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AUDIO

CDC

STEREO EQUIPMENT & RECORD REVIEWS

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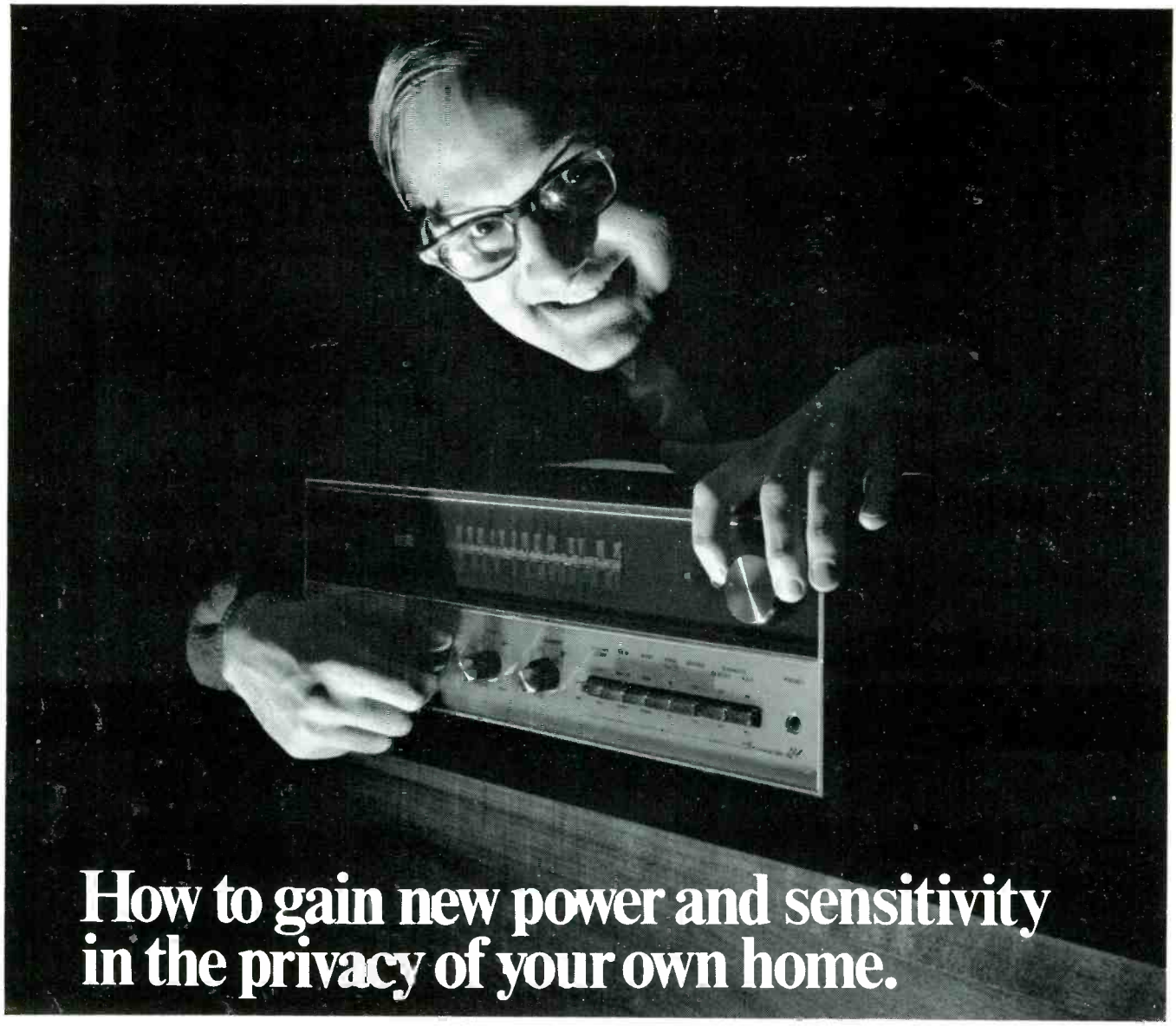

How to gain new power and sensitivity in the privacy of your own home.

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May 1968 Vol. 52, No. 5

AUDIO

Successor to RADIO, Est. 1917

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EQUIPMENT PROFILES

AUDIO IN GENERAL

AUDIO (title registered U. S. Pat. Off.) is published monthly by North American Publishing Co., I. J. Borowsky, President; Frank Nemeyer, C. G. McProud, and Arthur Sitner, Vice Presidents. Subscription rates—U. S. Possessions, Canada, and Mexico, $5.00 for one year; $9.00 for two years; all other countries, $6.00 per year. Printed in U.S.A. at Philadelphia, Pa. Second class postage paid at Philadelphia, Pa.

REGIONAL SALES OFFICES: Sanford L. Cahn, 663 Fifth Ave., New York, N. Y. 10022; (212) 753-8824. Louis Weber, 5201 N. Harlem Ave., Chicago, Ill. 60656; (312) 775-0755. Jay Martin, 9350 Wilshire Blvd., Beverly Hills, Calif.; (213) 273-1495.

REPRESENTATIVE: Warren Birkenhead, Inc., No. 25, 2-chome, Shiba Hamamatsu-cho, Minato-ku, Tokyo, Japan.

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Practical Aspects of the Dolby Noise Reduction System—Dr. Ray M. Dolby gives insights to practical considerations of the noise reduction system that took the recording industry by storm last year. He discusses the revolutionary system from an operational viewpoint, stressing its relationship to magnetic tape recording.

Focus on Stereo Component Installations in the Home—A variety of viewpoints is expressed here concerning stereo at home, from how to blend equipment into a room's decor through how to design a room to obtain the best sound reproduction without sacrificing its aesthetic appeal.

The State of Open-Reel Pre-Recorded Tape—Bert Whyte examines magnetic tape's $7^1/_2$-ips and $3^3/_4$-ips pre-recorded music, emphasizing audio attributes.

EQUIPMENT PROFILES

Marantz Model Eighteen FM Stereo Receiver

Jensen Model TF3B Bookshelf Speaker Systems

Plus: regular monthly departments, music and record reviews, and more.

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Audioclinic

JOSEPH GIOVANELLI

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

Another hum problem

Q. I own a Dyna PAS-2 and a Dyna Stereo 70. I am getting 60-Hz hum. The hum is audible through the speakers as well as directly through the power unit. From the speakers, the hum is constant, but quiet with only the power amplifier turned on. When the preamplifier is added, the hum remains the same in the high-level positions. Switching to the low-level input positions, the hum becomes quite loud when the volume control is advanced to about three o'clock.

The output tubes are new and the bias has been correctly set. All other tubes test okay in a standard tube tester. In servicing, no problem seemed to exist in the filter capacitors. With the bottom plate removed, hum was increased when the repairman's finger was placed near a wire running to a point between the two sockets that provide power for a preamplifier. The wire lies between two twisted a.c. power lines. This wire was replaced with a shielded wire, but the hum remains.

1. Does this suggest anything to you?

2. From my description, would you know if I could dub records onto tapes with my rig without the risk of recording the hum?—Ernest Lumer, Brooklyn, N. Y.

A. 1. The hum problem you're getting might be the result of a defective filter in the bias network. The voltage applied as bias to the output tubes must be pure d.c. or the ripple content of this voltage will appear as a portion of the modulation applied to the grids of the output stage of the amplifier.

It is possible that there is a bad tube in an earlier stage of the amplifier. (I know you said you tested all of the tubes, but this is no certain guaranty that the tubes are really good.) Pull out the input tube of either channel and see if the hum decreases or ceases in that channel. If it does not, you will have a further aid in determining that the trouble is in the bias filtering circuit.

If the hum does cease, then you will know that the trouble is in the input stage, at least insofar as the power amplifier is concerned. You should check the dress of all leads associated with this stage, to see that they do not come close to a.c. filaments or line input leads. Hum pickup will be the result of this proximity.

2. It is hard to tell if you will obtain the hum when using the preamplifier for recording purposes. This really depends upon the exact cause of the hum. I would imagine, however, that you will get some hum introduced onto your recordings because you do notice an increase in overall hum level when the preamplifier's gain control is advanced, especially in the low-level positions.

This logical process inevitably leads us to another consideration. If there is hum in the power amplifier, and some hum in the preamplifier under certain circumstances, we must now begin to think in terms of something common to both the preamplifier and the power amplifier.

One common element to a system where the preamplifier derives its power from the main amplifier, as I believe is the case with your equipment, is the power supply. Perhaps the power transformer is not symmetrical on each side of its high-voltage center tap. If this is so, you can expect hum in the preamplifier as well as in the power amplifier. It is natural to expect that this hum would be with the preamplifier set to the low-level position. You might wish to connect a 'scope or some other probe to the output of the power supply in order to detect the presence of 60-Hz voltages superimposed upon what is supposed to be pure d.c.

As I recall it, the preamplifier portion of your system operates from a d.c. filament supply. This d.c. voltage must be reasonably free from ripple if heater-to-cathode coupling is to be avoided. These filters must be in good order, and the diodes associated with this low-voltage supply must be free from leakage in the reverse direction.

This diode problem must be investigated in the case of the bias supply, too. If there is too much leakage when the diode is supposed to be in the reverse-biased, or non-conducting direction, the voltage thus produced will cause a ripple to be superimposed upon the d.c. The filters, despite their being in good condition, cannot cope with this situation.

You could also investigate the power transformer in terms of interwinding leakage. There might be a partial short between windings or between the primary winding of this transformer and its core. This will cause hum fields to be developed on the chassis, plus some

Introducing a new product in the Garrard line... the synchronous Module SLx, with magnetic cartridge pre-installed, pre-mounted on its base, and ready to use.

Here now, the latest concept in convenience... the Module SLx, a new Garrard automatic turntable with the remarkable synchronous Synchro-Lab Motor™, in a new integrated format: turntable; matched, high performance magnetic cartridge; and base together. It's the complete record playing section of a stereo music system—ready to plug into your other components and play. The entire package costs only $69.50... contains all the advanced Garrard features you should require in a fine record playing unit.

- Pencil-thin, ultra-low mass, ultra-light, dynamically balanced tubular tonearm
- First quality magnetic cartridge with high compliance, diamond stylus... pre-installed
- Long-lever cueing and pause control for both manual and automatic play
- Built-in stylus pressure adjustment with accurate scale from 0 to 5 grams. (Unit comes pre-set to correct tracking force.)
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- Oversized turntable with distinctive aluminum trim ring and mat
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- Two interchangeable spindles, for automatic and manual operation
- Ultra-compact; fits easily into small record-changer space
- Synchronous speed Synchro-Lab Motor for guaranteed constancy, unwavering musical pitch

For complimentary, full-color Comparator Guide describing all the new Garrard models (priced from $37.50 to $129.50, less base and cartridge), write Garrard, Dept. AE-1, Westbury, N.Y. 11590.

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danger of shock, depending upon the amount of the leakage current.

You noted that you could hear the hum coming directly from the amplifier, in addition to the sound produced in the loudspeakers. This is probably not symptomatic of anything. Many power transformers are so constructed that their laminated cores can vibrate a slight bit in accordance with the change in magnetic flux provided to the core by the primary winding wrapped around it. If, however, this noise has become louder than usual, it might mean that the laminations are loosening up or it can mean that the power supply is loaded too heavily. This possibility, too, should be investigated. However, anything is worth following when you have a hum problem.

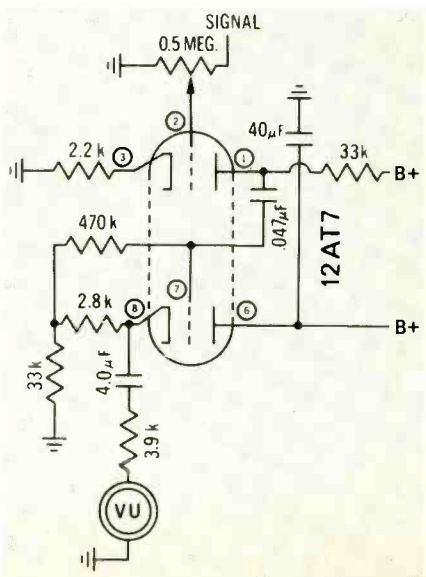
It is problems of this sort which give us real trouble, and it is for this reason that I have devoted so much time here and in some other columns to this very important and challenging subject.

Connecting VU meters

Q. I am using a stereo, tube-type preamplifier. This preamplifier has two outputs per channel, of which I am using only one. Into the two unused outputs I would like to put two VU meters. However, these are high-impedance outputs and the VU meters are only 3,900 ohms, which will surely overload the circuit. Is there a way to hook up these two VU meters without overloading the circuit?—Mrs. Mae Williams, Bronx, N. Y.

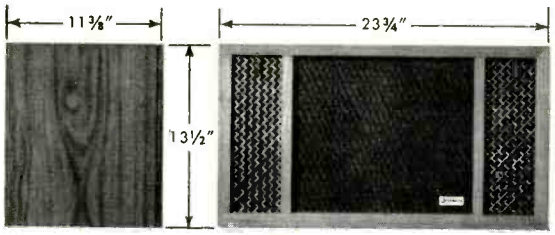
A. The circuit of Fig. 1 shows the basic design for a VU meter driver; it will match the high-impedance output of your preampifier to the low impedance required by your VU meters. Notice that a dual triode is used for

(Continued on page 63)



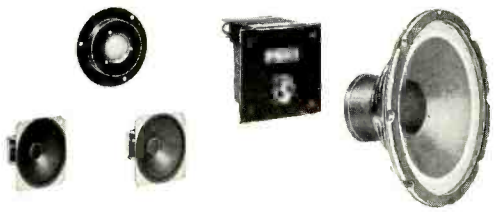
6 reasons why the new Jensen TF-3B should be your next bookshelf speaker

1. It's Great Sound in a Compact Size
The TF-3B proves that impressive sound can come in a compact enclosure. The popular shelf



size gives you true high fidelity anywhere—home, studio, lounge or theatre.

2. It's a 4-Speaker 3-Way System
The TF-3B uses four speakers to provide flawless reproduction of the entire sound spectrum.



A 10" FLEXAIR® Woofer supplies massive well-damped low tones from 2000 cps. to below 25 cps. In the middle register, 2000 to 10,000 cps., clean smooth output is achieved with two special 3½" direct radiator units. Crystal clear uniform highs from 10,000 to beyond 20,000 cps. result from the exclusive Jensen SONO-DOME® direct radiating dome-type ultra-tweeter.

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A handsome walnut cabinet makes this system compatible with every room decor. Attractive grille complements the wood grains. . . . $122.00
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What's New In Audio

Sony FM stereo tuner

The Sony Coporation's latest stereo FM tuner, Model ST5000FW, has some remarkable technical specifications claimed for it. For example, with a new FET front end, IHF usable sensitivity is said to be 1.5 microvolts. In the i.f. amplifier section, solid-state filters are used instead of tuned transformers.

Among the tuner's other specs are: Capture ratio, 1 dB; hum and noise, −70 dB; image rejection, better than 90 dB; i.f. and spurious rejection (IHF), each better than 100 dB; frequency response is listed at from 20-15 kHz ±0.5 dB; harmonic distortion at 100% is reported to be less than 0.35% in the stereo mode; stereo separation at mid-frequency is better than 40 dB

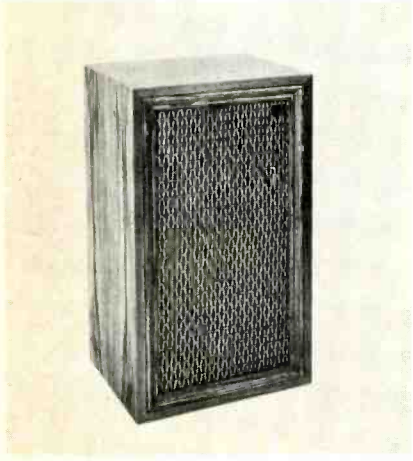
at 100% modulation; SCA suppression, that is, suppression of the background music channel transmitted simultaneously for commercial subscriber use on some FM carriers, is down 50 dB.

The ST5000FW features a tuner input-level meter, tuning meter, and stereo indicator lamp. Dimensions are 15¾-in. W x 12¼-in. D x 5¾-in. H. Price is $449.50.

Check No. 6 on Reader Service Card

ADC bookshelf speakers

Audio Dynamics Corp. introduces two new bookshelf-size speaker systems: the ADC-400 "Brookfield" (shown) at $159.50 and the ADC-200 "Oxford" at $79.50.



The larger, higher-priced Brookfield, measuring 25-in. H x 14½-in. W x 11⅞-in. D, is said to have a freqency response of 30-20 kHz ±3 dB "in an average room." The acoustic suspension speaker system uses three speakers: a 10-in. woofer, 6-in. driver and Mylar-domed tweeter. It requires a minimum of 10 watts, handling up to 60 watts. Features include a rear-panel treble switch (three positions) and a removable grille-cloth frame.

The smaller Oxford system, with dimensions of 19-in. H x 10½-in. W x 8-in. D, is reported by the manufacturer to have a frequency response of 40-20 kHz ±3 dB. It incorporates a high-compliance 6-in. bass speaker and a high-frequency speaker. Six watts minimum is required, with a power-handling capacity of 60 watts. Both speakers have 8 ohms impendance.

Check No. 8 on Reader Service Card

Pushbutton-tuning Fisher receiver

The new Fisher Model 160-T, 40-watt FM-stereo receiver features pushbutton tuning, a luxury long enjoyed with auto radios, but only recently introduced to component equipment. The 160-T has five vertical FM dials, with an adjustable pushbutton under each column to set for pushbutton selection of a favorite FM station. Stations may be selected manually, too.

The receiver is rated at 40 watts total power (IHF), with rms power of 15 watts each channel. Harmonic distortion at 1 kHz is 0.5%; IM distortion, 1%. Power Bandwidth at 8 ohms is 25-25 kHz.

Usable sensitivity (IHF) of the tuner section is 2.2 microvolts. Other specifications given by the manufacturer include: signal-to-noise ratio at 100% modulation, 60 dB; capture ratio, 2.8 dB; alternate-channel selectivity, 45 dB; spurious-response rejection at 100 MHz, 90 dB; image-frequency rejection at 100 MHz, 55 dB; i.f.-frequency rejection at 100 MHz, 70 dB; FM stereo separation, 35 dB.

The front panel displays a variety of controls and features: a three-position speaker selector switch, stereo head-

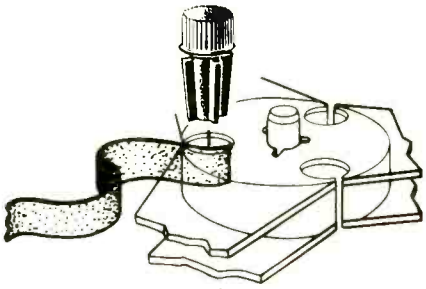
phone output; loudness contour switch; automatic frequency control on-off switch; and a stereo indicator lamp, as well as the normal complement of ganged volume, bass, treble, and balance controls. Circuitry incorporates two field-effect transistors and three integrated circuits.

Dimensions are 15¼-in. W x 11¼-in. D x 3⅛-in. H, the latter giving the unit a low silhouette. A gold-plated front panel and sculptured walnut sides are included at $199.95.

Check No. 10 on Reader Service Card

Tape-threading device

A new device to simplify threading of open-reel magnetic tape, called "Tape-It-Easy," has been made available by the Turnex Company, Darien, Conn. The non-metallic threader consists of four flexible vanes made of soft rubber material. Inserted into a tape reel's



slot, it prevents tape from slipping out of the takeup reel by pressing the tape against the side of the hold into which the tape end is threaded. According to the manufacturer, the pressure of the device cannot damage the thinnest of tapes, and should it be left in a reel which is unwound, the tape is said to slip out when the end is reached. Priced at $2.00 in a two-reel package which contains two tape threaders and two plastic holders.

Check No. 12 on Reader Service Card

!!! a Marantz receiver

Now everyone may enjoy the eloquent sound of Marantz components, combined in a single completely solid-state system — the Marantz Model 18 Stereo Receiver. Here is the incomparable quality of Marantz stereo components — tuner, preamplifier and power amplifiers — combined on a single chassis. Designed to the unequivocal standards which have made Marantz a legend in stereo high fidelity, the Model 18 achieves the level of performance of the most expensive components in a moderately priced compact receiver. Here is the total performance you would expect from Marantz. Finer sound than you have heard from most quality component systems and it is priced at less than half the cost of the fine Marantz components which inspired its design — only $695.00.

Features: An integral Oscilloscope, a Marantz hallmark, provides absolute tuning accuracy and permits elimination of multipath . . . Gyrotouch tuning provides a new experience in quick, silky-smooth station selection and precise tuning. The Model 18 features outstanding stereo control flexibility not normally found in a complete receiver. In addition to separate bass and treble controls for each channel, there are inputs for two stereo tape recorders (one in the rear for permanent connection, and one in front for tape dubbing from an external recorder), two inputs for stereo phonographs, a stereo headphone output, a switch for selection of multiple speaker system combinations, plus a multitude of other switching and control conveniences. Amplifiers: Solid-state throughout with a massive power output of 40 watts continuous rms per channel, from 20 Hz to 20k Hz, nearly three times the output of many receivers rated at 60 "music power" watts . . . Direct coupled design for instantaneous recovery from overload . . . Automatic protector circuits for amplifier and speaker systems eliminate program interruptions . . . Total distortion from antenna input to speaker output is less than 0.2 per cent at rated output . . . and substantially less at listening level. Flawless performance was the design objective. Flawless performance has been achieved.

Specifications: Tuner Section: Signal-to-Noise Ratio — 70 DB; Harmonic Distortion at 400 Hz, 100% modulation — 0.15%; Stereo Separation, 20 Hz — 43 DB, 1000 Hz — 45 DB, 10k Hz — 35 DB, 15k Hz — 30 DB. **Amplifier Section:** Distortion, 0.2% THD; Frequency Response, 15 Hz to 30k Hz, ±0.5 DB.

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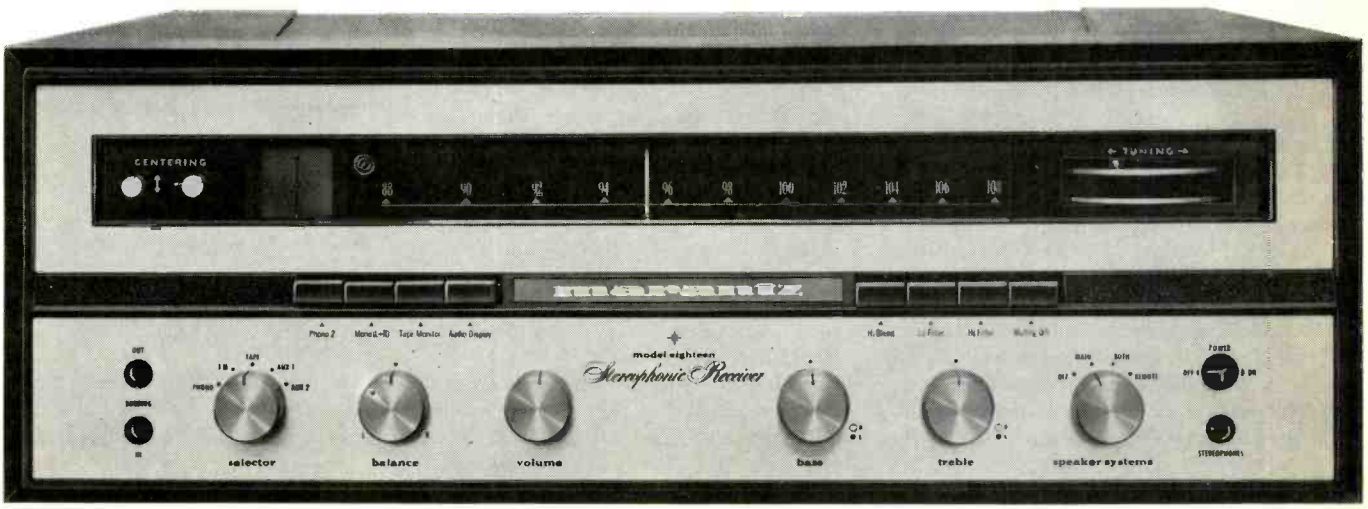


MARANTZ MODEL EIGHTEEN STEREOPHONIC RECEIVER

Check No. 7 on Reader Service Card

Tape Guide

HERMAN BURSTEIN

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

Vanishing mechanical buzz

Q. I have a problem with my Eico RP-100 tape deck. Since the deck is supplied without a base I tried it this way to hear how quiet the motors run. I tried it in the fast forward and rewind modes with no tape and there was a loud buzz, rising in pitch and sometimes vanishing. If the transport is turned off and on again, the buzz usually disappears. I believe the cause is somewhere in the mounting of the takeup or rewind motor. Or could it be that when the deck is out in the open that air currents cause the motor to make this buzzing noise?—R. Lackemeyer, Buffalo, N. Y.

A. I doubt that air currents cause your buzzing noise. I guess that some part of the transport mechanism is racing faster than the designers intended when you put the machine in fast-wind mode without tape to restrain the mechanism. What happens when tape is on? If you still get a buzz, I suggest that you query the manufacturer.

Trio

Q. I have three questions. First, I should like to be able to make use of the calibrated playback possibility on my Magnecord 1024 to utilize the playback level reading as a record indicator. Of itself this presents no problem. The difficulty arises in that a 0 VU reading gives a standard plus 4 dBm voltage output, while the source with which I should like A-B comparison puts out about 6 dB less. The solution seems clearly to insert some variable attenuation between the output of the recorder and the tape-in jacks on my Dyna PAS-3X. Presumably a simple volume control — perhaps with a fixed resistor at the bottom end to insure against loading—could be installed on the Dyna to serve as a sensitivity control.

Problem: What value components to use to avoid messing up the impedances? The Magnecord has an emitter-follower output rated at 1000 ohms. The input impedance of the Dyna tape-in jack is rated at 250K ohms. Can I install a simple 250K pot across the Dyna PAS-3X? Presumably a simple output to the tap, getting adequate attenuation (say 10 dB maximum) without loading down the emitter follower?

Second, I'd like to install a bias trap on the recorder output. Not enough bias leaks through at present to seriously affect the VU calibration at the +8 VU equals 3% total harmonic distortion level, but at −20 VU, where I make frequency-response measurements, enough bias is there to make the curves look a bit flatter than they actually are.

In your January 1966 column you suggested one might use a 2000 pF capacitor in series with approximately 2.5 mH simply tied across the recorder output. Maybe this could work well, but it seems to me that the reactance at audio frequencies of such a rig would be somewhere around 1000 ohms, which would seriously load down my emitter follower. Can I, without messing up the impedances, install a parallel-tuned LC trap (say a .0047 μF capacitor and a 0.5-1.5 mH variable choke) in series with my output lead? Would other values serve better? (Bias frequency in my case is about 80 kHz.)

Third, I'd like to try to lower the hiss level (who wouldn't), particularly of the first stages. At present the p/b amplifier starts with a 2N2613 feeding a 2N405. The microphone preamp uses an RCA 35688 (equivalent of 2N2613, they say) fed into a 2N1305. Do you know of lower-noise transistors which could be used? Would I be better off by putting in low-noise resistors in these stages, or is that source of circuit noise likely to be negligible? I've optimized the bias waveform with the balance control provided (I used a scope across the output of a harmonic distortion meter). Even with bias waveform as pure as I can make it, recording a virgin (bulk-erased) tape with no input signal adds 4-5 dB of hiss. Can anything be done about this?

A. (1) The usual rule is that the load impedance should be at least 10 times the source impedance to avoid significant effects with respect to distortion and frequency response. If you install a 250K-ohm pot, this in parallel with the existing load of 250K ohms will present 125K ohms to the source—with no seeming problems. However, in any design change, it is always safest to test the results for effect upon distortion and frequency response. You state that you will "run the tape recorder output to the tap" of the 250K-ohm pot. However, the recorder output should go to the high side of the pot, and the tap to the following circuitry of the Dyna.

(2) At a bias frequency of 80 kHz, a 2.5 mH inductor will resonate with a capacitor of about 1,600 pF. At 15,000 Hz, presumably the highest frequency of interest, the impedance of this capacitor is slightly over 10K ohms—more than 10 times the impedance of your emitter follower. For a greater safety factor, you might use a 1,000 pF capacitor, which would resonate with an inductor of about 4 mH at 80 kHz. If you went to a larger capacitor and smaller inductor, as you propose, you might deleteriously load the emitter follower. Your idea of a parallel-tuned trap in series with the output raises at least two problems: (a) the inductor may pick up hum; (b) a load impedance of at least 700K ohms is required to prevent appreciable low frequency loss, assuming the trap capacitor is about 0.005 μF, as you suggest.

