Paul Klipsch

THE Mud Factor

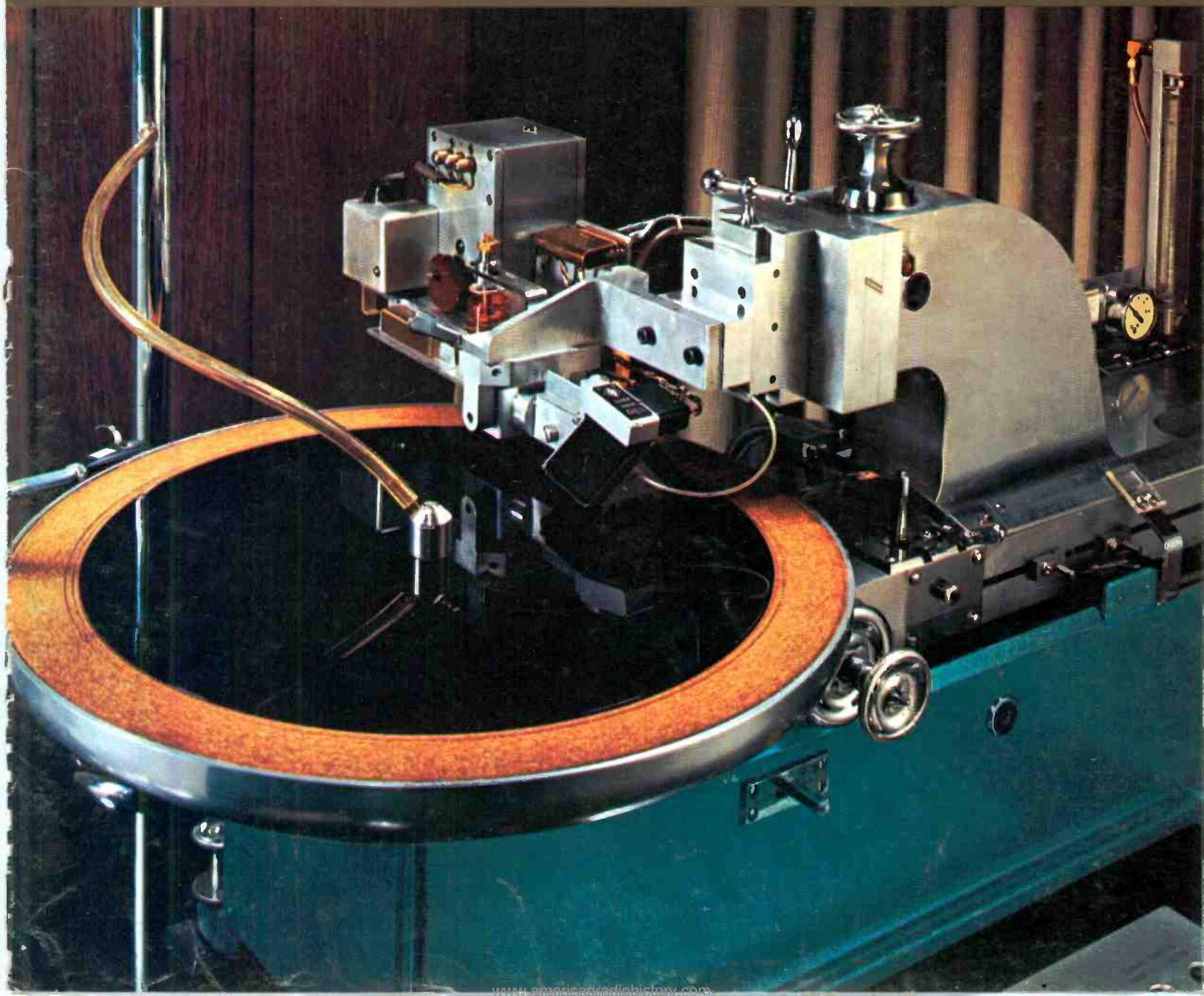
The Authoritative Magazine About High Fidelity

AUDIO

OCTOBER 1970

60¢

Keyboard Immortals • Stereo Receiver
Lexicon • Tape Recorder Maintenance



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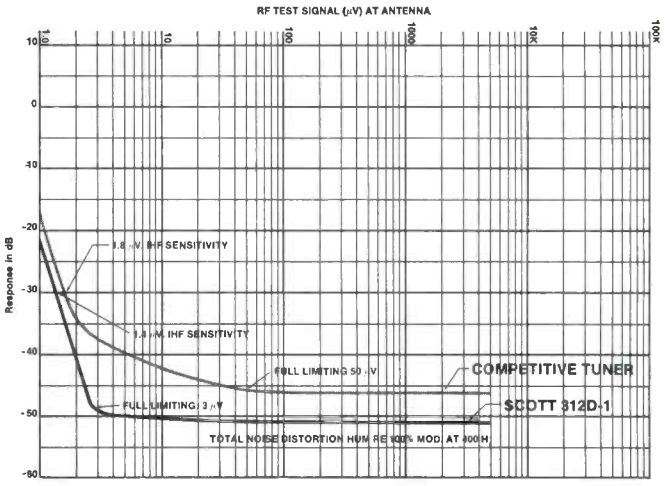
"Your tuner means that for the first time we have been able to monitor and rebroadcast stereo signals from WFCR in Amherst, a distance of over 110 miles. The signal quality is as clear as if it had originated locally . . . certainly a vast improvement over our earlier rebroadcast efforts."

William Busick (Shown below)
FM Engineering Supervisor
Lowell Institute Cooperative Broadcasting Council
Educational TV Channel 2 and WGBH-FM
Boston, Massachusetts



(Tuner sensitivity curve)

A Scott tuner reaches full limiting at a much lower signal strength than competitive high quality tuners and receivers. Professionals agree, a Scott receives more listenable stations with minimum noise... in other words, more stations more clearly.

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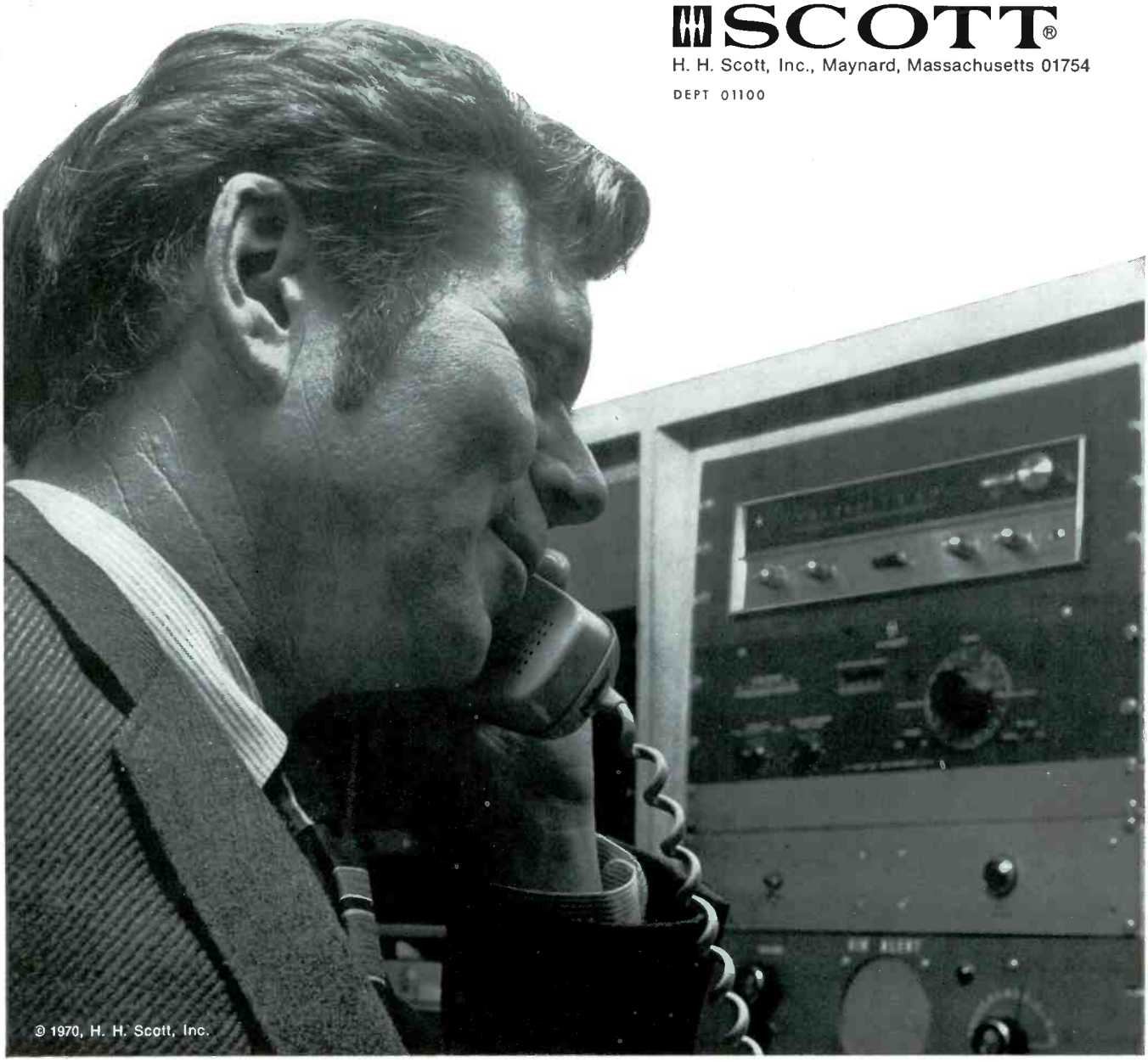

Music doesn't have to be dead just because it isn't live.

RCA tapes put life in your recordings.

And we have whatever kind of tape it takes to do it.

Low noise mastering tape for the pros. In ¼-, ½-, 1- and 2-inch widths.

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RCA
Recording Tape

Check No. 1 on Reader Service Card

AUDIO

Successor to RADIO, Est. 1917

OCTOBER 1970 Vol. 54, No. 10

FEATURE ARTICLES

EQUIPMENT PROFILES

RECORD/TAPE REVIEWS

AUDIO IN GENERAL

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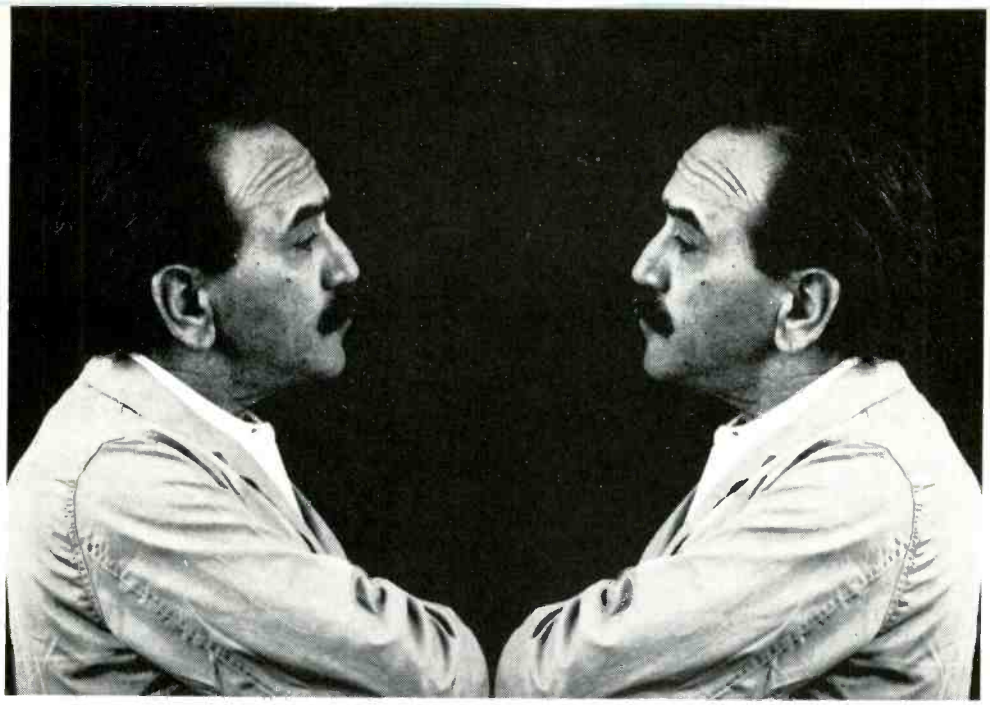


At our Swindon works, for every man who assembles we have one who tests.

Garrard of England is the world's largest producer of component automatic turntables.

And our SL95B is generally conceded to be the most advanced automatic you can buy, at any price.

Yet we confess to some startlingly old-fashioned ideas.

Instead of rewarding the speedy, for example, we encourage the persnickety.

In final assembly, each man who installs a part tests that finished assembly. The unit doesn't leave his station until he's satisfied it's right.

For a faulty unit to be passed down the line, a man must make the same mistake twice. An occurence we find exceedingly rare.

If something *isn't* up to standard, he adjusts it on the spot—or sets it aside to be made right.

Hardly the sort of thing production records are made of.

A modest record

But as Brian Mortimer, Director of Quality Assurance, has said, "We absolutely refuse to let units per hour become an obsession. It is simply a useful statistic.

"Each final assembly line for our 95B consists of nineteen men and women.

"In top form, they turn out twenty units an hour. A rather modest record in these days of mechanized production lines.

"But if we were to speed it up, we'd pay for it in quality. And, in my book, that's a bad bargain."

Of roots and heritage

We admit, however, to enjoying a special circumstance. Garrard recently marked its fiftieth year, all of them in the town of Swindon, England.

In a time of people without roots and products without a heritage, many Garrard employees are second and third generation.

Brian Mortimer's father, E. W., hand-built the first Garrard.

And in all, 256 of our employees have been with us over 25 years.

A happy circumstance, indeed.

To buy or not to buy

In an age of compromise, we indulge still another old-fashioned notion.

Of the 202 parts in a Garrard automatic turntable, we make all but a piddling few.

We do it for just one reason. We can be more finicky that way.

For instance, in the manufacture of our Synchro-Lab motor we adhere to incredibly fine tolerances.

Bearings must meet a standard of plus or minus one ten-thousandth of an inch. Motor pulleys, likewise.

To limit friction (and rumble) to the irreducible minimum we super finish each rotor shaft to one *micro-inch*.

And the finished rotor assembly is automatically balanced to within .0008 in.-oz. of the absolute.

Not parity, but superiority

Thirty-odd years ago, H. V. Slade (then Garrard of England's uncompromising Managing Director) set policy which endures to this day.

"We will sell a Garrard in the U.S. only when it is more advanced than any machine available there."

Spurred by this commitment, Garrard engineers have produced every major advance in automatic turntables.

Today's SL95B remains the world's premiere automatic turntable.

Its revolutionary two-stage synchronous motor produces *unvarying* speed, and does it with an ultra-light turntable.

Its new counterweight adjustment screw lets you balance the tone arm to a hundredth of a gram.

And its patented anti-skating control is permanently accurate.

The six Garrard component models range from the 40B at $44.50 to the SL95B (shown) at $129.50.

Your dealer can help you select the right one for your system.

Garrard
British Industries Co.

Check No. 3 on Reader Service Card

Coming in November

AN FM ADAPTOR UNIT:

Leonard Feldman describes an ingenious unit you can make yourself.

HOW MANY CHANNELS?:

Duane Cooper poses some provocative questions about quadraphonics.

EQUIPMENT PROFILES include:

Electro-Voice Model 100 compact System (held over from this issue)
Empire 1000 ZE Cartridge and Model 598 Turntable

PLUS

Record and Tape Reviews and all the regular features

About the cover: As most readers will recognize, this shows a Scully record-cutting lathe and Neumann cutter head. The photograph was taken by Nile Beesley and it appears on a record cover issued by Sheffield Records and the Mastering Labs of Hollywood. Every time I looked at that photograph, I thought – this will look fine on the front cover of Audio. . . .

Correction

The Rectilinear speaker shown on our September cover should have been described as Model X, not VI—which has been discontinued.

Audioclinic

JOSEPH GIOVANELLI

AFC, and Receiver Drift

Q. I have an FM receiver which works beautifully, except that every so often it must be retuned slightly. I can see the tuning shift by observing the center-of-channel meter. I thought all modern receivers employed AFC in order to prevent just such drift. However, I am unable to find any reference to AFC being built into this rather expensive receiver. How come? Dick Prokopowich, Ashborough, North Carolina

A. Modern solid-state FM receivers do not employ AFC because transistor oscillator circuits are so stable that AFC is not required. Heat was the major cause of drift in tube-equipped gear. Heat is, of course, produced in much smaller amounts with solid-state equipment eliminating the need for AFC circuits. This is to your advantage, for, as you know, AFC does not correct completely for mistuning. There is always a certain amount of error present. Further, some AFC circuits can lead to a loss of low frequencies and to a small amount of distortion.

You indicated that you retune via your center-of-channel indicator. I wonder whether the mistuning ever reaches a point of producing audible distortion, especially on stereo broadcasts. It might be that your tuning meter is extremely sensitive to small changes of frequency, so that even extremely small amounts of drift show up as large meter deflections. In other words, maybe your "problem" isn't a problem at all.

If your drift problem is indeed serious, then you will have to look into the oscillator circuit in order to bring about a cure of the condition. Oscillator circuits are voltage stabilized. If the regulator supplying voltage to this oscillator is defective, or if some other element in the regulating chain has failed, the oscillator voltage will wander, especially as the transistors heat slightly. This will produce a change in the internal capacitance of the oscillator transistor, which, in turn, will result in oscillator drift. You may need a service manual to determine the correct oscillator voltage. If the voltage is stable, it may be that there are defective temperature-compensating capacitors.

You should also check the bias resistors for proper value because it is altogether possible that the transistor is improperly biased. Further, as the values of the bias resistor change during operation, the resulting bias-voltage change will produce oscillator drift. Also, the oscillator transistor itself might be defective.

Playing 78's

Q. I recently started to acquire a large number of 78 rpm records. Modern amplifiers have no provisions for the equalization curves used with these old disks. How do I get around the problem?

Another question I have relates to reproducing these records from the stylus end of the system. Is a modern diamond stylus of appropriate tip radius suitable or is the old steel needle a more "realistic" answer? Will the diamond stylus of today be too severe on the grooves of yesteryear, and destroy them? Samuel Jacobs, Endwell, New York

A. The curves used when recording 78-rpm records were not uniform from one company to the next nor were they seemingly always uniform from one record to the next within the same company. When playing these old 78's, you will find that your best friends are your bass and treble controls.

It would also be helpful if you have high- and low-pass filters in order to eliminate rumble and record scratch. I set my filters so as to remove as much noise as possible, but without reducing whatever high-frequency response was on the records. Better signal-to-noise ratios could be produced at the expense of the highs. I personally would rather have my high frequencies, and put up with the noise. If a disk has highs up to approximately 6 kHz, then the filter should be set to cut off at approximately this frequency. If the frequency response is, say, 3,000 Hz, then the filter settings can be adjusted accordingly, again without degrading the response. This same approach is followed when dealing with bass response.

The biggest problem I have found in reproducing the low end of some 78's is record warpage, and this can be reduced by proper application of *small amounts of heat* and a small amount of weight placed on top of the warped disks. The disks should, of course, be placed on a flat surface. As to the exact temperature used, I would say that it should not be greater than about 100 degrees F. A few

(Continued on page 65)

we call our cartridge "groovy"

you should read before you laugh!

Cartridge design is no joke with our talented, imaginative Danish designers. When they say "groovy", they're talking about the Bang & Olufsen SP-12 cartridge and its high compliance, excellent frequency response, and amazing channel separation. ☐ They call it "groovy" because an ingenious, exclusive Micro-Cross mount for the stylus allows the solid one-piece diamond to float freely in the record groove, reach the most sensitively cut undulations. The result is crystal clear reproduction of every tone hidden in a record. ☐ Your hi fi dealer knows the story of Bang & Olufsen cartridges and the Micro-Cross design that is carefully created in Denmark, presently earning rave notices from European hi fi experts, and now available in the United States for the first time. Ask him about us. Or write for details now.

SPECIFICATIONS ■ **Stylus:** Naked Diamond (5X17) μ Elliptical (LP). **Frequency response:** 15-25,000 Hz ±3 dB 50-10,000 Hz ±1½ dB. **Channel separation:** 25 dB at 1,000 Hz 20 dB at 500-10,000 Hz. **Channel difference:** 2.0 dB. **Compliance:** 25 10^{-6} cm/dyne. **Tracking force:** 1.0-1.5 grams. **Output:** 1.0 mV/cm/sec. 5.0 mV average from music record. **Recommended load:** 47 K ohms. **Vertical tracking angle:** 15°. **Weight:** 8.5 grams. **Mounting:** ½" Standard 5 Terminal connection incl. separate ground pin. Balanced or unbalanced. **Replacement Stylus:** Original (5X17) μ Elliptical (LP), type: 5430 or 15 μ Spherical (LP), type: 5429. ■ MODEL SP-12.....$69.95

Bang & Olufsen of America, Inc.

525 EAST MONTROSE/WOOD DALE, ILLINOIS 60191

Check No. 5 on Reader Service Card

What's New in Audio

Pioneer SX-2500 receiver
Features of the 2500 include servo-operated automatic tuning, adjustable mute control, local-distance switch, step-type

tone controls, center-channel output, and a remote control unit for tuning and volume control that allows operation up to 23 feet away. Sensitivity is given as 1.6 μV and power output 340 watts total (IHF). Price $549.95
BIC/LUX
Check No. 76 on Reader Service Card

Tandberg 3000x
The new Tandberg 3000X is an inexpensive tape recorder which has the following features: 3-speeds (1⅞, 3¾, and 7½ ips), crossfield heads, peak reading VU meters, sound-on-sound, cueing, push-button rec-

ord controls and headphone jacks. It can be operated in horizontal or vertical positions and is available in quarter and half-track versions. Price $299
Check No. 77 on Reader Service Card

Environ microphone
This is a noise-canceling microphone using two dynamic cartridges mounted in such a way as to give exceptionally good discrimination. When switched to the Noise-Cancel mode, sounds from sources more than 3 feet away are rejected while sounds originating a few inches from the microphone are readily picked up. Frequency response is given as 40 to 15,000 Hz and output impedance is 250 and 50,000 ohms. Price $189
Check No. 78 on Reader Service Card

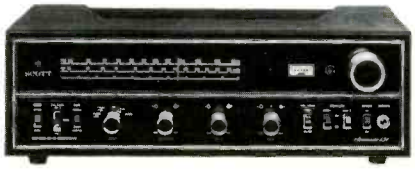
Sonex Compensator Model 100
This is a device for boosting low and high frequencies to compensate for speaker deficiencies etc. The spectrum is divided into four bands lo-bass, bass, treble, and

hi-treble leaving the mid-range unaffected. The unit is intended for connection between amplifier and pre-amplifier and it is self-powered. Price $229
Check No. 79 on Reader Service Card

Marantz Model 19 stereo receiver
Described as "The Flagship of the Line" this new receiver features oscilloscope display, parametric inter-station noise suppression, Butterworth filters, gyro-touch

tuning, photo-electric triggered stereo switching and stereo dubbing jacks. Rated power output is 75 watts (IHF) per channel and FM sensitivity is 1.8 μV.
Price $1000
Check No. 80 on Reader Service Card

Scott 631 AM/FM receiver
Rated at 82 watts (IHF) total this very inexpensive new Scott receiver has a FET 'front-end' FET tone control circuit and the MPX section uses the Scott Time-

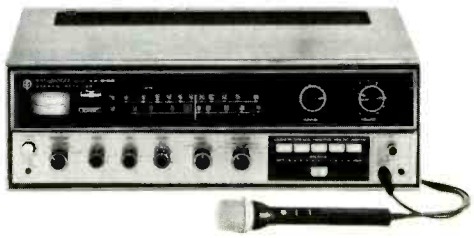


Switching arrangement. IC's are employed in the i.f. strip and the preamplifier. FM sensitivity is quoted as 2.2 μV and capture ratio 2.5 dB. Price $199.95
Check No. 81 on Reader Service Card

Nikko Model 1200 amplifier
This is an integrated unit having a number of interesting features. A time-delay circuit eliminates switch-on thumps, the drive circuit uses toroidal transformers, and a speaker compensation switch boosts low frequencies to compensate for loudspeaker deficiencies. Other features include circuit-breaker overload protection, two VU meters, separate tone controls for

each channel, switched rumble filter and scratch filters. Rated output is 65 watts per channel (IHF). Price $249.95
Check No. 82 on Reader Service Card

Kenwood KR-6160 receiver
This new Kenwood receiver has its own dynamic microphone for 'mike-mixing'—or as the makers say "Sing along with Kenwood" . . . Power output is 100 watts per channel (IHF) and FM sensitivity is quoted as 1.6 μV. Three FETs are used



in the 'front-end' and the i.f. stages employ 2 IC's with mechanical filters. The tone controls—bass, mid-range and treble, are step-types and a slider control is used for balance.
Price $379.95, complete with microphone
Check No. 83 on Reader Service Card

Catalogs

A 16-page four-color brochure explaining stereophones and headphones is available from **Koss**
Check No. 84 on Reader Service Card

Interested in Electronic Organs? A 24-page booklet describing the **Schober** organ kits is yours for the asking.
Check No. 85 on Reader Service Card

Kit-builders will be particularly interested in the **Xcelite** bulletin N 470 which describes a number of useful "fix-it" tools —including a 20-inch hex nut driver.
Check No. 86 on Reader Service Card

Tab Books have their new 1970 Spring catalog ready and it includes books on radio and electronics servicing, test instruments, transistors, and hobbies.
Check No. 87 on Reader Service Card

S.E.A. It's a sound revolution.

JVC proudly introduces the expensive stereo that isn't—model 5010.* Just look what it has going for you.

Its most outstanding feature is the Advanced Sound Effect Amplifier (SEA), JVC's exclusive ±12db, 5 zone tone control that opens up new dimensions in sound. SEA divides the sound spectrum into 5 frequency ranges. Let's you compensate for acoustic deficiencies in almost any room. Highlight a voice or musical instrument. Tailor sound to your own personal taste. The chart at the right shows the difference between SEA and conventional tone controls. But SEA is just the beginning.

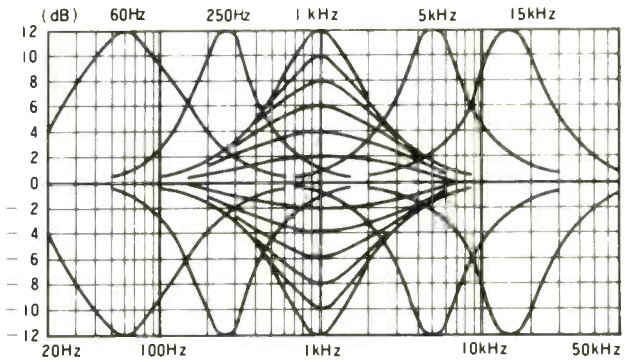
There's a new FM linear dial scale. Sophisticated FET. Wire wrapped contacts. 2-way speaker switch. 40 watts output at less than 1% IM distortion. A beautiful wood cabinet, and much more.

While you're at your dealer, also check out JVC's Model 5020, 75 watts IHF; Model 5030, 140 watts IHF; and our top of the line, Model 5040, 200 watts IHF.

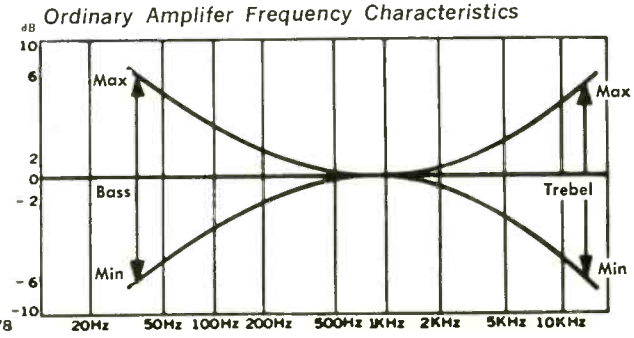
Whichever you choose, you will be choosing the finest. See them all at your nearest JVC dealer, or write us direct for his name, address and color brochure.

***Suggested list price $229.95**

SEA Frequency Controlled Characteristics



Ordinary Amplifer Frequency Characteristics



JVC Catching On Fast

JVC America, Inc., 50-35, 56th Road, Maspeth, New York, N.Y. 11378

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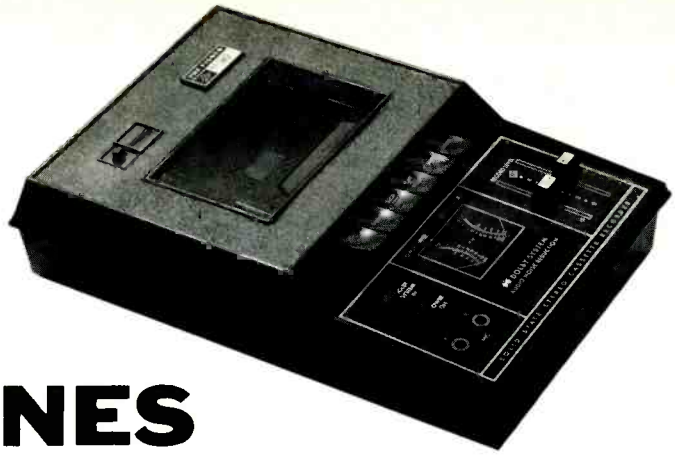


BEHIND THE SCENES

BERT WHYTE

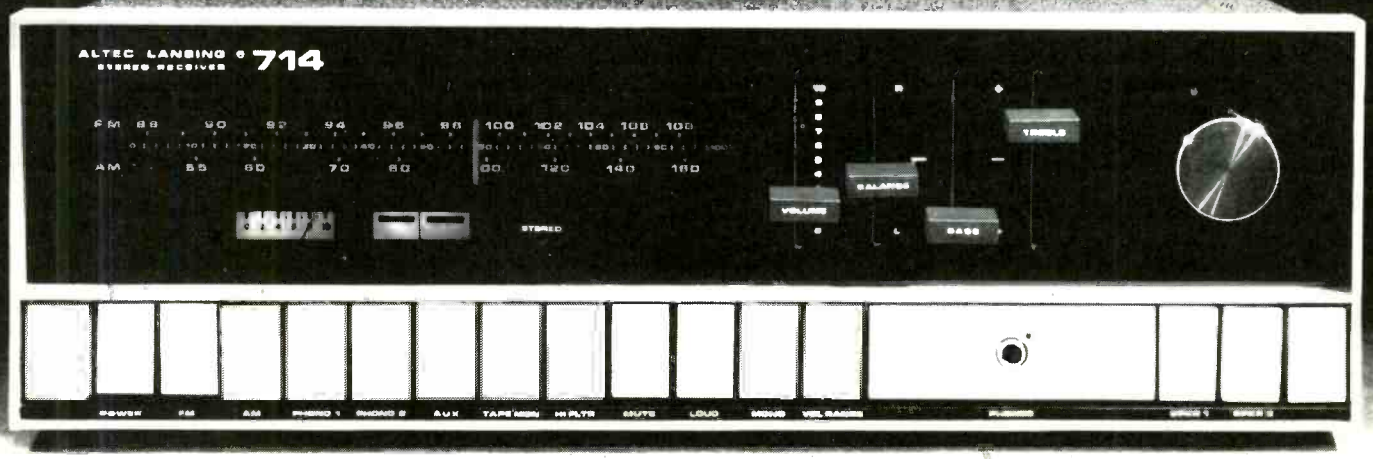
As most readers in the New York area are painfully aware, there was no Hi-Fi Show in the city in 1969. I'm not going to become involved in the pros and cons of the discussions which finally led to the cancellation of a projected show at the New York Coliseum. I can tell you that I have talked to many people, audiophiles and hi-fi retailers alike, and they feel that the lack of a show has had a very depressing effect on the New York hi-fi scene in general, and the retail market in particular. By the time you read this, the IHF will have staged the first experimental "suburban hi-fi show" in Westbury, New York . . . a "bedroom community" on Long Island, in mid September. A similar show will be staged in suburban Boston in late October.

