RSL 28 is a very inexpensive system costing only $39.95 and is only available direct from the makers. It uses an 8 inch bass unit having a 3 lb. magnet structure and a 2½ inch cone tweeter. Crossover is at 1800 Hz using a conventional LC network. (The inductance is air-cored.) The

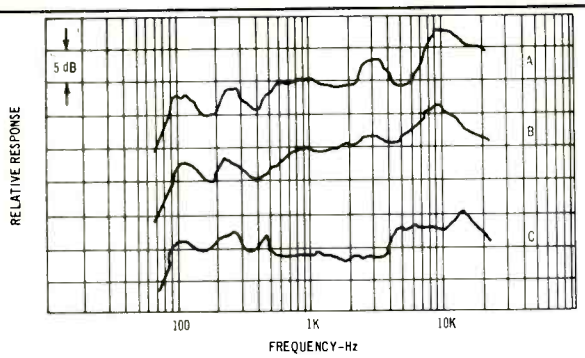


Fig. 1—Frequency response taken with one-third octave pink noise. A is on axis; B is 30 degrees off axis and; C is 60 degrees off axis.

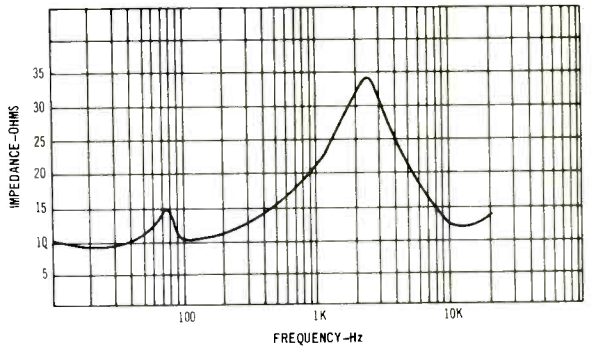


Fig. 2—Impedance characteristics.

enclosure is completely sealed and the system resonance is 70 Hz. Cabinet work is half-inch construction and the finish is oiled walnut.

Measurements

Figure 1 shows the frequency response taken with one-third octave pink noise. A is the response on-axis, B at 30 degrees off-axis and C at 60 degrees. It will be seen that the rise at the high frequency end is much less off-axis and that dispersion remains excellent up to 18 kHz. The impedance characteristic is shown in Figure 2. The lowest point is just under 10 ohms and the highest is 35 ohms, reached at 2.6 kHz. This range is normal for this kind of system. Tone-burst responses at 100 Hz, 1000 Hz and 5000 Hz are shown in Figure 3. Figure 4 gives the low frequency distortion and some SPL measurements. Distortion increases sharply below 50 Hz but the system would handle 40 watts continuous power at 40 Hz without distress and 96 watts at 100 Hz!

White noise tests confirmed some coloration—mostly in the mid-frequencies.

Listening Tests

The RSL 28 is rated at 35 watts rms so we used a small receiver for most of our tests. This was the Sansui 210 which puts out about 15 clean watts per channel and costs under $150. In other words, the kind of receiver most people would use with a moderate priced loudspeaker system.

As the sensitivity of the RSL 28's is above average, enough power was available for a medium-sized room. The best position for the speakers was angled inward—as might be expected from the response curves. A system in this price range cannot produce the 40 Hz deep bass of larger, more expensive systems but the overall sound was surprisingly good. The 28 can be recommended for those on a budget, either as the main speakers or for quadraphonic conversions.

Check No. 85 on Reader Service Card *T.A., G.W.T.*

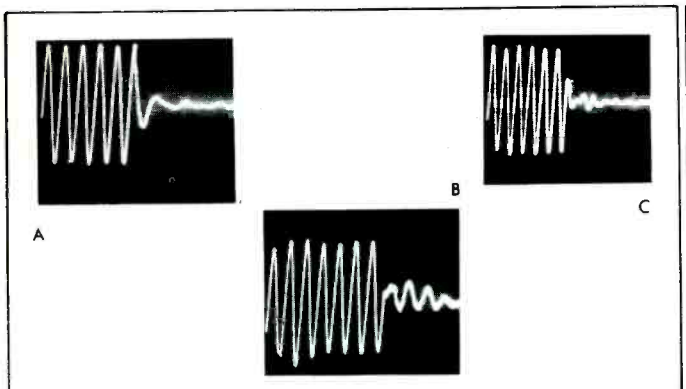


Fig. 3—Tone-burst responses at 100, 1000, and 5000 Hz.