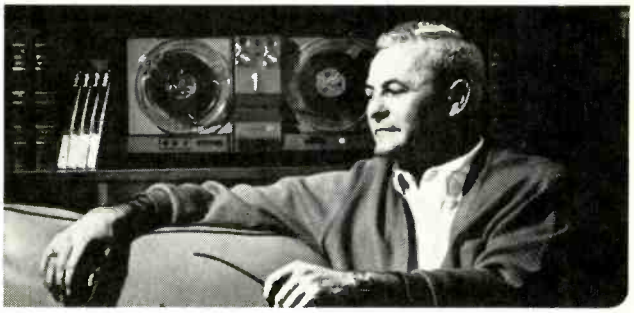
(3) I don't have the information you seek on low-noise transistors. However, from your description it doesn't seem that the first stage of the playback amplifier is the limiting factor. If it were, you would get no appreciable noise increase when comparing a "recorded" tape with virgin tape. In all, except perhaps with the very finest and most expensive of tape machines, the tape oscillator adds a few dB of noise; often more than a few. Part of the story, I believe, is in the bias frequency; some machines go well above 100 kHz to reduce oscillator noise. And part of the story is in the design of the oscillator circuit and in the quality of its components. Particularly important is the oscillator transformer; some of the best machines employ a toroidal transformer.

Better speakers for cartridge players

Q. The automobile tape cartridge players have limited frequency response. Would it be worthwhile to purchase speakers with extra large magnets?—Richard Edwards, Raleigh, No. Carolina.

A. Despite the limited frequency response of some tape cartridge machines, an investment in better speakers may be rewarding because of smoother response and lower distortion. Æ

Build a world of your own on "Scotch" Brand Dynarange® Tape.



Great moments in music . . . happy times at home and away—capture whatever sound you want to save on "Scotch" Brand "Dynarange" Recording Tape. "Dynarange" delivers true, clear, faithful reproduction across the entire sound range. Makes all music come clearer . . . cuts background noise . . . gives you fidelity you didn't know your recorder had.

And "Dynarange" saves you money, too! Delivers the same full fidelity at a slow 3¾ speed that you ordinarily expect only at 7½ ips. The result: You record twice the music per foot . . . use half as much tape . . . save 25% or more in tape costs! Lifetime silicone lubrication protects against head wear, assures smooth tape travel and extends tape life. Isn't it time you built your own private world of sound on "Scotch" Brand "Dynarange" Recording Tape?

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AUDIO, ETC.

EDWARD TATNALL CANBY

A Pitch for Portables

FIVE YEARS AGO—even two years ago—I wouldn't have believed it. That portable battery tape recording was practicable. At *any* price, except a fortune. Now it is, and cheap, too.

Thanks to long, long experience, I have always been *extremely* wary of any machine that purported to make good tapes while managing somehow to be small in size and, worse, to operate free of the power line. Size is one thing—but from the power line comes regulation. Precise, measured running speed, exactly repeatable, continuously accurate, the same whether hot or cold, new or old—this is the ONE factor in any sort of recording which simply cannot be compromised. Not, at least, beyond the thickness of a hair, so to speak.

And yet all of a sudden (in terms of hi-fi history) we now see dozens of little tape recorders, all of them tiny, all of them at prices much less than exorbitant, and every one of them defying the old power line with the most amazing ease, regulating themselves as nonchalantly as though there were no such thing as a speed problem. It's against all precedent.

Until recently *any* sort of portable tape recording was a chancy thing, even in the high-cost pro areas. I should know! (And so should you, if you've tried.) There are truly implacable built-in, inherent, obstacles in the very idea of portability in recording. Problems in all sizes. Problems over and beyond even those which are shared, at the sub-miniature level, with the transistor radio, which has been with us for so long. Radio got into the battery miniature area first because *it has no moving parts in the sound circuit*, no mechanical element. What little mechanism it does have it totally unconnected with *pitch*. That's the clincher. And it concerns every sort of tape recording, whether miniature or heavyweight.

On tape, pitch means mechanical speed stability, to an absolutely agonizing standard of exactitude. Alas, even with the power line to help we have had endless problems on this score, and they have always been worse in exchange for portability.

Think back, if you will, on the concept of tape portability over these last twenty-odd years. The problems have been basically the same. Size, bulk. And *pitch accuracy*. We've worked away at both, see-saw fashion. It took a decade to bring tape machinery down from mastodon size to a pygmy-elephant category. Small—for an elephant. And as for really accurate speed regulation, we hardly even tried—or so it would seem. It was hopeless. Instead, we played back all those variably speeded professional tapes, off the early machines, on variable-speed playback equipment, to do what we could to fix up the pitch mess after the fact. Not too successfully, either, for a long while. Just try a few of the earliest taped LP records.

Too many of our tape projects were over-optimistic, and ended up stillborn whenever they started towards portability. The tape recorder clung desperately to its only real regulator, the unsevered umbilical cord that led safely back to Big Mama—the a.c. power house.

And when our machines took to traveling, they found all sorts of strange Mamas elsewhere. 50 Hz—with luck, and more or less, plus or minus, the voltage varying freely and easily. Then, in desperation, there were those great carloads of portable Mamas. A most unhappy solution to the pitch problem; for if the "portable" generators were often accurate, they were always huge. And noisy. You didn't carry them around in your pocket. You hired station wagons, vans, lorries. You struggled through customs and permits and cables . . . enough said.

Handle on Top

In my own fashion I have had plenty of similar experience with hi-fi portability—much too much. I used to do a great deal of assorted lecturing on aspects of our noble hi-fi cause, and for those occasions I would cram my small car with the darnedest collection of "portable" equipment you ever imagined. Inevitably, when I arrived at the lecture place, there would be a quarter-mile walk and five flights of stairs between the hall and the nearest parking spot. Never failed. I scarcely remember the content of all those heady hi-fi talks. What I do remember, with relentless vividness, is every detail of the heavy haulage, right down to the last gasp.

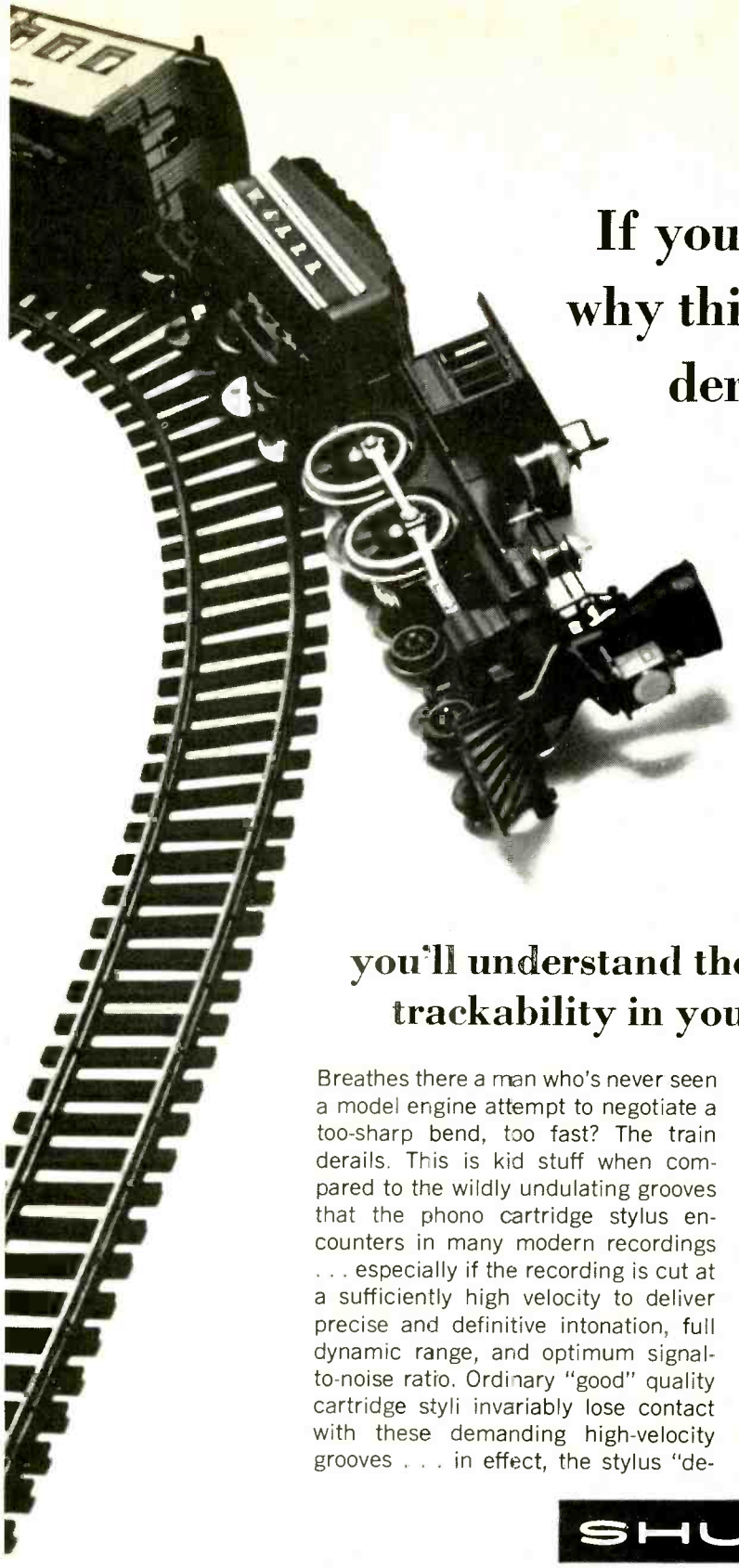
A lot of that old equipment still sits around in my cellar and attic. Some of it still is in use, my big ever-playable "portable" pro recorder, for instance, of 1955 vintage and as good as new. Portable? Why, of course! It packs into two huge black boxes and each one of them *has a handle on top*. That, alas, was the definition of "portable," as many a sadder and wiser sound engineer knows.

Don't think all this has ended (though hopefully it may, some day). I have to laugh, every so often these days, when I see some bright young engineer come zooming up for a "remote," i.e. portable, recording session, squeezed into the front seat of a monster station wagon with its tail dragging the ground, the rear solidly packed in enormous black boxes and miles of thick cabling. Still—portable, at least by definition.

So, you can see, when at last I saw and heard my first *real* portable professional tape recorder, I almost fell over in surprise. It was small. You could carry it casually over your shoulder, and no backache. It was totally free of any power line. AND it produced faithful, high-quality recordings which were accurate in pitch. It took them a good while to persuade me that, this time, the thing really did work.

It did, all right, and it still does. The machine is still tops, though in mono only. But, believe you me, it is tops at a price. If you think you'll take one along on next Sunday's picnic outing, I warn you that the Nagra is probably worth more than that car you're driving.

If these enormous difficulties had to be faced in professional recording of a portable sort, first via power lines and eventually on battery power, then what of the consumer? All in due proportion, needless to say. As a snooper who has snooped on both sides of the pro-amateur fence for as long as I can remember, I've had my moments with both pro *and* amateur taping—always with that tantalizing carrot dangling before me, the idea of really portable recording, effortless but accurate. And



If you understand why this model train derailed . . .

you'll understand the importance of high trackability in your phono cartridge

Breathes there a man who's never seen a model engine attempt to negotiate a too-sharp bend, too fast? The train derails. This is kid stuff when compared to the wildly undulating grooves that the phono cartridge stylus encounters in many modern recordings . . . especially if the recording is cut at a sufficiently high velocity to deliver precise and definitive intonation, full dynamic range, and optimum signal-to-noise ratio. Ordinary "good" quality cartridge styli invariably lose contact with these demanding high-velocity grooves . . . in effect, the stylus "derails". Increasing tracking weight to force the stylus to stay in the grooves will ruin the record. Only the Super Trackability Shure V-15 Type II Super-Track® cartridge will consistently and effectively track all the grooves in today's records at record-saving, less-than-one-gram force . . . even the cymbals, drums, orchestral bells, maracas and other difficult-to-track instruments. It will make all of your records, old and new, sound better. Independent experts who've tested the Super-Track agree.

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amateur or pro, the problems have always boiled down to the one overriding necessity—*pitch.*

Pitch

Item. My first magnetic recording experience of all, circa 1947, was with a "portable" wire recorder, which I rushed out and bought minutes after it hit the postwar market. Disastrous! That was very early in the game and in this case power-line stability did no earthly good at all. Playback pitch depended on how the wire managed to wrap itself on the take-up spool—no capstan drive. It wrapped differently at each play. Total chaos in musical terms (my main interest) and, as a matter of fact, in everything else. The pitched wavered and shook with a horrible palsy. I had that machine for about three days of agony, then junked it for a total loss.

Item. Some years later I got my first pro tape machine, a fine job but still not entirely reliable in pitch, in spite of line power and a hysteresis motor for the capstan. Even with careful adjustment, the inner segments of a 7-inch reel of tape got pulled too hard and the pitch went off. You could never edit an inner segment of tape to an outer segment. Pitch mismatch. (One reason why the standard hub on the 7-inch reel was later made larger.)

* * *

And so it is with repeated amazement that I now come to a statement which, in view of all the above, is nothing short of super-revolutionary.

Be reassured, you 1968 consumers! You may rejoice in the simple fact that right now, the basic portable tape problems *have been solved.* And even for inexpensive "home-type" battery portables. I don't yet quite believe it, but I'm going to have to.

To be sure, there are differences in performance from model to model among these new portables. Normal. But taken in the large, the formerly insuperable regulation difficulties have at last been brought under *acceptable* control, i.e. within generally acceptable limits. Why else so many new portables? Now—they satisfy.

How has this immensely improved speed accuracy been accomplished, so suddenly? Obviously, there has been, first, a convergence of technologies, many mutually aiding factors. Speed accuracy is better because of other improvements—smaller masses to move, marvelous new little mini-motors to do the moving, relatively more power available thanks to low-drain transistors, and longer-life batteries as well. But pitch is also stabilized via radical new means for the essential governing of the recorder's motion.

Now right here I must stop. For these are matters of variously complex technology, and they merit a much more detailed and professional look-see than I can give them here. But you will find one familiar principle at work—*electronics.* In place of the old, clumsy mechanical governors there is the new sort, electronic control, massless, miniaturized. A servo system, in some cases. Fantastic.

Cassettes and Cartridges

The cassette is the tape wave of the future, the first really feasible *all-purpose* enclosed tape system to fit into the mass-market consumer area. Moreover, it is truly forward-looking, and that is precisely why it seems to be lagging in some directions. It is right up in the forefront of present technology in tape terms. It uses an obviously daring new tape size—a miniature ribbon and a very thin one, too. And its tape speed is an obviously daring 1⅞ ips, which asks for trouble, but also aspires directly to the predictable tape future that we all see coming.

In contrast, the continuous-loop tape cartridges (4-track and 8-track) are successfully conservative, radical only in the one area, multi-track re-entrant endless-loop drive. The horrendous problems of friction, bending angles, feed and take-up, cross-talk and what-have-you have been neatly solved to a degree, we all admit. The things do work, miraculously well, for the most part. But the cartridge tape is the old quarter-inch size, monstrously big for the new age. The cartridge speed is the now "safe" 3¾ ips, double that of the cassette. And the cartridges themselves, finally, are huge, clumsy elephants in a day of increasing miniaturization.

Next to these monster cartridges, the cassette is a brave little mouse. With brave problems to face.

I can't help thinking, then, that the key to wider usefulness and an overall, across-the-board competitiveness in cassettes is the bottleneck of the slow-speed cassette tape itself, now pushed to its present outer limits of frequency response, distortion and background noise. (Cross talk is no real problem, probably less than in the case of the cartridges, especially 8-track. Steadiness of drive, low flutter, is also easier to achieve in the straight-line cassette drive than in the twisted and tortured endless-loop cartridge tape path.)

Thus if the new chromium tape does soon come to the cassette's rescue, as we may hope, the crucial technical corners may thereby be rounded—with that approximate 2:1 chrome advantage in vital respects over present high-quality ferrous tapes—and the cassette then may expand on its true larger and wider-range career, its real potential.

Stalling

It is only natural, you see, that as of early in 1968, and Dupont still non-committal on audio availabilities for chrome tape, we tend to find a bit of stalling on recorded (*pre*—darn it) hi-fi in cassette form. Maybe, as so often happens, the publicity departments' enthusiasm got ahead of the engineers' very proper wait-and-see. Whatever the reasoning, one surely *could* anticipate a delay. Yes?

But keep in mind that on other fronts the cassette is doin' fine. Direct or "home" recording, on the blank cassette, is booming, mostly via portable miniatures. (And if chrome comes, it'll go right into present machines for a noticeable improvement, assuming that the manufacturers have had enough foresight to provide the necessities, mainly a higher bias.)

And present cassette sound is also entirely OK for the less demanding and more remunerative background-auto market, where cassettes run head-on into cartridge competition. No real quality problem there, and chrome tape will merely offer a mostly unnoticed improvement, lost in the hazy mental background and/or the whoosh of rubber tires and wind.

* * *

Yes, I've tried present cassette sound AB'ing against continuous-loop cartridge sound, right on my living room hi-fi system. On quality-type hi-fi component equipment the cartridges I have tried do sound better than the cassette, by a certain margin. As I figure it, the cartridges *should* sound slightly better, at double the speed, though not by any whopping amount. Just a trace cleaner, shinier, quite a bit quieter in the background.

Yet, on the other hand, the cassette is infinitely preferable for all intelligent direct listening, simply because it is basically maneuverable; whereas the cartridge is decidedly not. It just plays. You just listen.

Though both cassettes and continuous-loop cartridges spell the death knell for cheap reel-to-reel machines, they cannot at this time compete with the better reel-to-reel types in performance quality; only in operating ease.

I could go further but I will wait. In due time, I expect, I'll be comparing the two systems in minute detail—when the moment seems ripe. Æ

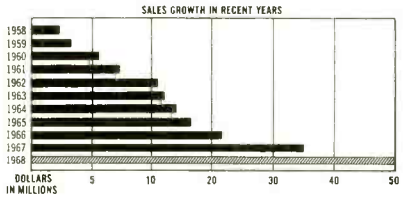
Pioneer celebrates its 30th anniversary

A History of Growth and Success.

Pioneer was founded in 1938 when only a handful of dedicated music lovers and engineers were working to bring sound reproduction to a higher level of fidelity.

Today, after 30 years of steady growth, Pioneer employs nearly 3,000 scientists, engineers, technicians, and skilled workers throughout the world, and has an annual sales volume of close to $50 million, up more than 100% in the last two years alone.

This record of achievement has made Pioneer the largest manufacturer in the world devoted exclusively to the production of high fidelity components and the world's largest producer of loudspeakers.



The secret of Pioneer's growth and diversity has always been its dedication to minute details... its meticulous craftsmanship. From the manufacture of electronic parts, or the selection of fine cabinet woods, to the precision assembly and extensive testing . . . to the final quality control, Pioneer never relaxes its vigilance in producing the finest.

The Latest Achievement Specially Priced!

To mark its 30th anniversary, Pioneer has developed **the most advanced and powerful AM-FM Stereo receiver on the market, the 170-watt SX-1500T.**

With an FET front end and four IC's in the IF section, the SX-1500T boasts a long list of superlative performance specifications.

It has an IHF sensitivity of 1.7 uv., a capture ratio of 1 dB (at 98 mc.), and harmonic distortion of less than 0.1%. The frequency response is 20 to 70,000 ± 1 dB and the power bandwidth is 15 to 70,000 Hz. With every conceivable control and input, this receiver is a cornerstone of the finest home stereo system you can own.

The few receivers with specifications comparable to the SX-1500T cost from $460 to $600. During Pioneer's anniversary celebration, the SX-1500T is being introduced at only $345.

***Also**, for the anniversary celebration, the value-packed SX-1000TA 120-watt receiver has been reduced from $360 to $299.95, without walnut cabinet, and the 40-watt SX-300T, the world's finest budget receiver, reduced from $199.95 to $179.95.*

A Promise of More to Follow.

While celebrating its 30 years of history and growth, Pioneer looks toward the future. Many of the concepts and products of tomorrow are now being developed and tested in Pioneer's advanced research laboratories; some of these concepts have already been introduced.

For example, Pioneer is leading the industry in advanced concepts of sound reproduction with bi-amplified speaker systems. The IS-80 Integrated System is a brilliant three-way acoustic suspension speaker system driven by two 45-watt (r.m.s.) power amplifiers. An electronic crossover eliminates the disadvantages common to conventional dividing networks. The result is the lowest distortion of any system on the market, and the most highly developed concept of high fidelity in the world.

In other component developments, the SC-100 preamplifier represents the ultimate state of the art for a home music system, while Pioneer speaker systems and headsets are noted for their superb sound reproduction, recreating the original sound with outstanding fidelity.

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...More Value All-Ways!

Upgrade your present system, or start off with the finest products your money can buy. Visit your dealer . . . if he doesn't have Pioneer products, it will pay you to find one who does. At Pioneer we deliver tomorrow's products . . . today!

For details on Pioneer equipment and the name of the dealer nearest you, write PIONEER ELECTRONICS U.S.A. CORP. 140 Smith Street, Farmingdale, L.I., New York 11735. Specify the type of equipment which you are interested in purchasing.

Check No. 13 on Reader Service Card

Letters

AM deviation

• In your article, "ABZ's of FM" (AUDIO, January 1968, page 14), you state that the carrier frequencies of AM broadcast stations assigned to the same channel may be several hundred cycles apart due to permitted tolerances.

Actually, the FCC regulations permit a deviation of ±20 cycles from the assigned frequency, and the state of the art is such that actual deviations are usually no more than 2 or 3 cycles. The result of the maximum deviation would not be noticeable in average quality equipment. The result of the more typical differences is a more or less rapid and regular "fading" of the stations' signals.

Aside from this minor question of the tolerances permitted, I found your article quite interesting and informative.

R. H. SMITH, JR.
Elk Grove Village, Ill.

Here is the Author's reply.—Ed.

Actually, the figure of "several hundred cycles" was by way of illustrating an effect which can take place in AM as distinguished from FM. A check on FCC regulations reveals that Mr. Smith is correct for non-modulated r.f. signals. However, under conditions of instantaneous audio modulations, two sidebands are developed. Each is removed from center frequency by a frequency equal to the audio modulation itself. Thus, two channels assigned to the same carrier frequency—even if both are properly within three cycles of each other—may well produce varying whistles or beats as each applies modulation and as this modulation provides sidebands whose *difference* equals "several hundred cycles" or even thousands of cycles, as discussed in the January 1968 issue.

LEONARD FELDMAN

Picket fence of mikes

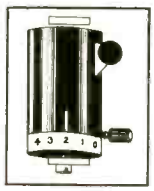
• For some time I have been bothered by the unsightly picket fence of microphones partially hiding the President and other important speakers when they are presented on television. It seems to me that some arrangement could be made whereby these mikes could be placed in a less conspicuous location or perhaps hidden by a suitably designed shield that would not detract from the dignity of the speaker.

RALPH E. EUGBERG
San Diego, Calif.

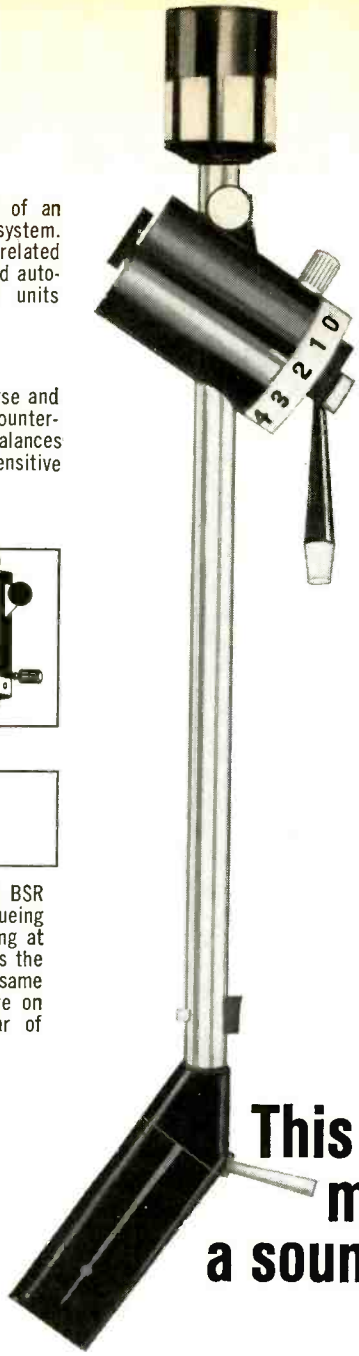
A vital determinant of the quality of an automatic turntable is the tone arm system. Here are some of the tone arm and related features that make the BSR McDonald automatic turntables the sophisticated units they are.

A resiliently mounted coarse and fine Vernier Adjustable Counterweight delicately counterbalances the tone arm assuring sensitive and accurate tracking.

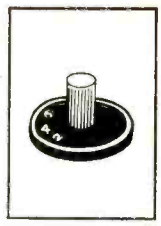
Micrometer Stylus Pressure Adjustment permits ⅓ gram settings all the way from 0 to 6 grams. This important part of the tone arm assures perfect stylus pressure in accordance with cartridge specifications.

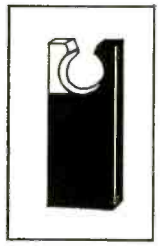


A much appreciated feature built into all BSR McDonald automatic turntables is the Cueing and Pause Control Lever. It permits pausing at any listening point and then gently permits the tone arm to be lowered into the very same groove. Positioning of the stylus anywhere on the record is accomplished without fear of damaging the record or the cartridge.



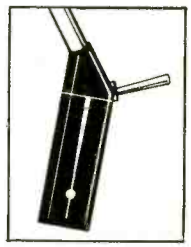
To achieve the ultimate in performance, BSR McDonald has brought to perfection the Anti-Skate Control. This adjustable dynamic control applies a continuously corrected degree of compensation as required for all groove diameters. It neutralizes inward skating force and eliminates distortion caused by unequal side wall pressure on the stylus. All of the BSR McDonald automatic turntables incorporate anti-skate.





After the last record has played on any of the three BSR McDonald automatic turntables, the tone arm automatically returns to the Locking Rest. In conjunction with this action, the On-Off-Reject lever automatically shifts into the Off position which securely locks the tone arm in its cradle to protect it from accidental drops and resulting stylus damage.

All BSR McDonald automatic turntables have a Clip-In Cartridge Head. This lightweight tone arm head, with finger lift and clip-in cartridge holder, provides universal mounting and quick change facility. It can accommodate practically every contemporary cartridge currently on the market.



This unique tone arm makes BSR McDonald a sound investment.

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ABZs of FM

LEONARD FELDMAN

FM Receiving Antennas

THERE IS, PERHAPS, no more misunderstood subject in all the world of FM than that of FM Antennas. The fault lies both with users and manufacturers of FM receiving equipment. The former, accustomed to "built in" antennas as supplied on AM equipment, have consistently resisted the need for an adequate antenna in FM applications. The latter, bowing to public pressure, have supplied all manner of makeshift "indoor" antennas, from a short length of wire to capacitive coupling to the power cord, to a T-shaped piece of 300-ohm twin-lead that is optimistically called a "dipole-FM-antenna."

Before discussing individual types of antennas for FM use, some fundamental facts must be established. First, FM transmission is basically a "line-of-sight" operation, much like TV. The so-called "ionosphere," responsible for long distance reception of medium and "short-wave" transmissions, is virtually useless in the VHF region associated with FM and TV transmission. On the basis of this fact, a formula can be derived for approximate range of transmission, considering only the fact that the horizon limits the distance. In simplified form, the formula boils down to:

$$d = 1.23 (\sqrt{h}),$$

where "d" is distance in miles and "h" is the height of transmitting tower. Typically, then, a transmitting tower of 1000 ft. height will have a "visibility distance" to the horizon of approximately 40 miles. The above formula assumes that the receiver is at "ground level." It has been found, however, that signals are received beyond the horizon, to some extent. This phenomenon is explained by two causes: refraction in the lower atmosphere and diffraction of the electromagnetic waves by the surface of the earth at the horizon. A good approximation of this added range may be obtained by modifying the above formula to read: $d = 1.41 \sqrt{h}$, so that our 1000 ft. transmitter tower might now be expected to cause reception at distances of approximately 45 miles, still at ground level. If the receiving antenna is also located above ground level, however, the range can be further increased. The new formula for this case becomes: $d = 1.41 (\sqrt{h_t} + \sqrt{h_r})$, where "$h_t$" is transmitter tower height and "h_r" is the receiving antenna's height.

Here we see one of the reasons why an outdoor roof antenna is inherently a better arrangement than the same antenna placed "under the rug" at ground level. In the example previously cited, an apartment house dweller able to mount his receiving antenna at a height of 100 ft. might be expected to increase basic range of FM reception (at a given signal strength) from 45 miles to approximately 59 miles!