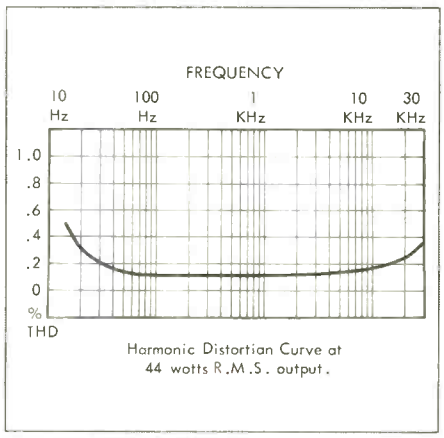
While I am sure these shows will have a generally salutory effect on the hi-fi market, my main purpose in mentioning them is that they most probably will usher in the era of four-channel stereophonic sound and Dolby noise reduction for the audio consumer. There is no question that these exciting new concepts in sound will be showcased by many manufacturers as *marketable products*. There will certainly be no shortage of "hardware" for four-channel sound and Dolby. Thus we will see and hear open-reel four-channel tape machines from such companies as Crown, 3M/Wollensak, Teac, Telex, Sony, Astrocom/Marlux and others, who are keeping their units, "under wraps," as I write this column. We will see the four-channel "Quad Eight" cartridge players from RCA, Toyo, and possibly Motorola. On view will be the competing schools of thought on four-channel cassettes . . . the four-channel-in line machines of 3M/Wollensak, Telex, and Astrocom/Marlux . . . and the four channels-in-each-direction unit of Norelco, utilizing 8-mil tracks. There will be Scheiber and possibly other types of four-channel disks. FM will appear in four-channel format via the Dorren multiplex system and possibly Scheiber and other versions. A number of four-channel/single-chassis amplifiers will be shown. Dolby will be well represented by Advent's Model 100 Noise Reduction Unit, and very likely they will show their less expensive "switchable" record/playback and playback only models. KLH will show their open-reel Dolby-System recorders and there may be several surprises in the introduction of other Dolby-System open-reel recorders. Cassette decks employing the Dolby System will be shown by Advent, Harman-Kardon, Fisher, Vivitar, and possibly several new entries if negotiations and manufacture can be completed in time for the show. With this impressive array of equipment, which is quite a vote of confidence for four-channel stereo and Dolby noise reduction, it is obvious that these innovative ideas can no longer be considered laboratory curiosities. Admittedly, for a while these developments will be for the delectation of the affluent audiophile, but like most everything else in the hi-fi scheme of things, costs will eventually level off and then stratify in various quality ranges.

The prospects for four-channel stereo and Dolby noise reduction look rosy for these upcoming hi-fi shows. However, there is one cloud of uncertainty on the horizon, which could possibly dim the lustre of these developments. I'll stay modern and use "computerese" to make my point . . . there is plenty of "hardware" for four-channel sound and Dolby, but there is a drastic shortage of "software"—music tapes processed for these systems. At the present moment we have the Vanguard open-reel four-channel stereo recordings and a new entry, Enoch Light's, "Project Three" company, which has issued several pop four-channel open-reel recordings (reviewed in my tape column). Vox Records has an initial release of nine "Dolbyized" cassettes, which will be available by the Westbury Show. That is the sum total of material available and were this to remain in effect during the shows, things would be rather bleak, to say nothing of the stupefying repetition we would be subjected to as we visited the various four-channel and Dolby exhibits.

Hopefully, this situation will not occur. I have talked to the various record companies, and have had my spies prying as well, to try and determine if they contemplate the release of any four-channel or Dolby recordings. It is well to remember that record companies are very secretive and may be setting up a smokescreen to cover their real intentions. The prevailing attitude was "we'll wait and see what happens." Here, with no guarantees whatever, is what appears to be the current situation: Vanguard continues to record four-channel stereo with the Dolby System. On the basis of conversations with Seymour Solomon, president of Vanguard, we can presumably look forward to some new open-reel four-channel recordings, some "Dolbyized" two-channel stereo cassettes, possibly some two-channel stereo "Dolbyized" open-reel tapes, and as a long shot, some "Dolbyized" four-channel open-reel tapes. (Mr. Solomon was kind enough to make me a Dolby B Type version of his by-now-famous four-channel sampler on open reel. This is *really* state-of-the-art!) Columbia has been recording four-channel stereo for some time, some of which I have heard. They recently recorded the Verdi Requiem with Bernstein at the Royal Albert Hall in London on four channels. They have no official plans for the release of four-channel material, but strong rumors say there will be some tapes available by show time. As far as Dolby is concerned, Columbia now has over 140 of the professional Dolby A301 units in operation . . . more than any other company in the world. Obviously they would be in a good position to convert their recordings to Dolby B Type, and release these recordings in any format at their discretion. RCA is of course,

Altec's new 714A receiver. It's built a little better.





Harmonic Distortion Curve at 44 watts R.M.S. output.

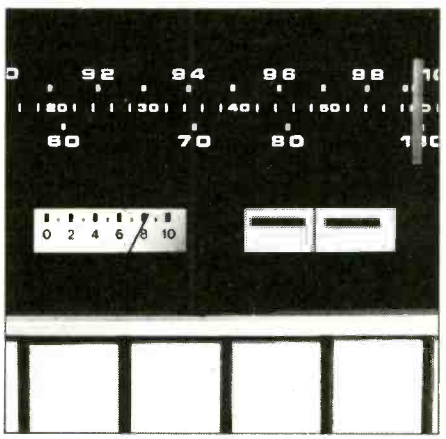
With 44/44 watts RMS power at all frequencies from 15 Hz to over 20 KHz (at less than 0.5% distortion). Most receivers meet their power specifications in the mid-band but fall way short at the critical low and high frequencies. The above curve shows the typical low distortion at all frequencies from the new 714A receiver at 44 watts RMS per channel. For comparison purposes, we also rate the 714A conservatively at 180 watts IHF music power at 4 ohms. This means that the 714A will handle everything from a full orchestration to a rock concert at any volume level with power to spare.

With 2 crystal filters and the newest IC's. Ordinary receivers are built with adjustable wire-wound filters that occasionally require periodic realignment. And unfortunately, they are not always able to separate two close stations. So we built the new 714A with crystal filters. In fact, 2 crystal filters that are individually precision aligned and guaranteed to stay that way. To give you better selectivity. And more precise tuning. The new 714A also features 3 FET's and a 4 gang tuning condenser for high sensitivity.

Built a little better.

ALTEC LANSING®

A QUALITY COMPANY OF LTV LING ALTEC INC



And with a lot of other features like these. Separate illuminated signal strength and center tuning meters on the front panel. A full 7 inch tuning scale and black-out dial. The newest slide controls for volume, balance, bass and treble. Positive-contact pushbuttons for all functions. Spring loaded speaker terminals for solid-contact connections.

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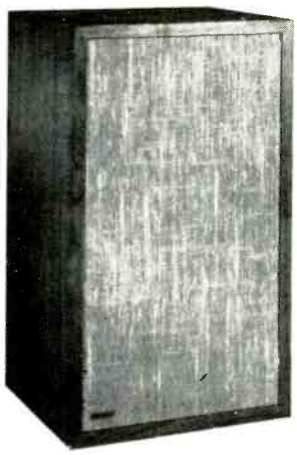
committed to four-channel recording with their "Quad Eight" cartridges. They will have an initial 25 productions available by show time, and have stated they will have as many as 120 four-channel titles by the end of this year. Although there are no official plans to release anything on four-channel open reel, I advocated such a move in a recent column, and just maybe they might heed the advice of a former musical director of RCA! "Dolbyized" cassettes or other tape formats with this process are on a strictly "wait and see" basis at RCA. All Deutsche Grammophon recordings of the Boston Symphony are being done with Dolby and on four-channels. Presumably some of their European recordings are being recorded in this fashion as well. Currently there are no official plans for the release of this type of recordings. London/Decca have indicated they will release "Dolbyized" cassettes and I would think there is a good chance they will be issued in time for the shows. They are undoubtedly recording on four channels, but no official word is forthcoming. The plans of Mercury/Philips and Capitol/Angel as regards Dolby and four-channel are quite ephemeral as of this moment. Nor was I able to elicit any information as to the Dolby/four-channel plans of American Decca. We can probably expect an odd Dolby or four-channel tape from some of the smaller record companies. So there you have it . . . some solid "sure things" . . . some good potentials . . . some very "iffy" attitudes on the release of Dolby and four-channel material.

I certainly hope that by the time of the Shows, we are deluged with both types of recordings. If we are not, some of the blame must be put on the cautious marketing attitudes of some companies, but another facet is the technical caution in dealing with four-channel recording. As I have said before, no one really knows a great deal about it. There is no standardization, and there probably never will be any really meaningful standardization other than broad guide lines. I refer in this context mostly to classical recording. Pop recording, with equal intensity of the front and rear channels, can be a fairly standardized proposition, limited only by the skill of the recording engineer and the imagination and ingenuity of the arranger. With the varying types of recording halls and the widely varying instrumentation of a broad repertoire, four-channel classical recording is going to require considerable experimentation. This is especially so in the area of microphone placement, and very likely in the placement of certain kinds of performing groups. Needless to say, four-channel experimentation must be conducted on a "live" basis, and this poses many problems. A case in point is a four-channel recording I made in late July.

I have always wanted to record a "mighty Wurlitzer" theatre organ. At one time, practically every movie theatre of top rank had one of these gargantuan instruments, and all you "over 30" types surely must remember the "bouncing ball" which kept time for the "sing-alongs." These innocuous entertainments never really revealed the tremendous power and dynamic range, and the incredible variety of the tonal resources of these great organs. After World War Two, with changing times and attitudes, many of the the theatre organs fell into disuse, and the advent of TV really sounded the death knell for most of these noble instruments. Movie houses were torn down and often the organs could be acquired by anyone who would pay the trucking charges to remove the parts from the theatre. The late Herb Schriner, the TV comedian, got one in this fashion, and it took a year and a half to install it in his home. But there were not many takers, and thus today there are not many of the big theatre organs in existence. Of those that are, few are in any sort of playing condition. Enter at this point an organization called the American Theatre Organ Society. This group, composed of musicians, organists, and devotees of the instrument, is dedicated to the preservation and restoration of theatre organs. They have saved a number of organs in New York from extinction, and are always ready to lend a hand in tuning existing instruments for concerts. Through my good friend John Eargle, chief engineer of Mercury Records (and an organist as well) I learned of the current project of the ATOS, which was the restoration of of the mighty Wurlitzer in the Brooklyn Paramount theatre. This theatre is somewhat smaller than the famed New York Paramount which was recently torn down, was saved from a similar fate by a stroke of luck. Long Island University was badly in need of room, wanted a downtown Brooklyn campus, and wanted a gymnasium. Unlikely as it might seem, the old theatre was able to satisfy their requirements with minimal alterations. In the theatre itself, all of the orchestra seats in front of the balcony were removed and in this space a basketball court was built! The removal of the heavily upholstered seats added some reverb and the large expanse of highly polished wood brightened the acoustics in general. The stage was brought level with the orchestra floor. These old luxury "movie palaces" were *huge*. The ceiling height for example, was over 80 feet. Width was more than ample to accommodate a basketball court. To fill this great space with sound, the Wurlitzer had to be mighty indeed! After conversion to a gymnasium, little attention was given to the organ for some years. Then somehow, the ATOS and the University got together, and the University agreed to the restoration of the organ with the parts being furnished by them and the labor to be donated by the ATOS. I got into the picture as this restoration was just completed and a convention of the ATOS and a concert were scheduled.

Mr. Billy Nalle, a charming southern gentleman, and one of the top theatre organists in the world, was to give the concert, and he graciously consented to a recording session of his dress rehearsal two days previous to his concert. As I pointed out some months ago, in many cases the rehearsals are more suitable for four-channel experimentation than the actual concert, since mikes can be moved, etc. When Mr. Nalle seats himself at the console of the organ, he faces four manuals (keyboards), a semi-circular array of over 200 "stop" tablets, (these control the various instrumental facilities of the organ—for example, a complete percussion battery), the pedal bars which he plays with his feet, swell or expression pedals, and many other items. This particular Wurlitzer was installed in 1926 and is a fairly large instrument with 26 ranks of pipes. The pipes are disposed in two chambers on each side of the stage. (The original stereo sound source?) The chambers are located at least 35-40 feet from the floor, and soar on up, almost to the ceiling. To furnish the vast amount of air needed when the organ is played full blast, a 50-h.p. Spencer Orgoblo turbine is used. Mr. Nalle pointed out the sad fact that the theatre organ was invented by Robert Hope-Jones only sixty years ago, making it the youngest of musical instruments . . . yet it has gone into decline in that relatively short span of time. All I can say is that when people today hear an organ as beautifully restored as this Wurlitzer, and played with the consummate artistry of Mr. Nalle, there may yet be hope for the "king of instruments."

As you can readily preceive, with the vast dimensions of this old Brooklyn Paramount, the logistics of recording this great organ were formidable. The footage of mike cable alone, was a big problem. We started to set up for the recording at two in the afternoon, and finished up after ten p.m. Next month, I'll detail the equipment, and how this recording was made, including a new kind of four-channel recording utilizing what is known as the "Cunningham Method." It is a sensational sound when properly recorded and played back, and probably I will be able to demonstrate some of it at the upcoming shows. AE



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AUDIO ENGINEERING SOCIETY

THIRTY-NINTH TECHNICAL MEETING AND EXHIBITION

October 12-15, at the Hotel New Yorker, New York

Here are some of the papers to be presented:

MONDAY, OCTOBER 12

Session A, commencing 9:30 a.m.

Some design considerations for electrostatic headphones—*John Bubbers, Stanton Magnetics.*

The Sound Field in home listening rooms—*Roy F. Allison and Robert Berkovitz, Acoustic Research Inc.*

The Colinear Array—a two-way loudspeaker system for sound reinforcement—*G. Augsberger, JBL Inc.*

Session B, commencing 2:00 p.m.

A low-cost educational music synthesizer concept—*R. Burhans, Ohio University.*

The Putney, a new generation of synthesizers—*Alfred Mayer, Ionic Industries.*

Session D, commencing 7:30 p.m.

The effect of microphone and loudspeaker directional characteristics upon recreating acoustics fields—*Edward Long, Ampex.*

Four channels and compatibility—*Peter Scheiber, Audio-data Co.*

Experiments in four-channel recording techniques—*John Woram, RCA.*

Tri-wave stereo acoustics—*John Volkmann, RCA.*

TUESDAY, OCTOBER 13

Session E, Commencing 9:00 a.m.

Audio developments in Europe—*John Gilbert, Northern Polytechnic, London.*

Analysis of crosstalk in stereo discs—*Bernhard Jakobs, Shure Brothers Inc.*

A mechanical disc recording and reproducing system (audio-video) with high storage density and information flux—*Horst Redlich, Teldec.*

Stephen Temmer, Chairman of this session, will demonstrate these new video discs in the absence of Horst Redlich.

Session F, commencing 2:00 p.m.

British contributions to audio during the past fifty years—*Percy Wilson, Percy Wilson and Partners.*

A discrete four-channel disc and its reproducing system—*T. Inoue, N. Takahashi and I. Owaki, Victor Company of Japan.*

Session G, commencing 2:30 p.m.

Possible methods for FM broadcasting transmission of four-channel stereo signals—*Leonard Feldman, SCA Services, and William Halstead, RTV International Inc.*

Session H, commencing 7:00 p.m.

Modern recording studio techniques—a live demonstration by John Woram, Steve Schwartz, Max Wilcox of RCA. Chairman William Windsor of D. B. Audio Corp. with David Greene of A & R Recording and Roy Halle of Columbia Records acting as panelists.

This applications seminar will be a live and pre-recorded demonstration of a multi-track recording and mixdown techniques, showing exactly how a modern recording is made. Excerpts from an actual recording session will be used, and additional guitar and Moog Synthesizer tracks will be recorded during the session. Presented by the New York Section of the AES.

WEDNESDAY, OCTOBER 14

Session I, commencing 9:30 a.m.

Tape noise in audio recording—*Eric Daniel, Memorex Corp.*

Dolbyized duplicating, its effects on the pre-recorded cassette—*David Sarser, Allison Audio Products, Inc.*

Session J, commencing 2:00 p.m.

Auditorium acoustics simulator—*Thomas Horrall, Bolt Beranek and Newman*

Session K, commencing 2:30 p.m.

Simple and complex test signals for music reproduction systems—*Thomas Saponas, Randolph Matson, and J. Ashley, University of Colorado.*

Impulse measurements techniques for quality determination in audio equipment—*Alfred Schaumberger, Neumann GmbH (Translated and presented by Stephen Temmer, Gotham Audio Corp.).*

THURSDAY, OCTOBER 15

Session L, commencing 9:30 a.m.

Audio transmission systems; theory, standards, and practice—a series of five panel discussions with Chairman John McKnight of Ampex, and panelists *A. Evans of CBS, George Maling of IBM, and Douglas Smith of Shure Brothers.*

Session M, commencing 2:00 p.m.

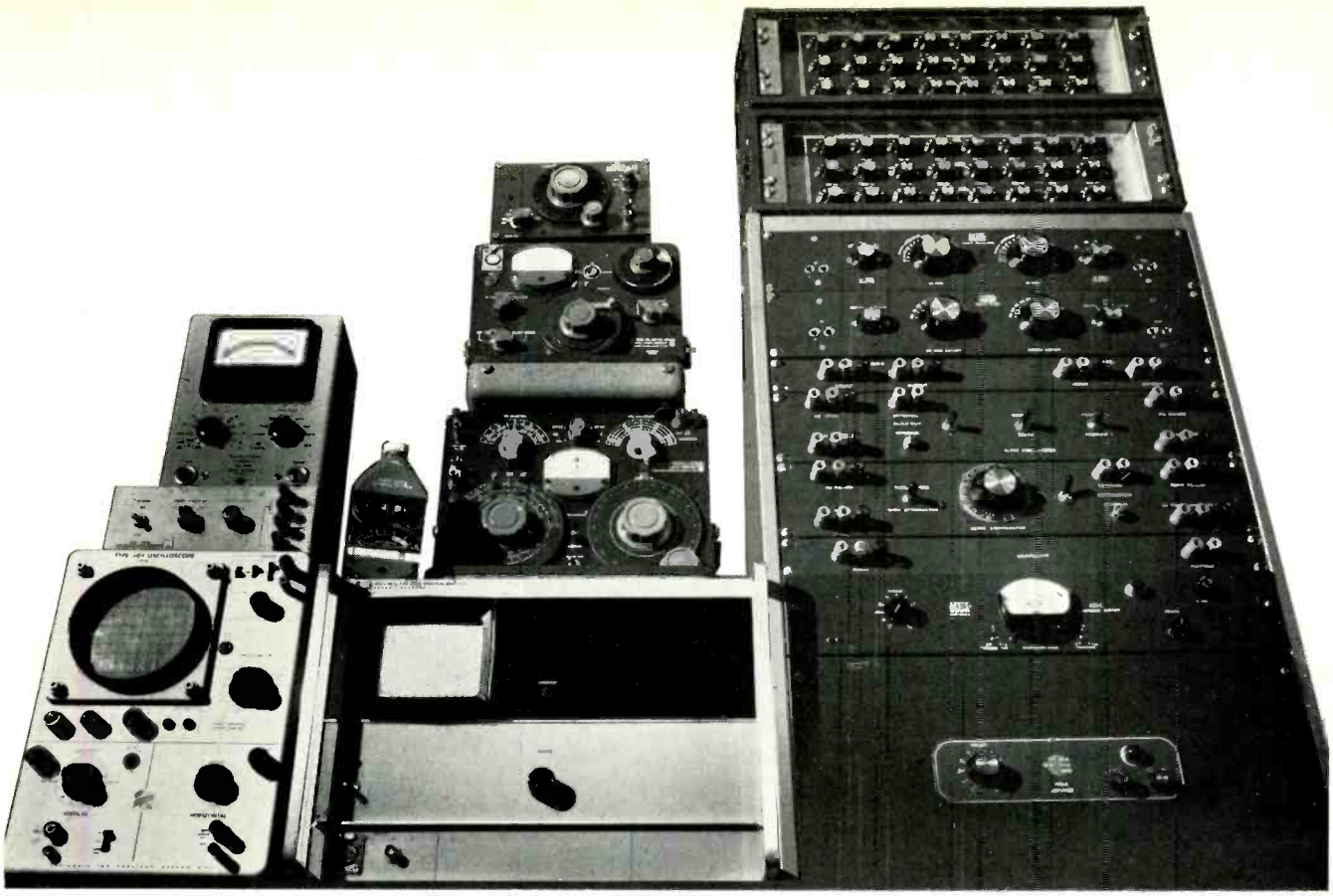
Investigation of various forms of distortion inherent in transistor amplifiers—*Shinichi Ohashi, Hitachi Ltd.*

A dynamic noise filter—*Richard Burwen, Consulting Electronics Engineer.*

Functional protection of high-power amplifiers—*Max Scholfield and Gerald Stanley, Crown International, Inc.*

A noise reduction system for consumer tape applications—*Ray Dolby, Dolby Laboratories.*

For readers who are unable to attend, many of these papers can be had in preprint form (50¢ each, AES members; 85¢ each, non-members) from the Audio Engineering Society, Inc., Room 428, The Lincoln Building, 60 E. 42nd St., New York, N.Y. 10017.



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G. W. TILLETT

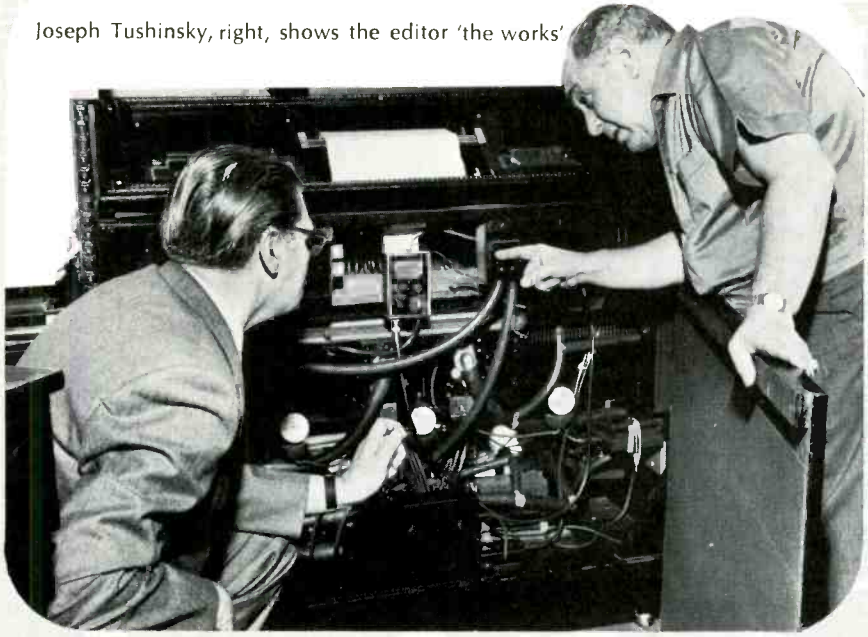
The Keyboard Immortals Play Again in Stereo

Highlight of my recent visit to Los Angeles was an evening spent at the home of Superscope's President—Joseph Tushinsky, listening to the Vorsetzer. Not that the day spent in the Superscope-Marantz plants was uninteresting—when you have seen one production line, you haven't seen them all—and I was very impressed with the high standard of engineering and sense of direction. But the Vorsetzer is something else. As many readers know, it is a kind of player-piano device and it forms the basis of the "Keyboard Immortals play again in Stereo" program carried by more than 200 FM stations. The story goes back to 1904 when Edward Welte invented a player-piano that really captured the original performance—unlike the crude machines of the day. Welte had attached to each key a light carbon prong that made contact with a tray of mercury, thus when the key was depressed an electrical circuit was made which could measure the initial transient and the duration. Similar devices were attached to the pedals. The electrical impulses were recorded on a paper roll by a kind of pen recorder and then the tracings would be laboriously punched out by hand. All very clever, but Welte's player mechanism was even more ingenious. He had a wooden box fitted with eighty felt-tipped fingers and two feet for the pedals, called the Vorsetzer (sitter-in-front) And this is what it does, it sits in front of the piano—any piano—and plays. It is operated by air suction controlled by the perforations in the roll. Now, Welte had a workable instrument that could reproduce every nuance, every inflection of the actual player. Welte did not stop there—he was a musician and an engineer, but he was also a Showman—the David Merrick of his time. He realized that something dramatic was necessary to persuade the great pianists of the day to record for his contraption. So what he did was to rent a castle on the Rhine and then he invited the virtuosos, the great masters of the piano for a champagne-gourmet vacation with a chance to record their genius for posterity. This move was very successful and Welte was 'in', he was established. The artists were full of praise; said Debussy "It is impossible to gain a greater perfection of reproduction." And Alexander Glazounoff "I must add that on the first demonstration, I gained an impression that this instrument reproduces my playing with the most complete artistic perfection." So Welte prospered and by 1927, his catalogue listed no less than 264 artists performing over 5000 compositions. This was probably the peak year and the decline in popularity took place so quickly that the last Vorsetzer was made only five years later. The emergence of the radio and phonograph may have had something to do with it but whatever the reason, Vorsetzers fell into disuse and rolls gathered dust in attics and basements. About 40 years later, Joseph Tushinsky was given a Welte catalog and it aroused such an interest that he began a hunt for rolls and Vorsetzers which soon spread to Europe. By 1968, he had unearthed over 300 rolls and spent a small fortune restoring Vorsetzers. The "Keyboard Immortal" program started in 1966 from station KFAC in Los Angeles and it is now heard throughout the country.

I had listened to the programs from a New York station off and on for the past two years and I was familiar with the history of the Vorsetzer. And so, I jumped at the chance of seeing and hearing one 'in the flesh' so to speak. Joseph Tushinsky's house is high up in the Encino hills and the long picture window of the listening room gives a superb view of Los Angeles in the valley below. The room is a large one but it is dominated by *two* 9½ foot Bosengorfer grand pianos. One was on a platform at the end of the room and going closer I saw it was mounted on rails which enabled it to be rolled against the wall. I walked onto the platform and I saw there was a panel in the wall through which I could now see the eighty fingers of the vorsetezer, patiently waiting to summon up ghosts from the past!

But why, I thought is the piano so large? Well, one of the reasons is the incorporation of an extra octave that goes way down to 16 Hz. This refinement helps to give a richness to the overall tone although I imagine it is not often used directly. For recording, a Sony (what else?) stereo professional ES22 recorder is employed and the microphones are three C55 condenser types. Two are suspended a foot above the strings and the third is placed through one of the circular sounding holes in the metal frame. This combination produces the best stereo image without giving the impression that there are two separate pianos! Going into the adjoining room where the Vorsetzer lived, I noticed the big library of rolls—now over 5,000. These have to be stored in a carefully controlled humidity and temperature environment—as might be expected. The mechanism of the Vorsetzer looks very clumsy but it works—and works well! It huffs and puffs like a fun-fair robot, but when the massive wooden cover is in place, all is quiet. Soon, the piano was rolled to its appointed position and then we sat back and listened to the sonorous notes of Chopin played by Josef Hofmann, some Debussy Preludes, Rachmaninoff playing his Prelude in C-Sharp minor, the great Master Joseph Lhevine,

Joseph Tushinsky, right, shows the editor 'the works'



Some of the 5000 rolls

and more until the lights of Los Angeles shone through the darkness like a multitude of stars and it was time to go. Truly an evening I will not easily forget . . . As I came down the winding road, I could not help thinking about that Castle on the Rhine, and the carriages coming and going, the music and wine, laughter and gaiety of the famous who had come from all over Europe, not knowing that the lights would go out within a few short years. And in the background, Edward Welte, clutching his paper rolls, pleased and excited. Yes, he was successful, he would record all the great pianists for posterity but even in his wildest dreams he could not possibly imagine that in 70 years time, thousands of people would listen to his Vorsetzers in their own homes—without a piano!

Showing the vorsetzer fingers and pedal controls

Tape Guide

HERMAN BURSTEIN

Tape Dust

Q. I have been using a very high quality tape on my recorder. After a few reels of use there is a residue of tape dust on the guides. This causes me to wonder if the tape is as good as I think it is. (William Mock, Baltimore, Md.)

A. I suggest that you compare the performance of your tape with that of other quality brands in order to ascertain whether it is the tape or your tape machine that is primarily at fault. All tapes produce some residue, so the real question is whether your present tape produces excessive residue.

Bias Traps

Q. I have three tape recorders, all of which use 100-kHz bias. For overall response measurement and equalization adjustment, I use a bias trap, which gives about 40 dB attenuation at 100 kHz but does not affect the audio range. Is there any reason I shouldn't wire such a trap permanently in the output of each channel of each recorder? This would save the bother of hooking it up for tests. (Richard S. Field, Jr., Pacific Palisades, California)

A. The best way to know is to try. You might try building a bias trap into your tape machine to see if there are adverse effects. However, unless the inductances in the trap are adequately shielded, they may pick up hum or stray signals, such as radio signals.

Head Demagnetization

Q. How often does one really need to demagnetize heads? I suspect very seldom. My manual says "every 8 hours of operation." This is a bother. I put it in the class of maintenance instructions that one gets on all the hundreds of household gadgets and appliances that people use. If you follow them all, you will not have time for anything else. (Richard S. Field, Jr., Pacific Palisades, California)

A. Demagnetizing the heads after every 8 hours of use is a fairly standard recommendation, although a few manufacturers indicate otherwise. Depending on the machine you are using and the material you are recording, less frequent demagnetization may be satisfactory. The recommendation is a precautionary one, and you might find that demagnetizing after, say, every 20 hours is adequate in your case. One just doesn't know. Getting top-flight performance out of a tape recorder involves paying attention to details, the same as for an automobile or a camera.

Tape Choice

Q. What type of recording tape would you recommend, bearing in mind the following requirements? It must be capable of reproducing wide, uniform response with minimum noise and print-through. It must be capable of being stored for long periods of time under normal household conditions. I will need as much tape per reel as feasible. (Charlie Perry, Jr., Ansonia, Connecticut)

A. I suggest that you try the low-noise tapes made by manufacturers of established reputation. Use tape with a polyester (Mylar) backing. To avoid the possibility of noticeable print-through, particularly after long storage, use 1½- or 1-mil tape. Do not use ½-mil tape, although this would more nearly serve your wish to get as much material as possible on one reel.

Cross-Field Heads

Q. What are the advantages and disadvantages of the cross-field head? (E. C. Smiley, APO San Francisco, California)

A. Some machines using the cross-field head claim response to as high as about 18,000 Hz at 3.75 ips. However, high-quality tape machines in general—with or without the cross-field head—can achieve such response if they are willing to make sufficient sacrifice in terms of noise and/or distortion. Manufacturers now using the cross-field head claim that for a given amount of noise and distortion, they can achieve a more-extended treble response by using the cross-field head. Inasmuch as a number of manufacturers of high-quality machines have not yet gone over to the cross-field principle, there is not yet any clear-cut evidence of its superiority. I don't know of disadvantages of the cross-field head, other than its added complexity (involving an extra head for recording, this head being located at the backing side of the tape), and therefore added cost.

Microphone Overload

Q. I would like to use the AKG condenser microphone with both my tape deck and my P.A. amplifier. These mikes have relatively high output. What can I do to prevent overloading the inputs of my tape deck and amplifier? (John D. Moss, Hartselle, Alabama)

A. Offhand I am inclined to doubt that the output of the microphone would overload your tape deck or amplifier. To find out whether there is a real possibility of this, and what steps to take in case the possibility exists, I suggest you consult the manufacturers of the microphone, the tape deck, and the amplifier. I would rather not venture a suggestion that might impair the frequency or other performance aspects of a fine microphone. Possibly the microphone incorporates a facility for decreasing its output; or perhaps a simple voltage divider across the microphone output, using values recommended by the manufacturer, may be the answer.

Dubbing Speeds

Q. Can a tape recorded at 15 ips be played at 7½ ips on one machine while recording from that machine onto another machine at 3¾ ips, so that the second tape can then be played back at 7½ ips? Will it sound as good as the original 15-ips tape except for the extra machine involved? (John D. Moss)

A. Yes, you could follow the procedure you describe in order to duplicate a 15-ips tape for replay at 7½ ips. But I would not vouch for the frequency response characteristics of the duplicate tape in view of the varying speeds employed. To maintain good frequency response you should play and record at the same speed. This would mean playing the original at 15 ips and rerecording it at 7½ ips.

Recording Quality

Q. My tape recorder has a cross-field head. Would I obtain quality equal to the original by recording at 1⅞ ips? If I record at 7½ ips, would I obtain better quality than the original? (Vernon T. Rose, APO San Francisco)

A. If you wish to preserve the original quality of the source, record at the maximum speed available. You cannot improve on the original quality. If your source is of low quality, you may lose very little if anything by recording at a reduced speed.