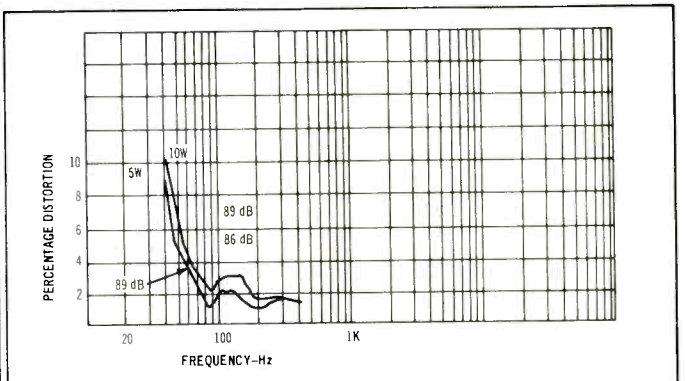
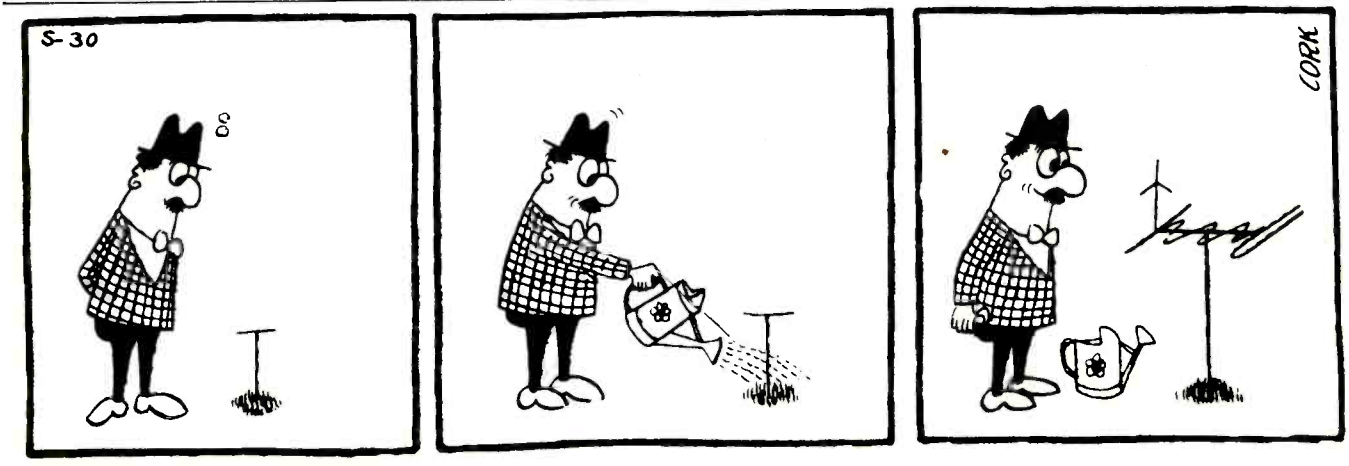


Fig. 4—Low frequency distortion and some SPL measurements.



(Continued from page 44)

thing like "Stanton is ready". There were two phono set-ups on hand. One used a regular Stanton cartridge. The other was what looked like an identical model. But it was designed to play CD-4 discs. Not in production, that one. But you can see how the thinking went *chez* Stanton, back then.

And now I have me an Audio-technica cartridge (a Japanese line which briefly bore the Electro-Voice name awhile back, and now is launched on its own). Mine is the next-to-top in a complete line in which four out of eight models are advertised as having a frequency response out to 45KHz, specifically to play the CD-4 discs. (The very top model is derived from the next-to-top by special quality control and selection.) Moreover, the top three cartridges have a nude-mounted Shibata stylus, some form of which looks to be increasingly necessary to track the tiny CD-4 modulations without wiping them off or rubbing them down. (The Shibata bears on a much larger area of the groove than the elliptical stylus and thus the pressure at any one point, for a given stylus "weight", is considerably reduced.) Here is clearly an all-out design effort to meet the new requirements head-on. It will not be the last, needless to say.

I removed my long-time Shure V-15 Type II and in a few moments had the Audio-technica AT15S playing, right in the same old arm. It is a pleasure to be able to switch cartridges so easily today, in comparison with the bad old times when non-standard connections, dribbly solder and melted plastic, hopelessly differing weights, screws, mounting sizes and shapes, made life miserable for the cartridge user. It is also a pleasure to report that in no gross respect did I notice any dramatic difference in sound. We are now close enough to total fidelity so that cartridge differences are micro and minute, if important (notably, again, tracking ability), and the over-all sound of all good cartridges is gratifyingly *the* sound of our records.

No—I wasn't even demodulating CD-4 discs! Just playing them through an SQ decoder into pseudo-quadraphonics. Also playing SQ discs, *per se*, plus regular stereo, mono and everything else at hand, all via Shibata and wide-range Audio-technica, flat to maybe 45KHz, right there in my system. No quirks, no freakishness, no problems. Play everything. (No problems yet, anyhow.) Hopefully, this is a good taste of what we could have, once the change-over to a wider-range cartridge and modified stylus tip makes for complete playing compatibility for *all* systems, as far as the cartridge goes. I like the idea.

How was this cartridge designed? Gotta be careful—I'm not a cartridge engineer. But it gets its performance basically via a dual magnet assembly, one for each side of the groove, and less mass, hence (I'm assuming) a higher resonance and extended response. In any case, it *has* the response, and the sound is good. No tests. Not me. Except that I'll be trying out Audio-technica with some glee on Shure's horrendous new set of testing discs, designed to wring the withers out of anything less sturdy than the Shure Type III—including the Type II, as I heard and saw for myself at Chicago. That'll be fun, you may be shure. After all, frequency response isn't the first parameter in a fine cartridge. It just happens to be very important at the moment, courtesy of CD-4.

* * * * * * * * *

As usual in my writing, this has been an attempt to put an evaluation on a new factor in the hi-fi scene, without necessarily taking sides, which I haven't. There are other ways, combinations of ways, to achieve a CD-4 type frequency response, even in lower-priced cartridges. Why not? We have an extraordinary cumulative cartridge know-how at this date. And here is the sort of problem where, given the impetus, we are supremely able to make acute, quick improvements, towards a specific end. I see no reason why we should not soon have a complete range of CD-4 capable cartridges, all the way up and down. Starting of course in the top brackets, which is merely normal. (Remember the Fairchild stereo SM-1 and the SM-2? The first stereo-capable cartridges on the market.) But from thence, rapidly descending, with all the normal grades of performance, down to the very bottom, short of sheer nothing. It's surely about to happen, and in awhile the new models should wholly supplant the old, just as the stereo cartridge took over from the mono to play everything available. All this, surely, unless the CD-4 dies tomorrow morning.