Of course, many other factors are involved in selecting the *type* of antenna to be used, and these cannot be generalized but must be evaluated in terms of individual needs.

Half-wave folded dipole

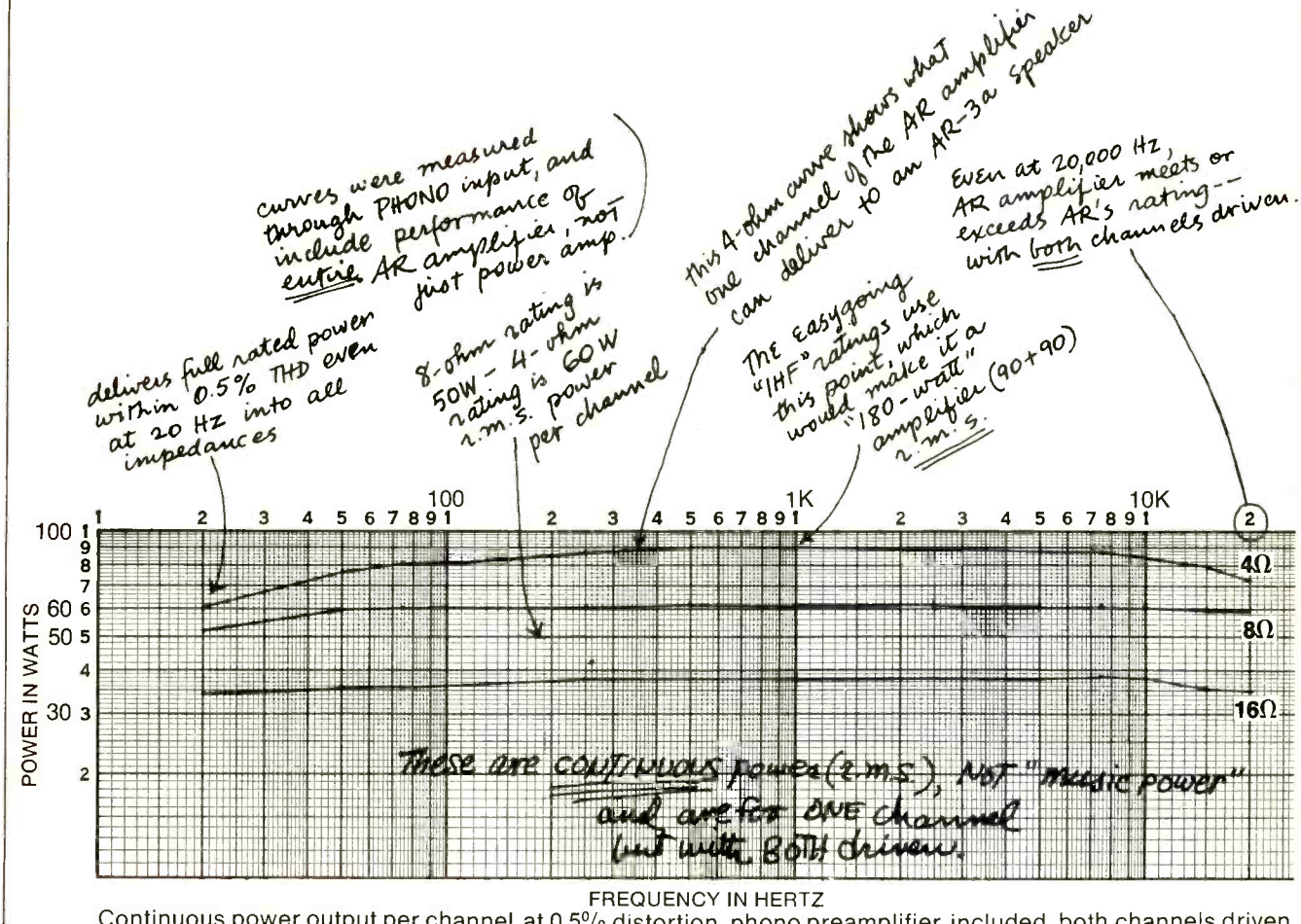
Perhaps the most popular type of antenna used for FM reception is the half-wave dipole. As shown in Fig. 1, it strongly resembles the early, popular TV antennas. For this reason, perhaps, many FM listeners couple their FM sets right to their previously installed TV antennas. This practice, while better than most "indoor" arrangements, is deficient in two very important respects. For one thing, the long dipole element of a TV antenna is usually cut to a frequency of around 50 or 60 MHz. To compute the length of a half-wave antenna, the following formula is used: $L_{ft} = 468/f$ in MHz. Thus, the TV antenna is probably about 8 ft. long, whereas a properly cut FM antenna, tuned to mid-band of about 100 MHz, should be 4.68 ft. long.

An antenna will exhibit greatest gain at or near its resonant frequency. Too, the simultaneous use of a TV antenna for TV and FM results in a mis-match and consequent reduction in available signal strength at the FM antenna terminals of the receiver. If a proper two-set coupler is used, the mis-match is less severe, but some attenuation of available signal still occurs.

As for the characteristics of the standard half-wave folded dipole shown in Fig. 1, it has a bi-directional receiving pattern. That is, it receives signals from stations that are perpendicular to the bars either from front or back. In the days of monophonic FM, it was considered adequate for signals up to about 30 miles away. Unfortunately, stereo FM is much more demanding and critical than is mono. For one thing, it takes about *five times* the signal strength for noise-free reception

(Continued on page 62)

What does AR mean, "60 watts per channel"?



Continuous power output per channel at 0.5% distortion, phono preamplifier included, both channels driven

One of the most important characteristics of an amplifier is its power output. Consumers might therefore expect this measurement to be presented clearly and accurately in amplifier advertising. This has not been the case. In recent years, a variety of vague and irrelevant terms has been used by manufacturers to describe power output: music power, solid-state power, stereo power, audio power, transient power, transistor power, IHF power and others. The list includes terms invented by manufacturers and applied to their products alone, as well as standards of measurement known only to advertising copy writers. In a recent issue of High Fidelity, for example, 18 manufacturers advertised amplifiers, but in only two cases were power ratings referred to a known standard.

Acoustic Research accepts the definition of a watt given in physics texts: work done at the rate of 0.7375 ft.-lb./second. We know of no "music watt" or "IHF watt" which science recognizes. AR amplifiers are rated exactly as we measure them, with both channels continuously delivering at least the rated power without exceeding our harmonic distortion limit of 0.5%, or our I.M. distortion limit of 0.25%. The laws of physics and the nature of music require that power measurements, if they are to be meaningful, be made with a steady, uninterrupted tone, similar to the purest sound of a pipe organ; this is what continuous power means. AR amplifiers must deliver their rated continuous power at all frequencies to which the ear responds, not just at 1,000 Hz, where most amplifiers can deliver much more power than at the extremes of the range of hearing. Distortion measurements are made through the AR amplifier's phono input because this is the way music goes through the amplifier — even though performance might be better with the preamplifier out of the circuit.

For these reasons, the power output rating of the AR amplifier is true for any kind of musical tone, not only those easy for an amplifier to reproduce, whether the source is an FM broadcast, a tape recording or a phonograph record.

The AR amplifier is covered by a guarantee unmatched in the industry. If an AR amplifier fails to operate as advertised within 2 years of the date of purchase because of a factory defect, AR provides parts, labor, freight both to and from the factory or nearest authorized service station, and even a new carton if necessary — all with no charge.

AR INC.

Acoustic Research, Inc.
24 Thorndike St.
Cambridge, Mass. 02141

EDITOR'S REVIEW

Audio adds columnists

We're pleased to announce that Bert Whyte and Stuart Triff have joined AUDIO Magazine as regular editorial contributors.

Bert Whyte will write a column, "Behind the Scenes," where he will explore every facet of professional and consumer recording and playback equipment and applications. In addition, he will review pre-recorded tapes. Bringing many years of experience as writer-critic-artist and repertoire director to his new post, he combines a fine knowledge of both music and technical know-how. Expect an informative, inside view of present and new developments.

Stuart Triff, Director of Light Music for the prestigious New York AM-FM radio station, WQXR, will be responsible for selecting and reviewing important new record releases for AUDIO's "Light Listening" music department. He studied composition, orchestration and conducting at New York University, earning a B.A. in Music, as well as doing post-graduate work in musical composition. Presently working on a comprehensive reference book devoted to the work of American show and film composers, his music knowledgeability and day-to-day work, which includes acquisition of new recordings for WQXR, will no doubt be invaluable in guiding readers in their selection of "popular" records. (He replaces Chester Santon, who, after seven years at the "Light Listening" helm, wished to spend leisure hours with his grandchildren.)

Awards for FM broadcast excellence

Eight FM radio stations were presented "Major" Armstrong awards (named for the inventor of FM) for excellence in FM broadcasting.

Award-winning commercial FM stations were: WGMS, Washington, D. C. (musical programming); WTOA-FM, Trenton, N. J. (news programming); WFIL-FM, Philadelphia, Pa. (educational programming); and WGH-FM, Newport News, Va. (public service programming). Noncommercial FM stations winning first-place awards were: WAMU, Washington, D. C. (musical programming); WBAI, New York City (news programming); WHA-FM, Madison, Wisc. (public service programming); and WFCR, Amherst, Mass. (educational programming).

Approximately 10 per cent of the FM stations in the United States entered taped programs in the 1967 contest. The contest was established in 1964.

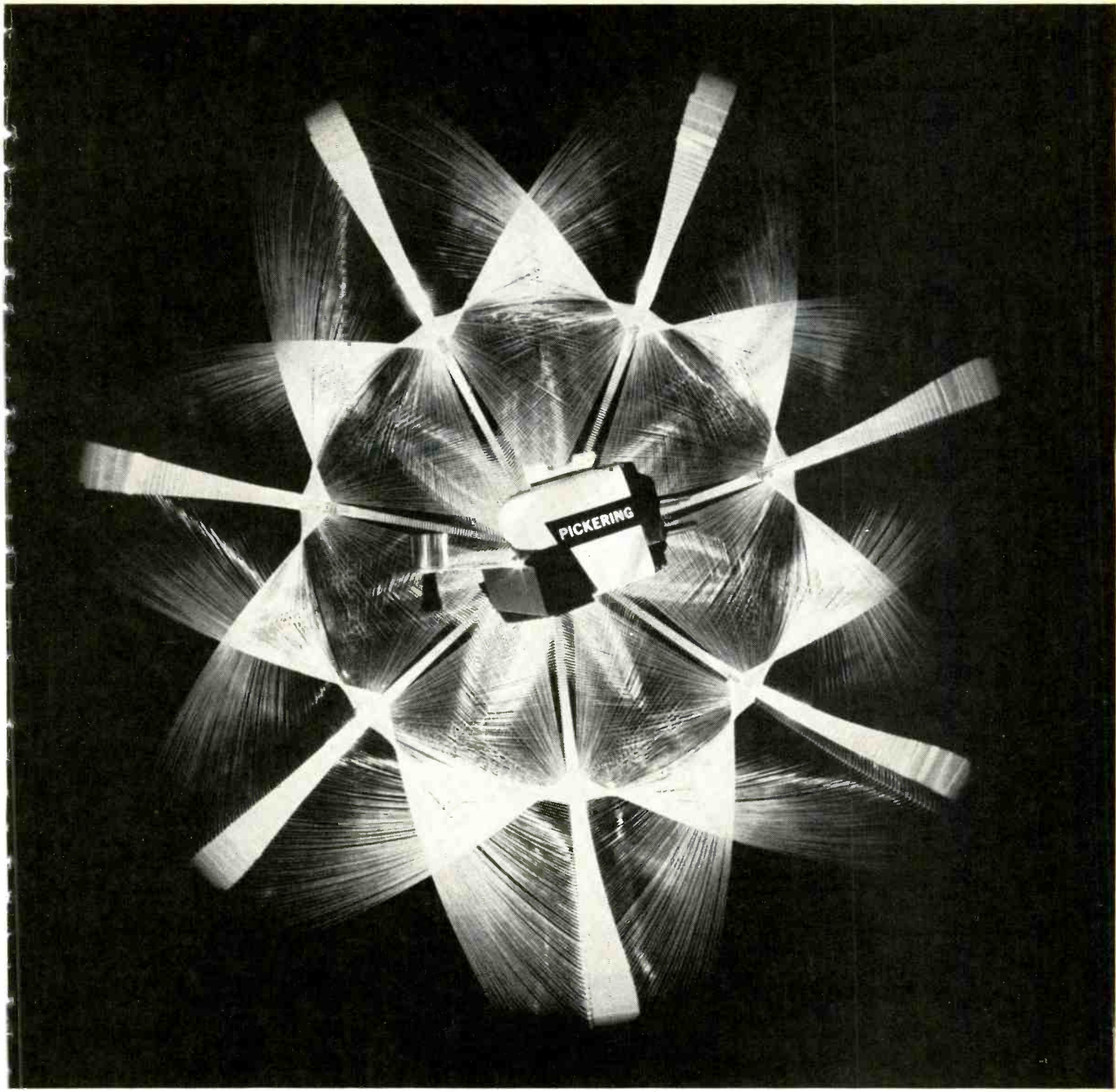
Free sound-effects catalog

Ever search for a recorded sound effect—an airline jet taking off, ladies giggling, and so on—only to dismiss the quest as being too troublesome? Well, there's a free catalog available that lists sound effects alphabetically so that it's easy to select the one you want quickly: *Major* Sound-Effects Catalog, 150 West 46th St., New York, N. Y. 10036.

The company sells sound-effect recordings, of course, making them available in three formats: 12-in. LP record, ¼-in. full-track tape, and 16-mm and 35-mm magnetic tape for motion picture and filmstrip equipment. But, again, the catalog is free.

A.P.S.

The X factor in the new Pickering XV-15.



The X in the new Pickering XV-15 stands for the numerical solution for correct "Engineered Application." We call it the Dynamic Coupling Factor (DCF).[SM]

DCF is an index of maximum stylus performance when a cartridge is related to a particular type of playback equipment. This resultant number is derived from a Dimensional Analysis of all the parameters involved.

For an ordinary record changer, the DCF is 100. For a transcription quality tonearm the DCF is 400. Like other complex engineering problems, such as the egg, the end result can be presented quite simply. So can the superior performance of the XV-15 series. Its linear response assures 100% music power at all frequencies.

Lab measurements aside, this means all your favorite records, not just test records, will sound much cleaner and more open than ever before.

All five DCF-rated XV-15 models include the patented V-Guard stylus assembly and the Dustamatic brush.

For free literature, write to Pickering & Co., Plainview, L.I., N.Y.

[SM] Dynamic Coupling Factor and DCF are service marks of Pickering & Co.

Check No. 19 on Reader Service Card

Sherwood

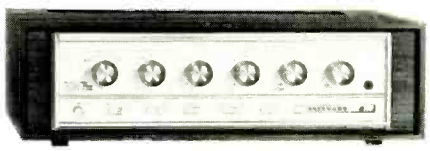
the low-distortion tuner

We are proud that Sherwood FM tuners were selected because of their low distortion by America's foremost heart-transplant pioneers to receive telemetered EKG data in their critical research programs.

Hirsch-Houck Laboratories evaluates the 0.15% distortion Sherwood tuner shown above as follows: "The tuner has a usable sensitivity of 1.8 microvolts, with an ultimate distortion level of -48 db. This is just about as low as we have ever measured on an FM tuner, . . ."*

The S-3300 features our unique Synchro-Phase FM Limiter and Detector with micro-circuitry, field-effect transistors, a stereo noise filter (which does not affect frequency response), and of course, only 0.15% distortion at 100% modulation. *Less case - $197.50*

* Electronic World, Oct., 1967



Amplifiers and speaker systems

best suited for low-distortion tuners!

Sherwood offers three low-distortion amplifiers precisely suited for your needs–led by the Model S-9000a with 160 watts music power (at 8 ohms). The 140-watt S-9900a and the 80-watt S-9500b feature main and/or remote stereo speaker switching and separate terminals for monophonic center channel or extension speakers. All feature 0.1% distortion at normal listening levels. *Prices from $189.50 to $309.50.*

Our acoustic-suspension loudspeaker systems were designed to reproduce music with minimum distortion and coloration. You can hear the difference low distortion makes. Hear Sherwood's low-distortion Tanglewood, Ravinia, Berkshire, and Newport at your dealer–then take a pair home for a no-obligation trial. *Prices from $84.50 to $219.50.*

SHERWOOD ELECTRONIC LABORATORIES, INC.
4300 North California Avenue, Chicago, Illinois 60618

Write dept. A-5

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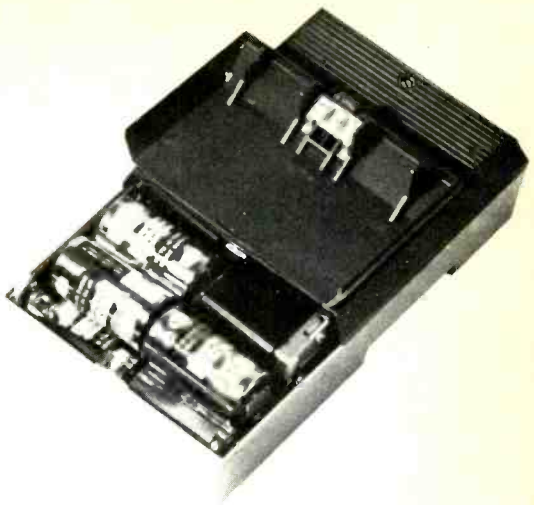
Batteries for Tape Recorders

WALTER SALM

A guide to selecting the right battery to power your portable tape recorder



BATTERY DEVELOPMENTS are keeping pace with the remarkable design innovations in modern battery-operated tape recorders. Many recorders on the market today are, in fact, designed around battery power supplies. Some transistorized portable tape recorders (are there any other kind now?) specify regular flashlight batteries, whether penlight, "C" or "D" cell; others may recommendt alkaline, nickel cadmium, even a storage battery.

What are the main considerations in choosing a battery? First of all, the nominal output voltage. If the equipment you are using demands a 1.5-volt source, then you're obviously limited to carbon-zinc and alkaline types. Another factor is the power density or the number of ampere-hours of energy that the battery can deliver before it becomes exhausted. There is no hard and fast rule for evaluating this ampere-hour rating; different manufacturers have different ways of specifying it. For that matter, the same firm may use various measuring techniques for different types of batteries. One rule of thumb: alkalines have higher power density than carbon-zincs (and mercury batteries have more power density than alkalines).

Another important factor is the battery's shelf life. Shelf life refers to the length of time that a battery can sit unused on the shelf or in storage before losing its electrical properties. Since the battery produces energy by chemical change, a certain amount of chemical deterioration occurs constantly in the battery even when it's not being used. Thus, if a battery has been sitting on the shelf for a year before it's put into operation, it has that much less usable operating life left. This factor also militates against the use of imported batteries of uncertain origin. The economy of buying off-brand foreign batteries goes out the window when the battery fails after a very short time because it spent so much of its shelf life sitting in a ship's bottom and in warehouses. Well-known foreign brands can be used almost interchangeably with domestic brands, of course, provided they're purchased from reputable dealers who keep fresh stock on hand.

A closer look

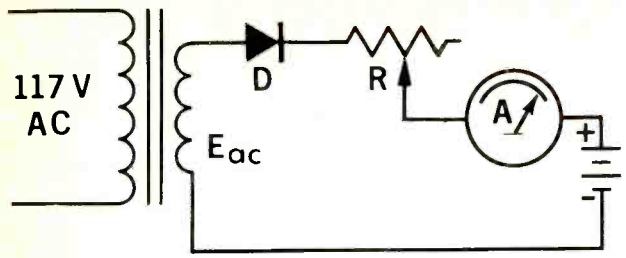
The voltage available at a battery's terminal is determined by the chemical composition of the battery. The carbon-zinc cell provides a nominal 1.5 volts. If more voltage is needed, several cells can be connected in series. The 9-volt transistor battery is actually six miniature carbon-zinc cells stacked together inside a single case.

The amount of current that a battery can deliver depends on its physical size and its chemical composition. Naturally, the miniscule 9-volt transistor radio battery can't deliver an appreciable amount of current during its operating life. Devices requiring a 9-volt battery at higher currents must use larger size batteries or much more efficient (and more expensive) ones. The method that's commonly used in today's tape recorders is several C or D cells connected in series.

► **The best-known type is the carbon-zinc** (sometimes called the Lechanché battery, after its inventor). This is the basic battery that you buy for your flashlight and for your tape recorder. The outer shell is a zinc can which is also the negative electrode. In the center is a carbon rod, and the area in between is filled with an electrolyte paste. This paste must be very moist—almost liquid—for the battery to operate, but since the entire thing is sealed in the zinc can and there's no liquid apparent, it's commonly called a dry battery or dry cell. This term differentiates it from the well-known wet-cell or rechargeable battery in your car. There's another distinction here also—the zinc-carbon battery is called a primary battery, meaning that it's not designed to be recharged and reused. There are several schools of thought on recharging primary batteries, and we'll have a closer look at this a little later.

The size C cell is most commonly used because of its smaller physical size and the fact that it still has a fairly high ampere-hour rating (the amount of usable current a battery will deliver during its operatnig life). The penlight or AA size cell generally is not used in battery tape recorders unless it's in a separate circuit for the transistor circuits only. Some battery tape recorders may use the miniature 9-volt battery in combination with the larger C cells. When you go to buy batteries for your brand-new tape recorder, try to keep in mind some kind of score card that tells you which battery is which.

► Next to the carbon-zinc, the most commonly used is the **alkaline battery.** This type has one great virtue—its



The transformer-powered battery-charging circuit shown here uses a silicon rectifier for half-wave charging. No filtering is needed in charging circuits for nickel-cadmium batteries, but the transformer provides appropriate voltage levels along with the safety of isolation from the a.c. power line.

Typically, when charging a single cell, such as a size D with a 1.0 ampere-hour capacity, charging current should be 100 mA for a period of 13 to 15 hours for the battery to reach full charge. For such a charge cycle, the transformer can be an ordinary filament-type with $E_{a.c.}$ (voltage at the secondary) at 6.3 volts a.c. The rectifier, D, should have a minimum rating of 0.75 ampere and 200-volts PIV. The limiting resistor, R, should be 22 ohms at 1 watt. To provide precise current level, R should be variable (or adjustable) and an ammeter should be wired in series with the circuit.

The same circuit and values can be used for two AA size cells in series—their capacity is 0.5 ampere-hour each, and recommended charging current is 50 mA for the same period. R may have to be adjusted, since the cell's internal resistances may not halve the charging current flow; an ammeter should be used in the circuit, as shown.

long operating life. If you believe the advertising claims, the alkaline will deliver 10 to 20 times as much power as a standard carbon-zinc battery. What it *will* do is deliver at least *twice* as much total energy, but not much more than that. One transistor tape recorder that we use quite a bit gulps carbon-zinc batteries like canapés at a 6 p.m. cocktail party. A set of alkalines in the same machine will last a good six months, and that recorder gets some awfully rough use. As opposed to the 25-cent list price for the carbon-zinc batteries, the alkalines sell for about 60 cents, and they are well worth it. Mother Nature has been very kind to us with the manganese alkaline also, since this battery's nominal voltage is 1.5 volts—exactly the same as the zinc carbon's.

Like the carbon-zinc battery, this type has a zinc anode of large surface area (near the center of the cell). The cathode (negative or electron surplus source) is manganese dioxide and the electrolyte is potassium-hydroxide. The major difference between the alkaline and the Leclanché cell is the highly alkaline electrolyte.

► Another type of battery that is becoming more and more popular is the **mercury cell**. This is an expensive and specialized type of battery that can provide very long working life along with some very desirable discharge charactertistics. Unlike the carbon-zinc and the alkaline, which provide less and less useful voltage as they near the end of their life span, the mercury cell maintains its full rated voltage until just before it's ready to fail; then the voltage drops off very sharply and the cell has expired. This characteristic is both good and bad. It's good because it provides its rated voltage of 1.34 volts right up to the very end of the battery's life. It's bad because there's no previous warning that the battery may be about to expire. At least with the other two types of cells, a battery indicator will show you that the battery's condition is deteriorating and it should be replaced very soon. A mercury cell can even start to corrode while delivering full rated power, and all the while oxide deposits are building up on the battery holder's contacts.

Another problem with the mercury battery is that its nominal voltage is 1.34 volts. This means that equipment designed around the Leclanché cell's 1.5 volts may not function properly with mercury batteries. Also, the potential operating economy of a mercury battery may not be as significant as it is with the alkaline type.

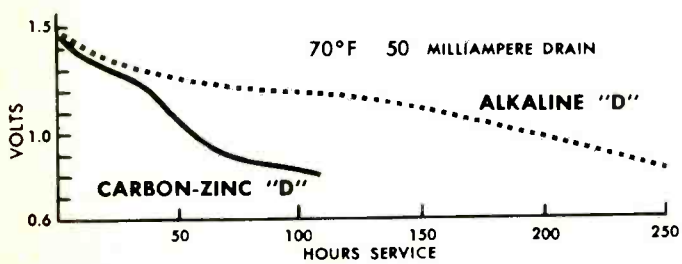
► **The rechargeable or secondary battery** has had a fast and well-earned success in the last half-dozen years or so. The vastly improved and refined nickel-cadmium battery has had an impact on many industries. You probably have some nickel-cadmium-powered devices in your home right now. These could include electronic flashguns, battery-powered toothbrushes, and other rechargeable battery appliances.

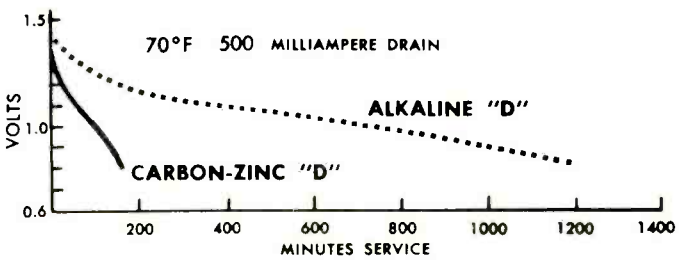
Most nickel-cadmium battery manufacturers will tell you that their cells cannot be overcharged. This is pretty much true. The gas (oxygen) formation from any excess charging that would normally rupture other types of cells is absorbed chemically as quickly as it's formed.

In the full-charged state, the positive electrode of a nickel cadmium cell is nickelic hydroxide. The negative electrode is the metal cadmium, and the electrolyte is potassium hydroxide. A fully charged cell provides about

(Continued on page 57)

E95 "D"-SIZE ALKALINE CELL VS. "D"-SIZE CARBON-ZINC CELL





Buyer's Guide to Outdoor Hi-Fi / *Battery-Powered Tape Recorders*

AL FANNING

BATTERY-OPERATED tape recorders have been around for some time. But having a portable power supply isn't the only thing that makes them so attractive. Today's portable recorders combine battery operation with light weight, relatively low cost, reasonably good sound quality, and a host of operating features and accessories which add to their flexibility.

There are probably some 100 or so tape recorders that fall into the above category. Some representative models are shown here to give you an idea of features that are generally available in different price categories.

With prices ranging from the $20s to $1,000 or so, weights from not much more than one pound to 16 pounds, not to mention different tape formats, it's no wonder that audio fans facing a buying decision are bewildered. What's good for one purpose may not be satisfactory for another, so let us explore some important considerations.

Before we do, however, you should be aware of some general facts surrounding battery-powered tape recorders. They differ from a-c tape recorders in a few important respects. Aside from employing a different power source (some "battery" recorders can also operate on standard a-c power lines), small d-c motors are used instead of a-c motors. In general, the d-c motors are less powerful. In one respect the lower power of a d-c motor works in its favor. It's less likely to develop the high torque which could, with poorly designed transport systems, cause some of the very thin polyethylene magnetic tape on the market to be stretched.

You must be sure to check the condition of batteries (battery-powered recorders generally incorporate a battery-condition indicator) before recording is started. If batteries are weak, the d.c. motor will rotate too slowly, impairing fidelity when played back on another machine.

With few exceptions, battery-powered tape recorders are *not* stereophonic types. They are usually monophonic, two-track machines. The reason for this is obvious: it's almost impossible to set up stereo microphones properly during most "live" recording situations you are likely to encounter.