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

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Editor's Review

Speaking at a meeting of the prestigious International Tape Association, Virginia Knauer, Special Assistant to President Nixon for Consumer Affairs, said "If the Tape Industry does not attempt to clean up its own shop, there will be a time when the option will no longer be yours" Strong words—which provoked swift replies from those who disagreed. Said Joseph Tushinsky, president of Sony-Superscope, "I don't think she knows what she's talking about." He went on to say that the industry has standardized already as far as tapes, microphones, and connectors were concerned. Jeff Berkowitz of Panasonic said the industry was almost completey standardized and that it was possible for anyone to buy a stereo 8 cartridge, cassette, or open-reel tape and play it on any manufacturer's machine. True enough, but when Virginia mentioned the lack of standardization for 4-channel and video tapes, she had a point. Her criticism of poorly-defined warranties was probably justified but I am not certain I would agree that "there is a lack of information concerning recorders and service facilities are poor."

Talking about standardization reminds me that very soon we will be confronted by a number of quadraphonic record systems—each with its own 'black box' decoder to convert the two composite channels back to the original four. One of the latest to appear on the scene is from the Japanese Victor company (JVC) and the leaflet makes the rather delightful statement, "The difference between two-channel and four-channel sound is the difference between a shower and a proper bath." Presumably, mono would be equivalent to washing under the pump. . . . Trouble, is—manufacturer A's Black Box will not work with manufacturers B's system and vice versa! Incidentally, the JVC system features carrier modulation with frequency-modulated low frequencies and phase modulation above 800 Hz.

JVC Four-Channel Decoder and Player

* * *

Doctor Van Klunge of the Hague, Holland, has invented a loudspeaker system based on the human throat. Says the good Doctor, "The human vocal system is very efficient and it is logical to use the principles for a loudspeaker."

* * *

The New York Audio Society (215 Adams St., Brooklyn, N.Y. 11201) announces an interesting meeting for November 11. The guest speaker is Martin Bookspan, of ASCAP and the place is the Dragon Seed restaurant, Jackson Heights, Queens. Time: 8:00 p.m.

* * *

Harold Leak is of course well-known as one of the pioneers of Hi-Fi. In 1946 he designed an amplifier with the very low distortion of 0.1%—and so it was designated the Leak Point-One. A few months ago, Harold decided to retire and so he sold his business to the Rank-Wharfedale group. Now I learn that Harold has bought himself a yacht which he has named—you guessed it—the Point-One. . . May he enjoy his retirement for many years. The same goes for Alexander M. Poniatoff of Ampex, who now retires at the age of 82. He founded Ampex in 1949 and the name is taken from his initials, plus, he says—EX for excellence.

* * *

At the end of the magazine is a Reader Service Card (known to the initiated as a "Bingo" Card). Observant readers will note that some questions have been added such as "Do you want more record reviews? What kind? More technical articles? Constructional articles? and so on. You may not want information regarding X speakers or Y receivers at this time, but please take a few minutes to fill in the rest of the card—it will be appreciated.

* * *

Many readers have been annoyed by the asterisks in "Tape Guide" and "Audioclinic." This kind of thing: "I have been using a * * * * machine with a * * * * amplifier and. . . ." Infuriating. From now on, we will print the names—so if you have a * * * * tape recorder—you'll know it!

G.W.T.

A lot of people don't know that a cartridge that's great for one high fidelity system could be disastrous for another.

That's why Pickering has done something fantastically simple.

We've developed *Dynamic Coupling Factor*—henceforth known as *DCF*.

All it is is a complicated name for an uncomplicated way to select the best cartridge for your system. It is your guide to the selection of that cartridge based on its intended application in playback equipment—just as horsepower is the guide to the proper engine for a vehicle.

It works like this. You own an XYZ model record changer. What cartridge do you pick? Not the $29.95 model because it isn't designed for the capability of your XYZ player. Not the $60.00 cartridge either, for its quality cannot be realized in that unit.

Our chart—available to you free—reveals that you need our model XV-15 with a *DCF* rating of 400 for optimum performance. This means that you will get 100% of the music from your records. Not 50% or 75% but *all* of the music capable of being obtained from your particular playback unit.

Technically, what we've done is taken virtually every high fidelity record player and pre-analyzed the vital variables for you; those affecting cartridge design and those related to the engineering features of the various turntables and changers.

So now all you need to be well informed on cartridges is to send for our *DCF* application guide containing our recommendations for what cartridge you use with which record player.

And next time you walk into a high fidelity salon, tell the man: "I'd like a Pickering XV-15 with a *DCF* of 400." Or whatever.

Pickering cartridges are priced from $29.95 to $60.00. For your free *DCF* chart, write *DCF*, Pickering & Co., 101 Sunnyside Blvd., Plainview, N.Y. 11803.

PICKERING

"for those who can hear the difference"

Stereo Receiver Lexicon (2)

LEN FELDMAN

Muting (T). Normally, when one tunes an FM receiver, an unpleasant form of wide-band noise is heard between stations. Special circuits have been developed by component manufacturers which eliminate this form of disturbance as the user tunes from station to station. Usually, the circuits are a form of "gate" or switch which permits signals of predetermined strength to be heard and eliminates all other signals (including noise) from the audio chain. These circuits are called "muting circuits." In some receivers, the threshold is adjustable, so that extremely weak station signals are not "blocked out" along with the undesired noise. Alternatively, some receivers are equipped with "mute defeat" switches which negate the muting action altogether for those instances when it is desired to pick up very weak (albeit noisy) signals.

NOISE AND HUM (T, P, A). While applicable to tuners as well as to preamplifiers and amplifiers, noise and hum in tuner sections are normally covered by the S/N (signal-to-noise) specification (which see below). Noise and hum in preamplifiers and amplifiers is usually stated with respect to a voltage or power output reference level. Thus, in the case of a power amplifier, the noise and hum may be stated as "75 dB below full output," for example. To describe the noise and hum characteristic of a preamplifier or amplifier properly, a separate specification should be provided for all the available inputs. High-gain phono inputs are likely to have a poorer hum-and-noise spec than high-level inputs such as Tape or Auxiliary inputs. Our qualitative charts relating to both low-level and high-level-input hum and noise (which is stated in dB) are shown in Figs. 12 and 13.

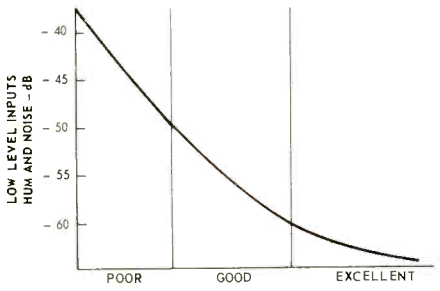

Fig. 12—Qualitative graph of hum and noise for low levels (phono, tape, etc.); dB figures are referenced to full power output.

Fig. 13—As above, but for high-level inputs (Aux, Tuner etc.)

Peak Power (A). Although, strictly speaking, Peak Power Output might be regarded as a "specification," we have purposely *not* capitalized it here because the component industry rightly considers this "spec" to be irrelevant. Peak power implies the absolute maximum power that can be delivered by an amplifier *regardless of distortion*. Since distortion-free musical reproduction is the objective of true high fidelity components, the use of such a specification is to be discouraged. It is mainly used by console and "packaged goods" manufacturers in an attempt to "look better" in print and has no bearing on the actual performance of a product. Mathematically, peak power works out to be *twice* continuous power. Now, since music or instantaneous power has been stated to be somewhat greater than continuous power (see Music Power), some of these same manufacturers have come up with yet another power term—Instantaneous Peak Power, which is a further inflated and equally meaningless specification. Our discussion of it here is only to remind readers to judge amplifier power on an equal basis when comparing one amplifier with another and to disregard "ad copy" such as that just described.

Phasing (A). When a pair of speakers are connected to the output terminals of the stereo amplifier portion of a receiver, it is important that each speaker be in phase with its companion speaker. By "in-phase" we mean that the cones of both speakers should move in the same direction, instantaneously, when driven from a common, monophonic signal. Phasing is best checked by listening to a monophonic program, standing mid-way between the loudspeaker systems to be checked. The check is repeated with the wires to one of the speakers reversed at the speaker terminals. If the second check results in better, more-centralized bass response, the speakers are now in phase. If the second check results in a diminution of overall bass and a seeming "hole in the middle" or vagueness of spatial identification of sound, then the speakers were in phase as previously connected and the original connection to one speaker should be restored. In making these tests, wires to only *one* speaker are reversed.

POWER BANDWIDTH (A). Since power output specifications are generally stated for a mid frequency (usually 1000 Hz) only, it is important to present an idea of power capability at frequency extremes, as well. Power bandwidth is defined as the two extreme frequencies (low and high) at which the amplifier can produce one half its rated power at its mid-band rated distortion. As an example, a 50-watt amplifier having 1% distortion at rated output would be said to have a power bandwidth extending from 15 Hz to 25,000 Hz if, at those two frequencies, it can deliver only 25 *watts* at 1% distortion.

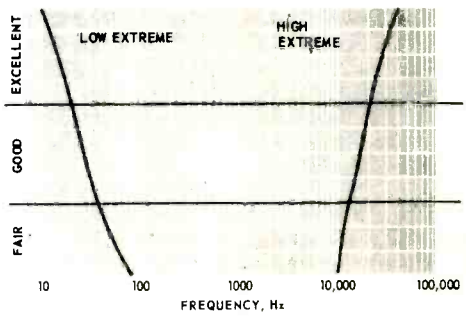

Fig. 14—Ratings for Power Bandwidth

Our qualitative graphic presentation of power bandwidth is shown in Fig. 14, and is to be interpreted separately with regard to low-end and high-end extremes.

POWER OUTPUT (A). See *MUSIC POWER* and *RMS POWER*.

Recorder Outputs (P). Featured on most receiver rear panels (and sometimes duplicated even as front panel jacks, for additional accessibility), the pair of jacks labelled "Recorder Out" are intended for connection directly to a tape recorder. The recorder is then fed with whatever signal you are listening to. Because the feeding signal is purely electrical voltage, results obtained in making recordings in

this way are greatly superior to "placing a microphone in front of a loudspeaker," since the inherent distortions of the microphone and speaker are eliminated from the process. Usually, the recorder outputs are so arranged as to be completely independent of tone-control or volume-control settings. Thus, the user can listen to the source material at any level or tonal setting without affecting the essentially "flat" characteristic of the signal being fed to his tape recorder. Correct recording level must be maintained by means of the tape recorder's controls rather than by any receiver controls.

Relays (A). Generally, two types of relays are used in the amplifier section of the modern stereo solid-state receiver. Thermal relays, as the name implies, are activated by excessive heat caused by excessive current flow in output circuits. Such relays are set to open when the case temperature of output transistors reaches specified limits for the devices. Re-set is automatic, occurring when temperatures cool down to safe operating values. Current-activated relays are more direct-acting, responding to predetermined values of excessive current flowing to amplifier loads. One type is not necessarily superior to the other and the use of either will be dictated by the circuit needs and the design philosophy embodied in a particular amplifier circuit. The presence of one or both types of relays in a receiver is evidence of a level of sophistication beyond that of the simple fuse, whose replacement constitutes a minor annoyance to the user.

RIAA (P). See Equalization.

R.M.S. POWER (A). Also known as "continuous power," this specification represents the most conservative statement of power capability of an amplifier. It denotes the amount of power that an amplifier can deliver to a load when fed with a constant, sinusoidal tone. This power rating must be accompanied by a figure of rated distortion to be totally meaningful. Thus, an amplifier might be said to produce 50 watts of power, r.m.s., at a maximum distortion of 1%. R.m.s. power is usually stated on a "per channel" basis, whereas "music power" is usually given as the total for both channels. The amount of power required for a given music system installation depends upon many factors, including listening-room size, efficiency of speakers with which the amplifier is to be used, number of speakers to be driven simultaneously, and the listener's tastes in program material and level at which it is to be played. Perhaps the greatest variable of those mentioned is loudspeaker efficiency, which may vary from under 1% (for some air-suspension, bookshelf enclosure types) to over 15% for some of the larger corner enclosures. The user should also remember that the use of two stereo speaker pairs simultaneously represents a splitting of the power to each system and allowance should be made for this contingency in selecting the proper power-amplifier rating in any proposed system.

SELECTIVITY (T). This specification describes the ability of a tuner to discriminate between the desired station and stations removed in frequency by one channel-width (Adjacent-Channel Selectivity) or two channel widths (Alternate Channel Selectivity). Alternate-channel selectivity is deemed the more important of the two specifications, since the Federal Communications Commission is careful not to assign adjacent-channel frequency to two stations in one geographical area. Still, with today's ultra-sensitive tuners, adjacent-channel selectivity may also be relevant in certain areas where, with a well-designed antenna it is no longer unusual to pick up two stations just one channel width apart. Qualitative graphs indicating both adjacent-channel and alternate-channel selectivity figures are shown in Figs. 15 and 16 and, as can be seen from the figures, the higher the number of dB's, the better the selectivity characteristics.

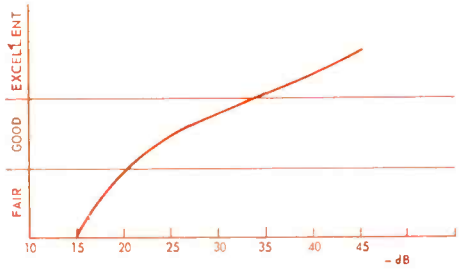

Fig. 15—Adjacent-channel selectivity

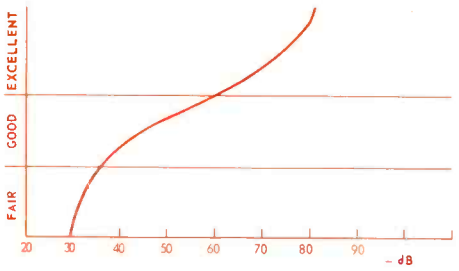

Fig. 16—IHF selectivity, alternate channel.

SENSITIVITY, IHF (T). See IHF Sensitivity.

S/N (SIGNAL-TO-NOISE RATIO) (T). Although the "Least Usable Sensitivity" defined by the Institute of High Fidelity (See IHF Sensitivity) requires a signal-to-noise (and distortion) ratio of only 30 dB, tuner sections of receivers are able to effect quieting far in excess of this modest figure when fed with greater (and more typical) input signals at their antenna terminals. Accordingly, the Signal-to-Noise specification, usually abbreviated S/N, tells how much lower the residual noise is, compared to the desired program, when the signal strength is of the order of 1000 microvolts. In FM tuners, application of a 1000-microvolt signal results in the maximum signal-to-noise ratio, in that any further increase in signal strength will cause no further reduction in noise content. The small amount of residual noise remaining at this signal level may be ran-

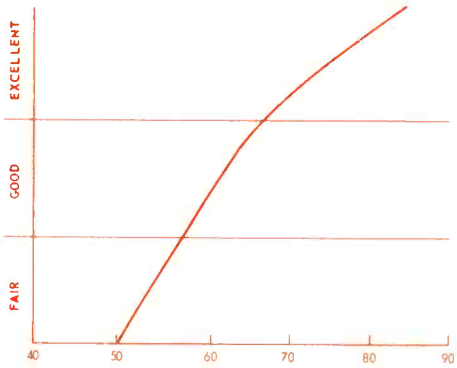

Fig. 17—Signal-to-noise ratios

dom wide-band noise, hum, or a combination of both. The range of signal-to-noise ratios and their quality ratings is depicted in Fig. 17.

Separation, Stereo FM(T). See FM Stereo Separation.

Speaker Selector (A). Many receivers are equipped with a switch enabling the user to select stereo pairs of speakers in more than one location. Usually, main and remote speakers are provided for, and the switch often enables selection of main, remote, or both sets of speakers to be played simultaneously. This is a useful feature, since more often than not the amplifier section of the receiver has ample power to drive two pairs of speakers to adequate sound levels at low distortion. In utilizing this feature, however, the user should be careful of one important point. Most solid-state amplifiers will work well with load impedances down to four ohms. In fact, most amplifiers deliver their greatest amount of power when coupled to a four-ohm load. However, applying a net load of *less* than four ohms to most solid-state amplifiers can damage the output transistors very quickly or, at very least, cause fuses and thermal relays to "pop" interminably. Two eight-ohm speakers connected to a single channel (as in the case of main-remote combinations) adds up to a *net* impedance of 4 ohms, which is fine. Two *four*-ohm speakers similarly connected, however, would result in net impedance of only 2 ohms—well below

the safe limit. With *three* sets of loudspeakers connected (one main location and two remotes), even if each speaker had a voice-coil impedance of 8 ohms, the resulting net impedance would be only 2⅔ ohms (⅛) and would also be unsafe for most amplifiers. These precautions apply only if more than one system is to be played at once. If your receiver selects only one pair of systems at a time, you need not concern yourself with these impedance considerations.

SPURIOUS RESPONSE REJECTION (T). There may be other forms of signal interference when tuning across the FM dial besides i.f. and image interference. False appearance of signals at improper frequencies brought about by complex mathematical relationships between the intermediate frequency or its harmonics and sub-harmonics are often the cause of such additional spurious responses. In a well-designed tuner, such false responses will be very minimal or hardly detectable. Nevertheless, many manufacturers publish this specification in dB. The higher the number quoted, the better the tuner in this regard. Typical spurious-response-rejection figures for modern tuner sections are shown in Fig. 16.

STEREO INDICATOR (T). Almost before the first generation of stereo FM tuners and receivers was off the drawing boards in 1961, manufacturers realized that the new stereo broadcasting system provided a simple way in which to denote a stereo broadcast in the tuner or receiver circuitry. Today, nearly every stereo tuner or receiver is equipped with a stereo indicator light to tell you when you have tuned to a stereo broadcast. Despite this convenience, there is still some confusion in interpreting the light. Some circuits allow the light to come on even when the mode selector switch of the receiver is set for mono listening. As a result, many listeners THINK they are getting stereo reception when in fact they are really hearing the same material coming from each speaker because a switch was set wrongly. Conversely, some circuits are arranged so that so long as the receiver is set to mono operation, the stereo indicator light will never light. In these circumstances, a listener who is unaware of this design format may well tune across the entire dial and wonder why his set was not receiving any stereo broadcasts! Finally, some less sophisticated stereo indicator arrangements will often become illuminated in the presence of interstation noise—leading the inexperienced listener to conclude that the interstation noise is being "transmitted" in "stereo"!

Tape Monitor (P). Many tape recorders (particularly the better ones) are equipped with multiple tape heads (separate heads are used for record and playback). The "Tape Monitor" feature present on most receivers enables the user to take full advantage of these tape recorder designs. Actually, the tape-monitor switch does nothing more than cause an interruption in the audio circuitry. The amplifier is, in effect, disconnected from the early preamplifier stages, internally. The recorder output jacks can then be connected to the tape recorder input, for making whatever recordings you desire, while the output of the extra head (suitably amplified by a preamp contained in the recorder) can be fed to the amplifier, via the tape-monitor jacks. In this way, the recordist hears not the original program material, but his own recording of it, played back a fraction of a second later. By monitoring in this way, any defects noted in the resulting tape can be immediately corrected without having to wait to listen to the entire tape—which might have been inadvertently ruined. Now, it follows that if the receiver owner is *not* equipped with a multiple-headed tape recorder which lends itself to this application, he should *never* actuate the tape monitor switch—since to do so causes a "break" in the circuit which is not restored by the presence of a tape recorder connection. Many, many service calls could have been avoided if more receiver owners checked the setting of their tape monitor switches before calling to report a receiver that "doesn't play."

THD (TOTAL HARMONIC DISTORTION), AMPLIFIERS (P,A). This form of distortion arises from the production of harmonics, or multiples, of the desired fundamental tone. Thus, a 1000-Hz tone may be fed into an amplifier and the amplifier may produce, in addition to 1000 Hz, small amounts of 2000 Hz (called the second harmonic), 3000 Hz (third harmonic), etc. The sum of all these harmonic overtones not present in the original signal is added up and expressed as a percentage of the total signal present in the output. In the case of most amplifiers, harmonic distortion is very low at all but full power output and beyond. For this reason, most manufacturers state THD for full output only, allowing us to assume that distortion figures at lower than full output power will be much lower. However, such is not always the case and a meticulous manufacturer will often give additional distortion figures for lower power outputs. Our qualitative curves, shown in Fig. 18, are general in nature and apply regardless of power level. Distortion is unpleasant at both low and high listening levels and large amounts of it in reproduced music in the home lead to a vague malady often called "listener fatigue." Interestingly, many people who have not joined the high fidelity component adherents often question our loud levels of playing. The reason they are not accustomed to lifelike levels is that if they were to attempt to play music at such levels via their "table model" radios or portable phonos, the distortion would be intolerable. It is, therefore, the distortion and not the loud level which most disturbs these people. Because high fidelity receivers have such low distortion (at all playing levels), one can turn up the volume with no aural discomfort.

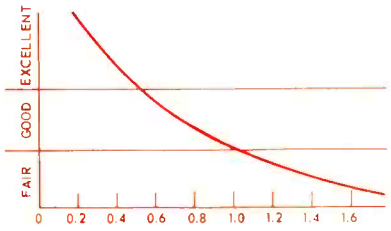

Fig. 18—THD, amplifier ratings

THD (TOTAL HARMONIC DISTORTION), MONO FM (T). The meaning of THD, as applied to the monophonic tuner section of a receiver is exactly the same as its meaning applied to amplifier performance. The causes of the distortion are quite different, however, and a statement as to the level of THD in the tuner section gives us an idea of how well that section (as distinct from the amplifier or preamplifier) has been engineered and produced. Too, the distortion created in the tuner detection process is independent of the level at which the volume control of the amplifier is set and for this reason, is perhaps more significant even than amplifier distortion. Our qualitative recommendations are shown in Fig. 19.

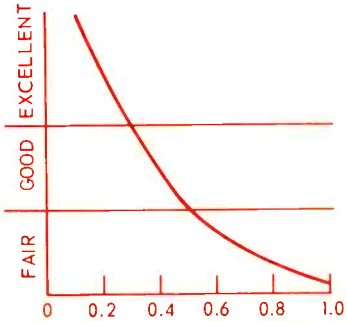

Fig. 19—THD, mono FM ratings

THD (TOTAL HARMONIC DISTORTION) STEREO FM (T). The remarks applicable to THD Mono FM (see above) apply here, except that few manufacturers publish this specification. There are two reasons for this: first, the IHF Tuner Specifications (written in 1958, before

stereo came upon the scene) only call for a disclosure of mono FM distortion and, secondly, THD in Stereo FM tends to be a bit higher than in mono, owing to the extra decoder circuitry which is required. Still, this need not be regarded as a general rule and some designers have been able to achieve low orders of distortion in the stereo FM mode which are as good or nearly as good as their equivalent monophonic distortion specifications. As of this writing, however, we shall be a bit more liberal in setting up the quality criteria shown in Fig. 20.

Tone Controls (P). The presence of wide range bass and treble tone controls on high fidelity stereophonic receivers often puzzles newcomers to the field. "Why," they say, "must a receiver have tone controls if the objective is to have 'flat frequency response' throughout the audio range?" This would be so if all other elements of the listening system were "flat," and by "all other elements" we include the room acoustics in the listening area as well as the loudspeakers, phono cartridge, and even the hearing characteristics of the listener. Properly (and moderately) used, bass and treble controls can correct for deficiencies in other parts of the system. Used to excess, the tone controls can totally distort the tonal relationships of the music we wish to hear. Virtually all receivers are equipped with separate bass and treble controls. In some cases, each of these controls affects both channels simultaneously, while in more elaborate designs, concentrically mounted knobs can be turned independently, thus enabling tonal compensation of left or right channel separately. There is also a growing tendency to divide the total audio spectrum into more parts than just "bass" and "treble." Thus, certain newer receivers sport five or more tone/equalizer controls, each responsible for compensating or modifying just a small segment of the audio spectrum. Such subdivision obviously affords more precise control over total tonal response, if that is what is required in a given installation.

Volume and Balance Controls (P). Both of these controls are involved in the level- or loudness-setting process. The volume control adjusts overall loudness on both channels, while the balance control sets up equality of levels between left and right channels. Often, it becomes necessary to readjust the balance control when the volume control setting has been altered substantially. This is because the volume control really consists of *two* controls actuated by a single shaft and the machanical rotation of both controls does not always correspond exactly to equal electrical sampling of the audio voltages present at the take-off point of each control. Manufacturers of quality receivers take great pains to select the volume control pairs in such a way that this discrepancy is kept to an absolute minimum and, though it is certainly not a vital specification, some manufacturers will note that they achieve good tracking (the term used to describe this dual-control effect) down to 60 or more dB below top setting of the control.

As for balance controls, most of them are constructed in such a way that only a very small amount of shift of left and right levels takes place near the center of the control rotation. In this way, it is possible to balance your stereo speakers

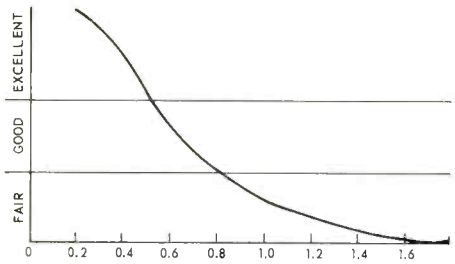

Fig. 20—THD, stereo FM ratings

with a high degree of accuracy. The best way to do so, by the way, is with the receiver set to monophonic operation. The balance control is then adjusted until the sound seems to be coming from a point exactly mid-way between the two loudspeaker systems.

Obviously, a brief glossary such as this could not possibly cover every aspect of stereo receiver technology and design—nor was that the intent. Whether you've read it "cover-to-cover" or found a single clarifying explanation of something that's been puzzling you, we hope it has been helpful to present and future stereo receiver owners. AE

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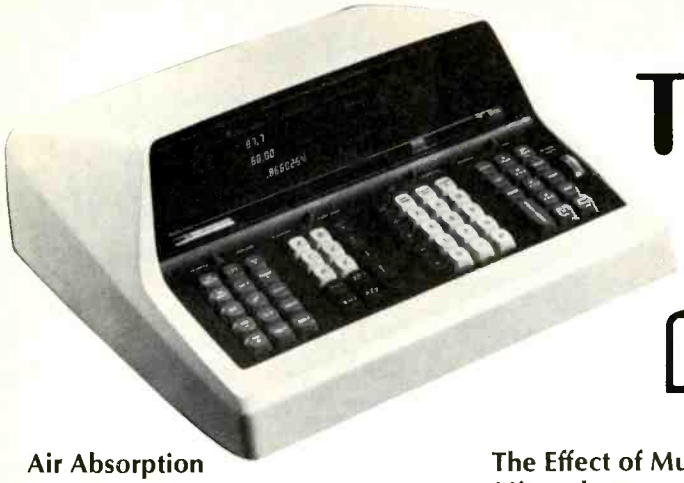

The Computer in Sound System Design

Part Two

DON DAVIS

Air Absorption

Higher frequencies, those between 1000 and 10,000 Hz, attenuate progressively more rapidly than do the lower frequencies. This frequency-discriminative characteristic is caused by air absorption and humidity. As frequency increases and humidity decreases, the attenuation increases beyond that predicted by the formulas already given.

Figure 8 allows the calculation of the expected additional attenuation when the frequency and relative humidity are known.[4] Typically at distances of 50 to 70 feet this additional absorption causes the *desired* acoustic response to exhibit a gradually sloping response starting about 2500 Hz and being about 5.0 to 6.0 dB lower at 10,000 Hz than at 1000 Hz. Air absorption plus the typical random incidence response of ½-inch condenser measuring microphone results in a house curve at 70 to 100 feet that looks like Fig. 9.

Equivalent Acoustic Distance (EAD)

Equivalent acoustic distance (EAD) is the maximum distance from a performer that still allows a clear intelligible understanding of his message without the use of a sound system. Obviously this distance will vary with the

1. Acoustic output of the performer.
2. Hearing acuity of the listener.
3. Ambient noise level.
4. Ratio of direct-to-reverberant sound.

Very useful charts have been compiled in recent years for showing the expected effects of performer-listener separation in given ambient noise levels. In considering typical noise levels in even the quietest environments versus a normal talker's acoustic output, twenty feet of performer-listener separation would appear to be a practical maximum for an EAD. See Fig. 10.

[4] Knudsen and Harris, *Acoustical Designing in Architecture*, Wiley, New York, 1950.

The Effect of Multiple Microphones

The number of open microphones (NOM) directly affects the acoustic gain of a sound reinforcement system. Every time the number of open microphones is doubled, the potential acoustic gain (PAG) drops 3 dB.

$$10 \log_{10} NOM = \text{loss in gain}$$

This assumes, of course, that the microphones are in the reverberant sound field of the loudspeaker.

Calculating the Needed Acoustic Gain

There is an almost universal tendency today to under-design the typical sound reinforcement system in spite of the fact that it is possible to calculate quite accurately the actual needed acoustic gain (NAG). Knowing the actual acoustic gain required can ensure against excessive measures being undertaken merely as a technical *tour de force*.

$$NAG = {}_{\triangle}D_o - {}_{\triangle}EAD + {}_{\triangle}NOM + 6\ dB^{(5)} \quad (17)$$

where ${}_{\triangle}D_o$ = the distance in feet from the talker to the farthest listener used as r in the formula

$$10 \log_{10}\left[\left(\frac{Q}{4\pi r^2}\right) + \left(\frac{4}{R}\right)\right]^{(6)}$$

${}_{\triangle}EAD$ = the equivalent acoustic distance in feet used as r in the same formula

${}_{\triangle}NOM$ = the number of open microphones used as NOM in the formula: $10 \log_{10} NOM$.

$+6\ dB$ = working "headroom" below unity gain.

[5] Don Davis, New ways to look at needed and potential acoustic gain, *Altec Lansing Technical Letter No. 198*, 1969.

See Figs. 11 and 12 for definitions of D_1, D_2, D_6, and D_8.

For an example, in a room where $S = 100{,}000\ ft^2$, $a = 0.12$ and the loudspeaker array had a $Q = 5$, we could calculate the following deltas for

$$D_o = 125' : {}_{\triangle}D_o = -34.96$$
$$EAD = 8' : {}_{\triangle}EAD = -21.86$$
$$NOM = 2 : {}_{\triangle}NOM = +3.01$$

Converting ${}_{\triangle}D_o$ and ${}_{\triangle}EAD$ to opposite signs for use in the NAG formula, we find $34.96 - 21.86 + 3.01 + 6\ dB = 22.11\ dB$.

NOTE. *The ${}_{\triangle}$ used throughout this paper denotes the dB equivalent of the parameter, rather than its usual application as a change or difference.* ED.

Calculating the Potential Acoustic Gain

The potential acoustic gain (*PAG*) is that maximum amplification possible at unity gain expressed as a relative advantage at the farthest listener's ears. For example, the actual unity gain would remain the same for any given microphone-loudspeaker separation but the apparent acoustic gain at the farthest listener will increase if the loudspeaker is placed closer to the listener than the talker is.

$$PAG = {}_{\triangle}D_1 + {}_{\triangle}D_o - {}_{\triangle}D_2 - {}_{\triangle}D_8{}^{(7)} \quad (18)$$

where ${}_{\triangle}D_1$ = the distance in feet from the microphone to the loudspeaker is converted by means of

$$10 \log_{10}\left[\left(\frac{Q}{4\pi r^2}\right) + \left(\frac{4}{R}\right)\right] \quad (19)$$

D_1 should be made equal to or greater than D_c whenever possible in order to ensure that the microphone is in the loudspeaker's relatively stable reverberant field, hence at a distance allowing *maximum acoustical separation*. D_1 should not, however, exceed 45 feet or time-delay

[6] H. F. Hopkins and N. R. Stryker, A proposed loudness-efficiency rating for loudspeakers and the determination of system power requirements for enclosures. *Proc. IRE*, March, 1948.

[7] C. P. Boner and R. E. Boner, The Gain of a Sound System, *JAES*, Vol. 17, No. 2, April, 1969.

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Tempo

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problems will be encountered. $D_1 \geqq D_c <$ 45′.

where $_{\Delta}D_2$ = the distance in feet from the loudspeaker to the farthest listener converted by means of formula 19.

D_2 should not exceed $4D_c$ if the ratio of direct-to-reverberant sound at the farthest listener's ears is not to exceed −12 dB. Solutions to situations where D_2 exceeds $4D_c$ are:

1. Shorten D_2. For example, use overhead distributed systems in place of a single-source array, thereby substantially shortening the D_2 to any given listener at the expense of realistic directional localization.
2. Increase the Q of the loudspeaker array.
3. Increase the a of the space.
4. Increase the physical size, thus surface area, of the space. (At the drawing board stage this can often be considered seriously.)

In any case, $D_2 \leqq 4D_c$ is the rule.

D_s = the distance in feet from the talker to the microphone converted by means of the above formula. Shortening D_s is the easiest way to increase *PAG* substantially.