Suppose it did? Or next year. Do you think that the world of cartridge design would remain unaffected? My feeling is that the mere existence of the *possibility* of commercial discs with a 30KHz carrier has long since had an immense stirring-up influence on cartridge design. This is the sort of challenge that gets the designers' best blood up. So things will not be the same again. Whether CD-4 is alive or dead. From the cartridge viewpoint it really doesn't matter.

Canby's Capsules

Schütz: The Christmas Story. Ian Partridge, narr.; Instruments, Heinrich Schütz Choir, Norrington. **Argo ZRG 671,** stereo, $5.95.

Two lively British performances of continental music, from that paragon of smallish companies, Argo—never a dull British moment on Argo. A year-old U.S. release, the Schütz is still a "find", an outgoing and enthusiastically alive performance of the late-Schütz drama, part reconstructed from various incomplete sources. Not wholly "authentic", but full of real verve and highly musical in spite of some G & S qualities—note the basso solo! Most enjoyable. The Palestrina Masses, six-part and four-part, are rendered ineffably British by the St. John's singers—the usual high choirboy soprani plus rich countertenors and opulent British bassi. Knowledgeable and communicative singing.

Palestrina: Missa Assumpta est Maria; Missa Brevis. Choir of St. John's Cambridge, Guest. **Argo ZRG 690,** stereo, $5.95.

Los Angeles Wind Quintet. Thuille: Sextet, Op. 6; Kohn: Little Suite; Roussel: Divertissement. With Dolores Stevens, piano. **Orion ORS 7263,** stereo, $5.98.

Orion is right—Ludwig Thuille, Austrian contemporary of R. Strauss, is a fine if conservative composer, a young-sounding Brahms, very eloquent and tuneful. Kohn's 1963 Little Suite is late and acid neo-classic, easy listening. The Roussel is the usual expert French wind music. But why such raucous sounds?? The piano is super-honky-tonk, bang-bang tinny, like an old upright; the winds shriek in hypertension, if expertly and musically. Is L.A., really *that* hysterical? And does music have to be recorded in stone-dead studio acoustics?

Homage to Pavlova. London Symphony Orch., Richard Bonynge. **London CSA 2232** (2 discs), stereo, $11.96.

Four sides of old-fashioned 19th c. ballet stuff, the music to which the great Pavlova and her ballet company did their dancing in a million small towns everywhere, before 1930. She *was* ballet, as Paderewski was piano, Kreisler, the violin. It's lovely old music, well and seriously played in perfect style, neither exaggerated nor put down. All sorts of composers, known and unknown—but they all sound alike. Fascinating big booklet, illustrated.

Art of Mihaly Virizlay, cellist. (Schubert: "Arpeggione" Sonata. Dvorak: Rondo in G. Haydn-Piatigorsky: Divertimento. Paganini-Virizlay: Fantasia on "Moses".) **Orion ORS 73103,** stereo, $5.98.

Orion has a first-rate cellist in Hungarian-born Virizlay; a clean, accurate technique, no arty effects, an unusually fine pitch sense even up into the highest and squeakiest cello registers. Very easy listening! The side 1 Schubert is beautifully done, with lively piano from 24-year-old Rebecca Penneys. On side 2, the Dvořak Rondo is excellent. The rest is cello show stuff—but the disc is worth it for its first two items.

Music of Paul W. Whear. (Decade Overture; Catharsis Suite: Psalms of Celebration; Joyful-*Jubilate.*) London Concert Choir and Orch., Whear. **Advent USR 5001,** stereo, (*23366 Commerce Park Rd., Cleveland, O. 44122*).

Whear is a top U.S. local pro conductor and composer, out of Indiana, presently in W. Virginia—recipient of endless honors, commissions, a voluminous producer of fat works for local performance all over. His music is big, thick, highly pro and wholly unoriginal, reminding of everybody from Brahms to, maybe, 1940. Just fine for the local players to work on, but who on the outside wants to listen? You may if you wish—see address. (Note incongruous British playing, an economic necessity for such a recording.)

Schumann: Quintet for Piano and Strings, Op. 44; Quartet for pf. and Strings, Op. 47. Cohen, Martin, Mester, Kouguell; David Hancock, piano. **Monitor MCS 2132,** stereo, $4.98.

It doesn't say so but I'll bet David Hancock was also the recording engineer. A piano/audio superman. Good Schumann of a modern performing sort, not as all-out Romantic as older (and very new) tradition demands, a bit too Bach-like in tempi, not flexible—but always musical even so. Nice disc.

Mahler: Symphony No. 7. Concertgebouw Orch., Haitink. **Philips 6700.036** (2 discs), stereo, $13.96.

Part of Mahler cycle (not in numerical order—No. 1 is a later release). This is less known than the other big ones but is still a gold mine of good Mahlerisms, at the beginning of his late-period harmonic concentration and dissonance. Solid Dutch performing, beautifully shaped for the long (*very long*) pull, nicely recorded. I like the inner movements best; the outer ones are too big and loud for my taste—but suit yourself! We all do.

Borodin: Prince Igor. Soloists, Bolshoi Chorus and Orch.; Ermler. **Melodiya-Angel SRDL 4166** (4 discs), stereo, $23.92.

Everybody knows the familiar *Igor* excerpts—the Polovetsian Ladies, etc.—here is the whole huge opera, four discs, in Russian, a massive, handsome production sounding surprisingly like *Boris Godounov.* But *Igor* is milder and mellower, for all the huge voices and big sonic pageantry. A marvelously effective recording.

Edward Tatnall Canby

Copland Conducts Copland. Preamble; Symphonic Ode; Orchestral Variations. London Symphony Orchestra. **Columbia M 31714,** stereo, $5.98.