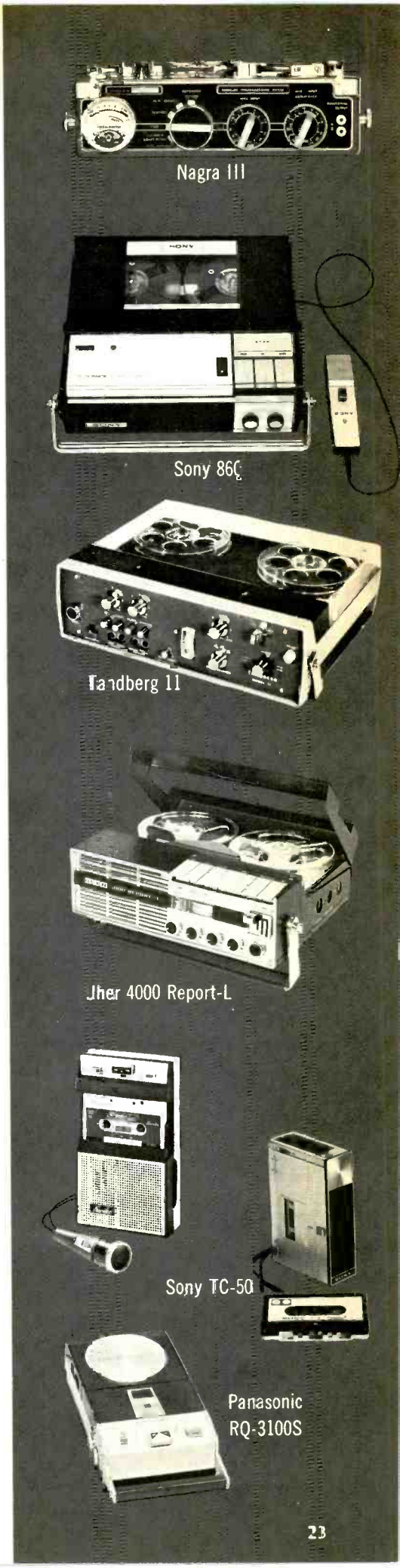
Sound quality

There are some inescapable decisions you'll have to make when buying a battery-powered tape recorder. Much depends on what you wish to record.

For example, if your prime recording target is capturing "live" music performances, to be played back on a tape machine through a high-quality stereo system, you should set your sights on a machine that can make musically-faithful recordings for an extended period of recording time.

This would eliminate a large number of battery-powered recorders right off the bat. Tape recorders that operate with up to 5-in. or 7-in. tape reels, the largest ones available on battery-powered recorders, would be most desirable in this instance. How about recording fidelity? Without doubt, select one with the highest speed possible. Tops in this case is 7½ inches-per-second (except for some very expensive professional machines which feature a 15 ips speed). The lowest speed you should choose if good music-recording fidelity is your aim is 3¾ ips. Consequently, this eliminates all the 1⅞ ips recorders from your list. And at this moment, bypasses cassette recorders, which will be discussed later.

Beyond the above, there are other factors which can be used to narrow your choice. For example, if you plan to play the tapes on a top-quality tape deck and stereo system at home after recording on a battery unit, you should consider the portable's speed-control characteristics. As mentioned earlier, don't forget



that batteries run down. As a result your motor could slow down progressively as battery strength diminishes. Some battery-powered tape recorders are designed with elaborate circuitry to maintain steady tape speed in face of weakening batteries. The Nagra ($1135), Tandberg 11 ($599) and Martel's Uher 4000 Report-L ($310)—parenthetical prices do not include accessories—have elaborate circuitry for this purpose alone, accounting in part for their relatively high cost. Sony/Superscope's model 800 ($199.50) and model 860 ($159.50) feature a "ServoControl" motor to correct, electronically, speed variations. Precise timing accuracy is the important goal.

Some of these fine units include provisions for obtaining power from a.c. power lines (prolonging battery life when a.c. outlets are convenient to use); some have extra convenience features such as automatic volume control for recording function, voice sync for slide projectors, monitoring facilities, etc.

Observe that you're trading off three things to gain *high* fidelity—size, weight, money.

It's obvious that you need a larger machine if you're to accommodate 5-in. reels as contrasted to a machine that handles, say, 2⅜-in. reels. More sophisticated recording and playback circuits, transport systems, etc., all contribute to increased size. By the same token, weight is increased accordingly.

Few battery-powered tape recorders incorporate audio amplifiers that can even be considered fair from a wide frequency range, high-fidelity view. But this makes sense. If it were otherwise, they wouldn't be portable, would they, unless you were an experienced furniture mover? The point here is: don't expect to learn all about a machine's recording ability by playing it back on its self-contained amplifier. Play it back on a better audio amplifier, preferably a hi-fi one.

There is a meaningful test you can make, even on the machine's own amplifier. A reasonable evaluation concerning the unit's signal-to-noise ratio can be made, for example. That is, are weak signals obscured by noise. To do this, talk into the machine's mike from a close distance, move farther back and speak at the same level, turn your back to the recorder and talk. Try this on a few different models and you'll be surprised at the difference in sound quality you'll note. Also, the old trick of jingling keys can give you some idea of a machine's ability to reproduce sounds with realism.

Cassette machines

If recording voice rather than music is your principal reason for yearning for a battery-powered tape recorder, you can lower your sights considerably. The frequency response need not be as wide, the signal-to-noise ratio not as great. If you're planning to record lectures in school or other voice recordings that might require pickup at some distance, however, don't go too low on the fidelity scale or you'll be sadly disappointed.

Should your prime reason for getting a battery-powered tape recorder be simply to record an occasional gooh! gah! of the new baby, to improve your speech privately, or a similar limited frequency-response use, the lighter, smaller, less expensive recorders could well be your dish of tea. These generally use a recording speed of 1⅞ ips or 1⅞ ips and 3¾ ips. But speed alone is no criterion because there are lightweight, low-speed tape machines that exhibit remarkably good fidelity. The choice here would be between cheap units (say, $29.95 or so) for limited voice recording or better machines that are sturdier and can do a passable job with music, too.

The 1⅞-ips open-reel machines are fast falling by the wayside due to the operating simplicity and small size offered by cassette machines (which also operate at 1⅞ ips, though with ⅛-in. magnetic tape as compared to the ¼-in. width of open-reels). About the only advantage left for the low-speed, open-reel types is the possibility of editing tape. And if this is desirable, a ma-

Battery-Powered Tape Recorder Sampler

MODEL	TRACKS	HEAD	SPEED	REEL SIZE(max.)	BATTERY	AC	SIZE (in.)	WEIGHT	SPECIAL FEATURES	PRICE
High-Quality Open-Reel										
Nagra III	1	3	15-7½-3¾	7″	12 "D"	—	14x9½x4½	13¼ lbs	Self-contained monitor amplifier/speaker, "Neopilot" sync accessory, electronic-speed control	$1132.00
Sony 860	2	2	7½-3¾-1⅞	5″	8 "D"	Yes	12½x10¼x4½	13	Servo-control motor, auto - record - level control	$149.50
Tandberg 11	2 or 1	3	7½-3¾-1⅞	7″	10 "D"	Adaptor	13x10x4	7	Movie-sync pilot accessory, electronic-speed control	$595.00
Uher 4000-L	2	2	7½-3¾-1⅞-15/16	5″	5 "D" or Recharg. Battery	Adaptor (incl.)	11x9x3½	7	Electronic speed control	$440.00 w/basic accessory group
Cassette										
Norelco 150	2	2	1⅞	Cassette	5 "C"	Adaptor	7⅞x4½x2¼	3 lbs	Remote start-stop	$64.50
Panasonic RQ 3100S	2	2	1⅞	Cassette	5 "C"	Adaptor (incl.)	9¼x4½x2¼	3¼	Remote start-stop	$69.95
Sony TC-50	2	2	1⅞	Cassette	4 "AA"	No	5½x3½x1½	1.3	Built - in spkr - micr., auto record control	<$125.00

chine that features a 3¾-ips speed and additional features such as a digital counter would be preferable to a 1⅞-ips open-reel recorder.

Cassette machines, through employment of the "Philips" cassette, which measures only 4-in. x 2½-in. x 7/16-in., can be made more compact than open-reel types can. A Sony TC-50, for example, measures only 5½-in. x 3½-in. x 1½-in., small enough to fit into a coat or jacket pocket. Yet it can provide a full 90 minutes of record/play time on a single cassette (120 minutes with an ultra-thin magnetic tape available in cassette format). True, the degree of fidelity obtained with a 1⅞-ips speed on ⅛-in. tape cannot equal higher-speed open-reel types, nor can editing facilities or a digital counter be counted as features. Compactness and simple operation combine, nevertheless, to make cassette machines immensely popular.

Accessories

An enticing innovation available with some of the low-cost units as well as with higher-priced ones is a voice-activated accessory. With this accessory, the machine doesn't operate (and use up tape recording "silence") unless a certain sound level value reaches the microphone. Of particular usefulness to recordists on the move is the automatic-volume-control system incorporated into some units. With this provision, your subject can move away and the machine will automatically increase in sensitivity so that the voice will not die away. It's like a magic hand on the volume control. Of course, there's a finite time for this to operate, so a defeat switch is preferable in case you want top fidelity on the first syllable.

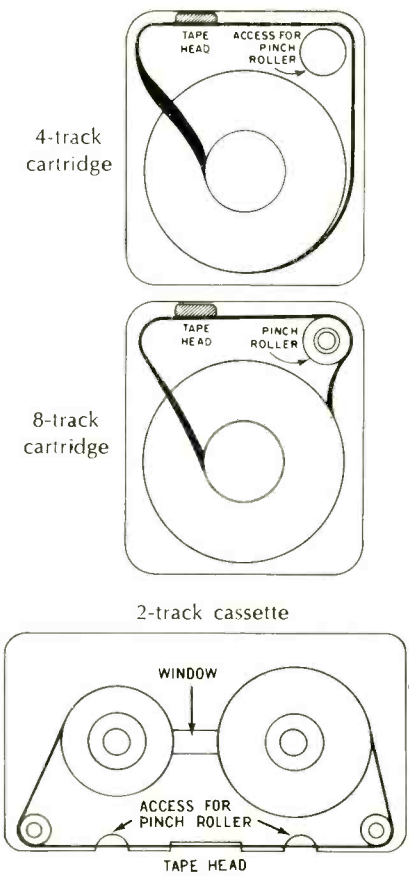
In essence, you get what you pay for. The important thing is to be able to determine what you want and shoot for those features, be it high fidelity, long playing time, light weight, a.c.-power provision, or convenience features. Somewhere, you must make a compromise, whether it's for greater size and weight, lower fidelity, or some other trade off. One thing for sure, though, you'll open up a new world of recording enjoyment with a battery-powered tape machine that is simply beyond the scope of an a.c.-only machine. Æ

Tape Cartridges/Cassettes For Auto & Home

EIGHT-TRACK continuous-loop tape cartridges burst upon the audio scene with considerable fanfare a few years ago. The Ford Company began an intensive advertising program which featured cartridge tape machines in its automobiles. RCA Victor promoted cartridge tapes which featured popular artists and latest "hits."

Even before the "Big Boys" got into the act, however, 4-track cartridge tape players were moving along at a brisk pace, thanks largely to the promotional efforts of Earl "Madman" Muntz on the West Coast. So based on this success, it was clear that the potential for cartridge players and cartridge tapes was great. Both cartridge types operate at 3¾-ips speeds.

Cassette machines, followed by pre-recorded cassette tapes, entered the picture later. If you attended some IHF-sponsored hi-fi shows, you no doubt witnessed Norelco's "Car Mount" for converting their cassette machine for auto use. However, cassette machines used for this purpose display a major drawback: the two-track 1⅞-ips cassettes must be flipped by hand to play a second side or rewound to play a side's selections all over again. Now, however, there is competition on the horizon which can negate this disadvantage. It is called the "Staar" system, which is an adaptation of the Philips-type cassette for auto use.



The new system, developed in Belgium, is said to enable a Philips-type cassette to play both sides automatically, without requiring the user to turn over the cartridge manually. Eleven Japanese manufacturers have already been licensed to manufacture Philips-type cassette machines with the novel system, reports indicate.

Before we continue further, let's be sure that we're all talking about the same cartridge tapes. The so-called auto cartridge tapes (a misnomer, really, because home cartridge players are available) are pre-recorded tapes which do away with separate supply reels and feed reels. Cartridge tapes employ a continuous loop system: magnetic tape feeds from the center of the reel, passes a tape head, and rewinds on the outside winding of the same reel.

Advantages of such a system are immediately apparent. In one swoop, you eliminate fumbling with a tape end to rethread it on a spool. Encased in a small, flat plastic package, the cartridge tape is therefore easy to handle. Four-track and 8-track cartridge units do not offer recording facilities in a compact package yet, so they take a back seat to cassette players in this respect.

The cassette system is a miniature reel-to-reel system encased in a cartridge. Therefore, it was simple to include fast-forward and rewind, functions which are lacking in the continuous-loop units due to mechanical difficulties encountered in its design. And cassette machines can provide recording facilities just as easily as open-reel types can (initial Staar system auto machines are reported to be play-only units).

At this writing, it appears that cartridge systems and cassette systems will live side by side, each refining its respective characteristics. Æ

Speakers for Outdoor Music

YOU CAN TAKE any loudspeaker system(s) and place it outdoors. But the open-air setting doesn't make it an "outdoor" speaker. To qualify, it must be weatherproof, if not waterproof.

The elements can play havoc with a speaker system not designed to stand up to them. (You'd be surprised at what heavy rainfall does to wood veneer.) That's why a host of speaker manufacturers produce speaker systems made specially for outdoor use and, in some cases, for underwater use.

You'll probably need more power outdoors than you would indoors because the wide open spaces soak up considerable sound. Bass response falls off outdoors, too. But the same holds true for "live" orchestras playing outdoor concerts, so don't let this discourage you. Another shortcoming of outdoor listening is a loss of stereo effect due to a relative lack of reverberation.

Your outdoor speakers can be used in a number of ways: connected to an indoor system, hooked into a portable radio to substitute for a tiny built-in speaker, or as part of a portable phono system. And nothing stops you from using outdoor speakers indoors, as extension speakers, when the swallows leave Capistrano.

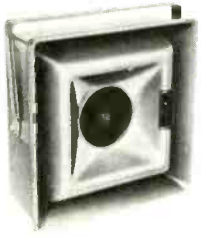
Insofar as underwater speakers are concerned, sound travels very well in this environment. Though using speakers designed for the purpose, you must still remember that there's a limit to the depth in which underwater speakers can be immersed without losing considerable fidelity because water pressure prevents the cone from moving back and forth properly. Some reasonably priced units, however, can operate satisfactorily in a depth of well over 10 ft.

For information on what's available for sunlight, moonlight and underwater fun, examine the outdoor speaker sampler shown here. Æ

OUTDOOR-UNDERWATER SPEAKER SAMPLER

Bozak B-1000 "Bard"—8" spkr. in hemispheric steel enclosure, 8 ohms, handles 15 watts, 80-10 kHz, 18" diam. x 21" H x 12" D, 20 lbs., $82.50.

Electro-Voice "Sonocaster I"—8" coax. spkr. in molded housing, 8 ohms, handles 30 watts (peak), 70-13 kHz, 16¾" x 17" x 5⅝", 6¾" lbs., $25.00.



Electro-Voice "Musicaster I"—8" "Radax" horn-loaded spkr., 8 ohms, handles 60 watts (peak), 60-13 kHz, 21½" x 21½" x 8½", 31½ lbs., $72.00. **"Musicaster II"**—Same plus VHF driver, extending freq. to 18 kHz, 33 lbs., $90.00.

Jensen Manufacturing HF-100A—8" horn-loaded with HF driver in fiberglass-plastic-alum. housing, handles 25 watts, 60-15 kHz, 24⅜" diam. x 11⅜" D, 23 lbs., $88.20.

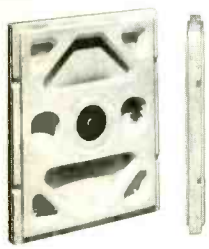
Lafayette "Poly-Planar" — 12" spkr. with wafer-type construction, 8 ohms, handles 20 watts (peak), 40-20 kHz, 11¾" x 14 11/16" x 1 7/16", 19 oz., $10.95.

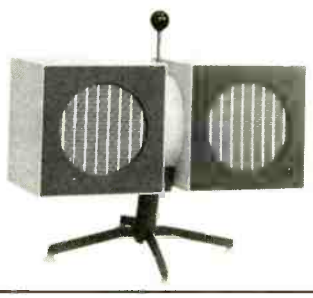
Pioneer UL-3 — Underwater spkr., 16 ohms, handles 30 watts (voice), 50-20 kHz, 5" x 5" x 4 1/16", 13 lbs. 3 oz., $47.50.

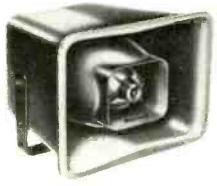
JBL "Carnival"—8" spkr. & 8" passive radiator in internally-connected, tiltable enclosure halves, 8 ohms, 30-40 watts/channel amplif. recommended outdoors, 22" x 22" x 10", $111.00. **"Festival"** — Same except with higher-performance LE8T 8" spkr., $144.00.

University Sound MLC — Horn-loaded spkr. in fiberglass housing, 8 ohms, handles 15 watts, 150-15 kHz, 12¾" x 9⅛" x 10⅝", 10¾ lbs., $39.95. **Model "ELC"** — Same, except 150-11.5 kHz, 9 lbs., $32.95.

University Sound MM-2PPS — Underwater spkr., 16 ohms, handles 25 watts (music power), 100-10 kHz, 7 3/16" diam. x 3⅝", 5¼ lbs., $46.50.







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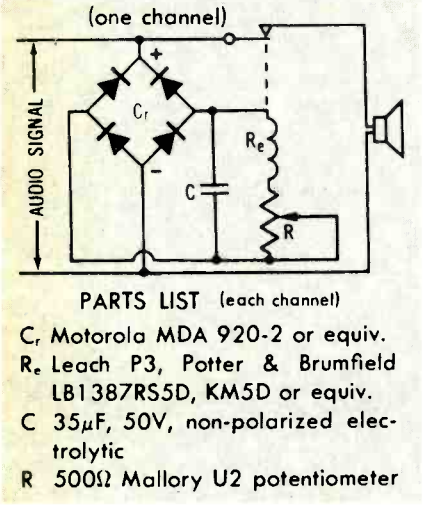
Protect Your Loudspeakers With Relays

JOHN R. KISSINGER*

THERE ARE MANY ways to protect a loudspeaker from excessive power. It is fashionable to design a solid-state circuit to accomplish the desired result. However a good solid-state loudspeaker protector is either expensive, complicated or both.

A fuse is the simplest and cheapest method. Unfortunately, fuse specifications provide a wide latitude of power protection. A fuse rated at 2.5 amperes (50 watts for an 8-ohm speaker) would never blow at 2.75 amperes (60.5 watts for an 8-ohm speaker) and might last as long as an hour at 3.38 amperes (91.3 watts for our 8-ohm speaker). On the other hand, if you de-rate the fuse to account for the 135%, one-hour rating on the fuse, any sustained high-power note (pedal tone on an organ)

Fig. 1—Loudpeaker protection circuit described in article.



PARTS LIST (each channel)

C_r Motorola MDA 920-2 or equiv.
R_e Leach P3, Potter & Brumfield LB1387RS5D, KM5D or equiv.
C 35μF, 50V, non-polarized electrolytic
R 500Ω Mallory U2 potentiometer

could cause the fuse to blow while the speaker is well within its power rating.

A relay protection circuit can overcome these objections. The relay circuit shown is both economical and fairly simple. It protects both speaker and amplifier. The speaker does not receive excessive power and the output stage of the amplifier will not be called on to furnish excessive current. Though this circuit is effective, it must be adjusted individually for each speaker installation and is, therefore, most suited to the experimenter.

Circuit description

The bridge rectifier shown is a low-current, moderate-voltage device. The accompanying capacitor should match the rectifiers' voltage rating. Its function is to smooth the low-frequency response of the relay to avoid both relay chatter and operation of the relay before the desired power levels are reached.

The relay used in this circuit was obtained from a junk box. Other relays, such as Potter and Brumfield RS5D, will perform just as well, but the rheostat resistance will have to be varied in direct accordance with the coil resistance. The relay used will operate with the help of gravity at 3.2 volts. The rheostat controls the voltage level at which the relay will operate and, therefore, controls the maximum power fed to the loudspeaker.

The audio signal is fed to the bridge rectifier and through the normally closed contacts of the relay to the loudspeaker. The bridge converts the signal to d.c. This is fed to the capacitor, which filters it sufficiently to extend low-frequency stability to below 60 Hz. As the average d.c. level comes closer to the pre-set operating level, the relay may start to operate. But unless there is a sustained high power passage, it will not do so. However, once it does operate, it will not drop out until markedly lower voltage is applied to the relay. Once the relay operates it is quite obvious that you had better turn the volume down as golden silence descends throughout the room.

Performance

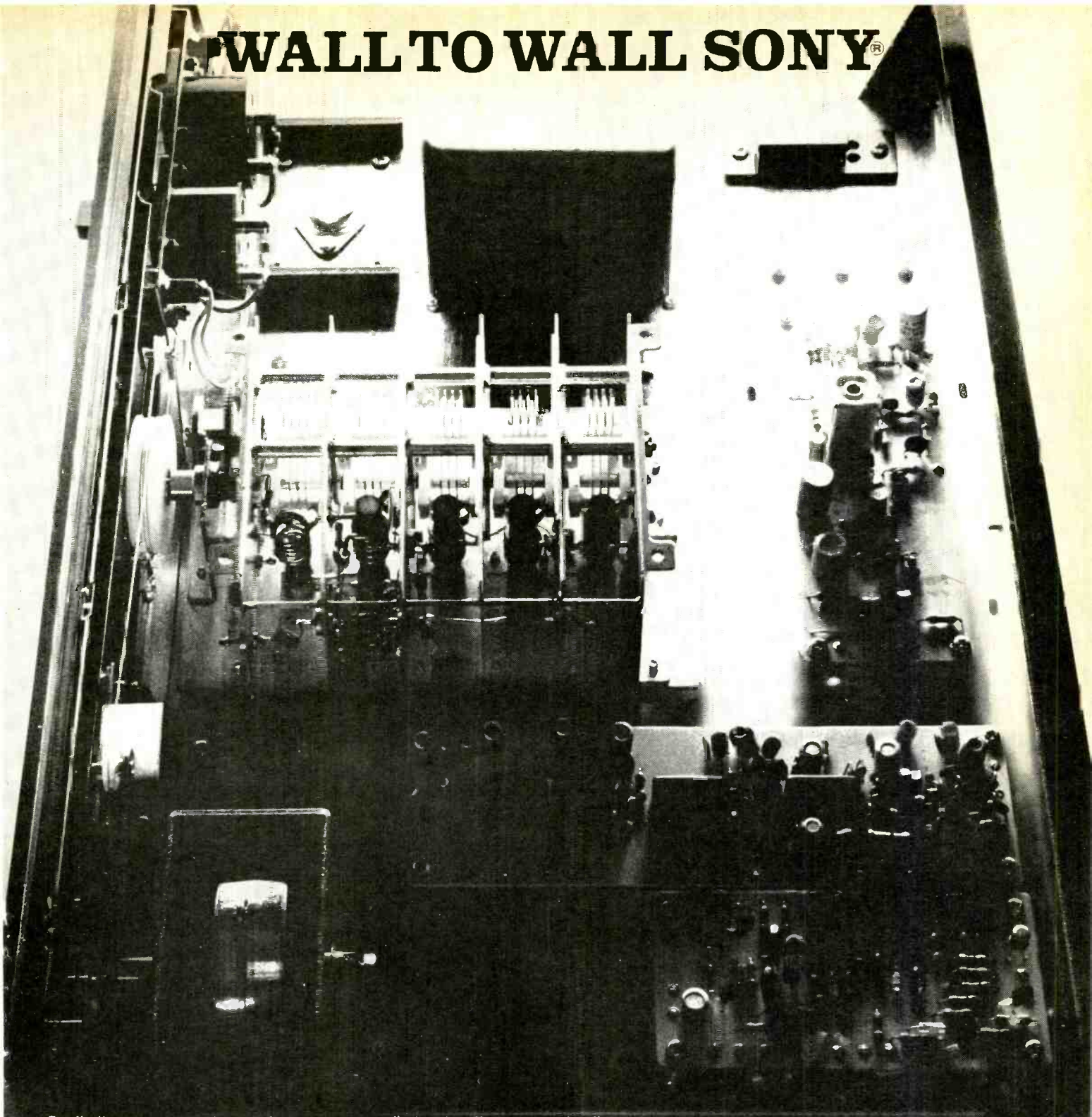
While this circuit is economical and simple, it is not on the market. The main reason for this is that good quality relays have operating voltage variations of ±10%. You cannot use a fixed resistor for R and then expect your protection point to stay reasonably constant.

Another troublesome point is the mounting position of the relay. It is quite possible that a P & B RS5D, when mounted vertically with the clapper up, would work at 6.3 volts, giving 5-watt protection to an 8-ohm speaker with no series resistor in the relay coil circuit. The same relay inverted might not at less than 9 volts, which means your poor 5-watt speaker is getting over 10 watts applied before protection kicks in.

The above reasons explain why the circuit should be packaged and mounted in final operating position before the power-level adjustment is made. If an oscillator is used to set the power level, rather than speech or music, set the operating voltage for ½ the maximum power you wish the speaker to have. The voltmeter used to set the power level should be across the speaker terminals. Æ

*Jensen Manufacturing Div., Chicago, Ill.

WALL TO WALL SONY®



Practically every component part in the new ST-5000FW FM stereo tuner is Sony-engineered and Sony-made. Especially the field-effect transistors. Is that so important? We think so. Because they're made to bring out the best in our unique circuit design.

Such as what?

FET's (particularly Sony's) are inherently much less susceptible to overload by strong signals. Used in the Sony front end, they are impregnable. You can enjoy even the weakest FM stations without annoying crossmodulation interference.

The best FET's (Sony again) have noticeably less noise than conventional silicon transistors. In the Sony front end they increase the usable sensitivity (1.5μV) right out to its theoretical limit.

Three unique solid-state filters are used in the i.f. amplifier-stages. They can never go out of adjustment, so they never need realignment. They contribute to the tuner's fabulous selectivity (better than 90db) and stereo separation. You can zero in on a weak station right next to a strong one.

Another Sony innovation is the unique selective circuit in the multiplex section. This prevents triggering of automatic stereo operation where the quality of the multiplex signal cannot assure noise-free, distortion-free stereo reception.

We use Sony FET's at many critical points. In the local oscillator in the front end, to keep drift to an absolute minimum. And in our nifty muting circuit, (which has 9 conventional transistors, too).

Hear the new ST-5000FW at your high fidelity dealer. Suggested list is $449.50.
Sony Corporation of America, 47-47 Van Dam St., Long Island City, N.Y. 11101

New Sony FET Stereo FM Tuner

More About Negative Feedback

NORMAN H. CROWHURST

Part 4

Multiple loop feedback

Practically all modern feedback amplifiers employ two or more separate "bits" of feedback. Often each will have feedback over that stage; then the whole amplifier will have feedback from output to input. For the moment we will assume that all these bits of feedback really add up arithmetically, as most sales promotion stories indicate.

This assumption means that reduction in gain will be the sum of the various amounts of feedback in dB. So if three stages each use 20 dB feedback and an overall loop applies an additional 14 dB feedback, the total reduction in gain, resulting from closing the four feedback loops, would be 20 + 20 + 20 + 14 = 74 dB (Fig. 1). Assuming this is true, then, what is the effect of the various properties for which feedback is applied?

The different feedback bits invariably use different basic ways of applying them. At either input or output end of the whole amplifier, where different loops terminate at a common stage, one may be series and the other shunt connected. This means that one will multiply and the other divide that stage's effective impedance by the respective feedback factors.

Suppose, for example, that one loop represents 20 dB and another 14 dB, so connected. The net effect will be to double or halve the working impedance at that stage, while gain and distortion are reduced by a factor of 50.

A further complication may occur because the terminating impedance, such as external input or output impedance, is changed. Under these circumstances the proportions of feedback due to the different loops will change because one increases and the other decreases.

At the output end, raising the impedance value of the load will tend to increase voltage feedback, while reducing current feedback (Fig. 2). Both may not be changed by the same dB amount. This will depend on the actual source impedance of the output before feedback.

In the example, if the source resistance is one third the design load value, doubling the load value will reduce current to 4/7 its former value and increase voltage by 8/7. Current feedback reduces by 4.8 dB, while voltage feedback increases by 1.2 dB, a net reduction of 3.6 dB.

Alternatively, if source resistance is 5 times design load, doubling the load value will reduce current feedback by 6/7, while voltage feedback will increase by 12/7. In this case current feedback reduces by 1.3 dB, while voltage feedback increases by 4.7 dB, a net increase of 3.4 dB.