Despite overwhelming popular belief in the ability of cardioid microphones to increase acoustic gain, it is normally easiest to reach maximum acoustic gain using a high-quality omnidirectional microphone. In a properly designed sound reinforcement system every effort has been made to maximize acoustic gain by providing the greatest possible *acoustic* attenuation between the loudspeaker array and the microphone. This is done by placing the microphone in the far reverberant sound field of the loudspeaker array. Hence, the sound arriving at the microphone impinges randomly on it and its directivity is not of any use.

The proper use of directional microphones is to discriminate against nearby unwanted noise sources that are at a distance substantially less than D_c for the space. For example, in our theoretical building we calculated a needed acoustic gain *(NAG)* of *22.11 dB*. By applying the above rules we can now find:

1. $D_1 = 40$ *ft.* ($D_c = 34.29$ *and* $D_1 \geqq D_c <$ 45′; therefore, 40′ makes a completely logical choice for D_1.)
2. $D_2 = 119$ *ft.* $4D_c = 137.17'$ and $D_2 \leqq 4D_c$.

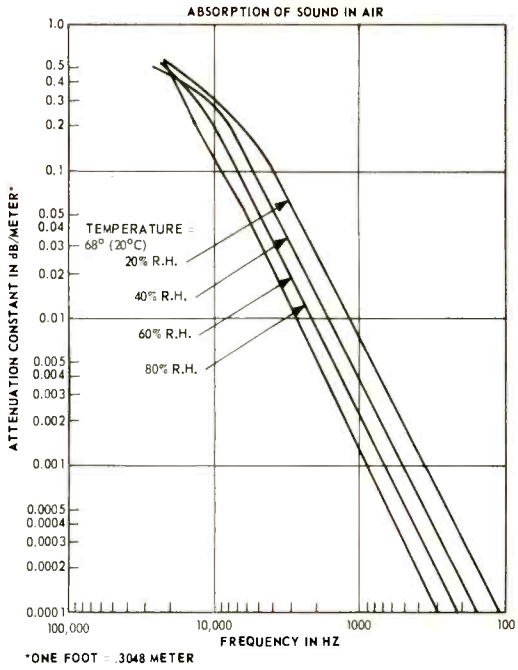

Fig. 8—The effect of humidity and frequency on air absorption of sound.

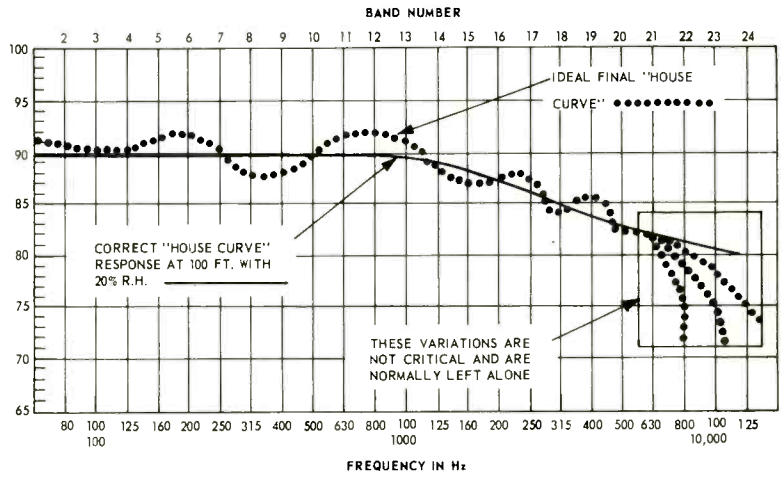

Fig. 9—A typical "house curve" considering air absorption and microphone characteristics.

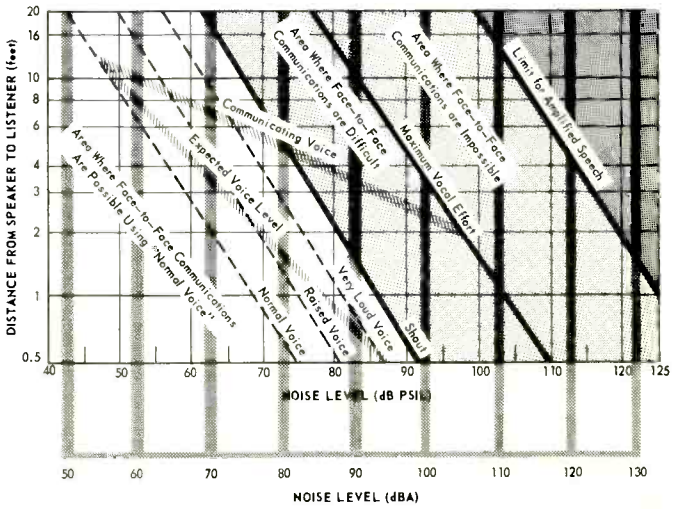

Fig. 10—Establishing an EAD by considering the ambient noise level.

BASF LH* tape sets a whole new standard in sound recording

*(LOW NOISE-HIGH OUTPUT)

Remember how tape used to sound? You'd turn up the volume and hear a background hiss — or turn it down and not hear the sound. With new BASF-LH tape (Low noise-High output) you eliminate all background noise and you get full-bodied, dynamic tones over an expanded volume range. The signal-to-noise ratio is improved by as much as 8 db over other low noise tapes.

BASF-LH tape . . . now everyone can have true professional recording sound reproduction — more clarity and realism, less distortion — from faintest pianissimo to booming crescendo. BASF-LH tape — packaged in the famous "Perma-Store" plastic library boxes for permanent protection. Combining quality with convenience for the most memorable recording results ever!

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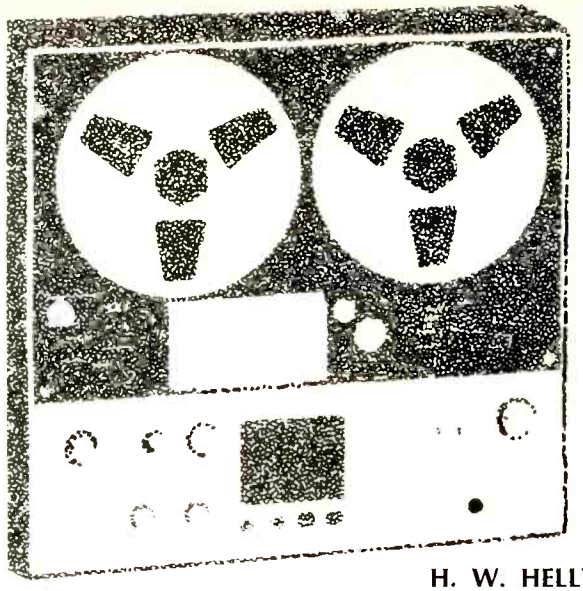

Tape Transport Maintenance

Part 6—Brakes.

H. W. HELLYER

BRAKES ARE MEANT to stop things. Although their malfunction is obvious when—in a tape recorder—they do not, more often the troubles caused by erratic brakes are those of binding, retardation, or incorrect timing. Diagnosis depends very much on a knowledge of the type of braking mechanism that is employed, how it should work, when it should work, and with what force. There are many different methods.

Basically, we are concerned with two different processes. First, and most obvious, we have to stop the spools in the shortest possible time without spillage. Secondly, and not so obvious, the correct tape tension must be supplied during playing, so that the tape enters the head channel without slap or flutter and leaves it without snatch. This operational braking is quite often the most difficult function to achieve.

The simplest type of brake is the peripheral pad—usually made of felt—which is spring-loaded to engage with the edge of the spool carrier. Levers hold it off during RECORD, PLAY, or FAST WIND. But the simplicity can be deceptive. When the STOP key is operated, the timing of the brake action is important and quite elementary braking systems can still have offset levers or brackets which enable the feed-side brakes to engage fractionally before those retarding the take-up spool. During servicing, care must be taken to preserve these small differences in brake application. Quite often they will depend on the bending of a bracket, or the setting of a screw.

Testing such simple brake systems consists of an operational run, with sudden 'stop' action applied during any function. It is a common mistake to set brakes for 'normal' braking, ignoring the crash-stop conditions from fast wind in either direction, and with full or empty spools, to which the machine may be subjected as soon as it has left your hands.

Such simple systems, too, may depend for their effective friction on the condition of a felt pad. Constant use, variations of heat and cold, perhaps the throw-off from capstan or idler bearing of minute particles of lubricant, will all cause a skin of 'brake spoil'. The effect is insidious: the brake engages quite firmly and appears correct when inspected with the mechanism at a standstill. But at the important moment when the brake begins to apply friction, the tendency of the spools to skid can cause either spillage of tape or excessive retardation—drag—with the resultant stretch of tape and the danger of breakage.

Peripheral brakes should first be checked for soft felt pads, clean cork or composition pads or shoes, and free rubbers. The last remark may cause some puzzlement: free rubbers? But the type of brake that is a small rubber wheel mounted on a spring arm which is disengaged to contact the edge of the spool carrier or brake drum when 'Stop' is selected is similar in principle to, though rather different in operation from the ordinary pad brake. The rubber wheel engages the running surface, turns briefly, then, as the spring pressure tightens, locks and grips. Usual trouble with this type of brake is binding of the wheel on its own spindle or bearing, with a consequent fierce application that is originally ineffective then *too* hard. The outcome is usually stretched or broken tape.

The cure, of course, is cleaning of the wheel mounting, easing of the spindle bracket, where this is pivoted, checking of the spring, cleaning and softening of the rubber (a bit of extra softening can help here—the wheel drives nothing) and resetting of the stops to ensure engagement at the right time.

Similar remarks apply to the simple pad brakes. Above all—keep 'em clean. Grit, dirt, oil, rubber parings, and other foreign matter spell death to brake pads, just as they do with your auto.

Where there may be some doubt about brake application, always err slightly toward the feed spool. During Play, this should come on slightly in advance, to keep the tape in correct tension through the head channel. Too much in advance, of course, means a retarded tape. The usual fault is the opposite, and a tell-tale spillage loop before the tape enters the first guide. No adjustment rule can be given, mechanisms differ in detail so much. Too often, the mechanic is left to decide for himself how much he shall bend, twist or screw the vital parts.

Servo-brake mechanisms require more than a simple 'off-on' adjustment. They work by applying a pressure to the braked drum which varies as the torque: the faster the drum is initially turning, the less the braking effect. A curve drawn to illustrate braking effect will show a pronounced difference in slope as the contact angle is increased, giving greater 'wrap.' The effect of greater wrap is not a 'tighter' brake but one that gives its retarding effect with a more rapidly increasing application.

The design problem is not one of working out the braking force, but of calculating the variation in that force between a full and empty spool rotating in one or the other direction. The servo brake tends to wedge itself on in the winding direction, i.e. the supply direction, and the contact angle, in the case of a band, or the wedge angle, in the case of a pad, has to be determined with some care. The outward force can be set, and the inward force calculated for differing loading conditions, and by reference to tables of coefficients of friction the angles can be worked out.

But like all carefully calculated plans of mice and men, external influences will make them go agley. The external influence in the case of tape recorders is inevitably dust, dirt, excessive heat, and a great growth of unwanted friction.

We put a little more feature into each feature.

The Miracord 50H not only offers more features than any top quality automatic turntable on the market, but each feature offers more. Here's what we mean.

■ Two worthy competitors offer a kind of synchronous motor. Neither motor, however, can qualify as a hysteresis synchronous motor. And, neither is a Papst hysteresis synchronous motor. The Papst is the one used in professional studio record-playing equipment. The Miracord 50H uses the Papst hysteresis synchronous motor with outer rotor for unvarying speed accuracy, regardless of the voltage or load fluctuation.

■ When examining the cueing feature, be sure to ask whether cueing works in both automatic and manual modes. Because, in automatic, where one leading automatic turntable doesn't work, cueing represents the ideal device to interrupt play for just a moment when there are a stack of records on the spindle. The Miracord 50H provides silicone-damped cueing in both modes.

■ Stylus overhang adjustment is essential for optimum tracking. Another automatic turntable does feature this adjustment, but it's internal and difficult to set. The Miracord 50H offers external overhang adjustment with built-in gauge — no shifting, no guess work, no templates. You can line up your stylus in seconds accurately.

■ Now here's the feature no one has. Those light touch pushbuttons that make it so easy for you to enjoy all of those other wonderful Miracord 50H features. The pushbuttons provide simple, foolproof operation. For example, the 50H is the only automatic changer that can go from manual to automatic or vice versa without re-setting.

■ Over the past few years, Miracord 50H has proven its reliability and enhanced its position of leadership by its superb performance in thousands of home music systems. The finest automatic turntable available today costs $175.00 At leading hi-fi dealers.

Benjamin Electronic Sound Corp., Farmingdale, N.Y. 11735, a division of Instrument Systems Corporation.

Miracord 50H

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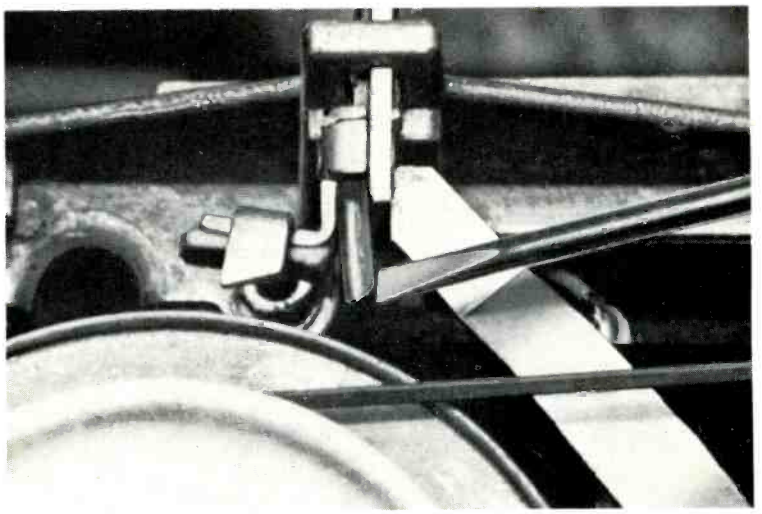
At first, the variation from 'as new' conditions is not noticed. By the time alarm bells ring in the mind, and the slowing spools are not as regular as they used to be, it is often too late. The cure may be to change the brake bands, reset the brakes (relaxed springs can by now have made this necessary), or change the pads, which may be of cork, felt or some rubberized composition, but should never be replaced by something different.

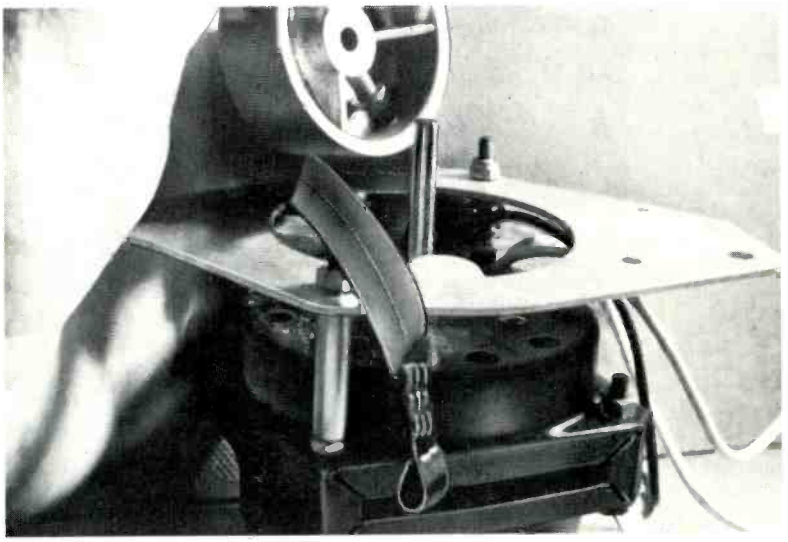
Shoe brakes of different sorts are used in servo mechanisms and also in straight brakes. Often, the shoe will be shaped to give the needed servo action, and care must be taken to get the shape right when replacement becomes necessary.

Wear is the big enemy, always accelerated by dust, dirt, and heat. Polished brake bands, pads, and linings are frequent causes of spillage, brake snatch, or uneven application. It often takes longer to clean such surfaces than to replace the material. As the designer has such a ticklish job in working out what materials to use, do him the honor of using the same substance he has chosen, and not a bit of the lining from your old hunting cap. Cork is a common material, with felt running it a close second. Rubber is employed at times, usually when metal rims are to be retarded, and plastic or fabric bands, some of them made from specially treated and tensilized materials, form the basis of simple servo brakes.

In the domestic machine, application is generally direct—though there are notable exceptions that use solenoid-operated brakes. But professional machines have larger spools, and are more often required to change direction, stop and start, or retard their motion from any functional operation. Auxiliary braking systems are thus employed. Stop braking takes two phases: the first is a rapid delay action, retarding the fast-moving spool, changing to a more gentle brake application as the spool decelerates. Relays with delayed-action circuits, and forms of braking magnets are often used. Quick-acting brakes which bring the spools immediately to a halt if the tape breaks, or after it runs through, are also part of the studio machine's make-up. Many of these special brakes are now being incorporated in so-called 'domestic' machines.

One of the special devices is the servo control brake. This is a form of electronic control which depends either on the rate of revolutions of the machinery compared with a standard-frequency reference source, or on a compared recorded track referred to the motor speed. Early forms were transistorized developments of the simple regulator—and not always as effective in practice as their designers may





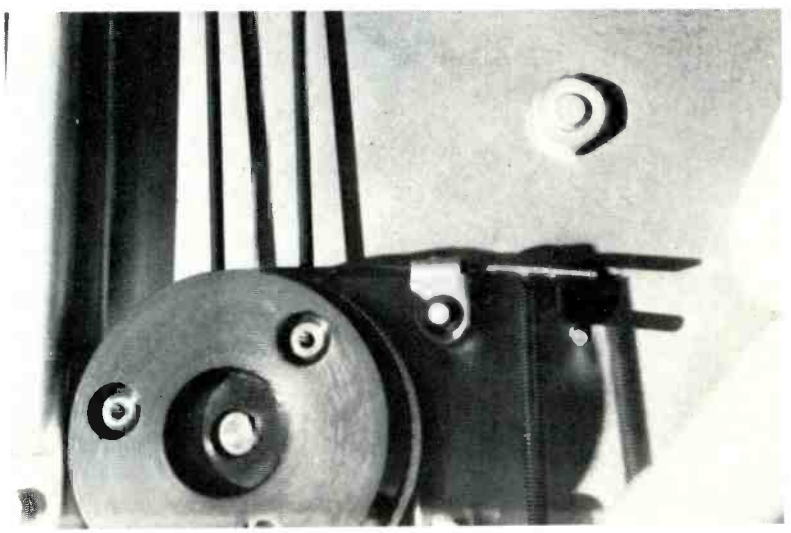


Fig. 1—Differential brake action provided by flexible tongue.

Fig. 2—Simple type of servo brake using fabric band, sometimes treated with graphite.

Fig. 3—The servo brake on the Revox G 36 is a steel band and the drum is rubber-lined.

To call it "an amplifier" would be like calling a Porsche "Basic transportation."

There is unusual satisfaction that comes from fulfilling a prosaic task in a far from prosaic manner.

Hence this amplifying system: the Sony TA-2000 professional preamplifier and the Sony TA-3200F power amplifier. Together, they perform all an amplifier's standard tasks in a satisfyingly impeccable manner; but their 67 levers, switches, meters, knobs and jacks allow you to perform some interesting functions that are anything but standard.

Dual-purpose meters.

The two VU meters on the preamplifier front panel, for example, are no more necessary than a tachometer on an automobile. But they do serve the dual purpose of simplifying record-level control when the TA-2000 is used as a dubbing center, and of allowing you to test your system's frequency response and channel separation (as well as those of your phono cartridge) and to adjust the azimuth of your tape heads.

A broadcast/recording monitor console in miniature.

The TA-2000 resembles professional sound consoles in more than its VU meters. In addition to the 20 jacks and seven input level controls provided on its rear panel for permanent connections to the rest of your hi-fi system, the TA-2000 boasts a professional patch board in miniature on its front.

Thus, you can feed the inputs from microphones, electric guitars, portable recorders or other signal sources into your system without moving the preamplifier or disturbing your normal system connections in the least. And a front-panel Line Out jack feeds signals for dubbing or other purposes into an external amp or tape recorder, with full control of tone and level from the front-panel controls and VU meters.

The tone correction and filtering facilities are also reminiscent of professional practice, allowing a total of 488 *precisely repeatable* response settings, including one in which all tone controls and filters are removed completely from the circuit.

The amplifier—no mere "black box"

A power amplifier can be considered simply as a "black box" with input and output connections, a power cord, and an on/off switch; and such an amplifier can perform as well (or poorly) as the next one. But in designing the TA-3200F Sony took pains to match the amplifier's facilities to the preamplifier's.

Thus to complement the TA-2000's two pairs of stereo outputs, the TA-3200F has two stereo pairs of inputs, selected by a switch on the front panel. Other front panel controls include independent input level controls for both channels, a speaker selector switch, and a power limiter (in case your present speaker should lack the power handling capacity of the next one you intend to buy).

Circuitry unusual, performance more so

The single-ended, push-pull output circuitry of the TA-3200F amplifier is supplied with both positive and negative voltages (not just positive and "ground") from dual balanced power supplies. This system allows the amplifier to be coupled directly to the speakers with no intervening coupling capacitors to cause phase shift or low-end roll-off (A switch on the rear panel does let you limit the bass response below 30Hz if you should want to, otherwise, it extends all the way down to 10Hz.)

The individual stages within the amplifier are also directly coupled with a transformerless complementary-symmetry driver stage, and Darlington type capacitorless coupling between the voltage amplifier stages.

As a result, in part, of this unique approach, the TA-3200F produces 200 watts of continuous (RMS) power at 8 ohms, across the entire frequency range from 20 to 20,000 Hz; IHF Dynamic Power is rated at 320 watts into 8 ohms (and fully 500 watts into a 4-ohm load).

But more important by far is the quality of the sound; intermodulation and harmonic distortion levels are held to a mere 0.1% at full rated output, and 0.03% at the more likely listening level of one-half watt. The signal-to-noise ratio is an incredible 110dB. And the full damping factor of 170 is maintained down to the lowest, most critical frequencies (another advantage of the capacitorless output circuit).

The companion TA-2000 preamplifier also boasts vanishingly low distortion and a wide signal-to-noise ratio, but this is less unusual in a preamplifier of the TA-2000's quality (and price). What *is* unusual is the performance of the phono and tape head preamplifier circuits; for though they have sufficient sensitivity (0.06mV) for the lowest-output cartridges (even without accessory transformers), these preamplifier circuits are virtually immune to overload—even with input signals 80 times greater than normal.

Their sole vice: they are hardly inexpensive

Of course, at a price of $329.50 (suggested list) for the TA-2000 preamplifier, and $349.50 (suggested list) for the TA-3200F power amp, this system cannot be considered other than a luxury. But then, it was intended to be. For there are those to whom fulfillment of prosaic tasks is unfilling. And among them are not only many of our customers, but also many of our engineers. Sony Corporation of America, 47-47 Van Dam Street, Long Island City, New York 11101.

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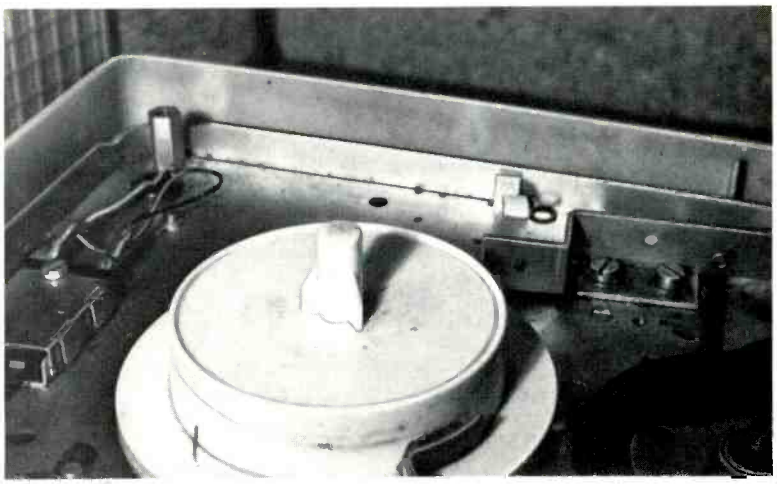
have wished. It seems likely that forms of servo speed control linked with servo-assisted braking will become more common, and a section of this series of articles will be devoted to the subject when space is available.

In general, maintenance of braking systems is a matter for common-sense and knowledgeable inspection. Most frequent problem is wear and tear, broken cork or composition pads, polished linings, loose linkages, and bent brackets. It should never be forgotten that mechanical systems are interdependent. Brakes depend on clutches and drive systems: the one will show evidence of defects if the other is malfunctioning. An example is the rewind action which spills tape when stopped with a nearly full respooled tape. Premature braking may be suspected, but the trouble could be a combination of weak clutch action and 'lazy' brakes.

Watch out for the 'double-action' brake, where the two brake brackets are linked by a common rod or lever, the frictional moment being provided by the direction of spool rotation. Some peculiar effects can be obtained by wrongly adjusting the linkages, and tests should always be made with full and empty spools, both sides, before assuring oneself all is well.

Watch out also for the compensated operational brake, where the angle of the tape over a rider pin is used to give the wedge of a brake a slight pressure against a supply spool carrier. The idea is to provide constant tape tension independent of the amount of tape on the spool. Like all good ideas, it is fine when it works, the very devil to adjust when it does not. Usual adjustment is at the pivot point, and should be made for maximum action with a near-empty spool. Æ



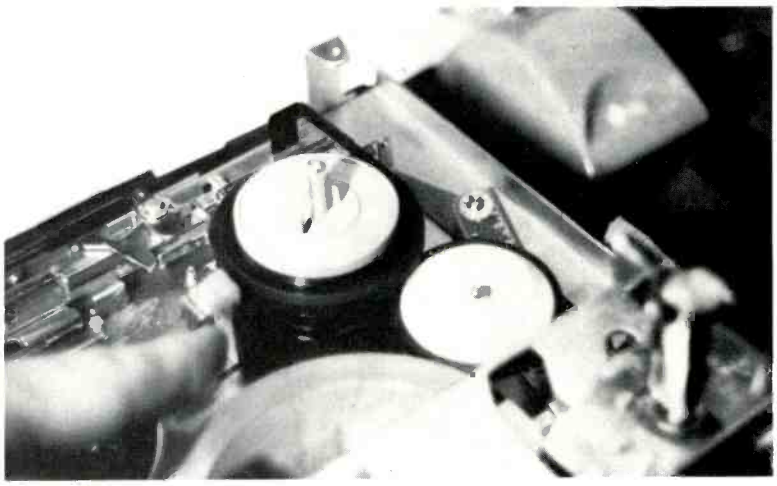


Fig. 4—(Top) Edge-contact brake as used by cheaper recorders.

Fig. 5—Auxiliary brake used by Sony at the take-up spool for the adjustment of tensioning.

Dear Editor...

Eccentricity

I was glad to see the subject of poor record pressings taken up in your column for July, because the scratched and dirty condition of many of the records I obtain from domestic sources has led me over the last several years to import most of my purchases from England, Germany, and Japan.

If the difficulty with off-center records were due to an off-center hole, as your correspondent complains, both sides of the record would be off in the same direction and of course by the same amount; this has almost never been my experience, and I am plagued by records well enough centered on one side only.

How much eccentricity ought to be tolerated? It is easy to show (and easier to hear) that the effect on the pitch of the music is greatest at the end of a side, where the radius is at least 60 mm. Nowadays a turntable wow specification of 0.1% is respectable, and applying this as a standard would require records to be no more than 0.06 mm. off.

A record off by this amount will cause the pickup arm to oscillate over a distance of 0.12 mm. as the record rotates, and this is about the smallest motion which can be measured easily on fine-pitch recordings. In my collection the records which meet this standard are the older ones and those made in Germany, with those made in England running a close second.

Which turntable manufacturer will be the first to provide a conveniently adjustable eccentric spindle?

J. D. Reed,
Chicago

Eccentricity used to be more prevalent in England, but seriously, the problem lies with the record manufacturers and it should not be passed to the record player designers for a solution.—Ed.

Integrity

In the midst of all the electronic marvels of today and tomorrow at the EIA/Consumer Electronics Show, it was an unexpected pleasure to see that at JBL they still care about the guy who bought

(Continued on page 44)

After you've introduced the world's finest $500 tape deck* what do you do for an encore?

You make the world's finest popularly priced tape deck.

When our Tandberg 6000X was reviewed by Hirsch-Houck Laboratories, they said it set a new standard for others to aim at.

Well, we're not about to rest on our laurels, because we've got another winner in our 3000X.

For a start, you'll probably never use its 7½ ips speed—except to play back your old tapes. After all, at 3¾ ips you can record everything from 50 to 16,000 Hz with perfect fidelity.

At a signal-to-noise ratio of better than 60dB.

That's because the 3000X gives you Tandberg's uniquely-engineered Cross-field bias head in addition to separate erase, record and playback heads. With full monitoring facilities, three speeds, cueing lever to locate recorded passages during fast-forward and rewind...and just about everything you're likely to need this side of getting your own professional studio.

At $299 the Tandberg 3000X is just plain unbeatable.

Prove it by testing it out at your nearest Tandberg dealer.

TANDBERG 3000X

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Pelham, New York 10803

*"It is difficult to imagine how the Tandberg 6000X could be improved."—Stereo Review, June 1970.

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Getting Hooked on Chamber Music

The Mozart piano quartets, indispensable to any chamber music collection, have never been poorly done. The Odyssey mono disk with George Szell as the keyboard companion of three-fourths of the Budapest Quartet *ca.* 1946 is as admirable for its realization of the good humor in K. 493 as for its aristocratic understatement of the pathos in K. 478. The Budapest's stereo remake with Mieczyslaw Horszowski on Columbia MS-6683 has far less magic, but it is first-choice among stereo editions.

A worthy companion in every way to the Beethoven trio in the same key (the *Archduke*), the Schubert Trio in B-flat is one of that prolific master's most inspired compositions, as rich in fine tunes as the *Trout* Quintet, but more volatile in its outpouring of them. The remarks on the recordings of the *Archduke* may be precisely duplicated in the case of Schubert's Opus 99: the Suk Trio's discontinued Crossroads (22 16 0158, with the lovely *Notturno*, Op. 148, as filler) ought to be checked on while copies are still to be found, but the impeccable Istomin-Stern-Rose performance on Columbia is the best of those in the current *Schwann*, recommended either on the single disk in our list or in the bargain-priced album with the *Archduke et al.* (See above for details of that set and the RCA album of the same material played by Rubinstein, Heifetz and Feuermann.)

"Delicious" is really not a bad word for Mozart's Oboe Quartet, which is as unpretentious, unprofound, and thoroughly delightful as music can be (and as challenging for the oboist). If memories of the old Columbia 78s with Leon Goossens and members of the Lener Quartet have not been entirely effaced, there are nevertheless several splendid accounts of this work in the current *Schwann*, including two with the New York Philharmonic's Harold Gomberg, one by his brother Ralph of the Boston Symphony, and one with the Chicago Symphony's Ray Still. If couplings were to dictate one's choice, first consideration would have to be given Andre Lardrot on Vanguard VSD-2074 (oboe concertos by Mozart, Handel and Albinoni) or Ray Still on Concert-Disc CS-204 (the Mozart Horn Quintet, with John Barrows and the Fine Arts Quartet). However, the most enchanting performance is clearly the stereo remake by Harold Gomberg, packaged with the Britten works on Vanguard/Cardinal. One of Gomberg's own paintings, by the way, is reproduced on the cover of the disk.

Beethoven's Opus 25 Serenade is not dissimilar to the Mozart Oboe Quartet in spirit, but is more varied in its moods, with less of a pastoral character. It is Beethoven in his lightest vein. The Philips recording listed is probably the most stylish performance available in stereo, but there is nothing lacklustre about any of the others, and if stereo is not a must the old Decca mono with Julius Baker still has a unique charm about it as well as the strongest companion piece in the form of the String Trio in C minor (DL-9574). It might be noted, too, that RCA's three-disk miscellany with the Boston Symphony Chamber Players (LSC-6167) includes both the Beethoven Serenade and the Mozart Oboe Quartet.