Columbia is systematically, and wisely, documenting Aaron Copland's musical output just as the company so wisely got vast quantities of Stravinsky down on tape in his own readings. Copland was conveniently born in 1900; you always know how old he is. Obviously he is now in the summing-up period of his long and busy career in the midst of American musical establishment, and it is the right time to get *him* onto tape, too.

Needless to say, what with so many recordings of his popular pre-war orchestral and dance works—*Rodeo, Billy the Kid, El Salon Mexico, Appalachian Spring*—the emphasis is bound to be on the more abstruse and "classical" pieces that form a Copland alternative throughout his life. So it is, partly, here. These are not new works, and one is a re-make of a 1930 piece for piano, the famed Variations. They are all of a rigorous sort and offhand might seem hard to take; but if you have any fondness for the lighter Copland, you will burrow into these harsher sounds with no great trouble. Interesting to hear where he derived his more familiar style! It's here, so to speak, in dress tails.

The bid Ode was, as Copland says, a major "statement" in 1929, intended to knock the symphonic world over, which it no doubt did. It has since been sweetened and simplified a bit but remains declamatory, severe, or alternatively lyric—except for a refreshing bit of Copland jazz en route (not related to current jazz, I should note). Then there is the Preamble for a Solemn Occasion (the Declaration of Human Rights and the U.N.) of 1949, which is even more declamatory. Finally, the 1930 Variations in a 1955 orchestral version.

I do believe I was at the premiere of this well known and caustically logical piano work. It was in my college years and I knew no "modern" music whatsoever. I walked in on a semi-informal gathering with my roommate, late—and there was Mr. Copland not ten feet away, whanging and banging, swooping out acrid, ultra-loud piano notes with his long fingers and, it seems, almost his long nose, practically down to the keyboard. Instantly, I got the giggles. So did my roommate. We huddled down on some steps near the door, horribly embarassed, unable to get *out* again, and periodically exploding into stifled hysteria, as the whanging sounds went on, so incredibly odd for our sensitive adolescent ears! It was, shall I say, an occasion to remember, though I hope Mr. C. doesn't.

Later on, I found (after much education in musical listening) that, to my surprise the Variations tamed themselves and came to make perfectly good sense, if somewhat rigorously. They still do, in their 1930 dissonant-tonal way, and the orchestral version makes things immensely easier for the unfamiliar ear. Anyhow, these days, music of this sort doesn't shock and cause giggles. Not even for hi fi fans. You might even like it.

Performances: A Sound: A–

Debussy/Ravel La Mer. (La Mer; Afternoon of a Faun; Daphnis and Chloë Suite No. 2.) Philadelphia Orch., Ormandy. **RCA Quadradisc ARDI 0029,** $5.98.

No sooner do I burst forth in generalities about the polished but routine Philadelphia playing (see April issue) than I am happily slapped down by this stunner! I take it all back. At least for this one. It is splendidly alive, beautifully styled and full of intensity.

Only the *Afternoon of a Faun*, no doubt in its ten thousandth Philadelphia performance, is of the familiar polished and routine sort. Not surprising for that ever-faithful favorite of the symphony concert.

We must remember that Eugene Ormandy is now one of our senior conductors, born before 1900, and that this early Twentieth century modern music is right out of his own times, his formative years as a musician. He was six when Debussy's *La Mer* was first heard—but that work came into its own only some years later. Ravel's *Daphnis and Chloë* dates from 1912 when he was 13, but again became a symphonic favorite via the two familiar Suites in the years afterwards. Thus this music grew up with Ormandy and it is *his* modern music, his background. That, surely, is what we hear on this surprising disc. Such intensity! Such fast-paced but virtuoso detail. (The excellent Philadelphia players, of course). Such ideal styling and expression. Many present conductors, many of alien nationalities, simply do not evoke much out of these complex and "old fashioned" modern scores. Under Ormandy, they are fluent and wonderfully natural.

Since RCA is distributing its quadradiscs as stereo too, at the same price (and only the one release), I am deliberately listening to some of them as though they *were* standard stereo discs. Interesting. This one is excellent, only barely noticeably down in volume, for my ear, and timed long enough to pass muster—though there is, to be sure, a pretty wide blank space around the label on each side, the touchy area where the quadraphonic grooves become a bit difficult in the cutting and playing. I would not have noticed anything at all, however, if I had not been specifically looking for "symptoms" and so I recommend this and the other recent Quadradiscs to all who wish to buy them as straight, standard stereo.

Performance: A– Sound: B

Rachmaninoff: Piano Concerto No. 2. Artur Rubinstein; Philadelphia Orchestra, Ormandy. **RCA Quadradisc ARDI 0031**, $5.98.

Rachmaninoff: Symphonic Dances, Op. 45 (1941); "Caprice Bohemien", Op. 12 (1894). London Philharmonic Orch., De Waart. **Philips 6500 362**, stereo, $6.98.

Well how's that? Two-way stereo costs more than four-way quadraphonic in this juxtaposition. But price is not all, if you enjoy Rachmaninoff.

I always do for the first five minutes. Then, strangely, I find my attention begins to wander and; pretty soon,

my eyes cross, my ears go blank and the great sea of sound just beats upon me unfeelingly. It does go on & on. But many souls swoon—all the way through. More power to them.

For just so long as old Rubinstein continues to put forth his matchlessly youthful and powerful piano playing, I will listen to *anything* he offers. How *can* he do it? He was born in Poland in 1886, and now he records in quadraphonic! Edison's phonograph was *invented* only nine years before this man's birth. I might add, for this record, that though Ormandy can be routine on his own, he is invariably a splendid accompanist, picking up the energy and bouyancy of his solo performers, backing them and strengthening them. So this one is superb, even in standard stereo reproduction or, for that matter, mono.