Note that in each case, adding the changes in feedback comes to 6 dB, which represents the 2:1 change in load value. But the parts are in opposite directions, reducing the net change in feedback. A similar thing can happen by interaction between successive loops within an amplifier. For example, series-injected feedback from a following stage depends on the source impedance of the preceding stage to determine the active amount of feedback. Now, the preceding stage will have its source impedance changed by its own impedance, so the following stage feedback is inevitably affected by that of the preceding stage.

Pursuing this, every feedback loop has an effect on loops preceding and following it, as well as on larger or smaller loops including the same stage or stages. The net result of these effects is that applying 20 dB of feedback over each of three successive stages may not—probably will not— result in a total of 60 dB feedback for the three stages (which the promotion for this product may claim). More likely, the total effect will be about 26 dB altogether. To be sure, applying each loop by itself may reduce gain by 20 dB. But then applying them all at once, the changes in impedance in adjoining stages reduces the feedback mutually.

How is the reduced value of 26 dB feedback actually distributed between the three stages? That's a good question. The calculation can

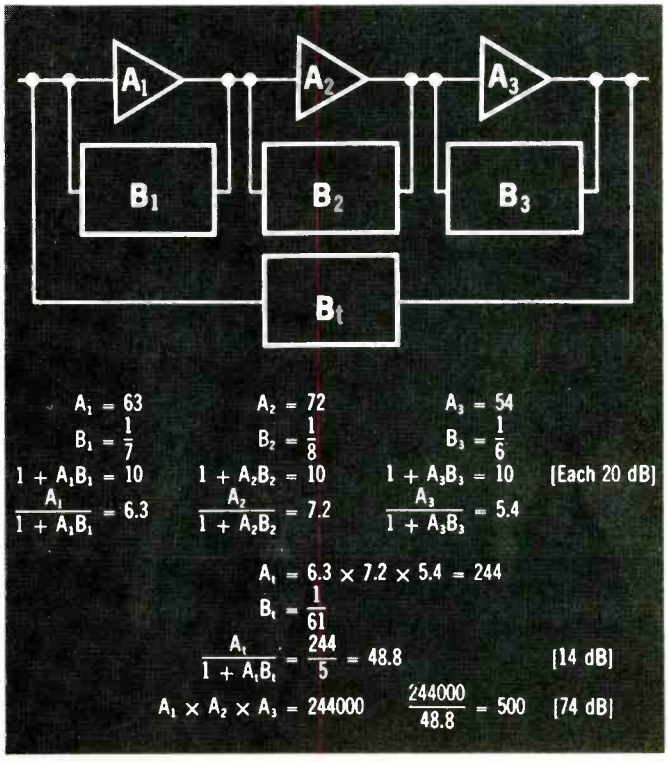


Fig. 1 – The hypothetical multiple-loop amplifier discussed in the text.

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The frequency response curve of the new Stanton 681 Calibration Standard is virtually a straight line from 10-20,000 Hz.

That's a guarantee.

In addition, channel separation must be 35 dB or greater at 1,000 Hz. Output must be 0.8 mv/cm/sec minimum.

If a 681 doesn't match these specifications when first tested, it's meticulously adjusted until it does.

Each 681 includes hand-entered specifications that verify that your 681 matches the original laboratory standard in every respect.

Nothing less would meet the needs of the professional studio engineers who use Stanton cartridges as their reference to approve test pressings. They must hear exactly what has been cut into the grooves. No more. No less.

But you don't have to be a professional to hear the difference a Stanton 681 Calibration Standard will make, especially with the "Longhair" brush which provides the clean grooves so essential for clear reproduction. The improvement in performance is immediately audible, even to the unpracticed ear.

The 681 is completely new, from its slim-line configuration to the incredibly low-mass moving system. The 681A with conical stylus is $55.00, the 681EE with elliptical stylus, $60.00.

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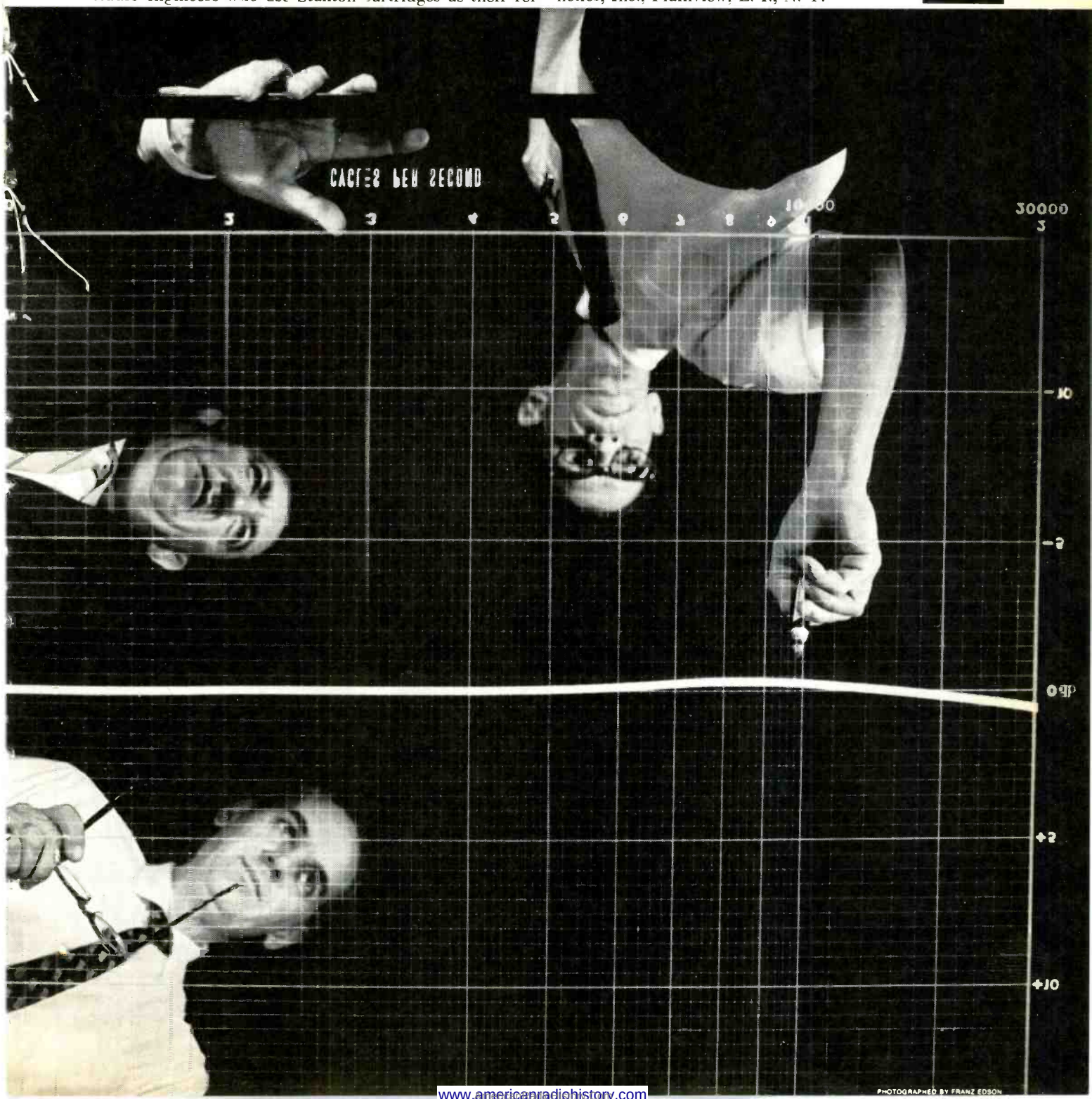


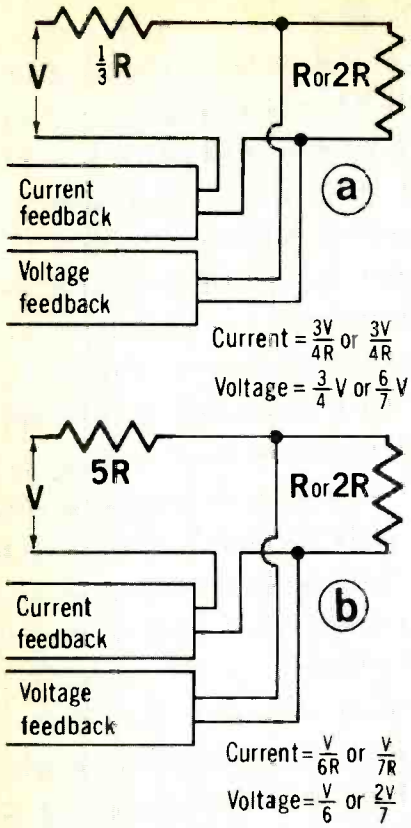
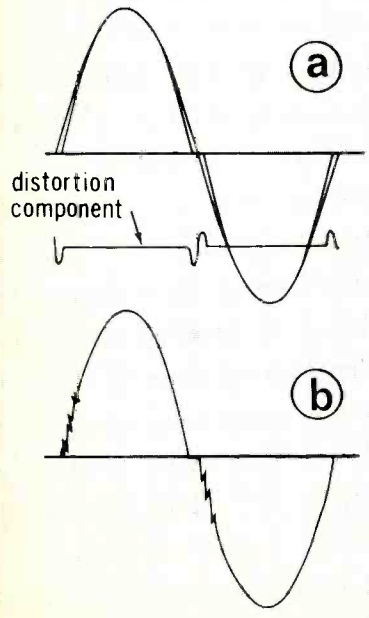


Fig. 2—Effect of changing external load impedance on relative proportions of voltage and current feedback: (a) when internal source resistance is a fraction of design load impedance; (b) when internal source resistance is a multiple of design load impedance.

Fig. 3—A case where frequency analysis does not apply, but time-delay analysis should be used: (a) the waveform, with the ideal sine waveform superimposed; also shown, offset for clarity, is the distortion component; (b) how time delay in the feedback loop causes feedback to aggravate the distortion, rather than reducing it.



become quite involved, because the impedance-changing effect of one loop controls the amount of feedback in each adjoining loop, and vice versa. Distortion reduction may also be reflected.

We have said enough at this point to indicate that simple addition of feedback figures, as manufacturers' promotion people like to do in the numbers race, is seldom if ever valid.

When an amplifier is quoted as having, for example, 80 dB feedback (which isn't too difficult a number to arrive at, using this technique) there is no way on earth that you could remove all the bits of feedback so the amplifier would acquire a total of 80 dB more again, which the promotion statement definitely implies could be done.

What does "dB feedback" mean?

The fact is, the amplifier doesn't really have that much feedback. In fact, any feedback figure quoted is somewhat arbitrary, even though the attempt to give a figure is reasonably honest!

The classic formula for feedback does come up with a factor of (1 + AB) which, converted to dB, is the amount of feedback for that loop. But the very reason for using feedback shows that the "A" in this factor isn't constant. If gain were constant, which use of this factor as a constant by quoting it in this manner implies, then feedback would never be necessary. Read this paragraph again, it is important.

Constant gain would mean zero distortion. Distortion is a variation of gain at different parts of the waveform. Gain can vary due to a wide variety of causes. Distortion is the variation of gain during the amplification of a particular waveform. But let's average that out, for the sake of arriving at a figure. This average gain can also change with working frequency or amplitude. The effect of different frequencies is first noticed in phase shifting, as described earlier.

Now combine the notions of frequency and distortion, as affected by feedback. The important thing to note is that distortion products generated within the amplifier are reduced by feedback, not by the factor that applies to the fundamental or test frequency, but by the one that applies to the frequency of the distortion component.

For example, the operating frequency may be 5,000 Hz, and the amplifier may generate a dominant 5th harmonic of this, which is 25,000 Hz. The feedback effect that will reduce this distortion must be considered at 25,000 Hz, not 5,000 Hz. Going further on this question, the distortion effect may not look like a simple harmonic. For example, it could be a notch occurring at certain points on the wave. For this kind of waveform, the frequency/phase-amplitude analysis on which we have based most of our theory does not apply. What affects the overall result is the delay/amplitude characteristic round the loop. We must use time, rather than frequency domain.

Instead of cancelling the distortion, feedback can actually aggravate it, as shown in Fig. 3. The negative effect doesn't get back to the input "in time" to offset the distortion component, but instead injects another component of opposite phase. This will continue circling the loop, with successive reversals, until it dies away. The common theory doesn't predict this behavior at all.

Amplitude of steady signal—and we're still thinking in terms of steady signal testing—can change operating points by altering demands upon the supply circuit. This may change gain or the a.c. resistance of circuit elements. So feedback can change when signal level or amplitude changes.

A feedback figure is quoted as if it is a constant. But in fact, whatever else may change the feedback, values of external impedance connected to both input and output definitely do. Practical impedances connected to inputs, such as microphones, phonograph pickups, tape-recorder heads, are never simple resistances of fixed value. Nor are loudspeakers, recorder heads (phono or tape) connected to outputs.

(Continued on page 63)

FM-3 TUNER
99.95 KIT, 154.95 ASSEMBLED

PAT-4 PREAMPLIFIER
89.95 KIT, 129.95 ASSEMBLED

LASTING QUALITY

In the evolution of high fidelity, there have been some "revolutions"—the stereo record, FM multiplex, and transistorization, to give some examples. Each of those changes left its trail of obsolete equipment, frequently replaced with much higher priced models. Through these periods of change, Dynaco has maintained a level of quality so high that our equipment is always current, never obsolete, and always adaptable to the newest useful innovations.

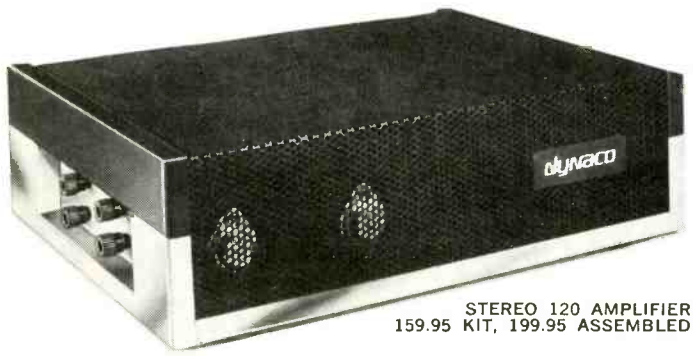
Dynaco's underlying philosophy is to deliver exceptional performance from designs so carefully and progressively engineered that they defy obsolescence. We add new products only when we feel that they can make a contribution of value to music reproduction. In each Dynaco high fidelity component the total value of the separate parts is greater than what you pay for the finished product, and you can save even more by buying the kit.

Dynaco's separate components give you the ultimate in flexibility and ease of installation. They can be interchanged with full compatibility, not only with Dynaco units, but with any other similar designs which are generally accepted as being of the finest quality. No industry innovation can make your **system** obsolete, and future changes, such as an increase in amplifier power, can be easily and economically accomplished.

The quality of performance obtained with the FM-3 tuner, PAT-4 preamplifier, and the Stereo 120 power amplifier cannot be matched in any single package regardless of promotional claims. Other Dynaco units which can interchange with this system will also give similar results at lower power, or with a bit less control flexibility at still lower cost, depending on the units chosen.

Whether you compare Dynaco with others by listening or by laboratory test, you will find that Dynaco gives sound closest to the original—with lucid clarity, without murkiness, noise or distortion. Every unit—whether purchased as a kit or factory assembled, is assured of delivering the same specified quality, for our reputation has grown through directing our design efforts towards perfection rather than to the planned obsolescence of yearly model "face-lifts."

You may find that your dealer does not have some Dynaco equipment in stock, however, for the demand greatly exceeds our ability to produce for a rapidly growing audience. Quality is our first consideration, so we must ask your patience. We believe you will find it is worth the wait.



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Equipment Profiles

This Month:

Harman-Kardon "Five-Twenty" stereo FM receiver

Sony/Superscope 230 stereo tape recorder

Elpa PE-2020 automatic turntable

Harman-Kardon Model Five-Twenty Stereo FM Receiver

MANUFACTURER'S SPECIFICATIONS – Power Output: 70 watts (IHF) at 4 ohms. Freq. Response: 5 to 45,000 Hz ±1.5 dB at 1 watt. Harmonic Distortion: Less than 1%. Tone-Control Range: ±12 dB bass and treble boost and cut. Input Sensitivity: Phono.: 3 mV; Aux.: 0.25 V. Scratch Filter: 10 dB at 10 kHz. Usable Sensitivity (FM): 1.95 μV (IHF). Image Reject.: Better than 50 dB. Spurious Response Reject.: Better than 75 dB. IF Reject.: 90 dB. FM Stereo Separation: 35 dB. Dimensions: 15⅝ in. W x 4⅝ in. H x 13½ in. D. Weight: 21 lbs. Price: $315.00 (Opt. walnut cabinet, $29.95).

Though performance and listenability generally lead styling in our reviews, we must begin here with a word of commendation concerning the elegant appearance of Harman-Kardon's new Five-Twenty Stereo FM Receiver. The mirror-like black front panel, trimmed in gold, is devoid of "clutter" and will complement traditional as well as modern furnishings. The tuning dial is totally invisible when the unit is turned off; all one sees is an expanse of opaque black plastic which is brilliantly illuminated when power is applied. Although this "now-you-see-it-now-you-don't" panel approach was first used by a prominent TV manufacturer, "you can be sure" that its application in the Five-Twenty renders a most pleasing effect. Figure 1 tells some of this story, but you must see the lighting effect in person to appreciate it.

Equipped with 25 bipolar transistors, 1 MOSFET device in the front end, two integrated circuits in the i.f. section, 8 signal diodes, 7 power-supply rectifying diodes and one 10-volt Zener regulating diode, this receiver is constructed along modular lines. Six of the seven printed-circuit sections can be seen in Fig. 2. The seventh circuit board, containing the tone control circuitry, is obscured from view. The empty area at the rear right of the chassis' surface is used in Harman-Kardon's $349.00 model Five-Thirty (not reviewed here) for positioning of an AM-circuit module.

Features

Examining the front-panel layout, all controls but the tuning control are located along the bottom half of the panel. A headphone jack is located at the extreme left, in this case wired to the output circuits with a full 180 ohms in series with each channel. This precaution reduces audible hum when using phones, which are sonically more efficient than loudspeakers. The presence of these resistors also enables the user to set the volume control at a reasonable point instead of just barely being able to "crack open" the control before a deafening blast of sound is heard through the phones.

A speaker-selector switch (with which to choose one system or another, or both simultaneously), master volume control (which also includes the power on-off switch) and balance control constitute the grouping at the left end of the panel. Symmetrically-placed right-hand controls include bass (ganged for both channels), treble (similarly ganged) and function switch. This last control has positions for Mono Phono, Stereo Phono, Tape-amp/Aux, FM Mono and FM "Stereo-matic," the latter a self-switching position (from FM mono to FM stereo) in the presence of a stereo signal.

Situated at the center of the panel are four secondary "rocker" switch controls for such added features as loudness-contour, Hi-Cut (a high frequency cut-off filter), tape-monitor and FM muting (for the elimination of inter-station noise).

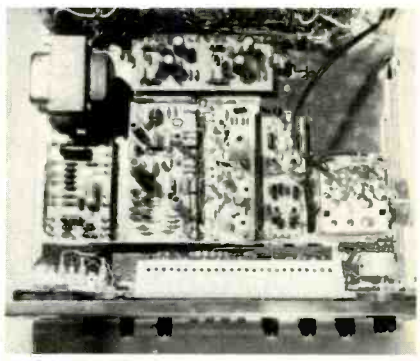
The upper half of the panel, that featuring the novel diffused illumination mentioned earlier, is stark, featuring only the tuning knob which, through adequate fly-wheel assembly, enables the user to spin from one end of the dial to the other with just one twist of the wrist. When the dial area is lighted, a center-of-channel tuning meter appears at left, as does the word "stereo" when an FM stereo station is encountered.

The rear panel, besides serving as a massive heat sink for the four power-output transistors, is equipped with tape output and input jacks, magnetic phono input jacks, a convenience a.c. outlet (switched), a pair of protective speaker fuses, the line fuse, two sets of terminal strips for speaker connections and a two-terminal strip for connection of an external 300-ohm FM antenna. The 300-ohm terminal strip has very widely spaced terminals. We wish that strips of this type had been used for the speaker terminals which are, unfortunately, too closely spaced for comfort. Of course, speaker connections should be made with care to prevent accidental shorts between frayed leads or loose strands of wire, but the manufacturer could help by spacing the terminals further apart. A temporary red-tag label covers the second set of speaker terminals (for speakers in another location) to prevent inadvertent misconnection of one speaker to the second system's terminals and another of the first stereo pair to "system one's" terminals. The power-output transistors are covered with plastic caps, making them inaccessible to the touch. While the collectors of these devices only have 21 volts applied during operation (plus and minus for each channel), some sensitive fingers might feel a slight "tickle" when subjected to even this low d.c. voltage, were it not for these covers.

Circuitry

Briefly, the receiver circuitry consists of a three-transistor FM front end (the r.f. stage uses the single MOSFET mentioned earlier to reduce cross-modulation and other spurious responses). The i.f. section utilizes 2 IC's for gain and limiting and a balanced ratio-detector stage. A conventional NPN transistor serves as a d.c. ampli-

Fig. 2–Top view of chassis shows circuit-board layout.



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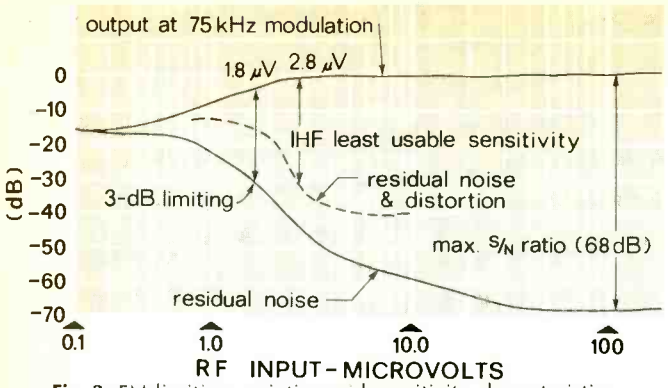


Fig. 3—FM limiting, quieting and sensitivity characteristics of the Harman-Kardon "Five-Twenty" stereo FM receiver.

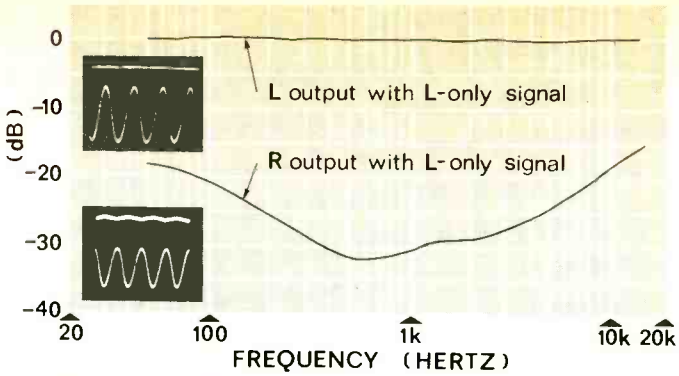


Fig. 4—FM stereo separation characteristics. The first photo shows separation at 1 kHz; the second, at 10 kHz.

fier for the muting function, while another serves to amplify the recovered audio prior to application to the multiplex section.

The multiplex section is quite conventional, consisting of two NPN devices for the generation of a 38 kHz signal when a 19 kHz incoming signal is present. A third transistor acts as amplifier for lighting the stereo indicator lamp. Demodulation is accomplished by means of four diodes in a bridge circuit, and the recovered "L" and "R" signals are further amplified by two transistor stages before application to the main amplifier portion of the receiver.

Each low-level (magnetic phono) preamp channel consists of two NPN transistors, with equalization carefully applied in the form of frequency-selective feedback from output to input. So accurate and well matched are these preamps that we were unable to measure errors in RIAA equalization greater than 0.5 dB at any frequency from 50 Hz to 15 kHz.

The tone-control module includes, in addition to bass and treble controls, volume and balance controls and the low-frequency loudness contour parts. Feedback tone compensation is employed for both bass and treble action, using one additional NPN transistor per channel for this purpose.

The driver board contains four transistors (two per channel), with the actual driver stage of each channel having provision for bias adjustment to ensure the most linear operation of this critical stage. Separately mounted, well-designed interstage transformers drive each pair of silicon PNP output transistors in a classical push-pull class B arrangement. With positive and negative voltage applied end-to-end, the speaker take-off point is at zero potential. Therefore, there is no need for a frequency-restricting coupling capacitor to the speakers.

Several finer points, apparent only from examination of the schematic, should be pointed out. For example, the function switch disconnects B+ from the front end when functions other than FM or stereo FM are desired. Many lesser designs merely ground the audio at the output of the FM section, which often leads to leakage into the audio chain via other paths. Disabling the FM completely, as is done here, is by far the better approach.

The massive power transformer has no less than three separate secondaries, producing (via separate rectifier arrangements) the various positive and negative d.c. voltages required for the various sections of the receiver. By not trying to derive the necessary operating voltages from one "economy" set of rectifiers, little interaction is encountered as large currents are drawn by the power amplifier section during moments of powerful dynamic passages of music. This design philosophy explains, in part, why the rms power of this receiver is so close to the stated "music power" and why the transient response and "musical attack" characteristics are so clean and devoid of even the slightest evidence of "hangover" or muddiness.

Measurements

As is true of many of the new receivers incorporating integrated cir-

Fig. 5—IM and THD distortion at different power levels.

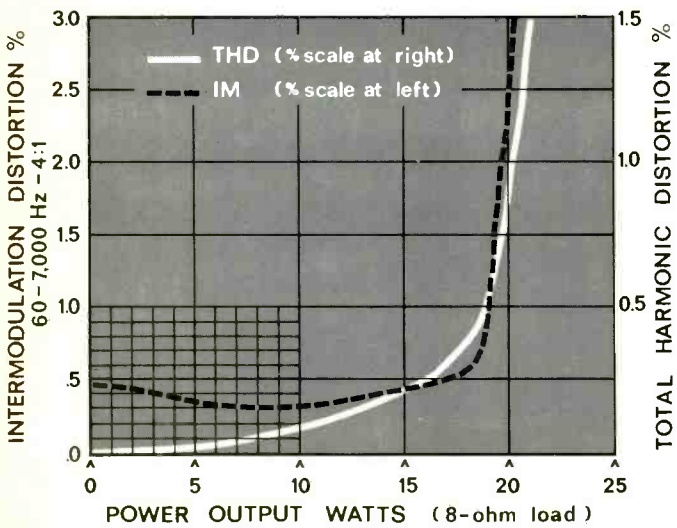
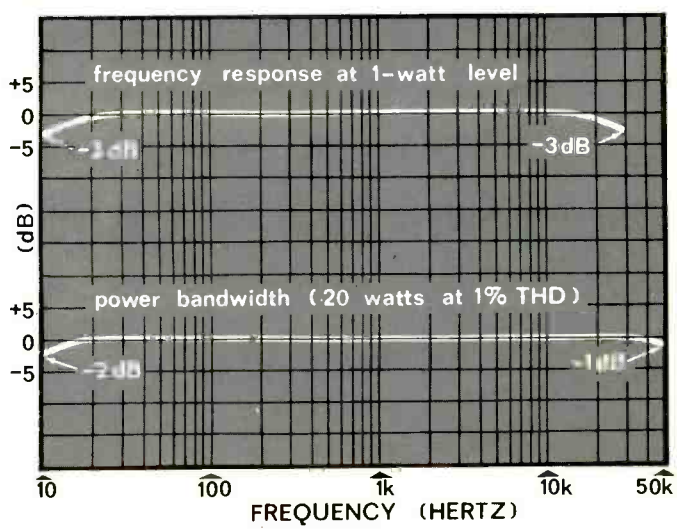


Fig. 6—Power bandwidth and frequency-response characteristics.

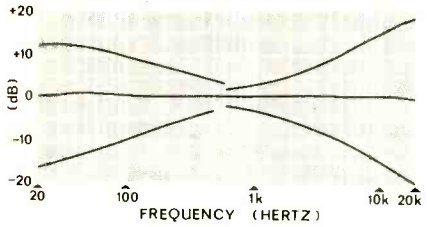


cuits in their i.f. stages, the limiting characteristics of the model Five-Twenty are outstanding, as can be gleaned from Fig. 3. Note that "3 dB limiting" occurs even before usable sensitivity has been attained—at a mere 1.8 microvolts. Average usable sensitivity across the band is 2.8 microvolts, while maximum signal-to-noise is a very respectable 68 dB. Distortion at full modulation is only 1% for all input levels above about 5 μV. Spurious response rejection exceeded the manufacturer's specification, measuring fully −85 dB!

Best FM stereo separation was observed at a frequency of around 500 Hz, as shown in Fig. 4. It was just a bit below the manufacturer's claim of 35 dB. More importantly, at least 20 dB of separation was observed at all frequencies from 90 Hz to 9 kHz.