There are many who venerate Beethoven's Opus 131 Quartet as the supreme achievement in the art of music, and it cannot be denied that even today it has a visionary quality about it. This *is* profound music, without question, but it also happens to be a compelling listening experience—not so much "easy to listen to" as simply impossible to resist as the sometimes quirky, sometimes sublime passages come tumbling out after each other through its irregular seven-movement sequence. Neither of the Budapest Quartet versions available now comes up to the standard set by that group in an earlier recording, deleted more than fifteen years ago. The most gripping performance on records now is the one by the reliable and frequently inspired Fine Arts Quartet, which also happens to be the cheapest, it is recommended as a single disk or as part of the five-record set of all the late quartets (Opp. 127, 130, 131, 132 and 135, plus the *Grosse Fuge,* Op. 133, in SP-502), but *not* in the nine-disk Everest album of *all* the Beethoven quartets. The new RCA set of the late quartets by the Guarneri Quartet (VCS-6418) is also an exceptional release, offering exalted performances and superior sound at roughly half the regular Red Seal price.

Schubert's unearthly Cello Quintet is another of the pinnacles of chamber music, a shrine at which musicians and laymen alike are content to worship. It has been singled out by an astonishing number of *cognoscenti* as the music to which they would like to be laid away. The two recordings from Vienna offer the most interesting performances now. The one in our list (with Willi Boskovsky as leader) has both style and soul, is splendidly recorded, and comes with the pleasant if inconsequential string trio as a bonus. The twenty-year-old Westminster mono with the Vienna Konzerthaus Quartet and Günter Weiss (XWN-18265) presents a more self-indulgent approach, lingering more over the unspeakably beautiful themes without running to excess, and the remastered sound belies its age.

The two string quartets of Charles Ives are characteristic of the composer: rough, craggy, luminous, unequivocally true to the unique path this remarkable creator laid out for himself. There are not only the citations of hymns and patriotic songs one associates with Ives, but, in the Second Quartet, even a reference to Beetho-

(Continued on page 67)

SANSUI

HITS THE DECK

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The SD-7000's frequency response goes down past 20 to 15 Hz. — and up again to 25,000 Hz. at the top end. In point of fact, you'll hear a little more of everything with this deck, thanks to its 60 db signal-to-noise ratio, and its low record-play distortion (only 1.2% at zero VU) . . . most deck manufacturers won't even quote distortion figures for their machines.

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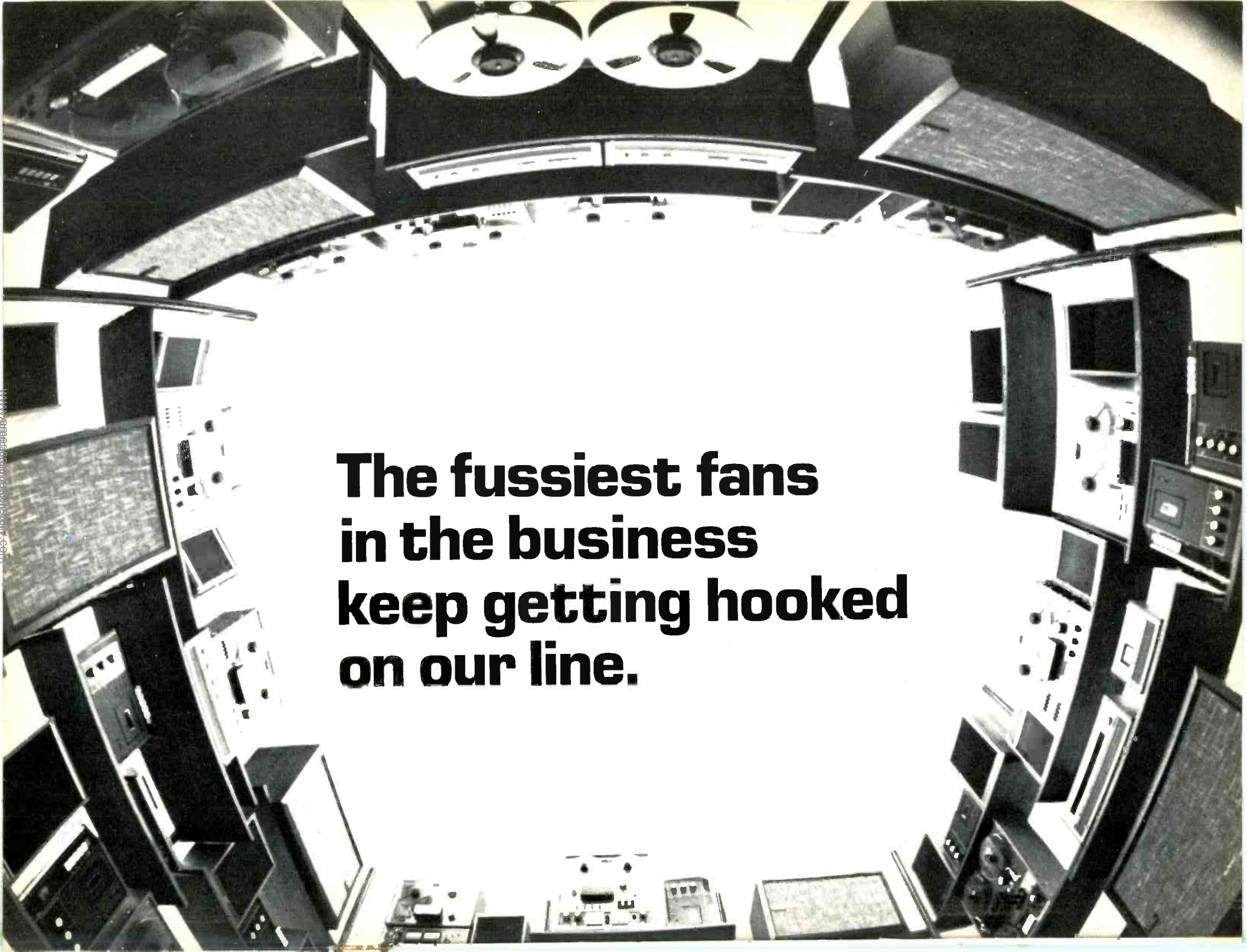
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Paul W. Klipsch

The Mud Factor

An inquirer posed the question "Why should I buy speakers costing $800 each when I could buy some crummy little speakers and tailor the response of both speaker and room with a 'voicing' device"? (I retain the questioner's vocabulary).

This looks like a simple question. The answer is not as simple.

And lets pose another question, Why do equipment reports rate the modulation distortion in amplifiers (often in hundredths of a per cent), but ignore the modulation distortion in loudspeakers which is rarely less than one per cent and often in dozens of per cent?

The attributes of a loudspeaker, in order of importance, are:

(1) Total Distortion, at a given acoustic power *output* level
(2) Polar Response
(3) Amplitude vs. Frequency response
(4) Harmonic Distortion

To give a quick and dirty answer to the first question, the "crummy speaker" will still be crummy after its frequency response has been flattened to ±4 dB, or ±2 dB, or zero dB, because its diaphragm has to move through large excursions to produce a desirable bass output, and the upper frequencies are subject to modulation distortion in direct proportion to how far the diaphragm moves.

The second question remains unanswered.

Which gets us to the kernel of the nut, Modulation Distortion.

Modulation Distortion

Let distortion be defined as the generation of frequencies not originally present. Thus it is distinguished from frequency response errors and the two may be measured and discussed separately.

Harmonic Distortion (hereafter abbreviated HD) is the introduction of harmonics of the original frequencies. This is not objectionable in the reproduction of music which is full of harmonics to begin with and the introduction of even considerable amounts of HD would merely alter the ratios of harmonics already present.

Hilliard[1] wrote that measurement of frequency response and harmonic distortion do not yield a true measure of quality. A single musical instrument transmitted through a system with harmonic distortion will be reproduced with a slightly altered harmonic content and the distortion will go unnoticed. But when a group of sources is reproduced, the effects of non-linearity introduce modulation ('inter" modulation) distortion consisting of sum and difference frequencies which are not harmonically related to the original sounds and which are harsh. Such distortion is far more disagreeable than is harmonic distortion in similar amounts. Further it has been shown that modulation distortion usually exceeds harmonic distortion; Hilliard remarks "As the intermodulation test is approximately 4 times as sensitive as the harmonic analysis method, it approaches the sensitivity of the ear in detecting intermodulation effects and it is a very valuable tool with which to measure distortion. By comparison, other methods are inadequate and inconvenient, as well as more laborious."

Applied to amplifiers, the modulation (pardon me if I drop the "inter") test has gained wide acceptance since 1941.

Scott[2] points out that many writers have realized that modulation distortion and not harmonic distortion is responsible for the annoying quality in amplifiers. A small percentage of harmonic distortion does not in itself produce a serious change in sound quality. But when two different tones are simultaneously amplified under conditions of distortion the modulation results in sum and difference frequencies which are not harmonically related to the original tones. He remarks that some writers ignore modulation distortion as negligible, but points out as an example the soprano with flute obbligato "reproduced with addition of growling difference frequencies." Recall that Scott was writing in 1945.

But loudspeakers display typically many times the total modulation distortion of amplifiers. Considering quality levels of 1970, the better amplifiers display total distortion in the order of 0.2 per cent or less. The best loudspeaker so far measured at a "moderate" output level (100 dB at 2 feet) displayed nearly one per cent, and lesser speakers at the same or lower output levels (90 to 95 dB) displayed up to 30 per cent. Examples will be given of speakers displaying 14 per cent distortion.

TABLE I

COMPARISON OF LOUDSPEAKER DISTORTIONS

Frequencies: 42 and 310 Hz	Output SPL at 2 ft.	Distortion Per Cent
Large Horn Loudspeaker	100	1
Small Direct Radiator	98	10
"Bookshelf" Speaker System	95	14+

In amplifiers only one form of modulation distortion exists, namely amplitude-modulation distortion (AMD). In loudspeakers frequency-modulation distortion (FMD) due to the Doppler effect, and AMD both exist.

The "crummy" speaker of our inquirer might be one that has been found to have 10 per cent or more modulation distortion. No amount of tailoring the response curve can reduce the distortion.

Frequency-modulation distortion (FMD) arises in a loudspeaker when the motion of a loudspeaker diaphragm at some low frequency, f_1, causes a higher frequency, f_2, to deviate due to the Doppler effect, resulting in the same kinds of sideband frequencies produced by AMD, namely $f_2 \pm f_1$, $f_2 \pm 2f_1$, etc.

* Klipsch & Associates, Inc., Hope, Ark.

How we saved our new $139 speaker from medium-priced boredom and conformity.

Ordinarily, there's nothing more boring than a medium-priced speaker system.

Low-priced speakers can be exciting because a few exceptions sound better than they have the right to. And high-priced speakers are, of course, endlessly fascinating because each expresses a different designer's concept of the "state of the art."

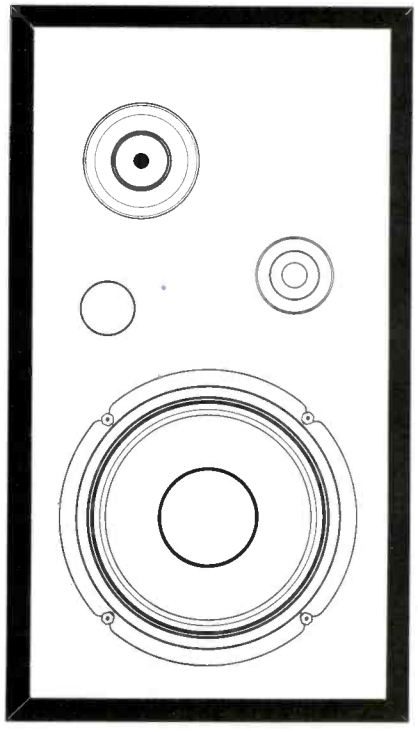
But bookshelf speakers in the $110 to $150 range? When you've heard one, you've heard them all.

That's why, having already created some of the world's finest low-priced and high-priced speakers, we decided that something distinctly new and different should be done for the music lover with a middle-sized stereo budget. The result was the **Rectilinear XII.**

First of all, we did something about efficiency. Unlike the conformist acoustic-suspension speakers in this price range, the **Rectilinear XII** is a high-efficiency tube-vented bass reflex system. All you need is 10 clean watts to drive it to ear-shattering levels. So you won't need a high-priced amplifier or receiver to enjoy your medium-priced speaker, even if you like to feel those bottom notes right in your stomach.

Then we did something about *time delay distortion*. The **Rectilinear XII** reacts faster to an input signal (it "speaks" sooner, with less time delay between electrical input and acoustical output, and with less lag between drivers) than any other cone-type speaker system except our own higher-priced models. Rectilinear seems to be the only speaker manufacturer to be concerned about this type of distortion, but the difference it makes is easily audible to any critical listener.

A nonconformist approach to crossover design is largely responsible for the superior time delay characteristics of the **Rectilinear XII.** The 10-inch high-excursion woofer is crossed over to the "fast," low-inertia 5-inch midrange driver at 350 Hz, a much lower frequency than is conventional in three-way bookshelf systems; the 3-inch tweeter takes over at 4000 Hz. To compound the unorthodoxy, we abandoned the customary parallel-type crossover network in favor of a very elegant series configuration, which gave us vastly improved phase response.



Finally, as our ultimate defiance of tradition, we listened objectively to our own speaker. Did it really sound as different as we had set out to make it? To our ears (which, after all, have a good track record), it did. The **Rectilinear XII** seems to reproduce music with a clarity and authority that few speakers, at any price, can even approximate. And certainly none at $139.

But this is something that each prospective buyer must decide for himself. So, if you're shopping in this price range, listen carefully to the **Rectilinear XII.** And, please, be cynical, jaded and hard to please.

For your $139, you're entitled not to be bored.

(For more information, including detailed literature, see your audio dealer or write to Rectilinear Research Corp., 107 Bruckner Blvd., Bronx, N.Y. 10454. Canada: H. Roy Gray Co. Ltd., Markham, Ont. Overseas: Royal Sound Co., 409 N. Main St., Freeport, N.Y. 11520.)

Rectilinear XII

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Frequency Modulation Distortion

Beers and Belar[3] give

$$d = 0.033\ A_1 f_2 \qquad (1)$$

where d is the effective amplitude of the spurious side-band frequencies, in per cent of the amplitude of f_2; A_1 is the amplitude of diaphragm motion in inches at the lower frequency f_1, and f_2 is the higher frequency being modulated.

With the availability of spectrum analyses the examination of the output of a speaker involves a few seconds of time. One must be forced to admire the work of Beers and Belar who had to "do it the hard way" to obtain meaningful test data on loudspeakers.

Amplitude Modulation Distortion

Modulation distortion in amplifiers has long been recognized as something to be minimized. Originally referred to as intermodulation distortion, I prefer to drop the "inter" prefix: modulation distortion requires two or more frequencies so that one may modulate another, hence the term modulation distortion should suffice. Typically high-quality amplifiers of 1970 as reviewed in various magazines devoted to "high fidelity" are rated in hundredths of one per cent AMD. And the closer to zero they get the more the customers complain that "Amplifier A sounds better than Amplifier B" when both exhibit a tenth as much distortion as the best loudspeakers through which the amplifiers are judged.

Loudspeaker Tests

A relatively few years ago the analysis of a complex wave was a matter of many hours work with a "harmonic analyzer," where each frequency component was sought out and measured. With a spectrum analyzer, the pertinent part of a spectrum may be examined in a matter of seconds. When the early papers were written, the analysis of speakers or amplifiers in detail represented a monumental amount of labor. Now the actual analysis may take 40 seconds, and the labor is mainly that of furniture moving.

In the case of amplifiers, the modulation testing involving two frequencies, say 30 to 60 Hz and 6000 Hz would normally suffice. In loudspeakers a considerable number of pairs of frequencies are needed, particularly in 2-way and 3-way speaker systems. For example, consider a 3-way system with crossover points of 500 and 5000. Use of 50 and 2000 Hz would radiate the two frequencies from different diaphragms so the modulation distortion might appear to be negligible. But applying 50 and 300 will cause the two frequencies to be radiated from the same diaphragm and they will interact. Even with high-quality loudspeakers a perceptible flutter will be audible if the power output is great enough, (say considerably in excess of 100 dB SPL at 2 feet).

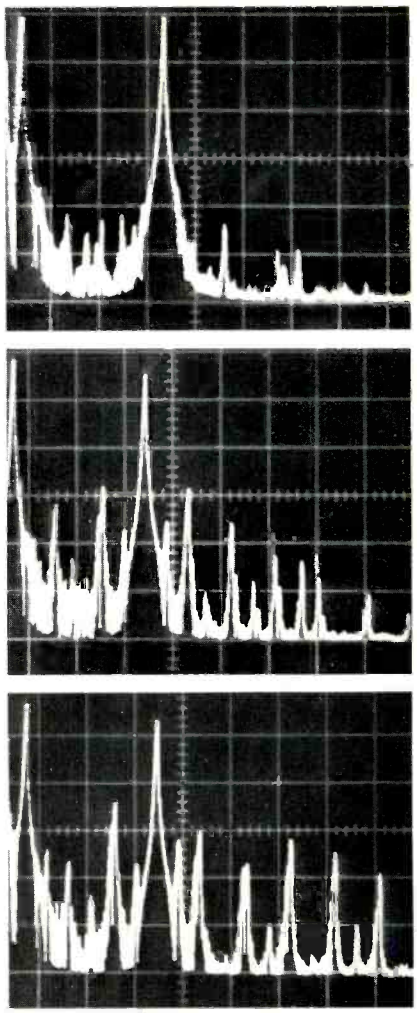
In amplifier testing, the two frequencies are usually mixed in the amplitude ratio of 4:1, the idea being that the power output requirement at 6000 Hz is much lower than at some frequency in the first three octaves. In loudspeakers, the woofer is required to deliver substantially its whole spectrum at high levels, so in testing bass loudspeakers, I prefer to choose two frequencies at the same power level (output) within the pass band of the bass speaker.

A number of loudspeakers have been measured with particular attention to modulation distortion.[4, 5] As would be expected from equation (1), speakers exhibiting the smallest total diaphragm excursion displayed the least modulation distortion. Well-designed horn-type speakers combine the advantages of smooth frequency response and low distortion. Even so, the best loudspeakers exhibit upwards of one per cent total modulation distortion, compared to tenths of a per cent for TMD (or IMD) in amplifiers.

The cited references give several examples of bass, midrange, and tweeter speakers. For the present discussion, three examples of bass speakers will be used.

Figure 1 is a spectrogram of a large bass speaker of the highest quality. The picture has been trimmed to put zero frequency at the left edge. (The spectrum analyzer used produces a zero frequency marker). The first peak, f_1, is 42 Hz at 100 dB SPL at 2 feet. The second major peak is 310 Hz at the same output level. The minor peaks are distortion frequencies introduced by the speaker. The horizontal scale is linear. The vertical scale is 10 dB per division. All the spurious frequencies $f_1 \pm f_2$, $f_1 \pm 2f_2$, etc., are at least 40 dB down from the amplitude of f_1, but this still represents about one per cent distortion for the very finest of loudspeakers.

Figure 2 is the spectrogram of a 12-inch direct-radiator driver unit in a total enclosure of about 1.5 ft³. This displays side-band frequencies of $f_2 \pm 2f_1$ about 23 dB down from the amplitude of f_2 (7 per cent) with root-mean-square total distortion of about 10 per cent. This speaker is regarded as "excellent in its price class" but muddy at any but very low volume levels. Note the extensive family of even-order side-band frequencies. The output level of 100 dB was about the upper limit before displaying "gross" distortion in the form of knocking sounds. The inner voices



In all the figures $f_1 = 42$ Hz
$f_2 = 310$ Hz
Represented by the two major peaks
Vertical scale 10 dB per division.

Fig. 1—High-quality woofer of large size: f_1 and f_2 output, 100 db SPL at 2 ft.
All modulation-distortion components are 40 dB or more down from the peaks of f_1 and f_2, representing 1% maximum for the worst component.

Fig. 2—Twelve-inch direct radiator in 1.5 ft³ total enclosure.
f_1 at 100 dB SPL at 2 feet
f_2 at 95 dB SPL at 2 feet.
Side-band frequency components of second order ($f_2 \pm 2f_1$) are 23 dB down from amplitude of f_2 (7%) and the RMS sum is 10%.
There are six other side-band frequencies exceeding −40 dB or 1% of the amplitude of f_2.

Fig. 3—Eleven-inch direct radiator in small total enclosure.
f_1 at 98 dB at 2 feet
f_2 at 94 dB at 2 feet
Side-band frequencies represent over 14% RMS total modulation distortion.

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Specifications: Power Output at 4 ohms, 260 watts ±1 dB • Dynamic Power Output (IHF), 220 watts at 4 ohms; 180 watts at 8 ohms • Continuous Power Output (per channel), 90/90 watts at 4 ohms; 70/70 watts at 8 ohms • Harmonic Distortion, 0.5% (rated output) • IM Distortion, 0.5% (rated output) • Frequency Response, 15-40k Hz, ±1.5 dB • Power Bandwidth (IHF), 12-30k Hz • Input Sensitivity: PHONO, 2.5 mV; AUX/TAPE PLAY, 180 mV • Hum and Noise: PHONO, 65 dB • FM: IHF Sensitivity, 1.6 uV • Signal-to-Noise Ratio, 68 dB • Capture Ratio, 1.5 dB • Selectivity (IHF), 55 dB • Stereo Separation, 35 dB 1,000 Hz • AM: Sensitivity, 15 uV • **Price: $379.95**

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of ensembles are obscured by spurious frequencies and reproduction by such speakers is called "Muddy". The ratio of these distortion products to the desired signal has been called "The Mud Index".

Figure 3 is the spectrogram of an 11-inch driver unit in a small total enclosure. Here second-order side bands are still larger (17 dB down or 14% for the most prominent component) and again displaying an extensive family of even-order sideband frequencies. In this speaker, the output amplitudes of f_1 and f_2 were 100 and 95 dB respectively.

The point of all this is to attempt to indicate the importance of modulation distortion in loudspeakers. If amplifier manufacturers deem it important to achieve (and advertise) "total distortion including modulation less than 0.25%" it is obviously ridiculous to ignore 100 times that much distortion in loudspeakers!

With 10 or more spurious side band frequencies being generated out of the two input frequencies, consider how a musical ensemble would be cluttered. The inner voices become submerged in a sea of mud. To ignore this form of distortion is to ignore the fact that some speakers are just plain muddy.

Just how important modulation distortion is can not be overemphasized. Since the modulation products are inharmonic relative to the signal, their power to irritate is large compared to that of simpler harmonic distortion. Furthermore, the amplitude of the modulation-distortion components is greater than the amplitudes of the harmonic distortion. Warren and Hewlett[6] show that the ratio of amplitude-modulation distortion to harmonic distortion in amplifiers ranges from a value of 1 up to over 4, and is ususally more than 3. The same forms of non-linearity exist in loudspeakers as in amplifiers, and the same analysis holds, so the AMD-to-HD ratio for loudspeakers must be of the order of 3 or more. Then the frequency-modulation distortion, not present in amplifiers, must increase this ratio of modulation to harmonic distortion by an appreciable amount. Without the spectrograms it should have long been obvious that modulation distortion is an important fault in loudspeakers; with the spectrograms the proof should be evident for all who care to see.

Conclusion

With loudspeakers displaying from 10 to 100 times as much modulation distortion as the best amplifiers, wouldn't it seem logical to include modulation-distortion tests of speakers instead of relying on a listening comparison between speakers and perhaps a response curve under non-specified conditions? I think the reviewers should be challenged to review loudspeakers with the same types of tests applied to amplifiers, including the one test—modulation distortion—which really separates the sheep from the goats.

Finally, "Muddiness" is the opposite of "Clarity." The speakers analysed may be summarized, calling the per cent total modulation distortion at the specified sound-pressure level the MUD INDEX.

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A highly controversial article and we would be pleased to publish some other points of view on the subject. For instance, Paul mentions the high distortion of loudspeakers compared with amplifiers. Granted, but the fact is that you *can easily* hear the difference between an amplifier with .5% IM and a similar amplifier with 3% IM with loudspeakers having a Klipsch MF of 14% or higher . . . In other words, speaker modulation distortion figures may *look* worse than the resulting sound. Consider this: direct radiator speakers have been used for a number of successful live-versus recorded sound demonstrations and if the 14% figure really meant anything such comparisons would be impossible. Then again, Paul compares direct-radiators with horn-loaded systems which have their own problems. I believe that a theoretically high modulation distortion is more tolerable to most people than a much lower percentage (by measurement) of distortion caused by coloration due to enclosure resonances, horn reflections, peaks in the frequency response and so on. This does not mean that we can dismiss modulation distortion as being of no significance, but it *does* indicate that more research is needed to assess the subjective effects compared with other types of distortion preferably using more complex signals than sine waves.—*Ed.*

Dear Editor . . .

Continued from page 34

last year's model. Their new tuner will have interchangeable fronts, one of which will match their discontinued SA 600 integrated amp. That's a kind of integrity consumers seldom see. I appreciate it, JBL, I'll bet others do too.

DAVID S. MONETT,
Elmhurst, N.Y.

To JBL's President, Arnold Wolf—take a bow . . .

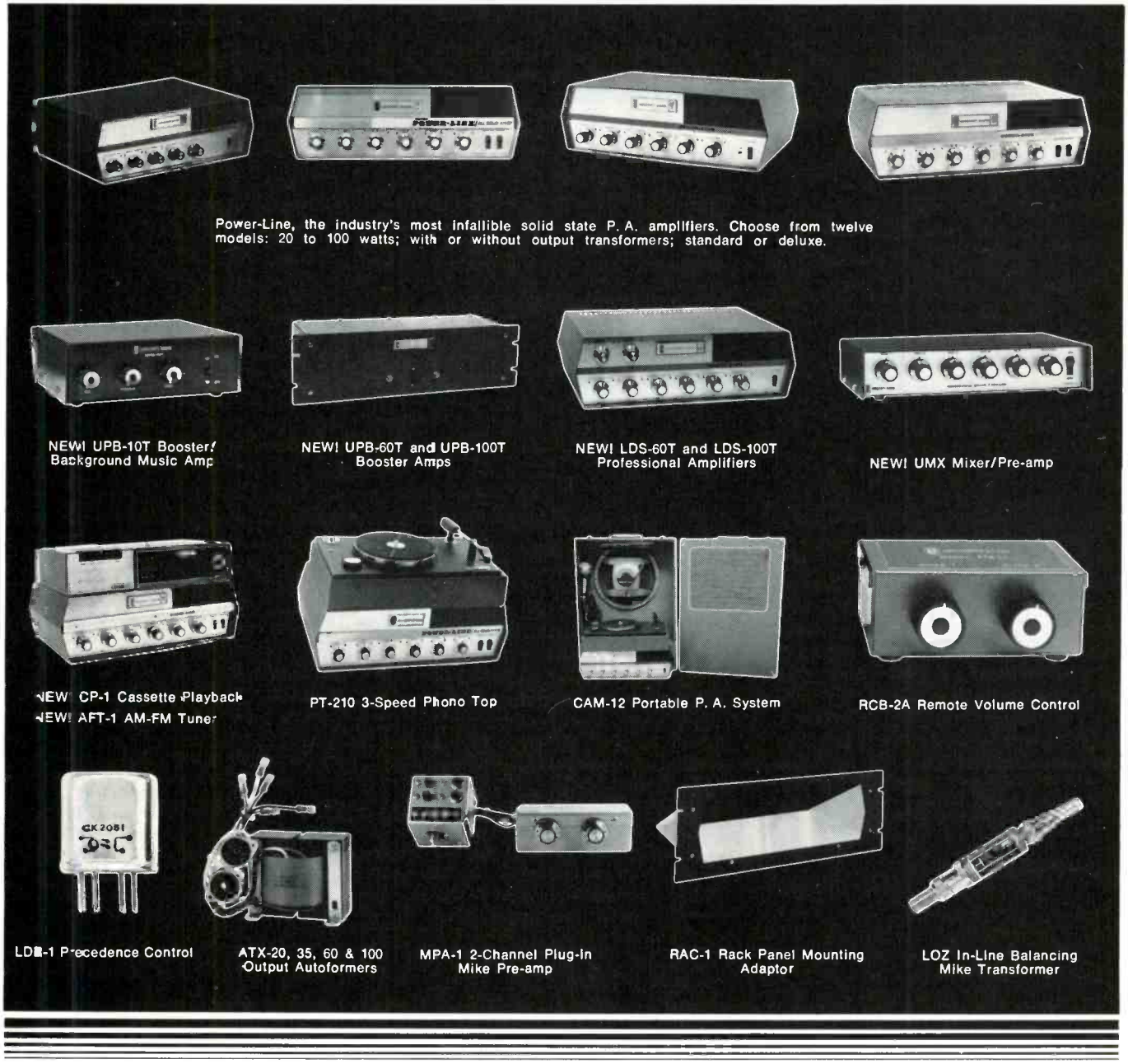
More on Doppler

I found the article on Doppler distortion by Roy Childs very interesting indeed. Little has been published on this subject—most experts apparently taking the view that Doppler distortion does not exist, or if it does, it is not significant. As far as I know, Paul Klipsch is the only one who has really investigated the problem, but unfortunately his articles in the AES Journal and elsewhere are spoiled by his 'blowing the trumpet' for horn systems. Perhaps you can persuade him to write a factual article without the propaganda?

James Russell,
Bridgeport, Conn.

Well, we did *manage to persuade Paul to write an article for us although I must admit, the faint but persistent sound of a trumpet can be heard in the background! Years ago, most experts* did *tend to disregard the Doppler effect. The late Henry Hartley, one of the early pioneers said in a letter to me in 1961, "I had a magnet design which avoided cross-modulation, mistakenly called the Doppler effect." He did in fact carry out a series of experiments which proved that certain spurious combination tones were caused by non-linear voice-coil excursions relative to the magnetic field. The present interest in Doppler distortion—or as Paul has it, modulation distortion—is due to the advent of bookshelf speaker systems using small speakers which necessarily have large-amplitude cone movements to produce a reasonable base.—ED.*

Eighteen reasons why University is the first word in PA electronics. And the last.



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Equipment Profiles

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Fig. 1

MANUFACTURER'S SPECIFICATIONS:

Power Output: 180 watts, total IHF music power, 8-ohm load. **RMS Power Output:** 60 watts per channel, 8-ohm load, both channels driven. **THD:** Less than 0.15% @ rated output from 20 Hz to 20 kHz, with both channels driven. **IM Distortion:** Less than 0.15% @ rated output, with both channels driven. **Total Noise (Mag. Phono):** Less than 2 μV equivalent input @ rated output into 8-ohm load. **Frequency Response:** +0, −0.5 dB, 20 Hz to 20 kHz at all levels up to rated output. **Damping Factor:** Greater than 50 with 8-ohm load. **Input Sensitivity:** (Low-Phono): 1 mV to equal 1 volt at preamp output. **Gain:** (Low Phono to Recording Out): 40 dB. Gain, Hi Level to Preamp Out: 20 dB. **Volume Tracking:** Within 2 dB at all settings. **Maximum Power Consumption:** 210 watts. (Split primary windings permit conversion to 240-volt operation). **Dimensions:** 15⅜ in. W. x 5¾ in. H. x 14 in. D. **Price:** $495.00.

When is an integrated amplifier really a professional preamplifier/control chassis plus a pair of powerful, basic amplifiers worthy of any superlatives we can conjure up? When it is the Marantz 30 Console Amplifier. This marvel of an amplifier has been around for nearly a year, now, but with all the backlog of receivers we've had to review, it's the first opportunity we've had to put it through its paces. And what a pleasure it was to operate and examine! Marantz has a knack of incorporating ample control facilities for the professional or semi-professional user, without rendering the front panel too complex for the true audio connoisseur. Figure 1 shows the very intelligent and functional layout of this instrument. Major controls are located at the left and consist of four typically massive turned-metal knobs which complement the gold anodized heavy front panel. The selector includes settings for Tape Head, a pair of low-level Phono inputs, Tuner, and two Aux settings—no shortage of input facilities here! Volume and Balance controls are located in this area, as is a mode switch which provides settings for Mono (Left+Right), Stereo, and Stereo Reverse.

The center section of the panel contains slide-type tone controls, with separate levers for bass and treble for each channel. A fifth, matching lever in this area takes care of the tape-monitor functions. The Low Filter and High Filter knobs located in the right section of the panel each have three positions: 50 Hz, 100 Hz, and "out" for the low filter and 5 kHz, 9 kHz, and "out" for the high filter. The control labelled "Tone Control" is also a three-position switch which allows complete by-passing of the tone controls and also has a position for automatic loudness compensation. The fourth knob in the area is a speaker selector control, with positions for main, remote, both or no speaker systems. Three jacks located at the extreme right edge of the panel are for dubbing in and out (duplicating the tape in and out jacks on the rear panel, so that another tape recorder may be connected without having to go 'round the back—in custom installed set-ups), and the usual stereo headphone jack. Power is applied to the amplifier by means of a push-push button located at the lower right corner of the panel. Indication that power has been applied to the unit is by means of a soft glowing bead of light at center panel, just below the word "Marantz."