The Philips disc from England is unique in that it contains two big orchestral works neither one of which you will have ever heard of. The Symphonic Dances are part of his last trio of works, the more familiar being the *Rhapsody on a Theme of Paganini*, with piano. The Dances remind one of that piece only too clearly, but are not really as good, full of weighty Rachmaninoffisms including the too-familiar "Dies Irae" theme, heard all through the Paganini piece. Waltz rhythms and the like seem almost incongruous in such a massive texture. The "Caprice", a lot more massive than that title would suggest, is ebullient in the early style, all-out late-Romantic, and—well, quite absorbing for the first five minutes. It goes well with the First Symphony, if you like that one. Excellent, incisive playing helps both works.

Performances: A, A– Sound: B+, A–

Schubert: Piano Sonata in A, D. 959; German Dances, D. 790. Alfred Brendel. **Philips 6500 284,** stereo, $6.98.

Mozart: Piano Concertos K. 459 in F, K. 488 in A. Alfred Brendel; Academy of St. Martin-in-the-Fields, Marriner. **Philips 6500 283,** stereo, $6.98.

Alfred Brendel is one of those strong, winsome, gentle European pianists of the central tradition whose life seems to have sprung right out of the Viennese classics. He plays Mozart with love, understanding, modesty, perfect style, though with perhaps a lower voltage than other pianists of similar central-European background. He plays Schubert, too, with innate and natural expression. The smaller Schubert, that is. And a good part of the large, late Schubert represented by the *Sonata in*

A. But there are some reservations to be made in this work.

The solo Schubert disc is superb in the last two of the four Sonata movements and, particularly, in the beautifully expressive and well tailored German Dances, remarkably like Chopin waltzes in Brendel's supple playing. But in the profound and difficult opening Sonata movement and in the slow movement that follows, I sense that Brendel (like many another otherwise major pianist) does not follow the involved and complex harmonies in the central portions, where Schubert rocks the whole concept of tonality in a wholly revolutionary fashion. In contrast, for example, Brendel's near-colleague Paul Badura-Skoda plays these movements not only with greater intensity but with an astonishingly dramatic understanding of their harmonic significance. A profound difference.

Brendel has no such problems in Mozart, where his apparently indifferent "ear" for strange and drama-fraught harmonies merely results in a somewhat low-voltage continuity, as abovementioned. No harm done at all, for in Mozart, drama is all too easily overplayed and should not be. I enjoyed the two well known Concerti from beginning to end and particularly the fine shaping of detail and phrase in the A Major, K. 488. The British orchestra in the fields of St. Martin (quaint name!) is crackerjack, and ideal for good Mozart.

Performances: B+, A– Sound: A–; A–

Eleanor Roosevelt. A Xerox Recorded Portrait. In Conversation with Arnold Michaelis. Xerox XRP 1001, mono.
Martin Luther King, Jr. A Xerox Recorded Portrait. With Arnold Michaelis. **Xerox XRP 1002**, mono. *(Xerox Corp., 300 North Zeeb Road, Ann Arbor, Mich. 48106.)*

For some years Arnold Michaelis has been pursuing a specialized sort of in-depth personal tape interview with celebrities—since a long time before all the young journalists have been toting around cassettes. In our fast-moving world, Michaelis is a pioneer though his product is not the more usual written account of today, transcribed from tape, but the actual audio itself. His superb offering on Mrs. Roosevelt, one of the great documents of our time (and that is to her credit, of course, as well as his!) appeared years ago on M-G-M and, I think, was once reissued—then vanished. I myself did a radio tape, inserting my own comments with excerpts, which has also appeared

on the air a number of times. Now, Michaelis has got Xerox behind him and there is a whole series, of which I have so far listened to the two here listed. Others are Oscar Hammerstein II and Maurice Chevalier, and, I can guess, there are more if these do OK.

Michaelis is astonishingly good at this job. As I get it, this is because of several talents not often combined in one person. First, his voice is unobtrusive, an anonymous, announcer type that does not intrude at all on the flow of the more individualistic voices he is interviewing, and yet is there, discreetly, as a helpful alternative sound contrast. Second, behind the anonymous voice is a brain—rare, alas, in announcers. And third, there is an implied *persona,* an ability to get his subjects to open out and talk, aided by (fourth) an obviously careful preparation of the entire background of factual material. It works—beautifully. I must congratulate Xerox for this worthy enterprise, and Michaelis for his persistence over the years.

The Roosevelt interview is absolutely fascinating as a portrait of an incredible great lady—as interesting for the eloquent things unsaid, the significant tiny pauses, the tones of voice, the careful balancing of pros and cons, likes and dislikes, as for the marvelous direct look at Eleanor's fabulous childhood and later life among the great, from Uncle Ted (Theodore Roosevelt, the President) right through to her own sons and that indomitable grandma, FDR's mother, who pampered Eleanor's kids and generally loused up the entire Roosevelt home life—all with the best of intentions, of course! And this a few feet from your easy chair as you sit in and listen! As I say, a great document and no two ways about it. If ever there was a historical proof of the vital importance of sound recording, this is it. Imagine the same interview with Queen Elizabeth I, two whole LP sides, with her own account of childhood under Henry VIII and the beheading of her mother, her own dire danger of the same as Princess a few years later . . .

Martin Luther King, Jr. is less a master of good talk, but his interview is also intensely interesting, if a bit longish and too drawn-out. It is more "dated", of course, with much that was of the time and is now, alas, partly forgot. But the odd feeling persists—this was *before* he was assassinated, without foreknowledge; and yet every word you hear seems to say that we know what is to happen, so soon. It is almost taken for granted. Curious document.