Although many manufacturers choose to state power capabilities of their products in terms of a 4-ohm speaker load, it is our continuing practice to follow the IHF recommendations (8-ohm loads) in making power measurements. Thus, the rms power per channel at 1% distortion, as shown in Fig. 5, is a fraction of a watt under 20 watts. In all fairness to the manufacturer, however, we repeated the measurements for a 4-ohm load and were able to produce 30.25 watts at 1% distortion (per

Fig. 7–Tone-control range.

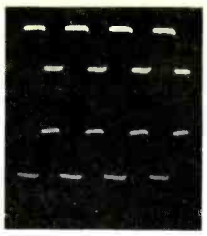


channel). This, too, was steady-state power. Note how close this comes to the music power rating (70 watts total, or 35 per channel) given by the manufacturer. This is what comes of a good, "stiff" power supply, as mentioned earlier.

Examination of the frequency response and power bandwidth curves of Fig. 6 confirm the fact that Harman-Kardon still favors the "wideband" school of amplifier response. Power bandwidth extends from 10 Hz to 30 kHz, while frequency response at a nominal 1-watt listening level is even broader, extending to 50 kHz with only 1 dB of attenuation.

Intermodulation distortion and harmonic distortion are shown in Fig. 5, while tone control characteristics are graphed in Fig. 7. The slight rise in

Fig. 8–Square-wave response. Upper trace is input waveform; lower is output at speaker terminals.



IM distortion at lower power levels indicates a smidgen of crossover distortion in the output stages, but nothing discernible to the ears since it rises not more than 0.15 per cent.

Since the manufacturer makes a point of specifying square-wave rise time (better than 3.5 microseconds), which is some measure of an amplifier's transient-response capabilities, we decided to apply some square waves of our own. The 10-kHz square waves shown in Fig. 8 confirm this excellent characteristic, as does the listening experience described later.

Performance

The Harman-Kardon Five-Twenty can be described as an extremely listenable FM/Stereo FM receiver. Opening the unit up with Purcell and Vivaldi trumpet selections (*Music for Trumpet & Orchestra,* Kapp KCL-9107) on the turntable caused no break-up whatever; the receiver exhibited perfect recovery and good damping even at extremes of level, and all with inefficient, "acoustic suspension"-type speaker systems which require (says the speaker manufacturer) 20 watts or more of power per channel.

Actual scope measurements revealed that we were getting all this marvelous sound with never more than 15-watt *peaks* observed. Seems that 20 watts of clean power down to 20 Hz and below really means more than 50 watts at mid-band and "hardly any clean watts" below 100 Hz. Under these circumstances a clean, higher-power amplifier would produce music at loud listening levels with a bit more "air" around it, of course. But the point is that this medium-power receiver does remarkably well.

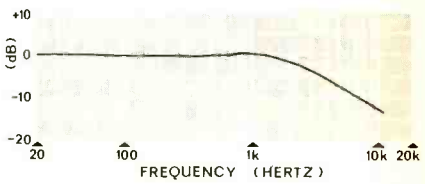
The Purcell Voluntary for two trumpets (which invariably reveals good transient response—and bad) was rewarding because the recording's brass was produced crisply. This much-played record, however, had some disturbing surface noise; a result of considerable use. Throwing in the Five-Twenty's Hi-Cut (noise filter), however, revealed a minor shortcoming: we lost much of the "highs."

A plot of the filter's characteristics (Fig. 9) shows why. Instead of permitting flat response up to, say, 5 or 6 kHz and then attenuating the response sharply, this "filter" is really nothing more than a 6 dB/octave simple R-C network—a fixed treble-cut tone control with a crossover at about 2500 Hz. True, it does cut out surface noise, but at the expense of too much treble loss, in our view.

It is well that the Five-Twenty provides a means for disabling the "loudness-contour" circuits, for we found that the gain in the FM and FM "Stereomatic" positions exceeded the gain of the phono channel (used with a medium-output cartridge). This is a minor point, but nonetheless a deviation from perfection. Thus, while we could take advantage of the "loudness" feature with the control set for low-level listening on phono (about "ten o'clock"), the same setting for FM listening resulted in a much louder volume which did not require loudness compensation—for our ears anyway.

The Five-Twenty receiver's FM sensitivity is the equal of receivers costing considerably more than $315.00. Thirty-five stations (nine of them in stereo) were received with more than adequate quieting. The muting switch is defeated at a signal level of only 20 microvolts and yet, with this switch active, the number of stations received

Fig. 9–The "Hi-Cut" filter reduces record surface noise, though it slices away much treble response in the doing.



was reduced to 24. This indicates that at least 11 of the previously received stations had signal strengths of *less than* 20 microvolts!

Automatic stereo switching on FM is positively accomplished, with no "in-between" states, and the stereo light glows only when a stereo broadcast is truly received (never on interstation noise or spurious responses of any kind).

Considering performance alone, the Five-Twenty FM receiver is a sharp competitor in its price class. Add to this its elegant appearance, and you have a fine all-around receiver package for those who do not require inordinate amounts of power output.

Fig. 1—Sony's Model 230 "Stereo Compact," a portable 4-track stereo record/playback tape system with a stereo control center, is shown at left. It's also available as Model 230W in a walnut cabinet, as shown above. Matching walnut bookshelf speakers (not shown) are optional.

Sony/Superscope Model 230 4-Track Stereo Tape Recorder

MANUFACTURER'S SPECIFICATIONS — 7½, 3¾ and 1⅞ ips; automatic equaliz. change. Reel Size: Up to 7-in. Freq. Response: 30-18,000 Hz at 7½ ips, 30-12,000 Hz at 3¾ ips, 30-6,000 Hz at 1⅞ ips. Signal-to-Noise Ratio: Better than 50 dB (peak record level). Flutter and wow: Under 0.1% at 7½ ips, under 0.15% at 3¾ ips, under 0.2% at 1⅞ ips. Harmonic Distortion: Under 3% at 0 dB (0.77 mV) line output. Inputs: (2) Microphone (250 to 1000-ohm impedance); (2) Aux. (Tuner); (2) Phono. Outputs: (2) line; binaural for 8-ohm (or greater) headset; extra speaker (8 ohm). Speakers: Two 5-in. in detachable lids. Power Output: Max. 4 watts/channel. Dimensions: Model 230, 17" W x 9⅝" H x 14" D; Model 230W, 15¾" W x 7½" H x 13½" D. Weight: Model 230, 29 lbs.; Model 230W, 22 lbs. Opt.: Speaker systems, Model SS-23 for Model 230W. Prices: Model 230, $249.50; Model 230W, $239.50 ($299.50 with 2 SS-23 Speakers).

The compact Model 230 is another fine addition to the comprehensive Sony/Superscope line of tape recorders, which runs the gamut from mini cassette recorders through reel-to-reel players and recorder-speaker combinations, to solenoid-operated professional machines. The unique feature of this particular unit is that it has its own control facilities to act as the audio control center of a solid-state stereo system, without assistance from a preamplifier or amplifier. That is, it accepts the output of a phono cartridge or FM stereo tuner directly, and its lever-type selector switch chooses between these sources just like a preamp control does. So with just a turntable and/or tuner added to the 230, we have a complete audio system—including tape recorder. If desired, the detachable speakers or internal amplifier, which are part of the 230 recorder (instead of being an add-on to an integrated amplifier or a receiver system, as most recorders are), can, instead, be the starter unit of a stereo system, with turntable and tuner planned as future acquisitions.

Features

The 230W model, as compared to the 230, which is a portable with leatherette-type case, is styled in walnut. The cabinet also has a walnut cover that conceals the tape recorder business end, revealing only the amplifier controls needed when using auxiliary input sources. This is a neat idea for installations in tight spots. The walnut-encased model is available with or without speaker systems. The portable 230 has split speakers which combine with the machine to become the carrying-case lid. In use they may be spread up to 15 ft. apart. Both models are identical in operation and performance. Two dynamic cardioid microphones with plastic, attachable stands are furnished with the machines.

As a recorder, the Model 230 contains most of the useful features which make a unit pleasurable to use. Simplified controls, automatic shutoff, a re-settable tape-footage counter, and easy threading are the main ones. Sony's tight, neat packaging and clever design is evident in the guts of the machine as well as on the outside.

A single motor with knurled, stepped pulley on its shaft, drives soft neoprene idlers. The latter, in turn, drive a heavy, balanced capstan flywheel and both turntables. See Fig. 2. A band of rubber links the pulley and one of the idlers. The supply and take-up turntable are clutch-driven. The drive is evidently pretty effective because flutter and wow measured as 0.07% at 7½ ips and 0.1% at 3¾ ips, which is outstanding for this type of machine (and, incidentally, is much better than the manufacturer's specs. The pressure pads at the erase and record/play heads also contribute toward reducing wow and flutter. The 3-digit index counter is driven by a band of rubber off the supply turntable. A useful feature of the machine is that, in the stopped position, the capstan pressure roller swings downward out of the way so that the tape can be threaded from the front of the machine, not into the usual slot or through some other obstacle course. See Figs. 3 and 4.

The automatic shut-off switch is controlled by a wire lever located under the head cover. In STOP position, the shut-off lever recedes to make tape threading easier. Tape is removed from the heads in FAST FORWARD and REWIND modes.

Unusual spring-loaded, mechanically actuated linkages engage and disengage all rotating components. They also apply the pressure pads, which are mounted on hinged shields. This gets them completely out of the way for

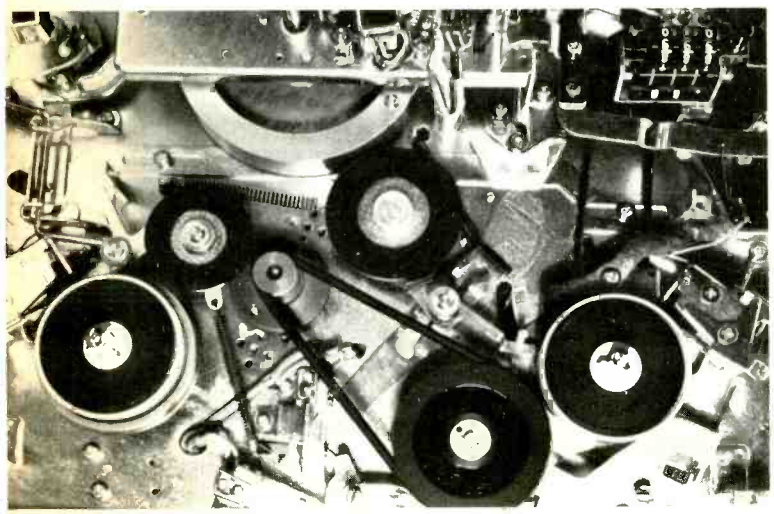
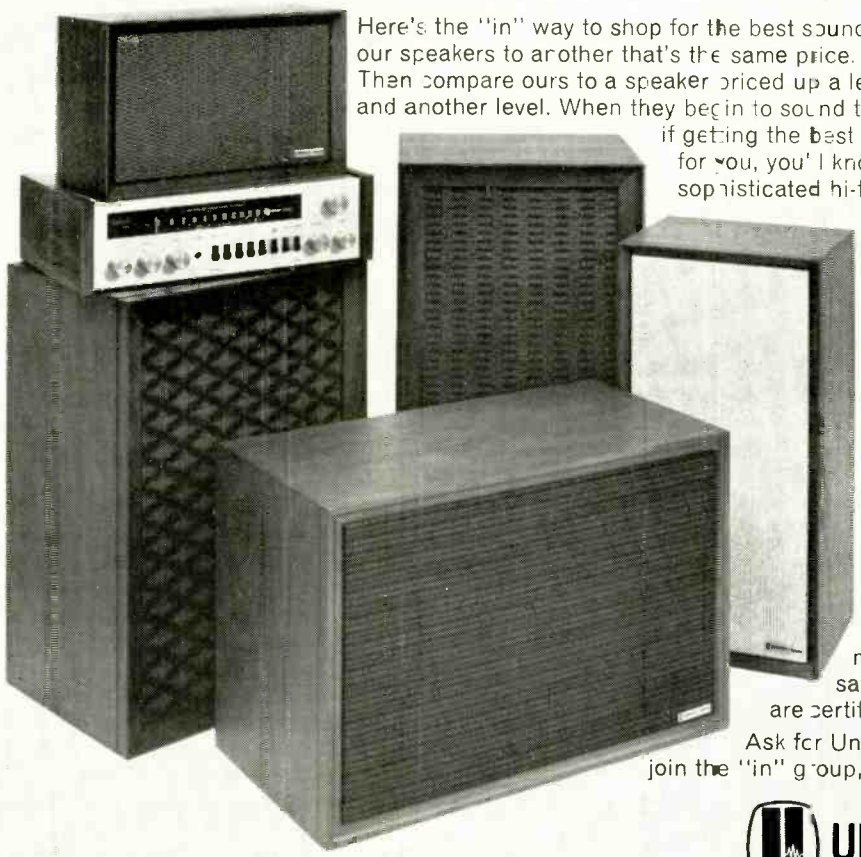


Fig. 2—The 230's drive mechanism is pictured here. In rewind position, the outside of a band of rubber around the idler drives a clutched supply turntable. For fast-forward drive, the small rubber idler is driven by the outside band of rubber around the motor pulley.

If we can beat a higher price speaker, would you mind paying less for University?



Here's the "in" way to shop for the best sound at the best price: Compare one of our speakers to another that's the same price. Listen to both for a few minutes. Then compare ours to a speaker priced up a level. Then go up another level... and another level. When they begin to sound the same, compare the price. Now if getting the best speaker buy on the market is "in" for you, you'll know why University is "in" with sophisticated hi-fi enthusiasts everywhere.

Just for your own amusement, listen to the amazing big sound of the University Mini-Flex bookshelf speaker. Then try our popular Ultra D, or revolutionary Laredo. For another real surprise listen to the magnificent Estoril. Then see if you don't agree it's "in" to save money.

But whatever you do, don't pass up our greatest triumph to date—the new University Studio Pro-120 Solid-State FM/Stereo Receiver. There's nothing like it.

It has the top-of-the-line quality that easily matches or beats any of the Big 5 receivers...with a very middle-of-the-line price. For your own satisfaction (and ours), all of the specs are certified by an independent testing lab.

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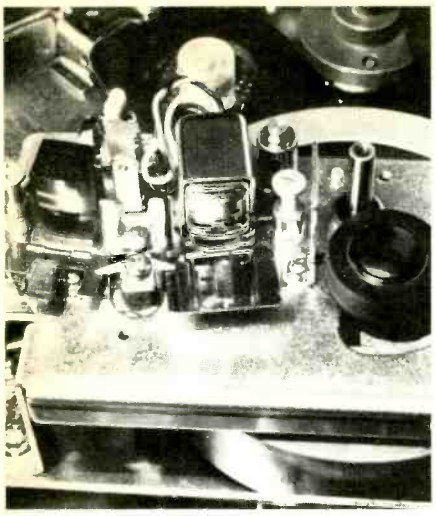


Fig. 3—At left, the head assembly is shown with the gate open. You can see the flywheel at the bottom.

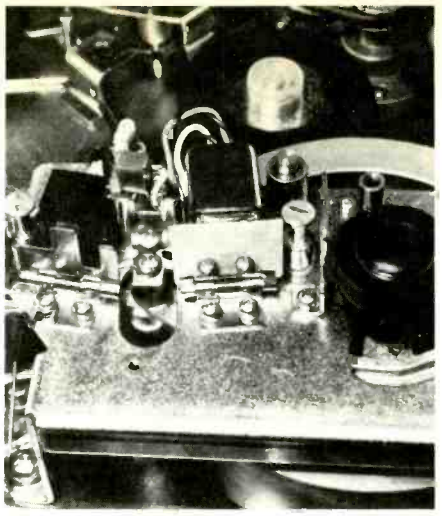


Fig. 4—The gate is closed here. Note how the pinch roller has moved up into position compared with Fig. 3.

cleaning the heads, as well as for threading tape. This feature also maintains good tape-to-head contact when closed. A terminal board-like tie point is used for the record/play tape head, useful in the event the head must be replaced. Heads and associated guides are mounted on a 1/16-in. steel platform, bolted to the 1/16-in. steel chassis.

The capstan idler has a plastic cap for protection against dirt; some springs have sleeving over them or styrofoam material stuffed into them to eliminate resonances. A plastic fan, which cannot become bent and therefore unbalanced, is mounted to the motor shaft, providing effective air circulation for cooling the motor and nearby power-transistor heat sinks. Other extra features, such as plastic retainer clips which hold the coiled-up speaker cables, are typical of the painstaking attention to detail put into the machine. There is a handy compartment in the rear which stores the microphones, cables and power cord.

Electronics are mounted on printed-circuit assemblies which are accessible though somewhat crowded, as seen in Fig. 5. Use of plastic sleeving and harness-ties helps. Electrical controls are of good quality; selector switches have positive detent action; front-panel ganged potentiometers for volume (concentrically clutched so they may also act as balancing controls) and tone controls are sealed and smooth-acting. Other front-panel facilities include a stereo left-channel right-channel mode switch, on-off speaker pushbutton, power switch, twin VU meters, and a binaural monitor (stereo headphone). A speed-change control switches in the correct equalization in addition to switching pulleys.

Performance

Measurements taken to check the unit's performance proved it to be a fine performer that meets most of its specifications. Playback frequency response at 7½ ips, shown in Fig. 6, is 50-15,000 Hz ±2 dB, which is very good.

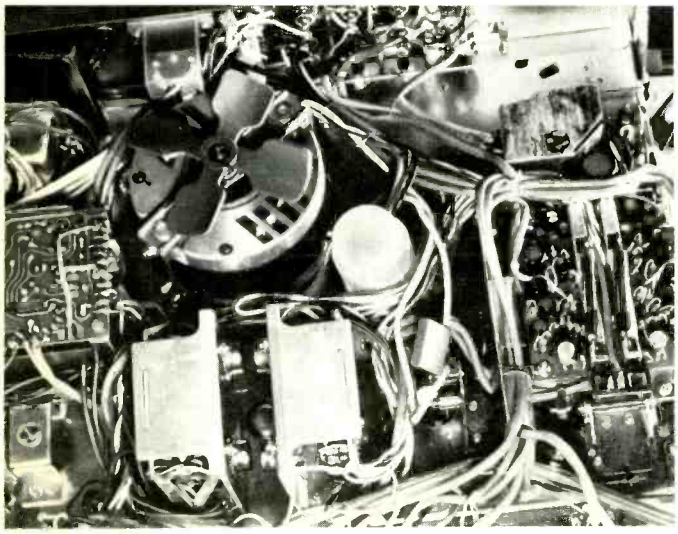


Fig. 5—The Sony 230's underside shows its electronics and motor. You can see the output transistors that are mounted in heat sinks in the bottom part of the photo, as well as a printed-circuit board at left.

Referring to the record/playback response in Fig. 7, at 7½ ips there is a 5-dB rise at 9 kHz, which can be compensated for by the unit's tone control. The tone control, which is actually a treble control, starts to act above 2500 Hz and swings ±15 dB at 15 kHz. Therefore, frequency response can be made fairly flat. The same is true for the other speeds. At 3¾ ips, the recorder has a respectable response, being down only 3 dB at 12 kHz. And the 1⅞-ips response is smooth, though the frequency range is compressed, naturally. The lowest speed is suitable for recording material that has no significant information above 6 kHz, where the unit's response is down 2 dB and starts to fall off rapidly. See Figs. 8 and 9.

The record/playback signal-to-noise ratio averages out for all speeds at −45 dB left and −40 dB right, which is average for this type of machine (perhaps there was a noisy component in the right channel of the sample unit, in which case the corrected signal-to-noise ratio would be better). Crosstalk is at least 45 dB away and therefore adequate. Harmonic distortion at −10 VU is a low 1%, while intermodulation distortion at −10 VU is below 3%—also excellent. On the built-in meters, 0 VU is 1 dB off from standard 0 VU, a most acceptable figure for this class of recorder. With the recording volume control turned up full, 30 mV is required into the high-level auxiliary input for recording at 0 VU. This means that the auxiliary input can accommodate any type of input source not requiring special equalization. RIAA equalization is provided internally when going through the phono input. Rewind time was a satisfactory one minute for a 1200-ft. tape. The same time period was consumed in the fast-forward position.

Unlike most playback amplifiers that are built into recorders, the ones inside the 230 are *really* good performers. In fact, they exceed specifications and are capable of driving efficient speakers to room-filling sound levels at low distortion. Amplifier frequency response, shown in Fig. 10, is practically a straight line, ignoring the rolloff below 30 Hz. Harmonic distortion and IM distortion are plotted in Fig. 11. With both channels driven simultaneously, 5 clean rms watts are available throughout the audio spectrum for each 8-ohm speaker per channel. In mass-market consumer parlance this could be called 20 watts total music power.

The magnetic input, sensitive enough for most cartridges, is RIAA equalized, as shown in Fig. 12.

In use, the 230 handles smoothly and efficiently. The tape deck is quiet, with remarkably little motor vibration,

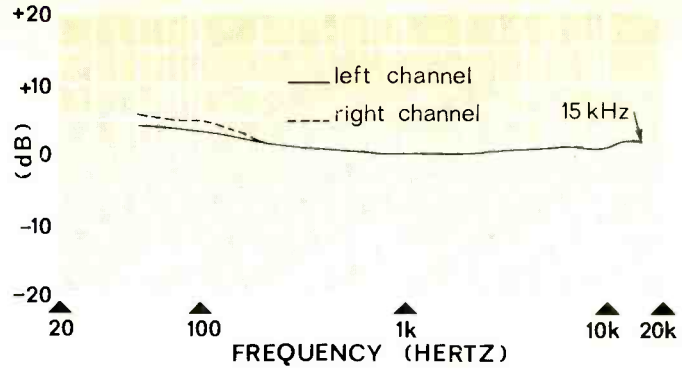


Fig. 6—Playback response of the Sony Model 230 at 7½ ips.

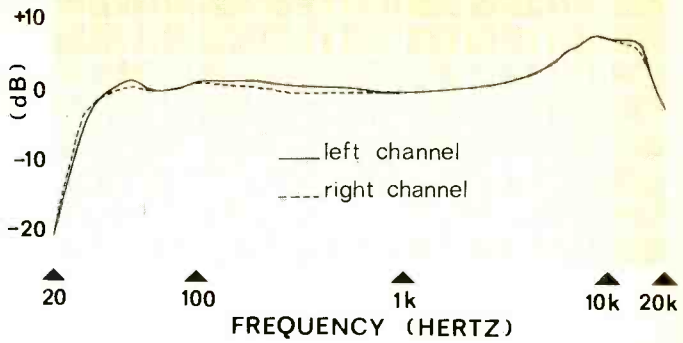


Fig. 7—Record/playback response at 7½ ips (recorded at —10 VU).

Fig. 8—Record/playback response at 3¾ ips.

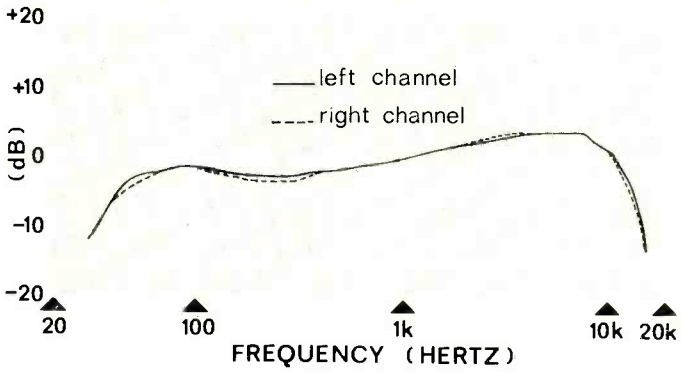
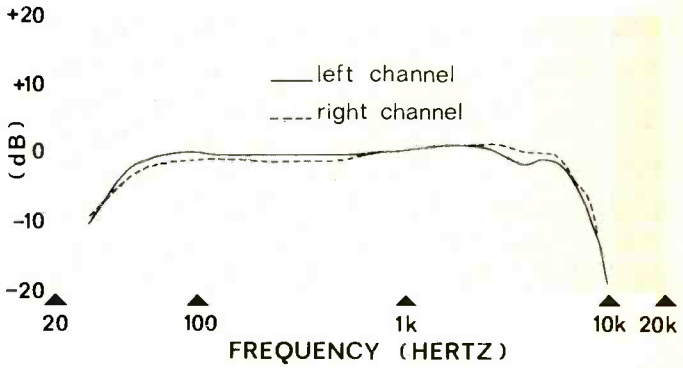


Fig. 9—Record/playback response at 1⅞ ips.



thanks to its excellent shock absorbers; tape threading is particularly convenient. A minor problem, correctible externally, is that with one orientation of the power plug, power-line filtering of the electronics is not as good as it could be because an oil burner going on caused clicks to be heard through the unit. Simply turning the plug around corrects this, though.

When a good sound source is fed into the unit, or when playing pre-recorded tapes while using efficient external speaker systems, the sound is crisp and full. Its own speakers are handy for portable or monitoring use and put out lots of sound. Each 230 speaker is a 5-in. unit, surrounded with felt-like insulation, in a wooden baffle. The baffle is covered with grey leatherette-type material that matches the rest of the recorder. The model SS-23 speaker option for the 230W unit utilizes the same 5-in. wide-range speaker as the portable's, but is in an oiled walnut enclosure (9 in. x 4¾ in. x 16½ in.).

Conclusion

The new Sony 230 (or 230W) is ideally suited for one who does not yet own a stereo hi-fi system and who wishes to start with a reel-to-reel tape recorder/player *first*, following this later with a turntable, a tuner and, perhaps, more sophisticated high-efficiency speaker systems. And for someone who already owns a good stereo system, the 230 will serve just fine as a moderately-priced tape machine (used as a deck) with the added fillip of being a good, complete portable tape recorder/player system.

This may not be a unit for the tape recordist buff, who will insist on three tape heads, echo facility, mixing provision, etc., but it is a fine unit in its price class. The 230's control amplifier is the real star here. Though a low-power one in relation to what we expect from component amplifiers and receivers, it nevertheless combines clean output with wide operating flexibility, all built into one compact package. The tape transport itself has been proved out in other Sony models, while incorporating additional refinements that recordists will welcome.

With the understanding that the amplifier will not be able to match the higher-power ones commonplace in component amplifiers, and therefore would not be able to drive low-efficiency speaker systems satisfactorily, we would have to call the 230 a particularly excellent buy at its price ($249.50), capable of producing good recordings and playback. (This would be enhanced further by better microphones and speaker systems, of course.)

Therefore, kudos go to Sony for creating this all-in-one concept—a respectable stereo control amplifier integrated with a good, basic tape machine—at what is truly a very low price when you consider the 230's versatility and overall quality.

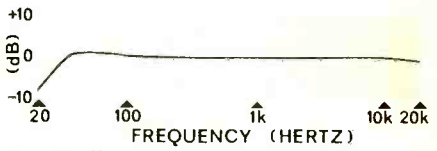


Fig. 10—Frequency response of the Sony Model 230's amplifier-preamplifier at 1 watts into 8 ohms.

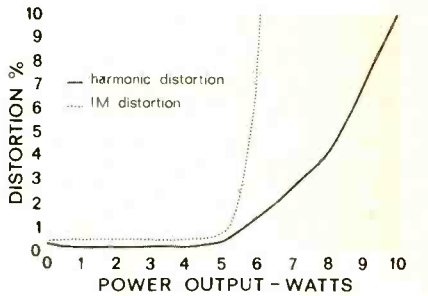
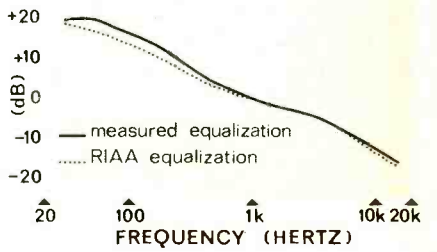


Fig. 11—Distortion characteristics.

Fig. 12—Phonograph equilization characteristics. The dotted line represents RIAA equalization; the solid line, measured equalization.



Elpa Model PE-2020 Automatic Turntable

MANUFACTURER'S SPECIFICATIONS – Speeds: 16⅔, 33⅓, 45, and 78 rpm. Pitch control: range of 6% at all speeds. Wow and Flutter: 0.1%; Rumble: 55 dB (CBS-RRLL). Tangential tracking error: 1.7 deg. max. Vertical tracking angle: Adjustable for 8 records. Tone-arm force, adjustable from 0 to 6 gms. Cartridge weight range, 4 to 18 gms. Dimensions of chassis plate, 14 3/32 x 12 3/64 in. Price: $129.50.