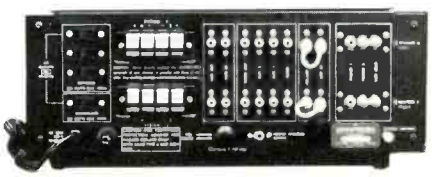


Fig. 2—Rear panel view.

The rear panel arrangement is shown in Fig. 2. Three switched convenience outlets and one unswitched outlet located at the left end of the panel enable connection of associated components. A line fuse is also located in this area. Next come

the speaker connection terminals for two sets of stereo speakers. The terminals are the fool-proof "piano key" type. Depressing each key discloses a small hole just large enough to accept the stripped end of a speaker wire. Releasing the key clamps the wire solidly in place—no chance for speaker-terminal shorts here! Tape-out and Tape-in jacks come next, in parallel with those already mentioned in connection with the front panel layout. A pair of 'scope output jacks follow, useful for connection to the horizontal and vertical inputs of an oscilloscope. Phase of input stereo signals, degree of separation, and balance are all easily checked by visual observation, using a scope, and Marantz provides the jacks for this purpose. High-level inputs are next (Tuner, Aux 1, and Aux 2), followed by a pair of jumper cables which connect from "Preamp Out" to "Amp In." It is this feature which renders the Marantz 30 usable as a separate preamplifier and basic amplifier combination for, aside from the common power supply, removal of these jumpers really enables the user to utilize the equipment as two completely separate units. With so many accessory items currently on the market (reverb units, multiple tone-contouring accessories, etc.) this is an added measure of flexibility that many users will appreciate. Low-level inputs (Phono 1, Phono 2, and Tape Head) are located at the right end of the panel, as is a rugged chassis-ground terminal. Along the lower edge of the panel, there is a center-channel output jack with an associated center-channel level control. No simple "voltage output" this, but a resistively matrixed "A+B" output that can be used to drive a third, center loudspeaker system, if desired, using an additional power amplifier externally.

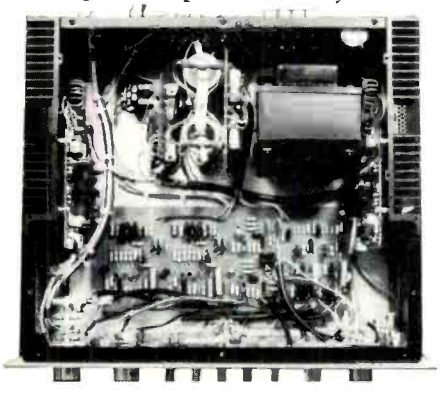


Fig. 3—Internal view.

Removing the walnut enclosure and top protective metal plate, we see that the Marantz 30 chassis is laid out in the form of an enclosed "U" shape, with massive heat sinks at each end of the structure used to dissipate output transistor heat and to support the entire structure. The heat sinks are fully twice as large as those we have seen used on amplifiers having equal power ratings. That, and conservative design, account for the fact that at no time during our measurements (including extended "full power" tests) were the heat sinks more than mildly warm to the touch. The "innards" can be seen in Fig. 3 which, though reduced in size, should still give the reader an idea of the rugged components (massive transformer and electrolytics) used in the more-than-ample power-supply design. The circuit is divided into logical modular sections, all securly fastened and interwired by carefully routed harness-type wiring.

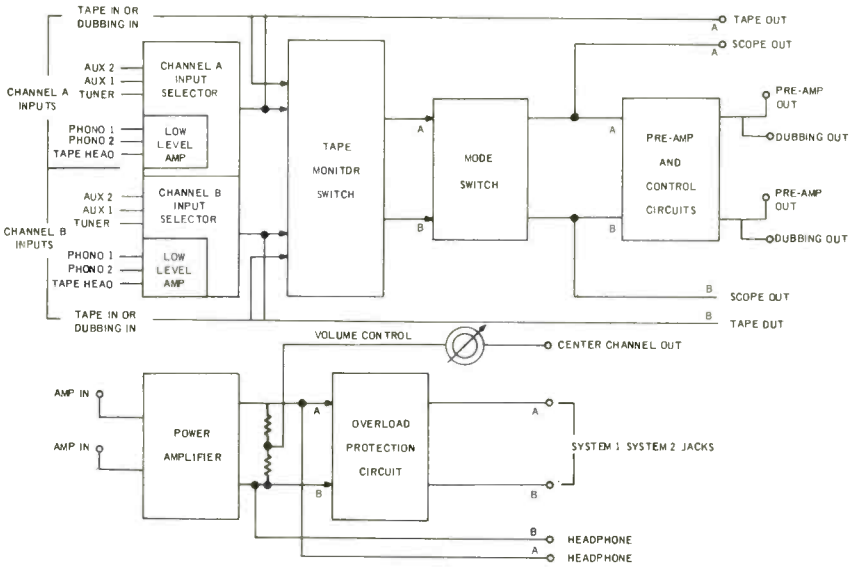


Fig. 4—Simplified block diagram of Marantz 30.

The extreme flexibility of the circuit layout and switching facilities of the Marantz 30 can best be understood by examining the overall block diagram of Fig. 4. Note that the preamplifier and power amplifiers are shown as separate diagrams since, in every sense, they really are separate units joined only by jumper cables supplied. The speaker overload protection circuits provide a minimum 5-second delay after turn-on to protect the speakers from any turn-on surges. This circuit also provides instantaneous turn-off for high-amplitude low-frequency (below 10 Hz) surges in the audio output, with a minimum 5-second turn-on delay upon resumption of normal operation.

The speaker overload protection circuit is, in reality, a separate circuit board. Output lines from each power-amplifier channel feed through this module to a rugged, 24-volt relay whose coil is activated by a three-transistor circuit powered by a separate bridge-rectifier arrangement. Normally open contacts of the relay are closed after a time delay of approximately five seconds after "turn-on," connecting the audio output lines to the speaker switch, headphone, and center-channel circuits. As noted earlier, a sudden surge of high-amplitude low-frequency current (such as might occur because of the transients associated with plugging in or pulling out an input plug while the unit is in operation) will instantaneously open the relay contacts, protecting speakers and/or headphones from possible damage. Normal operation is restored after an additional waiting period of approximately 5 seconds.

Test Measurement

Measurement of the Marantz 30 performance specifications proved to be somewhat of a frustrating experience. In the case of our THD measurements, for example, we know that our audio oscillator, read directly by our distortion analyzer, puts out 0.05 per cent distortion. Thus, until we read *more* than that figure, when measuring a product, we must assume that we are reading input signal distortion and that the product distortion is necessarily *lower* than 0.05 per cent. We did not begin to creep above this "equipment limited" reading until each channel of the Marantz 30 was putting out just over 50 watts! Furthermore, we read 0.1 per cent THD at a power output of 60 watts per channel (with both channels driven) instead of the 0.15 per cent claimed by Marantz. In fact, at 66 watts output per channel, the THD reading was only 0.3 per cent. These values are plotted in Fig. 8, along with the IM distortion

curve which is seen to conform nicely to published specs (limited, again, by our test equipment which is good down to about 0.07 per cent IM).

Power bandwidth, shown in Fig. 6, extends from about 10 Hz to well beyond 40 kHz, but more importantly, full power output is obtainable at *all* audible frequencies at less than rated distortion (which, in this instance, is a miniscule 0.15 per cent). Yes, we mean 60 clean watts at 20 Hz (or 20 kHz, if you like) with less than 0.15 per cent THD. It is this kind of specification that separates the outstanding from the very good.

Tone-control and high and low filter-response characteristics are shown plotted in Fig. 7. Since the front panel calibration of the tone levers is given in 2-dB steps, we measured response at each and every setting of these levers. Note that the individual curves shown are almost exactly 2 dB apart at around 80 Hz (in the case of bass) and 10 kHz (in the case of treble). Although a double network is used in the filter circuits, we would have liked to see a bit steeper attenuation from these filters.

We found that frequency response with the tone controls set flat was within a fraction of a dB of the "straight line" curve that we measured when the tone controls were switched out of the circuit altogether. This speaks very well for this tone control design. Intrigued with the precision response, we decided to use the "scope output" facility—not to check stereo separation of our source material (which was a single audio generator, up to now), but to check the phase characteristics of the two stereo channels of the Marantz 30. Thus, we fed a common signal to channels A and B and observed the phase relationship on our scope at every audio frequency. The results shown in Fig. 8 are what we obtained with tone controls out of the circuit at frequencies shown. The scope photo in Fig. 9 (hardly distinguishable from that in Fig. 8) is the result obtained with the tone controls "in-circuit" but set to the flat position. Only the tightest of component tolerances could lead to such total uniformity of outputs from two separate channels under such conditions!

We normally observe square-wave response at 100 Hz and 10 kHz in our amplifier reports. In the case of the Marantz 30, to have done so would have resulted in our presenting two practically identical squared-off photographs. Please bear in mind, then, that departing from normal procedure, we photographed square-wave response at 40 Hz and 20 kHz instead, and the results shown in Fig. 10 are as good or better than most amplifiers subjected to the 100 Hz and 10 kHz square wave test.

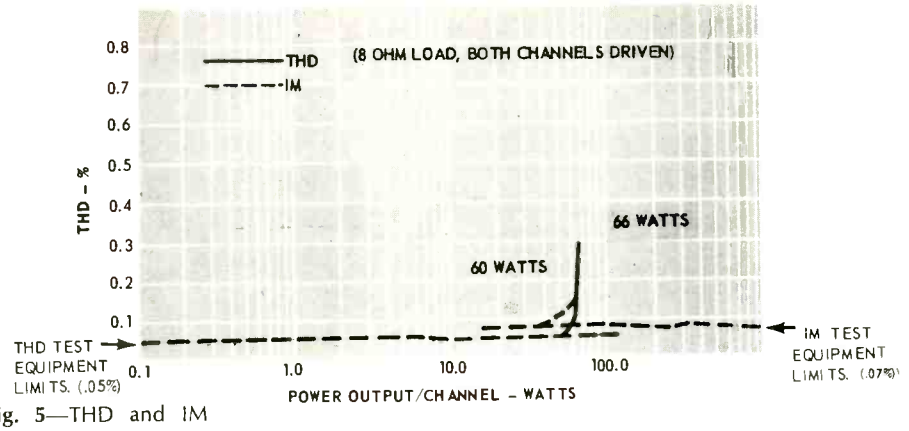


Fig. 5—THD and IM distortion.

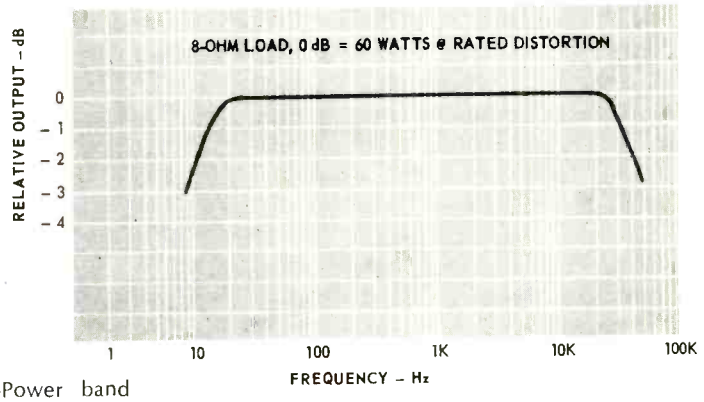


Fig. 6—Power band width.

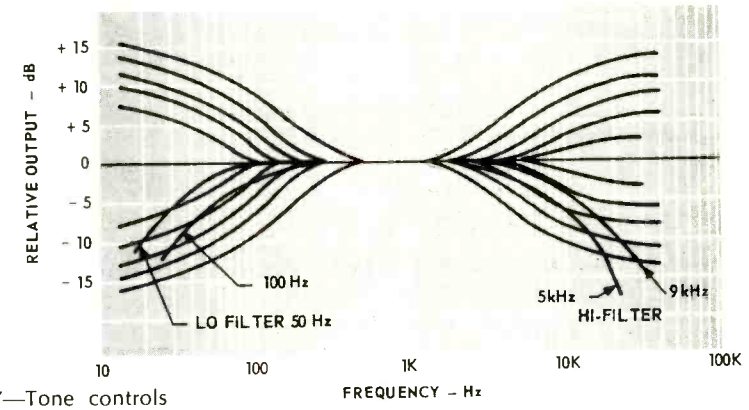
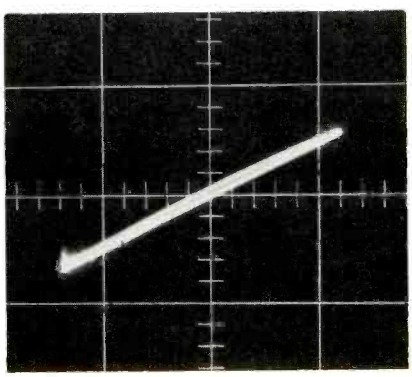


Fig. 7—Tone controls and filter.



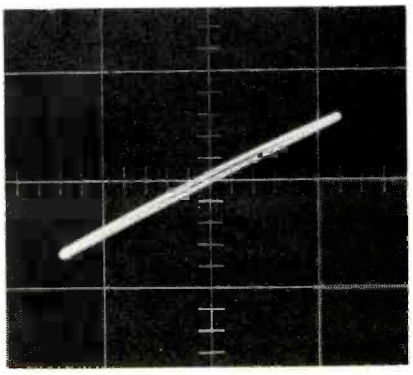
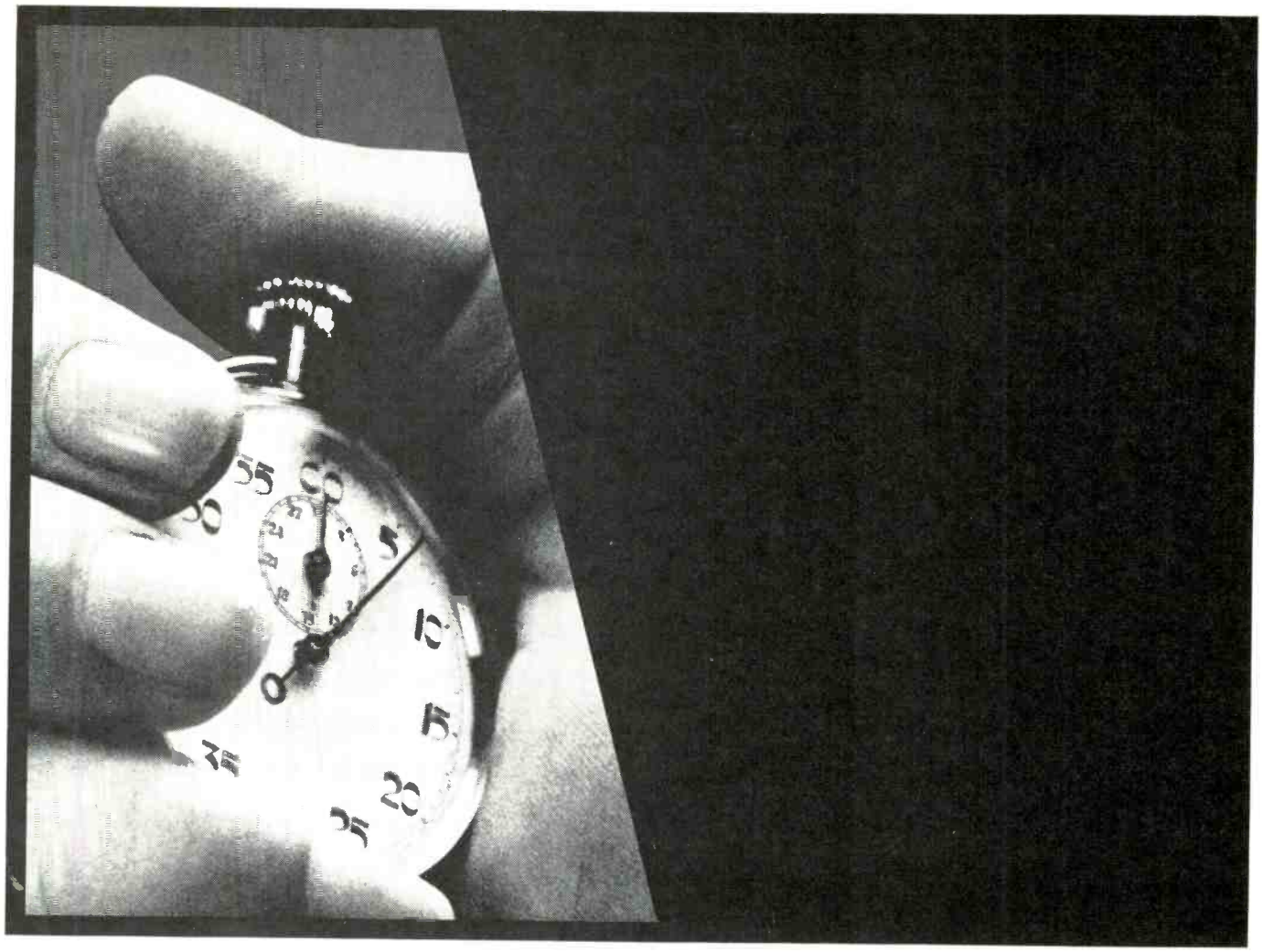
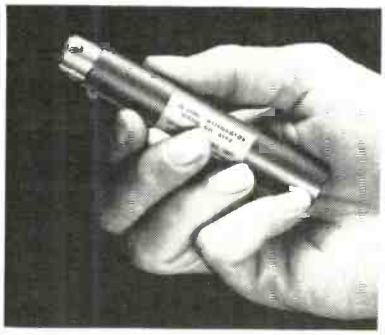


Fig. 8 (left)—Almost-identical phase responses using outputs from both channels. Tone controls bypassed. Test frequency: 10 kHz. **Fig. 9** (right)—Introducing tone controls shows virtually no change in phase relationships.



Solve 7 problems...in seconds.



Something totally new to add to your bag of tricks! We call them *Plug-in Problem Solvers.* They're designed to provide seven common modifications in microphone and sound system setups without soldering or rewiring—just plug them in! The Model A15A Microphone Attenuator that prevents input overload; Model A15PR balanced line Phase Reverser; and A15HP High Pass and A15LP Low Pass Filters to modify low and high frequency response; A15PR Presence Adapter to add brilliance; A15RS Response Shaper to filter sibilance and flatten response; and the A15LA Line Adapter that converts low impedance microphone inputs to line level inputs. Carry them on every job. It's a lot easier than carrying a studio console with you! Shure Brothers Inc., 222 Hartrey Ave., Evanston, Ill. 60204.

SHURE

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Marantz 30 (Continued)

Listening Tests

There are few superlatives that can adequately describe the flawless listenability of the Marantz 30. "Effortless" ability to reproduce source material of extreme dynamic range and transient effects does not begin to tell the whole story. We hooked up this unit to no less than three different pairs of speaker systems, ranging from medium-priced, low-efficiency bookshelf types to fairly efficient floor-standing larger systems. The only differences noted were in the coloration contributed by the speakers themselves. The amplifier was always in the background (as it should be) contributing no audible noise, hum, or distortion at any level of power. The variable-crossover design of the tone control circuits showed up to particular advantage in our experiments in that our listening room requires just a bit of bass attenuation at about 100 Hz and a small amount of treble boost starting at around 5 kHz because of our particular "upholstery." Both of these minor corrections were attained easily without affecting multiple octaves of response. All controls are smooth in use, and a direct A/B test with tone controls set flat and switched in and out of the circuit produced absolutely no audible difference, as would be expected from the electrical measurements.

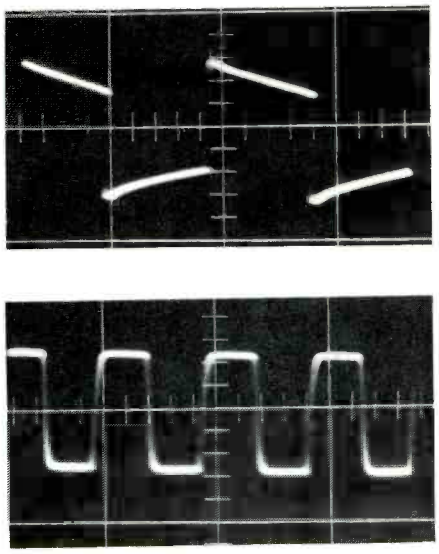


Fig. 10—Square-wave responses at 40 Hz (upper) and 20 kHz (lower).

With all its control features and flexibility, the Marantz 30 is sure to find its way into professional sound studios, recording studios, and other applications where precise sound monitoring is essential. At its attractive price of $495.00, this two-for-one component is, at the same time, well within the reach of the serious music listener who wants that extra, if subtle, measure of perfection. *L.F.*

Check No. 50 on Reader Service Card

TEAC A-1200U Stereo Tape Deck

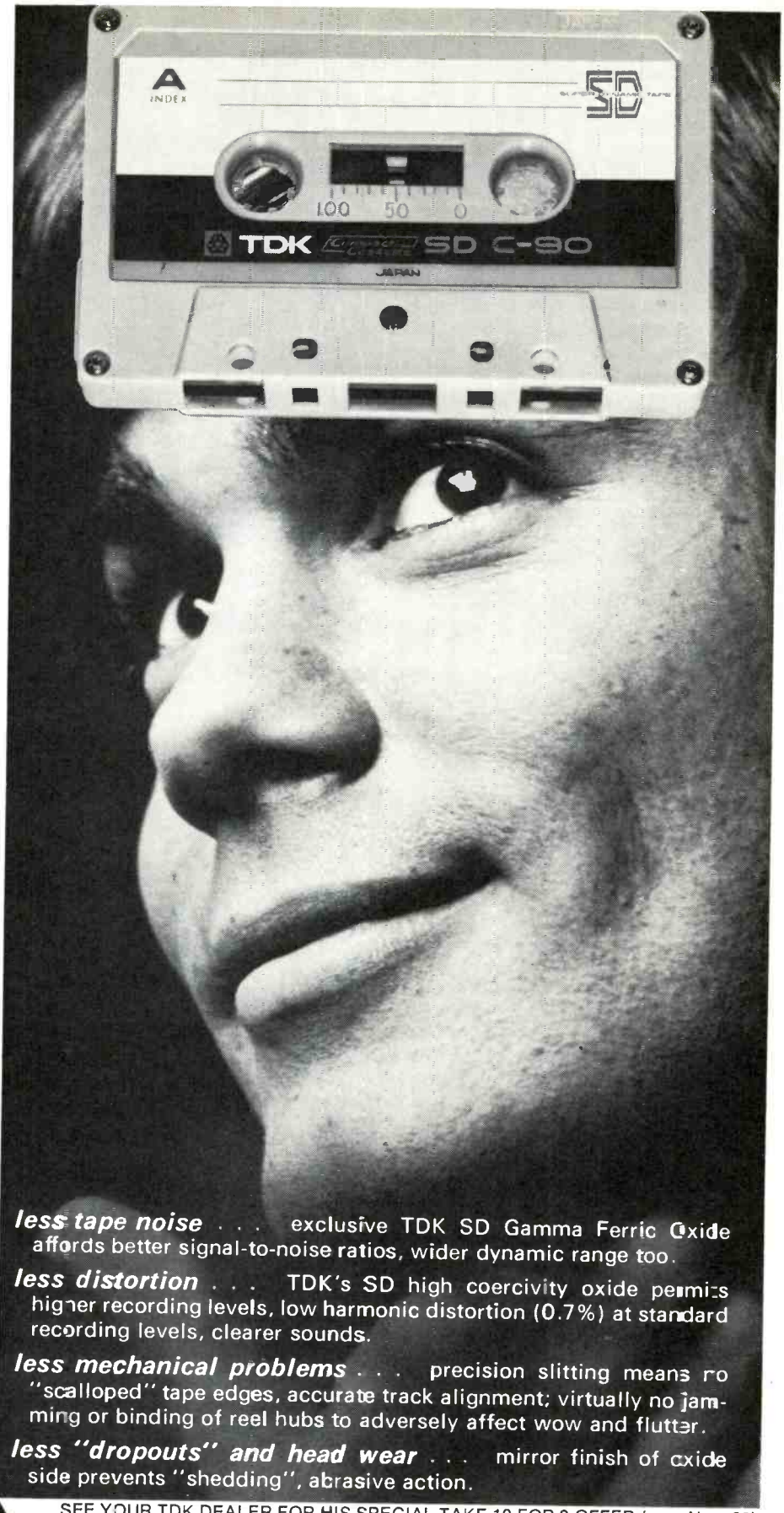
MANUFACTURER'S SPECIFICATIONS:

Heads: Three 4-track, 2-channel—Erase, Record, Playback. **Tape Speeds:** 7½ and 3¾ ips. **Motors:** Dual-speed hysteresis synchronous motor for capstan drive; two eddy-current outer-rotor motors for reel turntables. **Frequency Response:** 7½ ips—30 to 20,000 Hz (±3 dB, 50 to 15,000 Hz); 3¾ ips—30 to 15,000 Hz (±3 dB from 50 to 10,000 Hz). **Signal-to-Noise Ratio:** 50 dB; **Monitoring Headphones:** 10,000 ohms, min. **Reel Size:** 7 in., maximum. **Wow and Flutter:** 7½ ips—0.12%; 3¾ ips—0.15%. **Fast-wind time:** Approximately 100 sec for 1200 ft. **Crosstalk:** 50 dB channel to channel at 1000 Hz; 40 dB between adjacent tracks at 100 Hz. **Inputs:** Microphone, 10,000 ohms, 1 mV min.; Line, 10,000 ohms, 0.1 V min. **Output:** 10,000 ohms min., 1.0 V. **Dimensions:** 17" wide x 15½" high x 9¾" deep. **Weight:** 41 lbs. **Price:** $299.50

The three-head deck is becoming more and more popular with the serious recordist over the past year or so in spite of some additional cost. The added expense is, however, justified by the definite advantages offered to the user in his ability to know just what he is getting on the tape during his recording operation—he doesn't have to wait until the end of the selection to find out if all the switches and levers were in the right position. A still more important advantage of the three-head configuration is that no compromises must be made in the design of the heads to make one device do two jobs fairly well. The record head can be made to do the recording job at its best, and more importantly, the gap on the play head can be made smaller in order to give extended frequency response—a most desirable characteristic if the user wants to record at 3¾ ips.

While the specifications of the A-1200U are sufficiently impressive in themselves, they are extremely conservative, and they do not tell the whole story of the facilities offered by the machine. In the first place, the unit is solenoid operated, and a series of push buttons on the front panel control all tape motion. Another series of buttons provides for selecting channel A or channel B—or both—or a choice of adding channel A to the channel B signal for sound-with-sound recording, or the reverse (channel B to the channel A signal) by depressing either ADD 1 or ADD 2 buttons. In these positions, the playback output from one channel is fed to a mixing network in the opposite channel, with the level of the signal from the tape being controlled by the output-level control from its channel. For record-

it's funny- you pay more for a TDK *cassette and you get so much less*



less tape noise . . . exclusive TDK SD Gamma Ferric Oxide affords better signal-to-noise ratios, wider dynamic range too.

less distortion . . . TDK's SD high coercivity oxide permits higher recording levels, low harmonic distortion (0.7%) at standard recording levels, clearer sounds.

less mechanical problems . . . precision slitting means no "scalloped" tape edges, accurate track alignment; virtually no jamming or binding of reel hubs to adversely affect wow and flutter.

less "dropouts" and head wear . . . mirror finish of oxide side prevents "shedding", abrasive action.

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ing with added echo, both the ADD buttons are depressed at the same time, with the result that the signal from channel B is added to the signal being recorded on channel A with a delay of some 100 milliseconds, and the signal from channel A is delayed and added to the channel B recording. One other button in the series of five of the lower group is a SAFETY, which opens the current supply to the bias/erase oscillator to prevent accidental erasure of any previously recorded material when only playback is wanted.

The front panel is conventional in design, with the usual two reel hubs in the normal positions. At the top center is the 4-digit counter, while at the lower left is the group of pushbuttons which control tape motion—rewind, stop, fast forward, play, and the red record button which must be held down when the play button is depressed to start recording. A spring-loaded tension arm keeps the tape against the heads, which have no pressure pads. The tape then feeds past the capstan and pinch roller, around the automatic shut-off lever, and thence to the takeup reel. Tape speed is selected by two buttons at the right of the transport panel, and equalization is changed simultaneously with the speed, the latter due to the two-speed hysteresis-synchronous motor. Lifters hold the tape away from the heads during fast spooling.

The lower section of the panel provides the electronic controls starting with the five pushbuttons previously mentioned for selection of channel, the sound-on-sound and echo facilities, and the "safety" button. Next to the right is the power rocker-type switch, followed by the tiny slide switch for selecting tape or source monitoring, and then two small lights showing when the channels are in the record mode. A dual VU meter is next, illuminated when power is on. To the right of the meter are three dual-concentric controls with friction clutching between the smaller front knobs (channel A) and the larger rear knobs (channel B). The first pair controls output level to the LINE OUT phono jacks, the second pair controls recording level from the LINE IN jacks, and the third pair controls recording level from the microphone jacks, which are adjacent to the control.

On the right side of the case is a cutout which gives access to a panel on which are the LINE IN and LINE OUT phono jacks, the stereo phone jack for monitoring, a socket for a remote control accessory (with a dummy shorting plug in place when the remote control is not in use. There is also a line fuse and a power cord receptacle. Thus in normal use, there are no plugs or cables entering the front panel—only when recording from microphones.

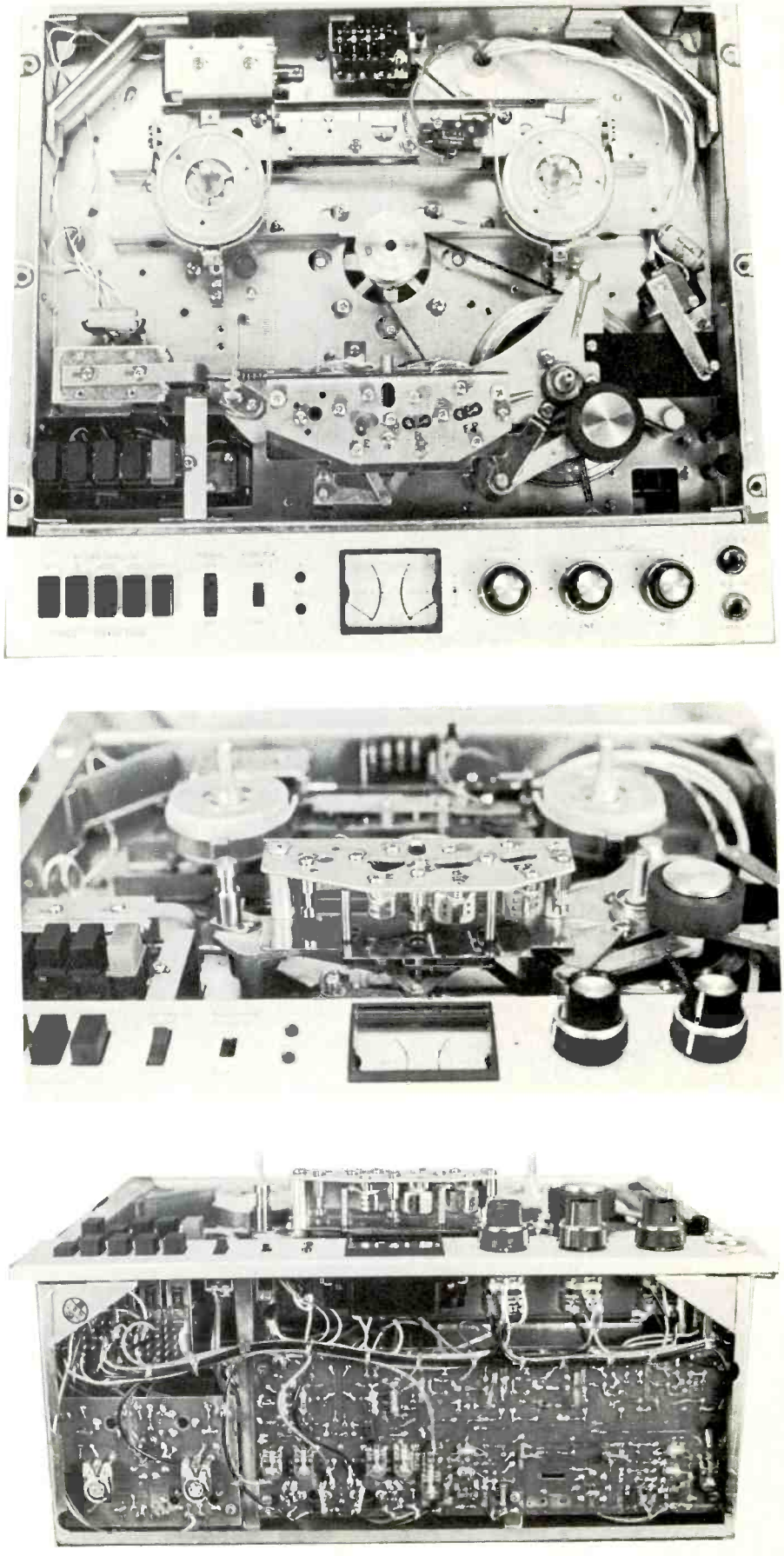


Fig. 2—Showing three different views of the inside of the TEAC A-1200U tape deck.