Performances: A+ Sound: B

weingarten: Off The Record

"You see, Dr. Kronkite, it's like this. I'm rapidly becoming a manic-depressive.

"I know you're the doctor and I'm the patient, but I do know my own symptoms.

"It all started years ago when I became a record critic. The idea was to comment on what was worthwhile and what wasn't, to make a personal yet professional judgment based on expertise of sorts. But after a while I noticed that the things I'd write about were the extremes—the discs and performers that were exceptionally good or excruciatingly bad. And that, of course, covered less than one per cent of what was released. All the middle-ground stuff, and that's one helluva lot of mediocrity, was ignored. But I could only ignore it in print; while listening, I cringed, horrified at the knowledge that so much blandness was being produced. So eventually I blocked it from my mind—or so I thought.

"And because of space limitations in the print media, I stuck to highlights or lowlights. But the problem started to carry over into my private life. Everything was either marvelous or disgusting, including people. Lots of cliche adjectives. Puerile attitude. Everything in solid black or white. Nothing allowed in the middle.

"What can I do, doc? What can I do?

"Hey, that's not a bad idea—just pick a handful of the stuff that I've been avoiding like the proverbial plague and write about it. Not a bad idea at all . . ."

Mediocrity? Perhaps the king of it all is Jerry Reed, whose latest offering is RCA's **HOT A' MIGHTY** (LSP-4838).

Now here's a guy who's loud, wild and full of energy. The only difficulty is that all that verve doesn't overcome his basic lack of talent.

Somehow he had a fluke smash, *When You're Hot, You're Hot*. That led to a short-lived replacement TV show, one that coupled the title of the song and Reed's moniker as the program's name, most likely because few adults had ever heard of *him* although they might have heard the tune once or twice.

At any rate, Reed continues to present his brand of copy-cat country-rock vocals. On this disc, for instance, he provides 10 cuts, including a five-piece medley by Chuck Berry; he further attempts to update *Goodnight Irene* and *Sixteen Tons*, hits of yesteryear, but botches them almost completely.

Despite all this, he's not as bad as many so-called recording artists who have attained status in the vinyl firmament. He's just a one-song singer who in a little while will be another name in the "What ever happened to?" parlor game.

And then there's **SILVERHEAD** (MCA, 306), a quintet whose name serves as LP title. If you want 10 tracks of super-ordinary rock, virtually all of the hard variety, and you don't mind repetition, repetition, repetition, give it a spin.

But the album, previously released on another label, is noteworthy only by the fact that so much sameness could be crammed into one project.

Maybe the next time it's released it'll catch on, like an ill-fated Phase III of the music business.

Okay, you're a glutton for musical punishment. Try **THE BLACK MOTION PICTURE EXPERIENCE** (Buddah, BDS 5129). At least here there are only *nine* futile attempts to do something different.

The record features The Cecil Holmes Soulful Sounds, who, among other things, lack soul. Instrumental blandness is their stock-in-trade, and what they do to *Super Fly*, *Shaft* and *Across 110th Street* ought to preclude their ever visiting Watts or Harlem. For bad measure, they also toss in commonplace renditions of *Ben* and *2001*, although I've yet to figure out how those two fit into the "black experience."

Need more? How about **COMMUNICATION** (A&M, SP-4380), which doesn't. Hookfoot is the group, a British quartet specializing in rock 'n' roll that niether turns you on nor off.

Granted, the group changes moods and chords on occasion; most likely the audiophile will not be moved sufficiently to change anything, except perhaps the disc itself.

This, not incidentally, is Hookfoot's third LP, which says a great deal about America's tolerance—if not adoration—of gray.

Even the Hugh Hefner organization, once innovative and now desperately trying to catch up with the competition, has joined the nothingness sweepstakes. Frontrunner is **WHAT'S USUAL AIN'T NATURAL** (Playboy, PB 108), with somebody named Sam Russell toying with soul singing.

Of the 10 cuts, he had a hand in penning half a dozen; the feeling after listening, however, is a resounding "so what?" or a sarcastic "big deal."

Russell's claim to fame is that he coproduced a Jackie DeShannon chartbuster, *Put a Little Love in Your Heart*. Maybe he does have a spark of something in that line, but when it comes to being a threat to James Brown, forget it.

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

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

"You know, Doctor Kronkite, I think the idea really was pretty good. Now that it's out of my system, maybe I can shove all that mediocrity to the back of my mind again. And perhaps there's even a good, one-of-a-kind record in the next batch . . ."

Jazz & Blues

Martha Sanders Gilmore

BIG BANDS GREATEST HITS

Selections: *The Very Thought of You*—Ray Noble and His Orchestra; *One O'Clock Jump*—Count Basie; *Drumboogie*—Gene Krupa; *Skyliner*—Charlie Barnet; *"A" Train*—Duke Ellington; *I Got Rhythm*—Glenn Miller; *Caldonia*—Woody Herman; *Sentimental Journey*—Les Brown; *All or Nothing At All*—Harry James; *Oh Johnny, Oh Johnny, Oh!*—Orrin Tucker; *Juke Box Saturday Night*—The Modernaires; *Beer Barrel Polka*—Lawrence Welk; *Billy*—Orrin Tucker; *Sing, Sing, Sing*—Benny Goodman; *Does Your Heart Beat For Me*—Russ Morgan; *I Can't Get Started*—Bunny Berigan; *Sugar Blues*—Clyde McCoy; *Snowfall*—Claud Thornhill; *Sunrise Serenade*—Frankie Carle; *Chopin Nocturne in E Flat*—Eddy Duchin.