The latest automatic turntable to appear on the U. S. market is the Perpetuum-Ebner PE-2020. It is loaded with features, some of which are real innovations for automatic turntables. Outstanding among them is the facility for adjusting vertical tracking angle for the optimum position with only one record on the platter, as well as an averaged position for best tracking angle when playing a stack of up to 8 records automatically.

The unit plays at four speeds, 78, 45, 33⅓, and 16⅔ rpm, all adjustable to ±3% speed variation for musical pitch control. It may be played manually, with the center spindle having a sleeve which rotates with the platter, avoiding wear on the center hole of the record. Automatic action functions to inaugurate the first play, and at the conclusion of the play it raises the arm and returns it to the rest. It is provided with a single-lever function control which starts or stops the action, or which lifts the pickup and lowers it at the command of the user.

The arm is "dynamically" balanced, with stylus force settable from 0 to 6 gms. That is, the arm/cartridge mass is balanced with a counterweight, and a spring applies the desired stylus force. Thus, it is more impervious to external forces than are other methods.

Fig. 1—The Elpa PE-2020 Automatic Turntable on its base.

The tubular arm is equipped with a resiliently mounted counterweight which has a plastic center that is threaded for easy adjustment to balance any cartridge weighing from 4 to 18 grams—which covers practically every one on the market. A tracking-force adjustment knob is situated at the side of the tonearm pivot area. When not in use, the arm can be locked to the rest by a plastic clamp.

The "command center," located at the front right corner of the base, has a single lever to control all functions. It has five positions—center is off, and to the right is the stop position and the start position. At the left is the lift position for cueing or for temporarily stopping the play, and at the furthest left is the position for lowering the pickup to the stylus again. At the left front corner is a lever which selects the speed, and a dial below it provides the vernier speed control.

The lifting and lowering of the pickup arm is damped so that it lowers gently to the record surface, with no bump or bounce.

It is possible to repeat a record indefinitely by inserting the center spindle and *not* rotating it to its lock position. The machine will then play the record continuously as long as desired.

Anti-skating is provided in an adjustable form, since different stylus contours require differing amounts of anti-skating compensation. The setting dial (located on the base plate) is numbered from 1 to 10, and a chart in the instruction booklet shows the correct setting of the dial for four spherical radii and for two sizes of elliptical styli, all at any stylus force from 0 to 6 gms.

One feature required by the vertical-tracking variability is the necessity of mounting the cartridge in a specific manner so that it is correctly positioned to make the tracking angle at the normal value when the indicator shows it is set for a given number of records. This mounting method involves the use of a plastic gauge which slips over the slide plate (which fits into the head of the arm). This gauge shows when the cartridge is positioned correctly, both as to height and overhang. Once this is done, the small knob on the front of the slide correctly indicates the 15-deg. tracking angle for the number of records shown by the knob. This number is visible through a small rectangular opening in the top of the cartridge head. The numbers range from 1 to 8—when playing a single record, the knob is set at 1, and when playing a stack of records, it is set at one-half the number of records on the stack, thus averaging the tracking angle over the lot.

Selection of set-down position for the arm is automatically determined by an ingenious method. The platter has a 3/16-in. depression which is 8¼ in. in diameter at the center—large enough for a 7-in. record. When a large record is on the platter, a small plunger in the platter is depressed part way down, and during the change cycle it actuates a lever to select the large diameter; simultaneously another lever outside the turntable rises and, if it contacts the rim of a 12-in. record, the arm sets down at that diameter. If a 10-in. record is on the platter, the second lever is permitted to raise higher, and the arm sets down correctly for the 10-in. diameter. If, however, a 7-in. record is on the platter, the plunger in the center is depressed further, striking a shoulder on the first lever, and causing the arm to set down at the 7-in. diameter. The exact set-down position for a 12-in. record can be adjusted by a screw accessible through an opening in the base plate. This sets all three diameters correctly.

If no record is on the turntable, the plunger, in its undepressed position, prevents the mechanism from being actuated. This eliminates the possibility of damaging the stylus by trying to play the turntable surface.

The chassis plate is a steel stamping, and bonded to it to avoid resonance is an attractive dress plate of grained aluminum, with neat square corners. It measures 14 3/32 x 12 3/64 in., and seats on three plastic housings for the damped springs which support it. Two sliding pieces of sheet metal engage the underside of the motor board to hold it in place and prevent removal. They do not touch the motor board in normal use.

The motor is a 4-pole, dynamically balanced induction unit which is mounted centrally on a rubber bushing. It has the usual four steps on its shaft, each of which is slightly tapered to provide the speed variation as the idler wheel is raised or lowered by the vernier speed control. This shaft engages a plastic idler wheel which is 1.75 in. in diameter, and the idler, in turn, engages the driven inside rim of the 7¾-lb. die-cast platter, which is also dynamically balanced. The idler retracts when the mechanism is stopped.

To effect the raise motion of the arm for cueing, the main cam has two idle points—when the control lever is

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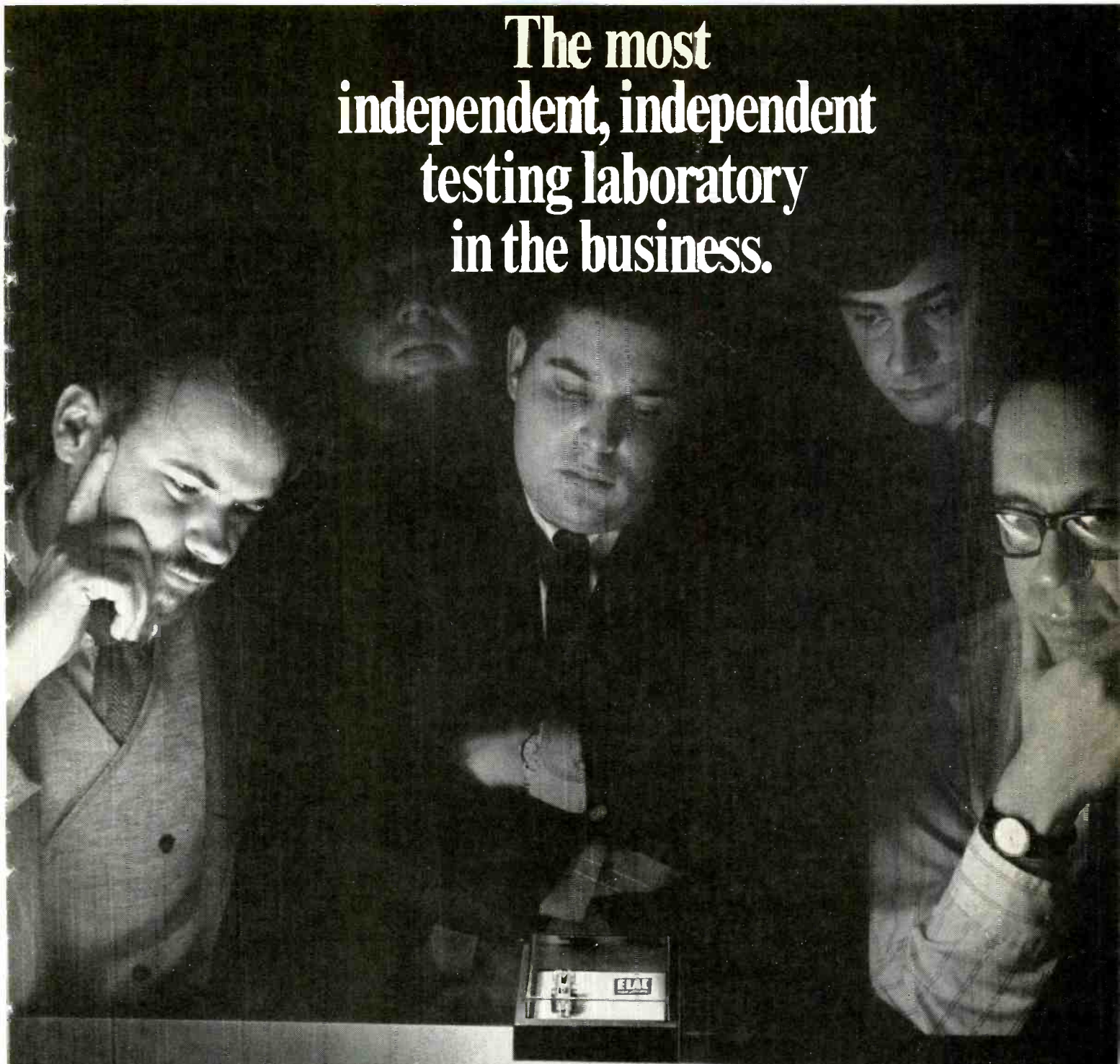

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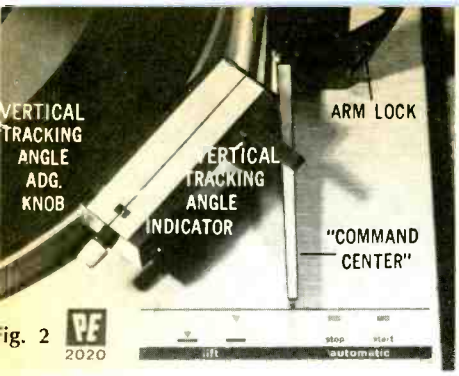


Fig. 2

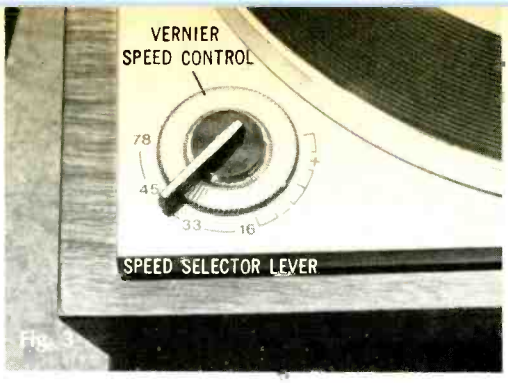


Fig. 3

Fig. 4

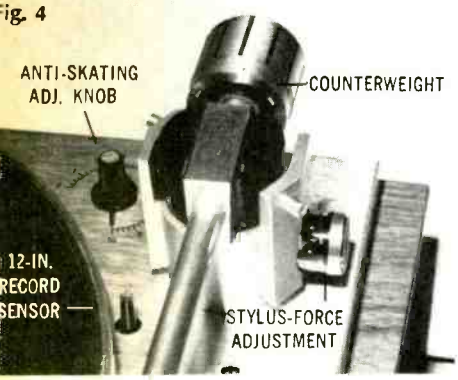


Fig. 2—Close-up showing tracking-angle indicator, arm lock, and "Command Center" control lever.

Fig. 3—Speed selector lever and vernier speed adjuster.

Fig. 4—Arm mounting, showing counterweight, stylus-force adjusting control, anti-skating adjuster, and 12-in. record sensor.

placed on ▼, the cam rotates only about half way, remaining in that position until the lever is pushed to the ▼ position, when it completes the revolution and lowers the arm.

When mounted, the PE-2020 requires a clearance of only $4\frac{15}{16}$ in. above the motor board, and $3\frac{37}{64}$ in. below.

Performance

The two most important measurements that can be made on a turntable are its rumble and its wow-and-flutter. The PE-2020 rumble (NAB method) measures 38 dB below 3.54 cm/sec in the stereo mode, and 42 dB below when in mono. All of the rumble appears to be below the audible range. Wow and flutter measures .09% in the range from 0.5 to 6.0 Hz, and only .07% in the range from 6 to 250 Hz. These figures are excellent for automatic turntables.

Tonearm resonance is below 10 Hz, and the maximum tracking error is 1.7 deg.

The vertical tracking angle was checked using the CBS Labs STR-160 test record, which is cut with 15 different adjustments to the cutter head, each representing a specific vertical tracking angle. With the pickup connected in the vertical mode—that is, with one pair of leads reversed—the output of the record is measured on a harmonic distortion meter. The cut showing the minimum distortion indicates the vertical tracking angle of the cartridge/arm combination.

The cut representing 16 deg. vertical tracking angle provided the least distortion with a single record on the platter (the next smaller angle on the record is 12 deg.), so 16 deg. is closest to the desired angle. Then the STR-160 test record was played at the top of a stack of four records, and minimum distortion appeared when the cartridge indicator was on 4. It was again played with the test record at the top of a stack of eight records, at which time the minimum distortion appeared when the indicator was on 8. The indicated distortion figures ranged from 3% on band 1 down to 1% on band five (16 deg.), and up to 5.2% on band 15.

This clearly indicates the virtue of the adjustable vertical tracking angle in reducing distortion from the record, and in combination with the variable skating-angle compensation shows that the PE-2020 is well equipped to reduce distortion to a practical minimum. As a consequence, the vertical tracking angle adjustment is not merely a gimmick. But can a difference be detected by ears? On a few records with a preponderance of highs, some "hash" did appear to be reduced through assistance from the adjustment. This is really a case, however, where every little bit of reduction in distortion helps, even though it is difficult to make precise aural observations.

It's all additive: a shaving off of distortion through an anti-skating adjustment, a sliver of reduction through proper vertical tracking angle adjustment, etc. Of course, not all modern records are cut at a 15° angle, though more and more record manufacturers are adopting it. And the truth is, not all cartridge/styli assemblies hit 15°, though they're usually pretty close to it. Nonetheless, the new PE automatic turntable does give you a choice of action, though it might be hit or miss on many occasions.

One of the disadvantages of the induction motor is its response to lowered line voltages, as has often been stated. The PE-2020 maintains exact speed at all voltages from 105 up, but is 1% slow at 100 V, 2% slow at 92 V, and 3% slow at 87 V. These can be compensated by the vernier control, of course, but only by giving up the + side of the vernier speed control. At 76 V the turntable runs 7% slow, but it is unlikely that any such reduction in line voltage would ever be encountered—most householders in average residential areas complain that their voltage is 120 or more, rather than below 110, as it often used to be.

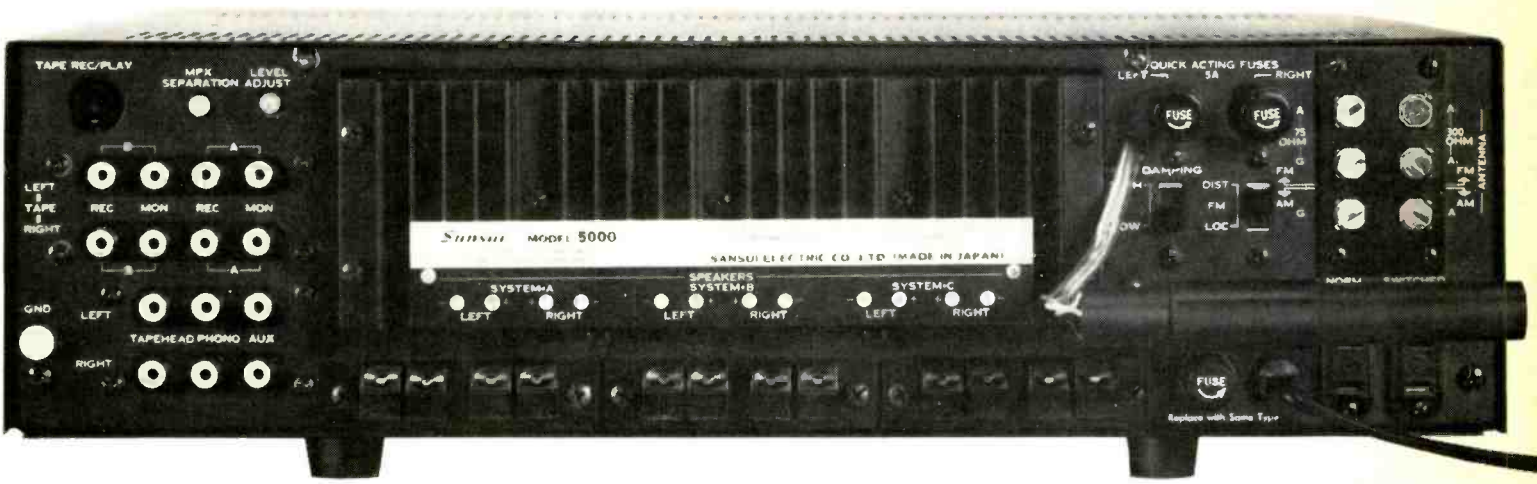
Priced at the now practically standardized figure of $129.50 for high-quality automatic turntables, the PE-2020 is at least equivalent in performance to other automatic turntables in its price class, and it is a most attractive unit. In operation, it leaves nothing to be desired from the standpoint of convenience or appearance. The simplified "Command Center" operating lever is particularly appealing since it enables users to control all most-used play functions with only one control.

Available as accessories are the usual bases, dust covers, and the automatic 45 spindle. The unit comes with a single-play 45 adapter, two spindles for automatic and manual operation, a stroboscope disc, and the cartridge setting gauge.

Check No. 42 on Reader Service Card

Fig. 5—Cartridge shown in minimum and maximum vertical-tracking-angle positions, indicated by "1" and "8".

Back Power!



Take a close look at the back of the powerful, exciting, Sansui AM/FM Stereo 5000. You'll see the inputs for 3 pairs of stereo speaker systems that can be played individually or in pairs—engineered quick holding plugs that eliminate the need for cumbersome clips; selective monitoring for 2 tape decks so that you can monitor while you record. Even the inputs for phono, tape, and aux. are grouped for easier access and to reduce the chance of wires accidentally touching. ☐ The Model 5000 Receiver features FET FM front end and 4 Integrated Circuits, with a set of specifications that exceed Sansui's unusually high standards — 180 watts (IHF) music power; 75 watts per channel continuous power; FM tuner sensitivity of 1.8 μV (IHF); selectivity greater than 50 db at 95 MHz; stereo separation greater than 35 db; amplifier flat frequency response from 10 to 50,000 Hz. ☐ The front of the Sansui 5000? See it at your franchised Sansui dealer. Price **$449.95**

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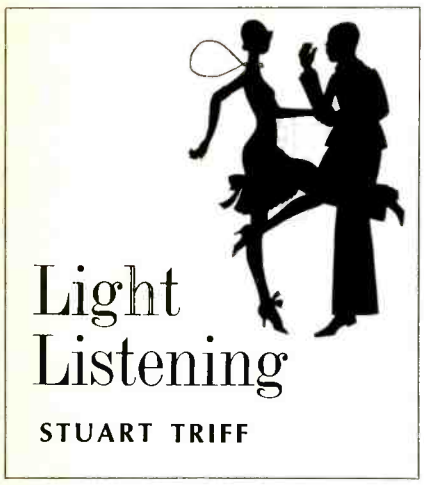
AUDIO MUSIC REVIEW



Light Listening

STUART TRIFF

The Twenties & Thirties Revisited

WHY, IN THIS nuclear neurotic age, has there been such a renaissance of interest in popular entertainers and entertainment of three and four decades ago? Dismiss it all as camp (high or low), if you will, or just another passing fad. I like to think that it's due, in part, to the desire for an escape to the gentler and less hectic way of life of a bygone era. Whatever the answer, the trend is clear: from pop art to old movie and radio serials, to the success of such recent films as "Thoroughly Modern Millie," and most noticeably, in the recent surge of recorded reissues of popular music emanating from America's two major companies.

Attempts have been made since the early days of LP to establish and release on a regular basis, esoteric material of historical significance to the popular collector. These efforts were not strongly supported by the record-buying public, and what began as potentially ambitious and admirable projects, were soon abandoned.

In the mid-Fifties, Victor inaugurated a subsidiary pop label, called simply, "X." For this label, Bill Grauer, Jr. and Orrin Keepnews produced an excellent series of eight discs, each devoted to a famous personality: Fred Astaire, Bing Crosby, Russ Columbo, Frank Crumit, Ethel Waters, Helen Morgan and Fanny Brice, Ethel Merman and Gertrude Niesen, and Cole Porter and Harold Arlen. This interesting collection of "vault originals," as they were aptly designated, has disappeared from the catalog, though the Astaire record is now available in England on London-Decca's "Ace of Hearts" label.

Columbia had, up until recently, been less active than Victor in providing us with recorded memorabilia. Hollywood's film version of Ruth Etting's life inspired an LP of a dozen originals done by the singer between 1927 and 1934. A 3-record set from Columbia, "The Original Sound of the Twenties," contains many fascinating items, including eight Paul Whiteman tracks, sides by Duke Ellington, Louis Armstrong, the Dorsey Brothers Orchestra, Bing Crosby, Kate Smith, Ethel Waters, Blossom Seeley, Rudy Vallee, Buddy Rogers and many others.

Columbia's treasure house, not as well-stocked with vintage material as Victor's, has had to tap the old Brunswick catalog for much of its material. An incomparable collection of Fred Astaire in songs from his RKO musicals was the first fruits culled from the Brunswick archives, released by Columbia's subsidiary, Epic. The latter has recently given us a dandy couple of 2-record sets, featuring popular personalities of stage, screen and radio. The first, "Those Wonderful Girls," offers an impressive array of names in some of their best recordings: Ruth Etting, Helen Morgan, Ethel Waters, Kate Smith, Marlene Dietrich, Grace Moore, Frances Langford, Irene Dunne, Kay Thompson, Dorothy Lamour, Alice Faye, Martha Raye and Lee Wiley. Less successful is the sequel, "Those Wonderful Guys." With few exceptions, the material in this compilation is not very good, nor are the performances always representative of these gentlemen at their best. Still, the roster of singers *is* choice: Eddie Cantor, Al Jolson, Russ Columbo, Cab Calloway, Dick Powell, Gene Austin, Cliff Edwards, Fred Astaire, Hoagy Carmichael, Nelson Eddy, etc., etc.

Modern reissues

The degree of success in the remastering of all the aforementioned recordings varies from poor to surprisingly good. This brings us up to the present and the new releases at hand, from RCA Victor's "Vintage Series" and Columbia's newly-established "Hall of Fame Series."

RCA's *Vintage Series*, founded about three years ago, has been yielding a group of invaluable reissues; excellently engineered, well-produced and handsomely packaged. Previous releases have been devoted to Jeanette MacDonald and Nelson Eddy, John Charles Thomas, and the Isham Jones Band. The latest additions to the series are dedicated to original-cast performances from early film musicals, and to George Olsen's Band.

"Stars of the Silver Screen, 1929-30" (LPV-538), is a delectable documentation of the early talkies and the personalities who appeared in them. Two of the songs actually predate the sound era: the title theme from "Ramona," recorded in 1928 by Dolores del Rio; Irving Berlin's "Where Is the Song of Songs for Me?" sung by Lupe Velez in "Lady of the Pavements"; a part-talkie, directed by the famous D. W. Griffith. All of these curios have their points of interest, but I especially enjoyed Charles King's rendition of the title song from "Broadway Melody" (reputed to be the first "all-talking, all-singing, all-dancing movie"); Gorney and Harburg's torchy "What Wouldn't I Do for That Man?" sung by Helen Morgan in "Applause" (an early Hollywood directorial effort by Rouben Mamoulian); Gloria Swanson's surprising soprano in "Love, Your Spell Is Everywhere" from her first sound film, "The Trespasser"; Maurice Chevalier's classic, "Louise" from his American screen debut in "Innocents of Paris"; and "Dream Lover" sung by Jeanette MacDonald in Ernst Lubitch's "The Love Parade." And there's more . . . much more! Anyone interested in the history of movie musicals, should not be without this collection.

One of the most popular dance bands of the Prohibition Era and into the early days of radio was the aggregation billed as "George Olsen and His Music." Olsen, along with Paul Whiteman, Art Hickman and Isham Jones, was one of the trailblazers in the development of American dance music. Over a period of years, the Olsen Band recorded nearly 200 sides for Victor, and this Vintage Series release (LPV-549) includes sixteen of them. The earliest selections ("A New Kind of Man" and "Sax-o-Phun") are acoustical, and date from 1924. The band's instrumentation, typical of the period, comprises three saxophones (one, interchangeable with clarinet), two cornets, trombone, tuba, banjo, piano and traps (strings were added later on). The customary male vocal trio is featured in the middle chorus of most of the songs and their singing, while quaint, is decidedly pallid compared with the irresistible sparkle and verve of the instrumentalists.

In the Twenties, leading dance bands were much sought after for featured spots in Broadway musicals and six of the numbers on this disc are from shows in which the Olsen group appeared, between 1925-27: the title song from Rodgers and Hart's "The Girl Friend"; "Makin' Whoopee" from "Whoopee"; and two songs each, from "Good News" and Jerome Kern's "Sunny." Two pop favorites of the Charleston era, "Doin' the Raccoon" and "Sam, the Old Accordion Man" are given the most infectious treatments imaginable. The re-mastering of the material on these welcome new entries in the Vintage Series is exceptionally well-done — perhaps the best from Victor, so far.

The initial releases in the *Columbia Hall of Fame Series* are derived almost entirely from Brunswick originals. The first, a 2-record set, "Bing Crosby in Hollywood" (C2L-43), is a survey of The Groaner's career in Hollywood, from 1930 to 1934. In listening to these four sides, one is struck primarily by two things. One is the Crosby voice (a high baritone in those days), used with unfailing musicality and an innate feeling for a melodic phrase. Then, there are the songs . . . oh, what wonderful tunes! The songwriting teams, toiling regularly in Hollywood in the 1930's, read like the ASCAP Dictionary: Ager & Yellen, Wayne & Rose, Rainger & Robin, Johnston & Coslow, Brown & Freed and Revel & Gordon, among others. No wonder Crosby had the opportunity of introducing so many songs that subsequently became standards!

The more than two dozen tracks are arranged chronologically, beginning with "The King of Jazz" (1930), in which Bing made his movie debut with Paul Whiteman's Rhythm Boys. Although Columbia originally issued a generous six selections from the film (remember, this was well before the days of soundtrack and original cast albums), featuring Whiteman's Orchestra, the Rhythm Boys and others; Crosby's one solo number, "Music Hath Charms," was not among them. His first starring role was in "The Big Broadcast" in 1932, singing the Rainger-Robin song, "Please." This launched his spectacular movie career and a twenty-year association with Paramount Pictures. Other highlights include souvenirs from "College Humor" ("Learn to Croon" and "Down the Old Ox Road"); "Too Much Harmony" ("Thanks" and "The Day You Came Along"); "Going Hollywood" ("Temptation"); "We're Not Dressing" ("Love Thy Neighbor" and "May I?"); and "She Loves Me Not" ("Love in Bloom").

A few years ago, Decca released a series of no less than sixteen LP's of songs from Crosby movies, spanning the years from 1935 to 1956. With the Columbia set, we now have a unique and virtually complete biography in sound of Bing Crosby's extraordinary Hollywood years.

The second *Hall of Fame* reissue features Ethel Merman, Mae West and Lyda Roberti. Ethel Merman recorded her first four sides for Victor in September, 1932, and then made several more for Brunswick from late 1932 to 1935. It's not surprising that today she is identified exclusively with the Broadway stage. Her early films, with the possible exception of "Alexander's Ragtime Band," were undistinguished and did not show the lady to her best advantage. Of the seven Merman numbers in this collection, five are

from shows and movies in which she appeared. "Eadie Was a Lady," from "Take a Chance," was her first original cast recording. This unusual *tour-de-force* is more of a serio-comic musical narrative than a conventional song, requiring six minutes of playing time, and first recorded on two sides of a 10-inch 78.

Accompanied by Johnny Green's Orchestra, Miss Merman sings Cole Porter's "I Get a Kick Out of You" and "You're the Top," both from her greatest stage success of the Thirties, "Anything Goes." From "Kid Millions," a 1934 Sam Goldwyn film in which she co-starred with Eddie Cantor, Merman belts out a bright Walter Donaldson tune, "An Earful of Music." And from Paramount's "Big Broadcast of 1936," the preposterous "It's the Animal in Me," sung by Ethel in a jungle sequence, clad in an animal skin and swinging from tree to tree . . . conjure up that scene, if you can! Merman's voice is a revelation in these recordings. Always the belter, she displays a big, open voice with none of the excessive vibrato and stridency she was later to develop.

Though Mae West's stage career spanned some thirty years, she is remembered today chiefly as a screen siren. An atrocious actress and a barely competent singer, Miss West is nevertheless deserving of a warm and affectionate place in our hearts as the First Lady of Camp. She's represented here by half a dozen songs from two of her most successful films: "She Done Him Wrong" and "I'm No Angel," both made with Cary Grant in 1933. The ditties are no great shakes, but they are chock-full of those hilarious double entendres for which Mae has become justly famous.

Lyda Roberti, the least-known of this trio of ladies, was a singing comedienne of the Fanny Brice school. Her trademark was the exclamation (in heavily-accented English), "I'm hot!" in which the word "hot" was given a peculiarly gutteral pronunciation, so that it sounded something like "ch-ot." Miss Roberti appeared on Broadway in Kern's "Roberta" and made a few movies, including "College Rhythm," from which she sings the title song and "Take a Number from One to Ten." These are the only two recordings she ever made. A delightful comic, she died at an early age in 1938.