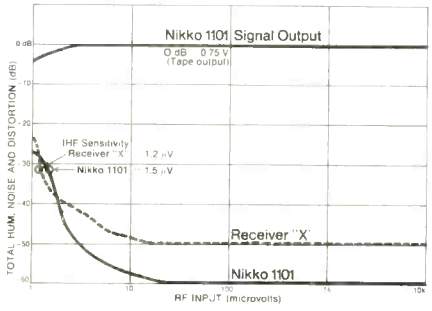
When you're laying out $400 for a receiver, it's no time for the numbers game.

With all the specifications that come with a receiver, there's room for a lot of games. And none of them are much fun when it's your money on the line.

You already know about the funny numbers in the power rating game.

You know that a "peak power" rating is about 25% higher than the "IHF music power" which, in turn, is usually 20-50% higher than the "RMS output."

And knowing this, you'll probably get a receiver that delivers about the amount of power that you expected.



Buying the best IHF sensitivity specification doesn't always buy the best receiver. Though receiver "X" has a lower sensitivity number, the Nikko 1101 is a better receiver because it contributes less distortion (indicated by the steepness of the drop in the curve) and provides more quieting (curve reaches much lower). As a result, the Nikko 1101 pulls in more stations and gives you a cleaner, purer audio output.

But it could still be a long way from your dream receiver.

Because the same kind of games can be played with sensitivity (see the chart for this one). And frequency response. And channel separation. And the signal-to-noise ratio. And just about any other spec you can think of.

So instead of shouting about our numbers, we'd like to offer you a little bit of help: the Nikko 1101 AM/FM Stereo Receiver.

Styling is elegant but functional. With black-out glass panels. Professional tone and volume slide controls for each channel. A separate volume control for auxiliary speakers. Microphone inputs. Separate AM and FM tuning to save a lot of dial spinning.

And every convenient feature on the front backed by the most sophisticated electronics in a receiver today. 6 FET's for greater sensitivity and lower distortion. 12 IC's. One solid ceramic and two crystal IF filters for maximum selectivity. An IC demodulator. A triple circuit-breaker protection system.

And most of all, clean, pure sound.

If that's what you're really looking for, drop by your Nikko dealer today. And just listen.

NIKKO

We're not playing games.

FM SECTION: Sensitivity: IHF = 1.5 μV. Hum & Noise: 60 dB. Capture Ratio: 1.5 dB. Distortion: (FM) 0.5%; (MPX) 0.8%. FM Separation: 1kHz, 40 dB. Selectivity: IHF, 60 dB. **AM SECTION:** Sensitivity: S/N = 20 dB, 100 μV/M. Hum & Noise: 55 dB. Distortion: 0.8%. Selectivity: ±10 kHz, 25 dB. **PREAMPLIFIER-AMPLIFIER SECTIONS:** Music Power: 200 W ±1 dB @ 4 Ohms. Frequency Response: Main Amplifier, 10-70 kHz ±1 dB; Aux. Input, 20-40 kHz ±1 dB. Power Response: −1 dB (0.5%) 20-30 kHz. Distortion: Rated output, 0.3%; 1 W output, 0.1%. Intermodulation: 0.6%. Input Sensitivity/Impedance: Phono, 2mv/50K Ohms; Tape, 200 mv/100K Ohms; Mike, 2 mv/100K Ohms. Tone Control: 70 Hz, ±13 dB; 10 kHz, ±12 dB. Speaker Compensator: 30 Hz, ±10 dB. Signal-to-Noise Ratio: Phono, 70 dB; Tape, 75 dB; Aux., 75 dB.

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Drive from the capstan motor to the capstan flywheel is by a flat belt, and the spooling motors drive the reel turntables directly. Separate solenoids actuate the pinch roller and the brakes. The d.c. supply to the solenoids, as well as all a.c. to the motors is cut off when the stop button is depressed.

The two identical record amplifiers each employ four transistors—the first is a microphone preamp, followed by a feedback pair, which are in turn followed by a final stage which drives the record head. Record equalization is provided by a resonant circuit across the final-stage emitter resistor, and the values are shifted by the tape-speed relay. Separate volume controls provide for mixing between microphone and line inputs.

The playback amplifiers also use four transistors each, the first two as a feedback pair providing the required equalization, while the remaining two provide additional gain to drive the outputs and the VU meters. The output-level controls affect only the signal at the output jacks, and do not affect the monitoring level to the phones nor the VU meter indications. The tape-source switch between the two pairs serves to select the monitoring and output signals.

The construction is modular, with the various sections being interconnected by a variety of plugs and sockets. Some are 7-pin tube-type sockets and plugs, others 9-pin types, and a 15-pin rectangular plug and socket is used for most of the non-signal circuits.

Performance

Figure 3 shows the playback response from standard tapes at the two speeds, as well as the record/play response from a flat signal fed to the LINE IN jacks. Note that the response exceeds the specifications appreciably, with the signal down only 2 dB at 22 kHz, and only 7 dB at 24 kHz at 7½ ips, while specifications claim only 50 to 15,000 Hz±3 dB. Thus

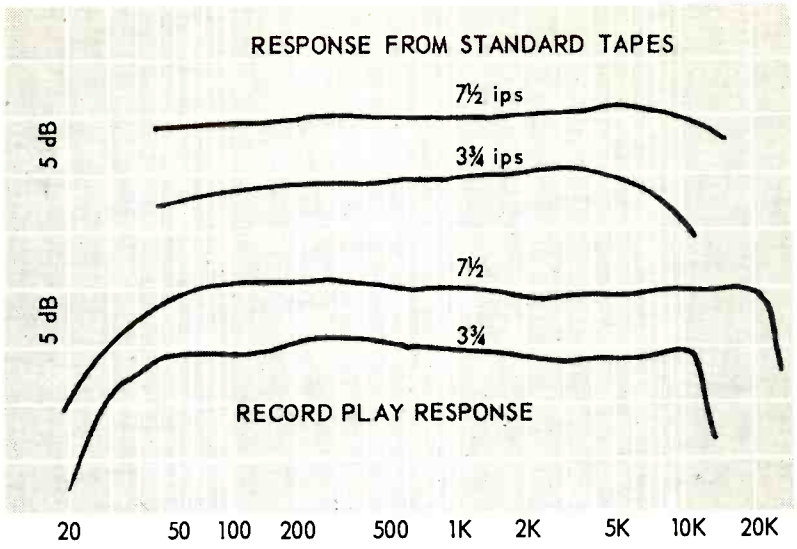

Fig. 3—Frequency response curves.

it is seen that specifications could well be ±1 dB from 40 to 22,000. Similarly, specifications could call for ±1 dB from 50 to 10,000 Hz at 3¾ ips, instead of the ±3 dB listed.

Distortion of the standard 3 per cent was noted at +7 dB on the VU meter scale, but was only 0.7 per cent at the indicated zero level from 100 to 10,000 Hz. Wow and flutter measured .02 per cent in the 0.5- to 6-Hz range, at 7½ ips, .06 per cent in the range from 6 to 250 Hz, and .07 per cent from 0.5 to 250 Hz. Corresponding figures for 3¾ ips were .05, .09, and 0.1 per cent. Signal-to-noise ratio was 53.5 dB below the 3-per cent distortion point, and channel separation measured better than 55 dB at 1000 Hz. with adjacent track separation 48 dB at 100 Hz. Bias-oscillator frequency was measured as 97 kHz. On the whole, these performance figures are all in the excellent category. The input signal required for a 0-VU signal with the record-level controls at maximum was 65 mV, and from the microphone jacks was only 0.1 mV. Line output at the same "0" level was 1.25 V. The unit employs 19 transistors—16 in the four amplifiers, 2 for the bias oscillator, and one as a voltage regulator for the d.c. supply to the record and playback amplifiers.

With the hysteresis motor, of course, there was no variation in speed over the range from 40 to 80 Hz in the supply, and practically none over an input voltage range from 80 to 135. Rewind and fast-forward times were measured at 95 seconds for 1800 feet of tape, though specifications claim 100 sec. for 1200 feet.

The TEAC A-1200 U is easy to thread, simple to operate, and offers most of the features needed by the typical recordist. We could not make it break tape under any condition of operating, but we felt that the reels are so high from the main panel that tape could wrap around the spindles quite easily, particularly if the reels are overly full. But that should be avoided with careful operation—we were only trying to confuse the machine.

C.G.McP.

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Dual 1209
Auto/Professional Turntable

MANUFACTURER'S SPECIFICATIONS:

Speeds: 33⅓, 45, 78 rpm. **Platter Diameter:** 10⅝ in. **Wow and Flutter** (33⅓ rpm): .08%. **Max. Tracking Error:** 1.75 deg. **Arm Type:** Balance & spring. **Arm Resonance:** 8 to 14 Hz. **Change Cycle** (33⅓ rpm). 13 sec. **Clearance Below Motor Board:** 2¾ in. **Clearance Above Board:** 5 in. **Overall Dimensions:** 13 x 10¾ in. **Weight:** 10 lbs. **Price:** $129.50.

Modern automatic turntables have almost replaced the earlier manual models, even in the installations of the more serious music lovers. Wow and flutter have been reduced, and the earlier bugaboo of the changer—rumble—has improved so much that there is no longer the great demand for the manual models, particularly since most of the automatics can be used manually just about as conveniently as the true manuals and still have some plus factors like automatic stop at end of play, automatic set-down on the first groove, and so on.

The Dual 1209 is not the top-of-the-line product, but it is of similar construction to the top—the 1219. It is somewhat smaller, thus permitting its installation in less spacious surroundings, and what is more important to many users, it is considerably less expensive. Among its features are variable anti-skating, with

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What Does True Pitch Or Zero Overlap Do For You?

Many years of stagnation in loudspeaker system design had to end. Most present day systems really do not sound any better than speakers produced years ago. With the great strides made in quality of signal source obtainable from today's better amplifiers, receivers, tape decks or cartridges, present day speaker systems leave much to be desired.

It took Fairfax, with their group of true audio zealots, to find a new direction, practically a new basic philosophy of speaker system design. We at Fairfax believe that a speaker system should be thought of as a musical instrument, which by electronic and mechanical means, reproduces the sound of other musical instruments, as well as the sound of a human voice, as realistic as the original source.

This is exactly what we have accomplished in our new series of 1970-71 speaker systems, designed for true pitch with zero overlap of all audible frequencies. This means that you can differentiate between the sound of each of the instruments of a complete orchestra.

The result is really astonishing with respect to the degree of realism that is so remarkably enhanced that you don't have to be an orchestra conductor, recording engineer or an audio technician. All you have to do is to love music and know how it should sound.

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FX-100

Excells in comparison with units priced to $175.00

2-way duo-harmonic speaker system; heavy duty 8" bass/midrange driver; special 3" tweeter; frequency response 30-20,000 Hz; 30 watt rating; 21" H x 12" W x 7⅞" D.

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FTA

Excells in comparison with units priced to $325.00

4 speakers, 3-way system; 1 low bass, 1 mid bass 8" woofers; 1 mid-high 3½" tweeter; 1 ultra-high tweeter; freq. response 24-20,000 Hz; 60 watt input; 25" H x 14" W x 12" D.

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Excells in comparison with units priced to $650.00

8 speaker, 5-way system; 2 low bass 2 mid bass 8" woofers; 2 mid-high; 2 uh 4" tweeters; 1" particle board cabinet; frequency response 20-20,000 Hz; 100 watt input; 28¾" H x 20" W x 12" D.

Suggested Audiophile Net . . . $249.50

fairfax industries inc.

900 Passaic Ave., E. Newark
New Jersey 07029
(201) 485-5400

Dual 1209
Auto/Professional Turntable

separate scales for conical and elliptical styli; counterweight arm balancing, with the weight flexibly mounted on the arm and adjusted coarsely by moving the rod on which it is mounted in and out to achieve an approximate balance, then turning it for a final fine adjustment. Stylus force is then set by means of a calibrated dial on the arm mounting. The anti-skating adjustment knob is set to the same number as the stylus force dial, using the red scale for conical styli and the black scale for elliptical points. The unit is mounted in its base or on a motor board cut to the specified shape. Damped spring mounts with stamped metal cups fit into the precut holes. Clamping screws are provided to hold the chassis firmly against the base or motor board while it is being transported.

A lever at the right corner of the chassis selects the diameter at which the arm will set down—12, 10, or 7 in.—and another similar lever to the left of the first one is used to start or stop the playing. When you move the lever to start, various bits and pieces in the unit are engaged to start the motor, raise the arm and move it to the proper set-down position, and then lower it to the record groove gently —all of this using power from the turntable platter itself. Move the lever to the stop position and the arm is raised from the record, moved to its rest, and lowered if there are no more records on the automatic spindle. If there are more, the arm again moves to the first groove and lowers. For those who do not want to use the changer function, there is a single-play spindle which fits into the turntable and rotates with it, thus eliminating wear on the record center hole from a stationary spindle. Just to the right of the arm rest is a cueing lever which raises or lowers the arm gently at the user's command. At the left front corner is the speed selector lever, similar in appearance to the other two levers. It is marked with the three nominal speeds—33, 45, and 78. Adjacent to this lever is the speed vernier which provides a ±3% speed variation for matching pitch precisely to a piano or other instrument—an important feature for musicians.

The platter is cast, and weighs 4 lbs., thus contributing substantially to the low wow-and-flutter figures of the machine. It is driven by a rubber idler which is driven in turn by the three-stepped motor shaft, each step being slightly tapered to provide the vernier speed control. The platter is semi-permanently fixed to the bearing in the chassis, but can be removed when desired by using a small plastic cone device furnished. The "C" ring that holds the platter in place can be lifted out with the device, and easily put back in place by sliding the ring down the cone and into its locking groove.

The cartridge holder is a plastic molding which is locked in place by the arm lift which also serves as the releasing lever when it is moved backward. The holder permits moving the cartridge backward or forward to the prescribed location, as indicated by a small plastic jig which is slipped over the holder. One simply fastens the cartridge at the point where the stylus fits into a notch in the jig, which also shows the correct height of the stylus from the holder for the 15-deg. vertical tracking angle.

The motor is a high-torque synchronous design which gets the record up to the desired speed in less than half a revolution. Being synchronous, its speed is affected by variations in line frequency (of which there are few in this country) but voltage variations, of which there are likely to be many in any large city or at the end of a long rural transmission line have less than a ±1 per cent effect on speed over a range from 80 to 135 V. The idler, which transmits the rotating motion from the motor shaft to the rim of the platter, retracts when the unit is shut off, thus preventing the formation of flat spots.

Adjustments are provided for the exact

set-down position to ensure that it is in the lead-in groove of the record, and also for the "cycling height" to ensure that the top of the tonearm should not touch the bottom record on a stack when using the automatic spindle. The output connections are made from phono jacks mounted on a bracket on the underside of the chassis. The a.c. connections also plug in, together with a ground lead, which should be attached to the system ground when the installation is first made.

Fig. 1—Showing arm balancing.

Performance

We made our tests on the 1209 with a B & O cartridge installed in the arm, and we found a wow and flutter measurement of .07% in the range from 6 to 250 Hz, but an increase to 0.13% in the range from 0.5 to 6 Hz, which also was reflected in the 0.5 to 250-Hz range. Since the range below 6 Hz would be inaudible anyhow, this could be a problem only with systems with the bass response extending down to d.c. and with speakers the likes of which do not exist. Arm resonance was found to be at 11 Hz with this particular cartridge, and the signal-to-noise ratio was 37 dB, referred to a stylus velocity of 3.54 cm/sec at 1000 Hz, which corresponds closely to the NAB specified level of 1.0 cm/sec at 100 Hz.

We have had experience with most of the Dual turntables over the past year, and we can say only that the 1209 carries out the tradition of its fellows. This model could easily be the second-choice selection by anyone who couldn't bring himself to disregard his budget. But it is unlikely that he would *hear* any difference between the 1209 and its more costly big brother, the 1219. There may be some other reasons why the 1219 is more costly, but for the average listener, the 1209 would certainly provide excellent record playing along with convenience. *C.G.McP.*

Check No. 56 on Reader Service Card

B & O 15° High Compliance Stereo Pickup, Model SP 12

MANUFACTURER'S SPECIFICATIONS:

Stylus: Naked diamond (no mounting bushing), 0.2 x 0.7 mils. **Frequency Response:** 15-25,000 ± 3 dB, 50 to 10,000 ± 1.5 dB. **Channel Separation:** Better than 25 dB at 1000 Hz; better than 20 dB between 500 and 10,000 Hz. **Stylus Force:** 1-2 grams. **Output Voltage:** 1 mV/cm/sec. **Load Resistance:** 47,000 ohms. **Vertical Tracking Angle:** 15 deg. **Weight:** 8.5 grams. **Price:** $69.95.

The B & O cartridge employs a radically different design for a moving-iron model in that it has a × mounted on the end of the stylus bar. The tips of the × are disposed adjacent to four pole pieces around which are the two pairs of coils. As the stylus follows the groove, the movements of the cross in the magnetic fields generate signals in the coils, which are in a balanced push-pull circuit that minimizes external hum fields and ensures low distortion. A similar model fitted with a conical stylus is known as SP 10, with a tip radius of 0.6 mils.

The cartridge is of molded plastic construction, with the coils and magnets enclosed. The stylus assembly with its "micro cross" is carried in a metal shell which slips over the plastic body, and the stylus arm is protected by a clear plastic cone.

The mounting lugs are part of the plastic molding, and a separable 3-degree plastic wedge is provided for mounting in the arm of an automatic turntable to ensure an average vertical tracking angle of 15 deg. throughout a stack of records —the variations being from 18 deg. on the first record, 15 on the fifth, and 12 on the tenth. The wedge is not used when mounting in a transcription arm. Five terminal pins are provided so that a separate ground can be connected when a fifth wire is available in the arm. Otherwise, a shorting spring may be fixed to the ground pin and one of the output ground pins.

Performance

Frequency response was measured using a CBS-100 record, with the result shown in Fig. 2, which also shows crosstalk between the two channels. Figure 1 shows square-wave response from CBS STR-110, which also provides IM measurement grooves at five increasing levels using 400 and 4000 Hz in the lateral mode, five levels using 200 and 4000 Hz, lateral, and three levels each in the vertical mode at each pair of frequencies. Since we have very little experience with these measurements, we will only give a distortion figure for the lateral +9 level at 200 and 4000 Hz—2.0 per cent—and for the vertical +3 level at the same pair of frequencies—10.0 per cent. Future measurements on other cartridges may be compared with these as they are published.

Regardless of the apparently high IM figures, we have little to compare them with, so we can only say that the cartridge in use gave an excellent account of itself, comparing favorably with other well-known models with a possible edginess on very high frequencies. We played the Deutsche Grammophon 139010, "Pictures at an Exhibition," with the Berlin Philharmonic Orchestra—one of our favorite test records—and could find no fault whatever with the reproduction. We also played RCA's "Alexander Nevsky"—a heavily modulated selection—and found it reproduced excellently. We noticed the

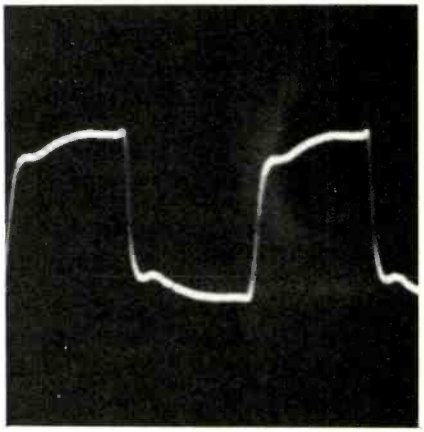

Fig. 1—Square-wave response.

edginess in some solo violin numbers in other recordings, and in a few passages cymbals were not as crisp as we would expect. On the whole, however, reproduction would satisfy most any music lover.

Frequency response is seen to be better than specifications, with response being within 1 dB from 40 to 15,000 Hz. There were two different peaks in the two channels, one of 1.5 dB at 17 kHz, and the other of 2 dB at 19 kHz. Using the wide-range pickup response record with its band from 500 to 50,000 Hz, we found response was down 5 dB at 25 kHz. Separation varies from 15 dB at 40 Hz to a range from 23 to 25 dB from 150 to 9000 Hz, then reducing to 10 dB at 20 kHz. Outputs and frequency responses from the two channels were within ±1 dB except as noted heretofore.

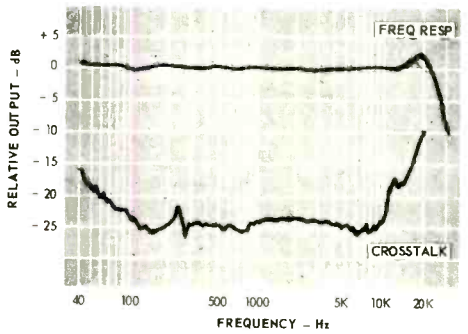

Fig. 2—Frequency response.

The thorough and complete measurement of cartridges involves hundreds of separate observations, many of which are beyond the facilities of this observer's laboratory. However, for the needs of the average user, our figures should be sufficient. *C.G.McP.*

Check No. 88 on Reader Service Card

SONY Model 366 Tape Deck

We have received the following comments from Fred Tushinsky, Superscope's Director of Marketing: "Your Equipment Profile on the Sony 366 was extremely thorough and generally complimentary but the importance of several of the features was somewhat neglected. For example, the automatic total-mechanism shut-off is, in our opinion, a great advance in single-motor recorder design because it eliminates the possibility of forming a flat spot on the pinch roller, a common fault of recorders which merely shut off the a.c. automatically. Also the absence of pressure pads (use of hyperbolic heads) is very unusual in recorders costing $200-$250. The Record Equalization Selector Switch is another unusual feature which aids both the economy and quality of home recording. This feature received minimal attention in the review despite the fact that the results of this switch together with SLH tape produces an almost incredible 57 dB signal-to-noise ratio."

In reply, we can only say that all of these features were mentioned, but possibly not stressed sufficiently. We felt they were so obviously advantageous that they did not need additional comment. At $229.95, it would be difficult to find a better deck.

Classical Record Reviews

EDWARD TATNALL CANBY

Black Music of South America (Colombia, Ecuador, Brazil). Recorded by David Lewiston. **Nonesuch H-72036 stereo** ($2.98)

Anthology of Music of Black Africa. Assorted sources. **Everest 3254/3 (3 disks) sim. stereo** ($14.94)

Hi fi technology has done wonders for the recording of so-called primitive music, on location or even in the studio, but it has not solved the more basic problems involved. Recordings still remain a contradiction of the very sense of the material recorded. And it still isn't easy to find ways around the difficulty.

Wide-range sound adds intelligibility; quiet backgrounds do the same and allow much-needed dynamic range; distortion-free peak levels help immeasurably to get around the often rude and sudden sonic violences of the sound—in the past mostly smeared into hopeless distortion. Stereo has gone into the jungle and the bush, adding immeasurably to recorded drama and clarity. Even Everest's simulated stereo adds its useful bit to the presentation. But the problems remain.

Is such a recording to be a slice, a sampling? Or is it a *work*, a whole entity, transferred (like Beethoven) to tape and disk for home replay? The distinction, you see, is meaningless; because in primitive music the very idea of a "work" is meaningless. Primitive music (and much other music, too) does not have beginnings and endings. It simply *exists*, and goes on until people tire, or fall exhausted.

Like the very arbitrary European idea of a *frame* around a picture (which seldom exists in other arts), the sonic "frame" of a beginning and an end, and a shape within the time-span enclosed by that beginning and ending, is entirely arbitrary. Music doesn't *have* to "begin"—nor end! Even our own pop music proves the point, via endless verses to a tune, via the ubiquitous fade-out (implying no real end, just a cessation) or via the Beatle-coda, an interminable extra tailpiece often longer than the tune itself.

The older way of documentation for primitive musics, as we all remember only too well, was the short sample—just enough to record the nature of the sound, to rouse a bit of listening interest. But dozens of short samples one after the other, each quickly faded away, merely confuses and tires the ear. On the other hand—where do we stop? What to do about a tribal dance that goes on for hours and hours? Most do, and so do most songs.

In truth, there is no answer, only a varying degree of compromise. One can, of course, tape the whole thing, hour after hour, at no great expense. There it is, complete on twenty five master reels! *Then what?* We are straight back in the soup again. The taping isn't what counts. It is the aesthetic choice of material for disk presentation that is the crux, and brings out the fundamental parameters of an essentially false situation. The true answer is—if you want to hear primitive music, *go into the jungle and hear it.* Hour after hour.

Nonesuch's Explorer Series continues to present such music in an optimum fashion, i.e. in uncompromised hi-fi stereo sound, and in long enough segments so that one can, in fact, become interested and, to an extent, immersed in the actual experience. Good! These Black recordings from South America are limited, wisely, to a few areas, each amply represented and musically satisfactory in the listening, the excerpts all reasonably long. But a curious thing has happened. Some of the sessions, apparently, have been set up expressly for the taping. The music suddenly does, in fact, *come to a stop*—as thought the engineer had signalled OK, that's enough for this take. Those stops, alas, are as false as the fade-outs that we usually hear! For the music should *not* stop. Not ever! It should merely peter out.

The Nonesuch Black Music is, as could be guessed, Latin-American in sound, sung in dialect-Spanish with a familiar Latin overlay blending into the African base. Subject matter, similarly, transfers African-type gods and personalities into European-based saints and the like. Interesting and an authentic picture of current race melding.

Everest has picked up its tapes, apparently, in France; each of the three disks contains a different collection, all under varying French auspices. The sounds are wonderfully varied, much more primitive (and free of European influences) than Nonesuch's South American material. The recording, originally mono, is reasonably clean and intelligible. Two of the disks are "on location," the third is via a traveling "troupe" presenting African culture, but in sound there isn't much difference; all are very authentic and unspoiled. Yet the old problem remains acute. Too many excerpts, and mostly much too short, virtually all of them faded out just as the interest begins to build. The majority are under three minutes, down to scarcely a minute. One musico-drama extends to eight minutes. Everest has reprinted the notes complete with references to non-existent photographs and a mix-up of sides (on the labels as well as the notes!) in a fashion that ill befits these relatively expensive disks (as per their list price). Even so, there are good sounds here. I'd recommend the album if you are intrigued by Black music, or merely for the novel sounds it contains.

Performances?? *Sound: A−; B−*

Mozart: Ascanio in Alba, K.111 (1771). Soloists, Angelicum Orch. of Milan, Polyphonic Chorus of Turin, Cillario. **RCA Victrola VICS 6126 (3 disks) stereo** ($8.85)

Mozart was fifteen when he was commissioned to do this full-scale festive piece for the Italian wedding of the Archduke at Milan (then under Austrian rule) with a princess from Modena, Maria Beatrice d'Este. It was a sort of pageant-ballet and cantata, not really an opera, and wholly for festive entertainment. But, curiously, the young Mozart and his elderly librettist managed to get a large quantity of classic elegance into their show. One recognizes the sound of Mozart at once, even at fifteen. But what is really remarkable is the nearness of this work to the older classic Baroque opera of Handel, Telemann, A. Scarlatti. Mozart has absorbed the older tradition to perfection. Only the gallivanting frivolity of the new

Canby's Capsules...

TITLE	CONTENT	SOUND
Bernstein Conducts Hindemith (Symphony in E Flat, Symphonic Metamorphosis of Themes by Carl Maria Von Weber). N.Y. Philharmonic. **Columbia MS 7426 stereo** ($5.98)	Add this to your "Bernstein Conducts" series—it goes well with his Copland, and the "Copland Conducts Copland." Hindemith was a pudgy, forceful sausage of a man. His late orchestral music, composed in the U.S., sounds exactly like him—big, fat, pompous yet full of muscle and not without humor.	Hindemith's orchestra, like Copland's, is excellent for hi fi in spite of its enormous sonic weight. Both men use their big U.S. ensembles brilliantly, with fine brass in particular. H.'s thickly written complex of inner counterpoints, all going at once, is especially well favored by close-up modern stereo clarity. These are very "right" recordings, for my ear.
The Contemporary Contrabass — New American Music by John Cage, Pauline Oliveros, Ben Johnston. Bertram Turetzky; Nancy Turetzky, flutes, R. George, percussion. **Nonesuch H-72137 stereo** ($2.98)	Wow! Is this the ultimate! All these works have an instant family resemblance, out of a specific school—that which draws graphs, lays down formulas, writes instructions, and leaves sonic details to choice or happenchance.	Maybe it is best to have this sort of material on Dolby-ized disks, for informal audition! The noises are uncanny, the Dolby silences even more so; the whole record has an oddly good-natured quality in this superior recording. Not at all unpleasant to listen to, I found.
Nicholas Maw: Scenes and Arias (1962). **Elizabeth Lutyens: Quincunx** (1967) Soloists, BBC Symphony, Del Mar. **Argo ZRG 622 stereo** ($5.95)	How far removed was British contemporary music from our own—until quite recently! These middle-generation Britishers write two monumental works in the serial mode, both with a dignity and—somehow—a certain traditionalism that is very British, for all the modernity. (Not *late* modern—rather, old-fashioned, as of our "chance music" and tape-sound era.)	The British recording, via the British Council, is somewhat conservative in sound though clean and well spaced. A bit more of the American close-up accent "edge" would—for our U.S. ears—bring more clarity of texture. The voices, baritone in one, three women in the other, are tastefully distant and well balanced against the instruments.

galant style sets it off from Handel himself.

Here we have the old gods and goddesses and demi gods, and the human beings that are mere pawns of the gods who control all. Here, too, are those cardboard human characters, not people but, rather, summaries of the various virtues and vices (not many vices in this one!)—the sweet, pure maiden, the dashing youth, her noble suitor, the maiden's doting father and adviser. Here are the gods, too, represented by Venus—the hero's grandmother. And here, even, is the inevitable messenger from the gods, a Faun. All these creatures in the classic opera simply stood and sang. Each aria, at length, depicts a single feeling or *Affekt*, as the Germans put it, with all the repetitive power of musical persuasion. Each of the quicker recitatives advances the "plot" by a single notch, no more, like a time clock that clocks forward a tape at regular intervals. There is no continuous play-like action, no dramatic development of character—all that came in a different age.

The astonishing thing about this youthful but highly professional work is that Mozart has so beautifully combined the lofty, static elegance of the old tradition with the effervescent new *galant* style, new in his own time. The gods remain statuesque and all-potent, the human beings rejoice or bewail in the old lofty dignity; yet Mozart bubbles along as light as a feather, all friskiness and brilliance, in a kind of ginger-ale Baroque. His singers leap daringly, launch into fearful cadenzas (now almost unsingable), race up and down dizzy scales, yet retain their classic dignity. Some feat—and Ascanio in Alba was rightly a hit at the wedding celebrations, repeated a number of times before they were over.

This performance has some mixed virtues. The lead singers, Venus (Ilva Ligabue) and her grandson Ascanio (Anna Maria Rota) are excellent in voice and musicianship and a pleasure to hear. The remaining singers, including the maiden Silvia, our heroine, tend towards the quavery and/or strident. Not unmusical—just uncontrolled in the vocal technique. Mozart's standards were far higher than ours for such parts. The orchestra, large for the time with brass, woodwinds and percussion, is full of verve if a bit squashy in the detailwork. The chorus, which acts as curtain to separate the various scenes, is solid and competent; Mozart nicely balances numbers for the women, the men, and the whole group.

One curious anomaly persists. The ardent hero, young Ascanio, who gets his girl as per Venus' orders, was originally sung by an alto *castrato*, a friend of the Mozart family and, since he was well known, presumably well into middle age. A preposterous embodiment of male virility, but common enough in opera of the day, where vocal expression was what mattered, not physical accomplishment. In this modern performance a later but no less preposterous tradition is followed—the hero's alto music is sung by a large-voiced mezzo soprano whose female chest tones suggest both maturity and, perhaps, considerable bulk. One imagines a good 180 pounds of it at least! (A still newer tradition would have procured a male countertenor to sing the part, *castrati* being now unavailable.)

Does it matter that our hero weighs a feminine 180? Not in the least. She is a superb singer and a splendid musician and in five minutes we are accustomed to her sound, representing male youth via female maturity.