In days when nostalgia runs high, it is quite in the nature of things for Columbia to issue this two-record collection of the best hits of the Big Bands. These are the swing and dance bands of the thirties and forties which just wouldn't stop roaring along the Great White Way prior to World War II. These were the bands people filled ballrooms to dance to, fed jukeboxes to hear, and this excursion back in time contains the numbers folks absolutely would not let them leave the bandstand without playing.

It is by no means complete—no such compilation ever can be and therein lies the frustration of samplers such as these which can only scratch the surface. If they leave out one of your pet bands or omit a choice entree from a certain band's smorgasbord of music you may naturally be offended, but it is at once understandable. And it goes without saying that a controlled selection such as this merely whets the appetite for more of one's favorites.

The Big Bands came in all sizes and flavors: smooth, swinging, and contrived to be cute. Columbia has included some of each here. One hears Count Basie, as dapper and quick as Nick, count down *One O'Clock Jump* which is replete with tongue-in-cheek orchestral riffs interspersed with that tinkling Basie piano. One of the "best and brightest" is the effusive *Skyliner* of Charlie Barnet followed by a choice rendition of Ellington's *"A" Train* with a wealth of Ellington piano. Woody Herman's *Caldonia* is a red-hot screamer by his First Herd with Herman vocalizing.

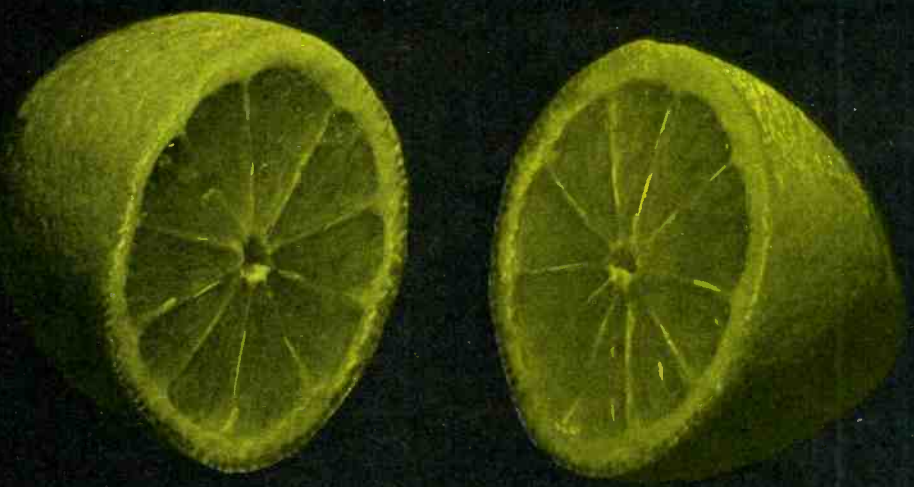
Benny Goodman creates a lot of hooplah in the company of Gene Krupa's tom-tom, a trademark of the drummer, in *Sing, Sing, Sing*. A classic treatment, it features Goodman's chipper clarinet and an articulate saxophone statement by Chu Berry. The lyrics of some of these old songs are truly unrivaled, most especially *I Can't Get Started* which bears out Bunny Berigan's excellent technical Facility on trumpet.

The list goes on and on: Clyde McCoy's *Sugar Blues*, straight out of the days when we listened to it on a broken-down Victrola down in somebody's rec room, and Claude Thronhill's delicately lush *Snowfall* in which his piano seems to simulate snowflakes. The singers are all here too: Wee Bonnie Baker, Snooky Lanson, Irene Day, Frank Sinatra, and The Modernaires.

The familiarity and sing-along quality of the collection is indisputable and I found myself easily remembering the Les Brown Band's modulation into Doris Day's vocal in *Sentimental Journey*, one of the most lucid audio-wise. The fidelity of these 78's do range far and wide and the sound is often predictably scratchy and periodically pitted. Columbia attempted to simulate stereo by re-recording it, an unnecessary step.

A worthwhile musical documentary in which traditionalists will delight and so cheerful that one can't help tapping a foot and anticipating melodic lines, this pick of the crop is a record for the record and John Wilson's notes make it ever the more attractive.

Sound C+ Performance B



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INSTITUTE OF HIGH FIDELITY, INC.
516 Fifth Avenue, New York, N.Y. 10036

(Continued from page 26)

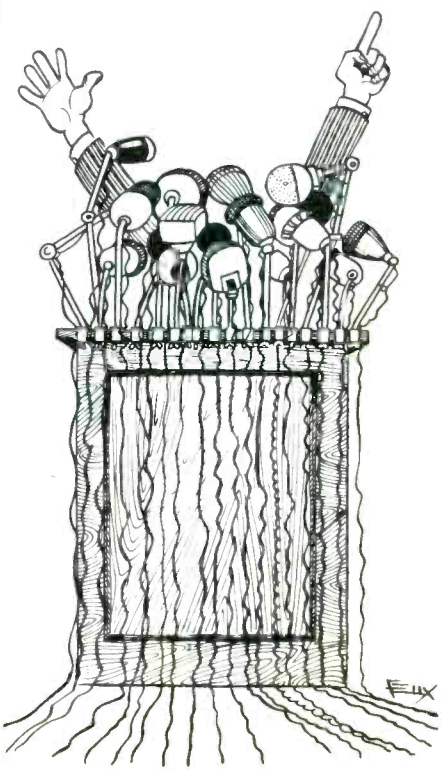
A word of explanation should be noted about other Counters. There is some difference between the general purpose Counter/Period Counter, and one designed specifically for high-speed frequency work.

For one thing, the readout should be non-blinking, and reflect both a continuation of count and change only when the input's frequency varies. The unit, then should be *latched*. We do not want the readout to reveal a count-up or count-down. With latched decade counters, the display continues to put out a given frequency while a new one is being counted. With the general purpose Counter, the count period is a divided down timing interval of the clock frequency.

The input shaping circuitry show some differences, too. Counters/Period Counters use a comparator input which is best suited for reducing noise or zero-crossing, while the other kind of unit uses well designed amplifiers and a precision Schmitt Trigger. The latter is better suited for rapidly and idiocincratically changing frequencies.

Readers who try out the above test procedure will probably notice what appears to be either a mis-cue or falsely recorded as FM of the least significant digit. The "± 1" flicker of this digit is inherent to most Frequency Counters, and should not be noted down as a speed variation. (It occurs when the count gate opens and a plus-or-minus one-count ambiguity exists.)

Present specs are far from perfect. The DIN is not really an improvement. RB's idea is an interesting one but it has snags too.–*Ed.*



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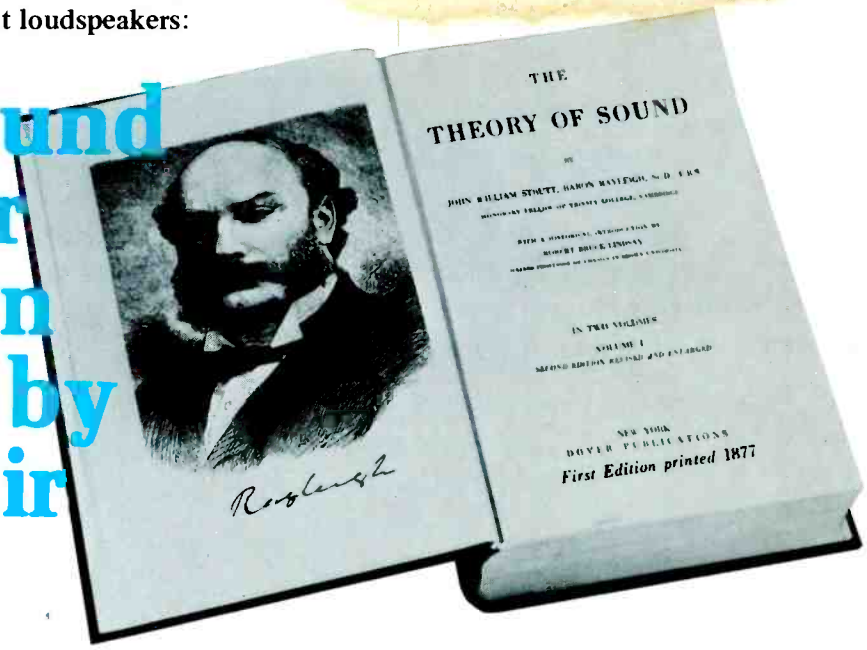

All speakers sound different from each other and when you hear a difference between two speakers that employ different principles of moving the air, it is only natural to wonder whether the variance in sounds is a consequence of the principles involved. After all, moving the air is what produces the sound.

Back in the 1950's, when electrostatic speakers reached a peak of popularity, some people thought that they might have a fundamental advantage because of the lower mass of the moving element compared to that of a cone speaker. Then, in the 1960's, ionic speakers were developed with no moving parts at all, and therefore, zero moving mass. Today, in the 1970's, a wide variety of transducers exists using principles ranging from piezoelectric to magnetostrictive, which either push the air with a diaphram or squeeze the air out between moving surfaces.

Indeed, some of the principles of moving the air do have advantages over others in terms of size, weight, efficiency, and cost. **But there is absolutely no advantage of any particular method of moving the air in terms of the potential quality of the sound that can be produced.**

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Therefore, a source (speaker) influences the sound field only through the amount of air it moves at each frequency and through the directions that the speaker moves the air. The method of moving the air in no way affects the sound that you hear.

In a basic experiment presented at a meeting of the I.E.E.E. professional group on Electroacoustics in 1964, it was demonstrated[2] that a multiplicity of full-range cone speakers can produce music that is subjectively identical to that produced (with the aid of computer simulation) by an ideal massless membrane free of all resonances and distortion. While this very basic result was proved only for full-range cone type speakers, the above discussion indicates that the same result could be obtained by the use of other types of full-range speakers as well. Thus, the secret of excellent performance doesn't lie in the type of speaker used (i.e. the way the air is moved). It lies in the use of a *multiplicity of full-range* speakers in one enclosure, in the *exact proportioning* of the *ratio and the directions of direct and reflected* sound radiated by the total enclosure, in the *precise equalization* of the speakers to radiate the correct balance of frequencies, and in *extreme quality control measures* that select and match all the speakers in the enclosure.

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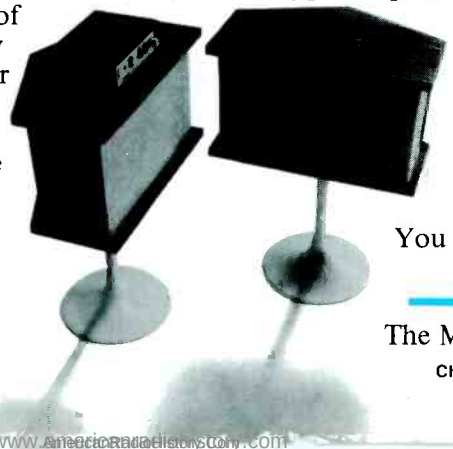

References
1. The Theory of Sound, Vol. 1, By J.W.S. Rayleigh, 1877.
2. The results are documented in the Audio Engineering Society Paper, ON THE DESIGN, MEASUREMENT AND EVALUATION OF LOUDSPEAKERS, by Dr. A. G. Bose. Copies are available from the Bose Corporation for fifty cents.

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