Performance: A— *Sound: B—*

Catharsis

Eric Salzman: The Nude Paper Sermon. Tropes for Actor, Renaissance Consort, Chorus and Electronics. Stacey Keach, Actor; Nonesuch Consort; Members N.Y. Motet Singers, Rifkin. **Elektra H 71231 stereo $2.98.**

Luciano Berio: Sinfonia. Swingle Singers; N.Y. Philharmonic, Berio. **Columbia MS 7268 stereo $5.98.**

Believe me, it took awhile before I could bring myself into writing consecutive words about these wildly similar con-

CLASSICAL RECORD REVIEWS

Continued

structions in modern sonics. Phew! They represent a curious meeting of minds, out of the world of the big symphony orchestra and that of the Renaissance Revival, two types of music which seldom meet in concert. Yet, here they are on common ground to celebrate the modern age sonically as it must be celebrated—via noise, elaborately montaged. It works. But it leaves you limp.

The urge to express one's own time—somehow or other—is basic to every age. Ours demands implacable plurality. That is the idea behind many a multi-media show, bombarding the senses with unconnected, unrelated simultaneous messages. It is emphatically the idea between these two recorded works (and their "live" versions). Poly-noise. Poly-music against poly-music. Poly-voices. Electronics. All combined in a fiendish hodgepodge of layered impact. Wears you down. Talk, talk, *talk*, never ceasing! Like tuning a dozen radios in and out, or listening to a cocktail party. And layers upon layers of music, or semi-music, bits and pieces. All ceaselessly combined, merged, bombarded outward. Don't we hear the same on any city street or crowded summer beach?

It's a shocking sort of sound at first but you may yet come to feel, as I did, that the contrived sonics do convey the very stuff of life's pressures—and thereby, oddly enough, help us to feel much better about them. Catharsis, they call it. Just forget about "art" or "music"—take it as it is.

Of the two works the Nude Paper Sermon, smaller scaled, is the most stylishly modern. It takes Renaissance music, both for voices and old instruments, as its base and makes use of text with a somewhat Renaissance flavor. (The Renaissance—a time of change . . .) Its performers normally play the older music itself; so you will hear recorders, lute, portative organ, not to mention countertenor and other Renaissance-style pro voices. Indeed, the singers often seem to be singing actual old music, until they dissolve into dream-like dissonance or, more often, sheer off into wild whoops, groans, hiccups, and heavy breathing sounds. The recorders and lutes do likewise as well as they can and there is an overlay of occasional electronic burps to help out. A "chorus"—many voices all talking at once like at a party—they, too, tend to dissolve into wild shouts and yells.

Against all *this* there is the ceaseless monologue of the Actor, who spouts endless high-speed cliches, non-sequiturs, total generalities about Modern Life, out of which you are intended to catch only fragments, like radio. Such pompous nonsense—shades of a million news commentaries, public-service messages, political announcements, and radio sermons! Very healthy satire on meaningless message-bombardment, and I liked it. The whole big melange is mixed down, easily enough, from eight original tracks and the only question I ask is how do they get the pro singers to make such incredible noises? If actors now must go nude, then singers must be ready to pant, gargle, gasp, or shriek on demand. These do it beautifully, and note in particular the soprano, Diana Tramontini. She's terrific.

As for Berio's more modestly titled Sinfonia, it is bigger and, in a way, more old fashioned, coming out of the symphony-concert tradition. But again a ceaseless babble of voices, all talking, or singing, or gasping at once. Mostly in French (the Swingle Singers are French) but also in other languages. Again the intermittent shrieks and pantings and general vocal hysteria, all beautifully controlled. And against this vocal barrage you hear the N.Y. Philharmonic in all its sonorous majesty, playing a horrendous mixture of old-fashioned music and squealing disso-

nance, put together in the fashion noted above—into a patchwork of deliberate irrelevancies, tossed up like life itself. Tough to play, but not half as zany as the Swingle element; the two together really make a fine controlled chaos! Good job.

The Berio stand-out movement is No. III, which is "assembled" (Berio's word) on top of the third movement of Mahler's Second Symphony, into which orchestral "container" he (Berio) projects fragments of all sorts of other familiar orchestral works—Bach, Schoenberg, Ravel, Strauss, Stravinsky, Beethoven, even Berio himself, against the ceaseless babble of the Swingles. (The soprano sometimes airily joins in on a bit of familiar tune.) This part I'd like to hear minus Swingle. It makes a fine musical guessing game. I caught about half the items, first time through.

After you've played straight through all four sides on these two records you'll experience the final catharsis: you will positively revel in the *total silence* that hits you when at last you turn off your machine. That is an experience which justifies all the rest.

Performances: A *Sounds:* A
Everything: A

THE BEETHOVEN YEAR

Carl Czerny: Variations for Piano and Orchestra on a Haydn Theme, Op. 73; Ferdinand Reis: Piano Concerto, Op. 55. Felicja Blumental; Vienna, Salsburg Chamber Orchs, Froschauer, Guschlbauer. **RCA Victrola VICS 1501 stereo** ($2.98).

A terrific record this—in spite of unknown composers, two different orchestras and two conductors with lumpish names (see above!). The music is quite extraordinary; the performances on the piano are excellent and the pair of orchestras, no Philharmonics, nevertheless offer very adequate accompaniments in the full-Romantic style. RCA doesn't say where it picked up this one—not, I gather, the usual Harmonia Mundi tapes that glorify the Victrola label, mostly in Baroque and Mozart-period music. Wonder who was responsible? (Surely not RCA itself.)

Czerny is hardly unknown, but his name means mainly those endless musical exercises trudged through by pianists-in-development. (But they are musical, even so.) Actually, he was one of Beethoven's big proteges, and the unknown Ferdinand Reis was another. Czerny played the first performance of the Beethoven "Emperor" concerto; Reis similarly played the Third Concerto its first time. Both, of course, played Beethoven's piano works as they appeared, straight from Beethoven himself. Both were tremendous musicians—performers and also composers—as who but Beethoven should have known. In those days, a protege was more than a mere finger musician.

What one feels, in both works, is a sort of kindly tolerance of the Old Man's genius, an enormous appreciation, born of closeness, but no slavish submission. Beethoven is everywhere in both works. There are even seeming direct quotes, or semi-quotes, perhaps unintentional. (Reis's last movement begins with a note-for-note Beethoven idea.) Yet not a trace of the dogmatic, copycat imitation we expect from pupils of a Great Personality. Throws abundant new light (for me, anyhow) on Beethoven's relationship with his musical associates—which could be stormy.

Czerny's variations turn out to be upon an ultra-familiar tune, Haydn's *Kaiser* hymn, later made into *Deutschland uber Alles*. Haydn's own celestially reserved variations on it are found in a late string quartet. These are almost funny, so totally different in style from Haydn are the giddily explosive Romantic fireworks,

out of Paganini or Rossini. A grand show piece and beautifully styled for its period, post-Beethoven.

But it is the Ferdinand Reis concerto that steals the show. It is an astonishingly mature, expressive work after Beethoven, totally professional and authoritative, a really first-class piece of writing without competition that I can think of in the period. *Reis*! Listening, you would never know that this was other than one of the "great" genius-composers of the Romantic era. No wonder that the entrepreneur Salomon, who had brought Haydn to London, took up Reis in that city and made him famous in his day, if later on forgotten. He deserved his short-lived fame.

Performance: A– *Sound: B+*

Wilhelm Backhaus Beethoven Sonatas Nos. 13, 24, 3. (Op. 27, No. 1; Op. 78; Op. 2, No. 3) **London CS 6638 stereo** ($5.98).

Wilhelm Backhaus is surely the grandest old man of the recorded Beethoven piano sonata. His recordings for London would seem to beat all records (in both senses)—for longevity, quantity, and quality—though I haven't totted up the others to be absolutely sure. My oldest Backhaus LPs date from the early fifties, among the very first London long-play recordings. He still goes right on, and the current Schwann catalogue is full of his Beethoven sonatas, though not in the sweeping "complete" format of such as Angel's young Barenboim, old Artur Schnabel (who did the first such set before the war) and that other Wilhelm, W. Kempff, whose complete set is available on imported Deutsche Grammophon. (He used to appear on U.S. Decca Gold Label LPs.)

Kempff, who mustn't be confused with Rudolph Kempe, is a precision performer on his records, impeccable in phrasing and sharp detail, powerful, passionate but, even so, a bit chilly. One admires, but at a distance. Backhaus is a very different sort. Elderly now, he is sometimes clumsy, blurring up the details in old-man fashion; but to my memory he has always been this way, a pianist interested in the grand lines and impact, inclined to be uneven in detail, using both a bouncy, staccato technique and a good deal of blurring pedal. But this man has such an unerring (and continuing) feel for the sense of Beethoven that these matters are of no account at all. His wholly natural, persuasive way with the composer is utterly musical.

Best of all, perhaps, is the lack of pose, the naturalness. So many pianists approach Beethoven with furrowed brow and determined mein, advertising loudly that now they are performing THE MASTER. (Orchestras likewise!) Yet for all their determinedness, many of them do not really understand nor feel the music. With Backhaus, Beethoven is so comprehensible, so familiar, that there is no thought of anything but straightforwardness. For which, the thanks of us all.

Only the OP. 27, No. 1, "Quasi una Fantasia," runs into noticeable technical trouble here. The fugal segment with the running fast notes is just too much for the elderly fingers, though the sense is all there. The rest, and notably the early Op. 2, No. 3, is just fine. Backhaus is particularly good in the early works, so often treated as semi-youthful immaturities. He gives them their full due, without a trace of exaggeration. Try Backhaus first—then measure all the others.

Perfomance: A– *Sound: B+*

hours is all it will take to remove most warps.

Because of the wide difference in frequency response from one record to another, even when produced by the same company, I simply to do not care what the curve might have been during the recording process. I simply adjust the playback system to suit my taste.

I definitely suggest that you use a modern diamond stylus for playing these old 78's. The disks will both last longer and sound better. Of course, you must use a stylus having the correct tip radius, which is generally considered to be 3 mils. You might have to use slightly more tracking force than you do with your LP's.

In any case, you will not be tracking at nearly so great a force as was common when the 78 was king. Because of these light tracking forces involved, these disks will last infinitely longer than they would with the original phonograph equipment common in those days, including steel needles. The diamond stylus holds its shape even despite the friction produced by playing the rough surfaces of 78's. Because it does maintain its geometry, there are no sharp edges produced, and this improves record wear. Steel needles do not hold their proper tip for more than a side or two. This, together with heavy tracking forces, ruined many a 78-rpm record prematurely.

Using FET's

Q. Can I directly substitute an FET for a vacuum tube? Arthur Darrow, Albany, New York

A. You cannot directly substitute an FET for a vacuum tube, and there are a number of reasons for this.

1. I have not seen FET's which can deliver large amounts of power. Hence, an FET cannot be substituted for an output tube.

2. The voltage applied between plate and cathode of most vacuum tubes is much higher than the FET can withstand. The voltage must be reduced to a safe level before it can be applied to the FET. The excess voltage must be dissipated in the form of heat, and this might be a problem in some circuits.

3. The FET must be wired into a circuit, whereas most tubes are plugged into sockets. You would either have to wire the FET into the circuit point-to-point or you would have to mount it in an appropriate plug so that it can be fitted into the existing tube socket.

4. In the case of r.f. circuitry, the substitution of the FET will require a complete realignment of the circuit.

5. Circuits of the type normally found in phonograph and tape-head preamplifiers often have feedback to provide the necessary equalization. Some changes in component values for such equalization circuits must be made so that proper frequency response is maintained.

6. Bias values will almost certainly have to be changed.

7. I suggest that you consider only N-channel-depletion type FET's. They are more like tubes in their operation than other types. AE

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

Is Classical Music Dead?

Many people are discouraged by the decline in popularity of what is called classical music—especially among the younger generation. Various explanations have been given—lack of musical education, high-powered commercial exploitation, reaction against the 'establishment' and so on. Here is the view of Greg Morrow, a 16-year-old youngster. You may not agree with him but we think he should be heard.

by
GREG MORROW

RECENTLY, I walked into a record shop in a nearby city, and as I was scanning the titles and labels I reached a very sad conclusion: classical music is in its death throes. In fact it may be dead already. For some people this may be a rather startling pronouncement. However, consider the sales of classical disc and tape recordings. The percentage of classical recordings has declined from about 20% during the nineteen-fifties to a dismal 5% now. Of course, we have to realize that people's tastes in the nineteen-fifties were somewhat simpler than they are now. Small town America *was* America and life for many people during the Eisenhower Administration was uncomplicated and peaceful. As for music, well, there simply was not the variety to choose from and for the most part, popular music was rather unexciting. It seemed classical music was one of the few alternatives. . . . But, with the emergence of a young man from the South named Elvis we had something new.

"Something new" was a distinctly American phenomenon: rock and roll. All the supporters of the musical establishment were properly shocked by Elvis Presley and his new style of music. "Sure, classical music is fine for the older folks" the younger set said "but who could possibly imagine our idol, Elvis, listening to a Beethoven violin sonata?" By the early nineteen-sixties classical music was in trouble. Anyone who listened to classical music in teenage circles was suspected of being something less than a swinger. After all, this was the Space Age, and was it really relevant to listen to the musty old music written by some guy a century or more ago? Young people across the land gave the verdict: classical music was not relevant. On the other hand, sales of classical recordings should have actually increased. After all, stereo was now on the scene and it was almost possible to recreate concert hall sound right in your own living room.

Never before had there been such a flood of recordings. But there was one thing missing—education. Musical educators had failed to provide a solid course in music appreciation at the elementary and secondary school levels. For years it seemed they could offer nothing more than the "William Tell Overture," "The Sorcerers Apprentice," and their like. Now I have nothing against these two war-horses but it seems to me that music educators have driven the good old standards into the ground and exhausted their potential. Music appreciation courses were and are a sometime thing for many schools and the choice of music was often left to the discretion of the music teacher. Often little or no modern music was included. This lack of contemporary music seems to have driven many young people away from the enjoyment of classical music. There are two other causes related to this decline of interest.

First of all, merely *obtaining* classical recordings is a problem in itself. Many of the record shops I have visited have only a few recordings on hand. Those shops who have a decent selection available usually charge full list price. I myself buy recordings from a large mail order discount house in New York but this method of buying cannot always be depended on. How can the problem of record availability be solved? No one appears to know the answer.

The second cause is lack of quality in recording. The popular music boom of the sixties has forced record plants to stay open virtually around the clock to meet the insatiable demand. The trouble is, quantity has increased at the expense of quality. In my opinion the quality of classical recordings is lower than it was a decade ago. And what about the current repertoire of classical recordings in the United States? The public taste in classical music has never stagnated for so long. Brahms and Beethoven form the background of popular recorded classical music. Much of the recorded material sold is made up almost entirely of nineteenth century (or older) works. Contemporary music should be given much better representation on recordings and in the concert hall. In my opinion, Igor Stravinsky is the only well-represented twentieth-century composer on recordings. Columbia has done a superb job of recording the majority of his works for posterity. I believe part of the reason for his popularity is due to the magnificent recorded performances of his music by such masters as Ansermet on English Decca (London), Bernstein, and of course by Stravinsky himself. Aaron Copland's major works are also being given good coverage by CBS. This can be done with other contemporary composers. It may be expensive to produce these new recordings, but if the record companies expect to attract new customers for classical recordings it must be done.

So here we have one of the ironies of the electronic age. There is a plethora of almost all types of music and one can even select the program source e.g.—radio, records, tapes, or live performances. Yet classical music seems to be declining in importance in this nation today. If something is not done to make classical music popular again we may find ourselves a musically second-rate nation.

CHAMBER MUSIC

(from page 36)

ven's Ninth Symphony. This music, though, is anything but eclectic. Ives himself described the Second as a string quartet "for 4 men—who converse, discuss, argue (in re 'politics'), fight, shake hands, shut up—then walk up the mountainside to view the firmament." The approach of the Kohon Quartet on Turnabout and that of the Juilliard Quartet on Columbia MS-7027 could hardly be more contrasted, especially in matters of tempo. Both records are fascinating, but the Kohons seem more attuned to the "rough, craggy" qualities of the material—and the Turnabout price is more attractive.

It has already been observed that not all of Mozart's serenades and *divertimenti* are classifiable as mere "entertainment music," and the B-flat Serenade is surely one of the most substantial works ever composed for winds. All four of the current recordings are enormously satisfying, the Klemperer version perhaps a bit more than the others.

While most of us think of Shostakovich primarily as a symphonist, it may be that his finest works are in the realm of chamber music. His string quartets now number eleven, and all of them may be had conveniently in two three-disk Seraphim sets (SIC-6034 and 6035), played by the Borodin Quartet, whose magnificent performance of the Piano Quintet leaves no doubt at all as to why this work is regarded as the

most beautiful example of chamber music to come from any Soviet composer so far. The Melos Ensemble, on L'Oiseau-Lyre SOL-267, gets the Quintet on a single side, and the Prokofiev work on the other side of that record (the Quintet for oboe, clarinet, violin, viola, and bass) is a more appealing item than Stravinsky's *Three Pieces*, but the English group's very good performance is no match for the idiomatic intensity of the Russians on Melodiya/Angel.

All the familiar Mendelssohnian qualities, elfin and otherwise, are delightfully present in the two quartets played by the Fine Arts on Concert-Disc CS-224. The *Canzonetta* of the E-flat Quartet is one of those gems recognized as familiar by thousands who have never knowingly listened to chamber music. Curiously, there is only one other recording now of each of these quartets, and the disk listed here is by all means the best way to enjoy both.

Like the Mozart Serenade cited above Hindemith's utterly different *Kleine Kammermusik*, a work as saucy as it is brief, has become one of the staples of the wind repertory. The brilliant performance by the New York Woodwind Quintet is clear and away the one to have, and the quintet by Danzi (a contemporary of Beethoven who wrote many wind quintets) provides an interesting contrast.

It is hoped that some or all of the records recommended here will give the newcomer to chamber music some idea of what he has been missing and encourage him toward further exploration on his own. There are many peaks to be scaled, not even hinted at here, and each brings its own unique satisfaction. Æ

20. **Mozart:** The two Quartets for Piano and Strings. Szell and Budapest. *Odyssey mono*
21. **Schubert:** Trio in B-flat, Op. 99. Istomin-Stern-Rose. *Columbia*
22. **Mozart:** Oboe Quartet; **Britten:** Fantasy Quartet, etc. Harold Gomberg, oboe, et al. *Vanguard Cardinal*
23. **Beethoven:** Serenadé for Flute, Violin and Viola, Op. 25; Serenade for String Trio, Op. 8. Maxence Larrieu, flute; Grumiaux Trio. *Philips*
24. **Beethoven:** Quartet in C♯ minor, Op. 131. Fine Arts Quartet. *Concert-Disc*
25. **Schubert:** Cello Quintet in C. Vienna Philharmonic Quartet with Richard Harand, cello. *London*
26. **Ives:** The two String Quartets. Kohon Quartet. *Turnabout*
27. **Mozart:** Serenade for 13 Winds, K. 361. Klemperer. *Angel*
28. **Shostakovich:** Piano Quintet; Quartet No. 4. Bernathova, Janacek Quartet. *Artia*
29. **Mendelssohn:** Quartets Nos. 1 & 4. Fine Arts. *Concert-Disc*
30. **Hindemith:** Kleine Kammermusik; **Danzi:** Quintet Op. 67/2. New York Woodwind Quintet. *Concert-Disc*

"YOU'RE RIGHT—IT WAS RATED AT THIRTY WATTS."

Recorded Tape Reviews

BERT WHYTE

As I pointed out in my "Behind The Scenes" column, we have a definite shortage of four-channel tapes. Therefore, when I was invited by Enoch Light to hear some of his new four-channel recordings in a joint demonstration with 3M/Wollensak who were furnishing the playback equipment, I hastened to accept. The demonstration was held in the main studio of A&R, Inc., one of New Yorks' top recording companies. The speaker set-up consisted of four studio Altecs driven by a pair of what appeared to be gray-painted McIntoshes. The tape machine was Wollensak's new "Quad/Stereo," a nicely designed unit that furnishes two-channel stereo record and playback, plus four-channel playback. I have been using one at home, and I find it a versatile unit of fine performance in either the two- or four-channel modes.

Enoch Light has been one of the industry's most venturesome entrepreneurs, and it is good to see him take an early interest in four-channel stereo. Mr. Light feels that four channels can enhance music in a way that will have great appeal to the pop-oriented market. He argues that equal intensity on the front and rear channels is perfectly legitimate in relation to today's kind of recording. As I have said a number of times . . . pop recording has been divorced from reality, in terms of a dance hall format, for example, for a long time. So what is one more manipulation to produce this "mind blowin'" effect? With pop music controlling 95 per cent of the market, you may as well get used to the "full surround/equal intensity" kind of stereo. I also agree with Mr. Light, that after one accepts this premise, we should be looking for arrangers and engineers who can take advantage of the four-channel medium. Thus far, Mr. Light's "Project Three" label has released three four-channel 7.5-ips open-reel tapes. These are as follows:

Spaced Out—Enoch Light and the Light Brigade
PR4T-5043, 4-chan. **open reel,** 7½ ips, $14.95

The Brass Menagerie—Enoch Light and the Light Brigade
PR4T-5036, 4-chan. **open reel,** 7½ ips, 14.95

Permissive Polyphonics—Enoch Light and the Light Brigade
PR4T-5048, 4-chan. **open reel,** 7½ ips, $14.95

Two things characterize these four-channel recordings . . . big, bright, ultra-clean sound and clever utilization of the four-channel medium. These recordings are typically mixed down from 8- or 16-track masters. Usually the tracks are well isolated acoustically and reverb is added in the desired proportion. In these recordings, it is frequently possible to detect when one or another speaker is totally out of the reproduction, the isolation is that pronounced. We have fairly extensive use of "pan-potting," in which a particular instrument, or group of instruments is made to "jump" from speaker to speaker, thus forming a circle of sound. Sounds are also "criss-crossed," diagonally between the speakers, as well as shifted "front-to-back." In the "Spaced Out" and "Permissive Percussion" tapes, there are some vocal tracks which kind of flip you when you hear them behind you! The instrumentation is fairly heavy in both of these productions, with a large amount of "bleeps and bloops" from a Moog synthesizer. My favorite of these tapes is the "Brass Menagerie." A real big band is used here and the sonorities produced are massive. The arrangements are top notch and well thought out for the four-channel medium. The music on these tapes is a catch-all of mainly current hits, which should please many and offend few. As noted, the overall sound is sharp and

clean and the hiss level on the tapes, even at good room-filling level was pleasingly low. The quality of the overall effort, must be rated quite high and an auspicious beginning for Enoch Light in the four-channel format. On one point I did a double take . . . I threaded the tapes on the Wollensak, started playback, and was astonished to hear the familiar voice of Sandy Drellinger announcing how to balance your system for the four channels, just as heard on the Vanguard tapes! The answer is that Vanguard is presently doing the processing for Enoch Light, hence the familiar voice.

Festival of Russian Music—Fritz Reiner cond. the Chicago Symph.
RCA-V8S1025, **8-track** cart. $4.95

You can't go wrong with this cartridge. It is a great bargain and the music and the sound are just great. The program is a well-balanced one with Tchaikovsky's "Marche Slav" and "Marche Miniature," Moussorgsky's "A Night on Bare Mt.," Kabalevsky's rarely heard "Overture to Colas Breugnon," Borodin's "Polovtsian March," and the "Overture to Russlan and Ludmilla" by Glinka. Reiner performs these works in eminently authoritative style and gets great playing from the orchestra. This was the heyday of the Chicago Symphony, with the then incomparable acoustics of Orchestra Hall lending their magic to the recording. The sound is big, sonorous, with wide dynamic range. All is quite clean and the bass end is striking with some really low bass drum and deep dark contrabassi. Hiss was moderate, with no discernible crosstalk . . . just a hint of print-through. This sounds equally good in the car or at home.

Darling Lili—Julie Andrews and Henry Mancini performing from the film score
RCA-PK1596, **cassette,** $6.95

I was prepared to dislike this music as it is supposed to represent the World War One era, and I never have cared for the corny, rinky-dink stuff that was current at that time. But I guess you just can't fault ole Uncle Henry Mancini. He rarely bombs with any of his music. I can't honestly say I am dazzled by the score, but much of it is engaging and entertaining enough in an innocuous way. Julie Andrews is . . . well, Julie Andrews! I'm probably one of the minority who hasn't cared much for anything she has done since "My Fair Lady." I'll have to see the picture before I can get more involved in this. Good arrangements as usual and good clean sound too. No quibble about sound that is bright and clean, but I did think it was down in level for some reason. AE

NOW MUSIC

SHERWOOD L. WEINGARTEN

Zing!

That's what Mike Curb, who obviously not only knows where it's at but where it'll be, has injected into MGM's record division. The boyish president, who doesn't try to hide the fact he's a few years past 30 (not far enough, however, for his brain to have atrophied yet), found himself on the top of the heap after a corporate shakeup designed to rid the company of a fossilized structure.

Sweeping mediocrity away by concentrating on innovations with meaning and established performers with talent, Curb kept in touch with the *now* scene—and avoided an Ivory Tower cushion—by producing LP after LP that bubbled over with urgency. His latest success: a film soundtrack album, THE MAGIC GARDEN OF STANLEY SWEETHEART (1SE-20ST), that contains 11 tracks of contemporary sound geared to please the multitudes on both sides of the generation gap.

Among the highlights are a pair of tunes rendered by a studio chorus, dubbed appropriately The Mike Curb Congregation. Bouncy, pleasantly cool arrangements that showcase intelligible lyrics are pushing "Sweet Gingerbread Man" and "Happy Together" higher and higher on the charts—perhaps because youngsters dig the beat and oldsters the hum-a-long quality of soft rock.

But that's only a small part of the vinyl. Hear, also, "Peace on Earth," a straight pop melody by The Wheel that begins with a music box aura. Or "Funny How It Happens," a stellar performance by Stilroc that includes a country flavor with spice provided by occasional brassy overtones a la The Tijuana Brass.

For hard rock addicts, Eric Burdon & War offer "Magic Mountain," and Angeline Butler, who also sings "Sands of Love," solos soulfully on "Keep on Keepin' That Man." The only failure is a noisy entry by Michael Green, whose vocal is overshadowed by a cacophony from the instruments on "Water."

Not incidentally, the album begins with "Nobody Knows," a winning white soul vocal by Bill Medley, half of the old Righteous Brothers. His marvelous bass voice, reminiscent stylistically at times of Brook Benton, is a perfect combination with the smooth, stringed ballad orchestration.

The Medley piece, by the way, also is featured on another MGM disk, entitled, naturally, NOBODY KNOWS (SE-4702). Featuring slow tempo tunes that usually build to emotional climaxes, the LP—produced by Medley himself—shows how much good phraseology can do for a song. Witness, in particular, his versions of "Let It Be," a brassy number that is soul personified; Simon & Garfunkel's "Bridge Over Troubled Waters," with nuances not present in the original, and "Peace Brother Peace," a thought-provoking marvel (slightly marred by an ending that brings to mind the saccharine finishes to tear-jerking flicks, with everyone walking, sheepish grins glowing, into the sunset). Another of the dozen cuts, "Brown-Eyed Woman," easily could become *the* recording.

Anthologies of old hits, Curb seems to believe, is something the label should have produced long ago. To remedy MGM's late entry into the compendium arena of yesteryear, he has initiated a "Golden Archives Series." Repackaging cuts into highly listenable offerings, he released the best of dusty tunes by JUDY GARLAND (GAS-113), TIM HARDIN (GAS-104) and THE COWSILLS (GAS-103).

The Garland vinyl rewinds the clock in the direction of her classic movie extracts, "Over the Rainbow" and "The Trolley Song." And there are eight other "golden oldies" taken from the days when MGM and other studios proclaimed that "movies are better than ever." Exercises in nostalgia, reminding us of an era when life was less complicated, are "Look for the Silver Lining," "Danny Boy," "The Boy Next Door" and "You Made Me Love You (I Didn't Wanna Do It)."

The Cowsill family of singers is represented by such hits as "The Rain, The Park & Other Things," "We Can Fly," and "Hair." Soft rock for children of allllllll ages, as the ringmaster might cry.

Hardin's 10-tune outing emphasizes folk melodies, highlighted by "If I Were a Carpenter" and "Lady Came from Baltimore," evergreens that should last as long as man inhabits the planet.

Others in the archive series, aimed at varying tastes, include disks by the Righteous Brothers, organist Jimmy Smith, the zany Mothers of Invention, thrush Connie Francis, and Burden & The Animals, who pre-dated his current combo, War.

* * * * *

. . . Donovan's OPEN ROAD (Epic, E30125) spotlights the singer-composer's new permanent background musicians, Mike Thomson on bass and guitar, and John Carr on drums. The vocalist-poet, who penned each of the dozen new tunes and produced the LP, shows a maturity in both words and music. He has, however, gone back to his beginnings—when the stress was on social comment. "Poke at the Pope," for instance, is just that. And "Riki Tiki Tavi," an allegory of sorts, calls for changes—as does "New Year's Resovolution." It's his best in a long time—and that's saying a great deal, for his worst was still better than most others' best.

* * *

. . . ERIC CLAPTON (Atco, SD 33-329) is the rock guitarist's first solo outing, solo in that he's starred (but supported by a bevy of Big Names in rock including Leon Russell, Stephen Stills, and Bonnie & Delaney Bramlett, the last also being the LP's producer). Fans of Clapton, an acknowledged egomaniac, will rejoice; others will say it's just another attempt to capitalize on supergroup status. There are eleven tunes, eight of which were written totally or in part by Clapton. It's hard rock with overtones of gospel and blues.

* * *

. . . SUSAN SINGS SONGS FROM SESAME STREET (Scepter, SPS 584) is a virtual magic wand: one spin and it keeps tots glued to the stereo while mommy does her own thing. Featuring Loretta Long, who portrays Susan on the Emmy-winning video show, the disk contains 12 cuts that have enough magnetism to keep *adults* enthralled. Most interesting are upbeat soulful treatments of the ABCs and counting song. But she also is hauntingly sweet singing "Happiness." Joining the former school marm is The Children's Chorus, a collection of eight playful knee-high-to-a-grasshopper types trained by Lois Winteer. Production is from Joe Raposo, musical director for the TV show.

. . . BESSIE SMITH: THE WORLD'S GREATEST BLUES SINGER (Columbia, GP 33) is a collector's item, a two-disk package that includes many songs previously not released in LP form. They date back to 1923, but the sound has been cleared for the most part. Album includes a booklet with information about each cut; Columbia expects, eventually, to reissue all her tunes, and this is the initial release in the series.

* * *

Dick Jensen already has been compared to Tom Jones—with good reason. Certainly the style similarities are evident on WHITE HOT SOUL (ABC-Probe, CPLP-4512). The same kind of frenzied vocals with which Jones has stirred up the video waves, are present on all eight cuts.

Jensen, born in Honolulu, shows in microcosm what he can do via a 6:42 medley that strings together "Try a Little Tenderness," "Expressway to Your Heart," "I Heard It Through the Grapevine," and "Yesterday." The medley, performed before a live audience, is dedicated to the late Otis Redding, one of those mostly responsible for the popularity of the soul movement.

But the *real* white hot soul is seen mostly on "Cry on My Shoulder," "I'm Good for You," and "Hard to Handle." The fire in Jensen's voice is matched by the fire created in the mind of the listener.

Don Costa is noted for his low-keyed, sprightly arrangements, so it's somewhat of a surprise to discover he aided Jensen —and did it so effectively. Witness "Jealous Feeling," a slower-paced melody that retains its intensity; "That Lucky Old Sun," a chestnut revitalized via a straight soul rendition and humming vocal group, and "My Elusive Dreams," countrified rock that features verbal insertions.

Also interesting is a tune Jensen wrote, "Home Again at Last." Although pleasant, it to often appears a combination of "Green Green Grass of Home" and "Windmills of Your Mind." Nonetheless, it works . . . somehow.

Jensen has nowhere near the name Jones does, but then Jones floundered for a long time on vinyl before his TV pyrotechnics caught hold.

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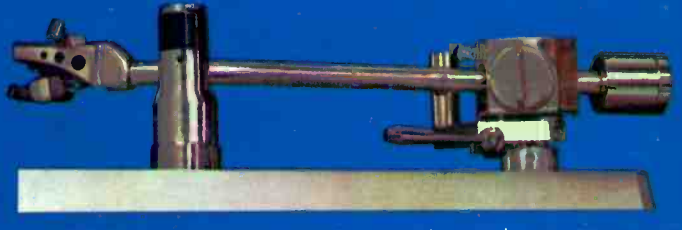

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