The importance of this reissue and the Crosby set as well, is enhanced immeasurably by the truly astonishing re-mastering job of engineer George Engfer. Using a special equalizer developed by Columbia, Engfer has virtually eliminated the surface noise in these old 78's. Briefly, the technique is this: The source of noise can usually be found in one frequency. What the engineer has done is to cancel out that frequency or substantially decrease it, while building up the frequencies around it so that the noise is eliminated without damaging the sound inherent in the original. The improvement is such, that the discs sound better than they ever could have in their own time. Congratulations to Mr. Engfer on a remarkable achievement. Hats off, too, to both Columbia and RCA, for making all of this vintage material accessible to a whole new generation of listeners. Keep 'em coming! Æ

Stars of the Silver Screen, 1929-30
RCA Victor LPV-538 ($5.79)

George Olsen and His Music.
RCA Victor LPV-549 ($5.79)

Bing Crosby in Hollywood, 1930-34.
Columbia C2L-43 ($9.58)

Ethel Merman, Lyda Roberti & Mae West.
Columbia CL-2751 ($4.79)

Show Scores/Movie Hits

Music From Million Dollar Shows: Boston Pops Orchestra/Arthur Fiedler.
RCA Victor LM/LSC-2965 ($5.79)

This latest recording by Arthur Fiedler and the Boston Pops is devoted to music from a quartet of the best show scores of the past decade. Richard Hayman, one of the finest arrangers in the business, is represented on side one by medleys from Frederick Loewe's "My Fair Lady" and Burton Lane's "On a Clear Day You Can See Forever." The latter, a vastly underrated score, is presented in an imaginative and impressive fifteen-minute medley, demonstrating the superb talents of both composer and arranger.

The second side is given over to generous samplings from Richard Rodgers' "The Sound Of Music" and Loewe's "Camelot," the latter a score for which my affection continually grows with each successive hearing. Both of these medleys were arranged by Robert Russell Bennett, and typify this great orchestrator's fine craftsmanship and good taste.

I do not invariably approve of show tunes being treated symphonically, but these four scores are eminently suitable for such treatment, especially when done as well as they are here. Fiedler and the "Pops" are sometimes guilty of playing with an indifferent-sounding casualness, but they perform these selections with admirable polish and razor-sharp ensemble.

The sonics are the most satisfying I've yet heard in the Dynagroove process, with rich and full-bodied stereo separation. For the show buff: a highly-recommended supplement to your collection of original cast albums. S.T.

Performance: A *Sound:* A

Today's Greatest Movie Hits: Andre Kostelanetz Orch.
Columbia CL-2756/CS-9556 ($4.79)

If you happen to be an Andre Kostelanetz fan from way back, chances are you won't find this disc very rewarding. For this is the *new*, streamlined Kostelanetz approach to popular music. Gone is the huge orchestra, the symphonic arrangements, and the repertoire that relied heavily on Gershwin, Kern, Rodgers, et al.

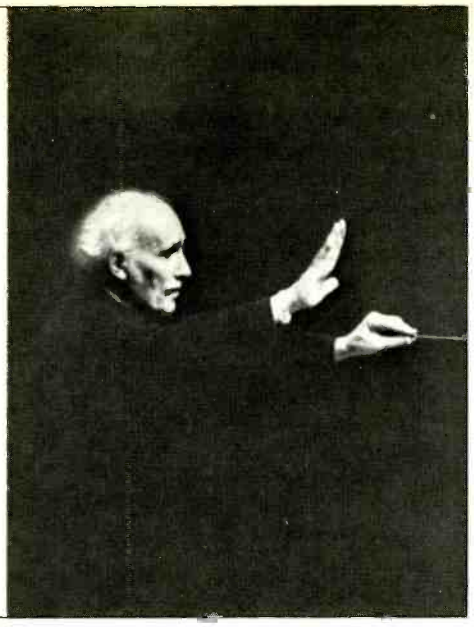
Here, we are given eleven themes from nine current movies, mostly by filmdom's younger generation of composers, played in arrangements suitable for the cocktail hour or as a background to any other worthwhile pursuit. Included are two selections each from Mancini's score for "Two For the Road" and "Doctor Dolittle" by Leslie Bricusse, as well as themes from "Barefoot In the Park," "Woman Times Seven," "Banning" and others.

The music is pleasant, if undistinguished, and nothing in the arrangements is likely to make you sit up and take admiring notice. The recorded sound is eminently satisfying, with excellent stereo quality. But I'll take the "old" Kostelanetz . . . swooping strings, harp glissandos, and all. S.T.

Performance: B *Sound:* A

Classical Record Reviews

EDWARD TATNALL CANBY



Recent Reissues

The Young Horowitz. Edited and Produced by John Pfeiffer. **RCA Victor LM 2993 mono**

"First time on LP including his first recordings," says the cover, and an interesting collection it is, dating from the earliest piano recordings, made on March 26, 1928, through a postwar recording of a Kabalevsky sonata from December of 1947. The dates and places are all given—Camden for the very early electrical 78s of 1928, then Liederkranz Hall in New York in 1930 (it later went to Columbia, and then was converted to TV use), Hollywood in 1942 and 1946 and, finally, New York's Town Hall in 1947. The recorded acoustics and the piano sounds vary accordingly, from fat, close-up and tubby to thin, metallic and distant. But the famed Horowitz trip-hammer style, that can nearly break a piano key and snap a triple-steel string, or touch a faint whisper of sound, is perfectly clear in all of these and the essence of musicality (that is, technique), however potent, put to musical ends.

Two major omissions, I suggest. First, Horowitz has long been noted for his dislike of recording, and if I am right, many of his productions have been taken down at concerts. That does, after all, make a big differnece in the recorded impact; but there is not a word here from Mr. Pfeiffer (who surely knew) on that matter. Possibly RCA would just as soon not bring it up.

Second, there is much omitted in relation to the technical side of these many recordings, which sound so different. Such a varied collection of background hisses, burbles and rumbles, you have never heard—not at all objectionable, since they are subdued very neatly, but interesting for their differences. Is the first 1928 music taken off a shellac disc? Sounds so. The recordings made a week later in the same studio are quite different. From the original masters?

Then there is that uncomfortable era of the 1940s, the war-shortage days and the time of transition from wax to acetates and then to magnetic tape. The last recording, the 1947 Kabalevsky, sounds very much like tape. Is it? That, or some fancy new disc equipment. Not so 1946, nor 1942; and there is much unmemorable flutter to be heard in these late recordings that is, of course, absent in the solid 78s of the earlier days.

Performance: A— *Sound:* C+

Toscanini Schubert Symphony No. 8 ("Unfinished"), Symphony No. 5. NBC Symphony Orchestra. (1950, 53). **RCA Victrola VICS 1311(e) stereo**

RCA is very sparing with its electronic stereo. Most of the Toscanini reissues are put out straight mono, nor are they treated to reverb, though natural reverberation is sadly lacking in most of them. Here are two Schubert recordings, dated 1950 and 1953, which *do* get the stereo treatment. It is very sparing, however. At first you may not think there is any separation. But it is there, and it does help, without adding appreciable distortion.

An odd mystery here, though I'm not the one to start phoning the authorities to find out what happened. The little Fifth Symphony is listed as having been recorded in Carnegie Hall in 1953, the big "Unfinished" in the NBC Studio 8-H in 1950, that famed acoustical padded closet of the earlier NBC broadcasts. But lo!—the Fifth is here close-up, inches away, in a very dead surround. *Carnegie???* Whereas the "Unfinished" suddenly booms out huge and impressive, seemingly in a great, big space. *8-H?* I wonder whether somebody let slip a monumental clinker, reversing the information on the record jacket? If not, then I marvel.

Both are really excellent performances—and I do not *always* say that of Toscanini. The Fifth goes, as we might expect, pretty fast, and there are the usual moments of mild disensemble. No retakes, remember. But it is nice, and fresh. The "Unfinished," surprisingly, is both massive and quite slow, with all the ponderous impressiveness that the Germanic conductors give it, and the Toscanini intensity too. The sound, again, is big and important in impact, just as it should be for this symphony. Wherever it was recorded.

Performances: B+ *Sound:* C+, B—

Tchaikowsky: Manfred Symphony. NBC Symphony, Toscanini (1949). **RCA Victrola VICS 1315(e) stereo**

"Manfred," a super tone poem and a full-length, four-movement symphony, all in one, is not too often heard, its reputation not being the highest. I figured that if anybody could make it swing, Toscanini could, even nineteen years ago; so I played this Victrola reissue from start to finish, just to see how "Manfred" sounds as of today.

Well, it isn't really top drawer Tchaikowsky, in all truth. In two major respects. First, it uses "all the old tricks," notably some striking reminiscences of the familiar "Romeo and Juliet." Second, more important, it sprawls. All this has been said in more concise form in other Tchaikowsky works. This one, according to the style of that day (1886) is long winded.

Still, if you can take your time, you will find many lovely things. The fabulously professional scherzo, for example, as light as a feather, all the instruments playing double time with an electrical tension that seems, oddly, to recall Berlioz. This movement is worth the whole. And the slow (third) movement, a pastorale, unusual for Tchaikowsky, more in the Beethoven line; also an unusual movement. (As you can see, I like the insides of this

sandwich; the outer movements are the bombastic ones.)

Yes, Toscanini does a splendid job. He is wise enough not to flog a sluggish horse; he lets the music sing in its own expansive fashion, relaxedly—which is rare for this particular Maestro! He of the super-tension high voltage approach.

As for RCA's 1949 recording, there isn't much to say except that the sound is adequate (in mild electronic stereo) and does not get in the way—and one wonders how they managed to make Carnegie Hall so dry. The standard semi-closet Toscanini sound. (Maybe there was an audience with lots of fur coats—the date was Dec. 5th, 1949.)

Performance: A— *Sound:* C+

Mozart: Cassations No. 1 in G, K. 63, No. 2 in B♭, K. 99. Salzburg Mozarteum Orch., Paul Walter. **Pirouette (Janus) JAS 19015 stereo**

Reissues within a record company's catalogue—RCA Victor to RCA Victrola, Columbia to Odyssey, Angel to Seraphim—are one thing. Reissues via licensing are something else and, more often than not, fraught with mystery. Like this release, on one of Everest's large group of associated labels. Excellent music. Very so-so sound quality, and (for my ear) a strangely familiar sound. Could it be?

The little Cassations, a species of divertimento or "entertainment," are very early Mozart works. But they are quite lovely in their appointed fashion, perhaps for outdoor performance, with plenty of wind-instrument color. They are unusual—we ordinarily are treated to the more familiar later music in the same general style.

The recordings? Quite unpleasantly, though bearably, distorted, with that grainy sort of string tone that was all too familiar in early "wide-range" recordings. (Before that, we didn't hear any highs, distorted or otherwise.) There was a notable series with the Salzburg Mozarteum Orchestra once released years ago on Epic, via European Philips. It had precisely this same sound.

Electronic stereo does not reduce the distortion, though it improves the distribution.

Performance: B *Sound:* C

British Steam

LET'S ADMIT IT, music isn't the only sound in hi-fi. Yes, perhaps 90 per cent of it is music, roughly speaking, and it ranges all the way from Beatlemania to Beethoven, hard rock to soft mood, not to mention show tunes. Yet among the few recorded sounds that undeniably are *not* music, those of steam railroading stand out remarkably.

Steam is a feature, of course, because it is antique and therefore precious; whereas diesel sounds are just everyday current noise. But steam is recorded, more vitally, because steam-sounds fascinate. They have all the basic attributes of music and all the "humanity" of things alive. Moreover, because steam on records must be *organized,* planned, shaped, pointed up for listening impact, recorded steam is invariably art. Good art or bad art, depending.

Steam has *rhythm.* Inherent, built-in rhythms that stir the same deep human impulses as the rhythms of rock and jazz and Beethoven. Pitch, too. Those marvelously wailing, near-human whistle songs. (Who wants a diesel horn?)

Above all, steam has Personality. A diesel engine is just another mass-produced machine, impersonal; and on records it sounds just that way. Its roar expresses only a single thing —power. Something, but not nearly enough.

The steam engine is like a huge tamed animal, vibrantly alive but also fallible, and thus human. It pants, it pulses, its insides gurgle; it breathes, whispers, roars. And occasionally—it falters. Wheels slip and lose traction. Like a wrestler losing his grip. (Whoever heard of a diesel losing traction? You wouldn't hear it, anyhow.) The steam engine always seems to be overloaded. It perennially labors up long hills—will it make the grade? It often doesn't. It even runs out of steam—*slowly,* like a great, tiring athlete. (A diesel would merely quit, like an auto out of gas.) Its behemoth rhythms are powerful but never tireless; it fights for every foot of rail and we hang on its stertorous breathing, almost holding our own breath, as it agonizingly loses speed before implacable uphill gravity. Something to hear!

What an emotional triumph, then—for us—when steam hits the straightaway and blasts past our mikes with that long lion's roar of success, then quickly fades into distance, into the future, into paradise, or what have you. Very symbolic. This is why steam appeals to all musical ears, trained or untrained. Pun intended.

Now it's *British* steam. First time I had run into the old-country approach to this art form.

It came to me on the British Sonologue label, which has a lovely address: 9-10 Pollen Street, London W1, England. Indeed, I had not realised [*sic*] that steam in Britain is almost as antique as our own. Oil is scarce in Europe and, until recently, the steam engines continued to run everywhere, mainly via the coal that Europe does have on hand. (In 1962 I hurtled from Le Havre to Paris behind a casual behemoth belching smoke and moving at an outrageous speed. Scared me stiff.)

The "British Steam" record is graced with a bravely enthusiastic liner-ful of printed explanation and an ingratiating narrator's voice, over the steam sounds, which points out the highlights à la BBC and keeps us more or less on the track. There's even a glossary of terms in translation "for our listeners in the U.S.A." —and much needed. After all, you have to know what a footplate is (engine cab), not to mention a signal box, which is a tower, and a driver, who is the engineer, not the big wheels that go 'round down below. Fun and games. But even so, I found myself a bit at sea, so to speak, what with all the mysterious gongs gonging (in the signal box) and the totally unintelligible conversations between good-humoured hands as the points are set and the wagons go clattering by.

So if you enjoy steam and you'd like to visit awhile at Horton-in-Ribblesdale, Shap, Crewe or Lymington Pier—then tally-ho to you, and good listening!

British Steam, vol. 1. Sonologue SL102 mono

Performance: B+ *Sound:* B+

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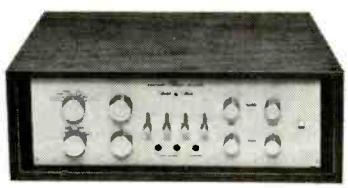

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Dixit Dominus

THANKS TO RECORDS, the days when each of the "great" composers was known for one or two "great" works have definitely ended. For Mozart, we used to settle on the last few symphonies—out of forty-one—and for Haydn it was the last dozen, or rather, a handful from that dozen—out of a total of a hundred and four listenable works. Remember? "Surprise," "London," "Military." Why bother with the rest? For Tchaikowsky, there was the "Pathétique" and, maybe, "Romeo and Juliet." For Handel? Why of course—what else: "Messiah."

Actually, in all the impractical pleasure arts one can never really say what each of us *ought* to hear or see, and what may safely be put aside. Unless we are to govern ourselves strictly by the polls, the statistics and the publicity releases. (Not so easy there! In publicity, *every* performance is acclaimed.) Times are indeed changing. Even the statistics on musical preferences fall hopelessly behind before they get into circulation. Or they are just plain misleading. Built on a misleading base.

Thus if you poll this country's symphony orchestras for frequency-of-play data on their programs, you will find one thing. And if you poll the record shops where "classical" music is on sale, you'll find something else again. Check still further, on *availabilities*, that is, what's to be had on records, what music the producers have hopefully released, with at least a small profit in mind via sales, and you'll find still another statistic, wildly unlike the symphony concert figures.

Not merely three or four Haydn symphonies, but dozens; and the same with Mozart. *All* the Tchaikowsky symphonies, even down to the little-known "Little Russian"—and who's to say that's not the one for you? (It could turn out to be your favorite, statistic or no.) As for Handel, there are pages in the catalogue, almost overwhelming the good old "Messiah."

The thing about records is that they are so personal, in the listening. The ballyhoo is still around, the critical acclaim, the big ads, the best sellers and all the rest. But when you get a record into your own living room, "far from the madding crowd," suddenly, it is on its own. The powerful voices of publicity, the persuasive reassurances of those lists of "great music" masterpieces, the opinions of the critics, including this one, are all muted, toned down, brought to silence. Nothing, really, is left but the sound of music. And the ear of the listener.

Handel? Well, why not try the recording that has prompted these thoughts, a wholly unknown piece (in terms of the popularity charts), performed by a batch of little known players and singers (same), called *Dixit Dominus*. Compared to Handel's "Messiah," its reputation is absolutely zero. So much the better! Superb Handel, charts or no charts. It was composed brilliantly at the age of 22, and its gets a lively, sincere, beautifully recorded performance with all the big Baroque trimmings — string orchestra and *continuo*, chorus of men and boys, soloists. One of those records that'll put you to hopping around the room in time with the beat.

But what makes *Dixit Dominus* especially interesting is that it is totally un-British. It was composed in 1707, before Handel had moved to England; he was then a rising young North German who had gone to Italy, that Mecca of older music, and was absorbing everything the Italians had to offer and giving it back one better. This was thirty-five years before "Messiah"—and fifty years before Handel's final English oratorio, an unknown item (as per above) called "Triumph of Time and Truth."

So if this muscular young music sounds like a skillful mixture of early Bach and Arcangelo Corelli (who lived just around the corner in Rome), don't be surprised. Be delighted. You'll find, by the way, that young Handel (Georg Friedrich), often sounds like Handel, too, well before the fact.

Handel: Dixit Dominus. Soloists, Choir of School for Church Music, Halle, Bach Orch. of Berlin, Wenzel. **Vanguard Everyman SRV 249 SD** stereo

Performance: B+ *Sound:* B+

Opera/Drama

Janácek: The Makropulos Case. Prague National Theatre, Gregor. **Epic B2C 167 (2) stereo**

The above slightly abbreviated heading stands for an immense venture into opera performance by soloists and orchestra of the Prague National Theatre (and Opera) troupe, including a brace of those incredible Czech names that might just as well be left out. Like Slávka Procházková, Premsyl Kocí, Jirí Joran . . . it's an opera in Czech, and the title is hardly enticing, nor is the composer yet very well known hereabouts (the work dates from about 1924). But even so, I found this a pleasing album, the music both expertly written and highly accessible to the ear, the drama and plot easily projected with the help of a bit of translation (provided). If the idiom is a bit old fashioned, so what? It gets its message over.

The opera has to do with a weird story of a gal who is 327 years old, having been given immortality—to a point—via a magic formula that must be renewed. She is about to run out, and tries to regain the paper with the secret on it, mislaid and now a part of a contested legacy. Sounds silly, but the story is very convincing, especially the lady's past "aliases" and her eerie knowledge of bits of past history and people long dead. At the end, the paper is found, but she is exposed—the secret formula is burned as she dies. Very fine scene.

The nice thing here is that the opera is so natural, so easily operatic—no false attempt to write a "modern" opera in stilted terms, just a fast flowing, persuasive musical story. The style, a more modern and less pretentious parallel to Richard Strauss, boasts the same sort of rapid musical speech that carries his operas along, the same persuasively casual and natural dialogue like so much normal conversation. Excellent. And the Czech performers are obviously thoroughly at home in this, their national opera.

Performance: A *Sound:* B

Handel: Hercules (Musical Drama). Stich-Randall, Forrester, Young, Quilico; Vienna Radio Orch., Academy Chorus, Priestman. **RCA Victor LSC 6181 (2) stereo**

For a long time it seemed as though we would never get to hear the many Handel operas—let alone the very numerous other oratorios (other, that is, than *Messiah*). But at last they are

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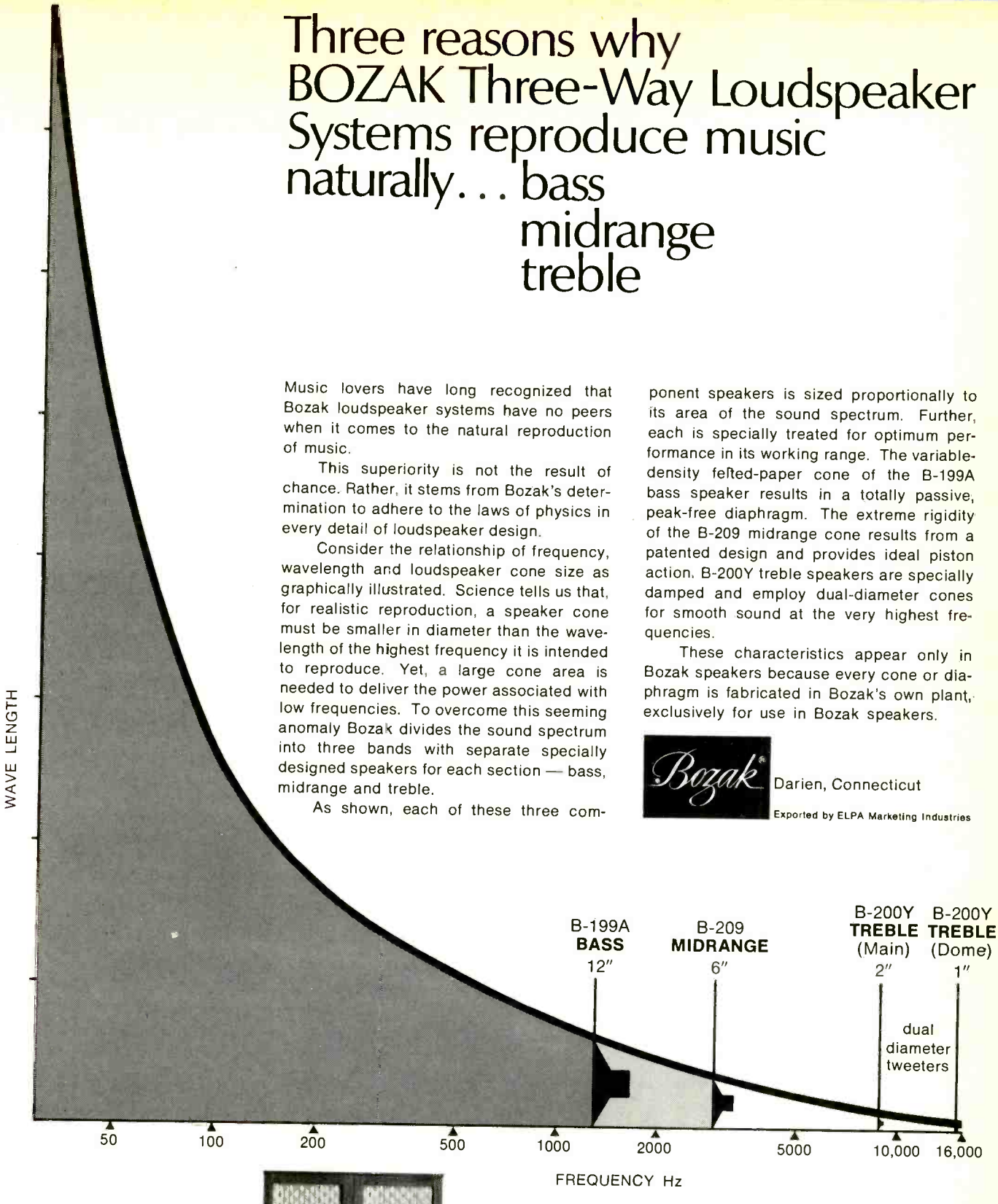

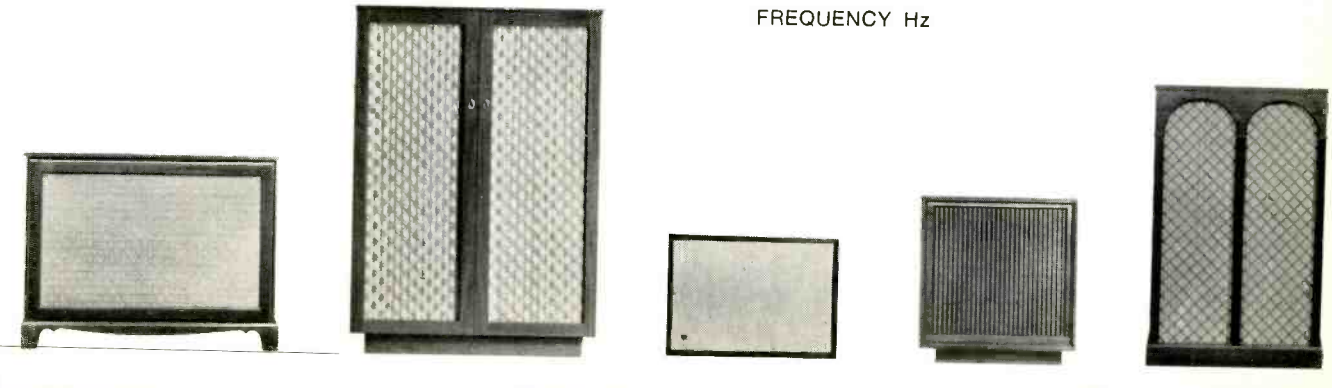

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coming. On the concert stage, with increasing success, and on records. It was Wagner who supposedly invented the term "music drama" for his enormous works—but Handel himself called this work in English a Musical Drama rather than an opera. (It is to some extent a partial oratorio since the sacred-subject oratorios were at first presented with actual scenery and costumes.) Even RCA Victor has come around to Handel! Heaven be praised.

Excellent. A typically RCA assemblage of wildly improbable internationalism, a venture recorded in Vienna by the "New York" Handel Society under the Englishman James Grayson, with singers from all over including Canada —and yet, astonishingly, the performance pulls together all these disparate elements and the Viennese musical environment for a show of quite remarkable unity. I wouldn't have believed it, ahead of time.

Like all Handel of this sort, the work is carried forward in the formal terms of recitatives and arias, one following another straight through, with only an occasional chorus to mark the major divisions of the story. Yet in spite of this formality, the stylized plot takes on human warmth and musical dignity in terms of Handel's own expressed feelings and his wonderful sense of drama, even within a relatively rigid structure. (It wasn't rigid to him; it just seems so to us.)

You'll need to read up on *Hercules* in the large and expansive booklet, though you may skip the varied publicity pictures without much pain. The text is given complete, in English as it is sung, and there is extensive and interesting background material too.

Performance: A— *Sound:* B

Telemann: Pimpinone (opera buffa). Erna Roscher, sop., Reiner Süss, bass; Berlin Ch. Orch., Koch. **World Series PHC 9066 stereo**

Pimpinone, or the Unequal Marriage, is for anybody who knows the standard comic two-character opera of the sort made famous by Pergolesi's *La Serva Pardona.* Here's the same comic burlesque style—the stuffy, amorous old bachelor after his pert little servant, who winds him around her finger in no uncertain terms. (He has to marry her, natch, to get what he wants; and she gets what *she* wants — his money and the old man as her slave.) But this is an incomparably richer, more sumptuous score than that by Pergolesi. Indeed, it has all the famed Telemann lushness of melody, texture and rhythm, via the simplest of means, a most astonishingly attractive score.

Not that we can downgrade Pergolesi. His was the prototype, and though it is lean and spare, it is full of humor and good music. But Telemann, with his North German magnificence, expands the simple form and plot into an altogether bigger affair, to the German Baroque taste and with a German text.

Excellent performance! The two voices are good, if not superb, but their possessors are both intelligent and full of understanding and humor. The action races along, the plot is easily understood (via a running English synopsis) and the German is wonderfully projected; both the arias and the rapid-fire recitatives are well performed.

Performance: A— *Sound:* B

Echoes from a 16th Century Cathedral. Roger Wagner Chorale. Angel 36013 stereo

An ever-flowing series of discs comes from this group, and now, on the heels of the new ones, comes a brace of reissues (transferred from Capitol to Angel). Have to take note of them every so often—they have virtues, all right.

The R. W. Chorale—in title an offshoot of the original Robert Shaw Chorale—is a highly commercialized group which, unlike many such, can do a surprisingly sensitive job on "classical" music of the sort here sung. These pieces, by 16th c. church composers, are intelligently and musically performed in most respects and therefore are communicative and meaningful. They include music by Victoria, Sweelinck, Palestrina, Dez Prez, etc., all for voices alone without accompaniment.

(Maybe the Chorale is, like the Columbia Symphony, any number of different groups, to fit each occasion?? Could be!)

This particular record is not new but there is no important quality lack, though the stereo is somewhat simplified (two-moke?) by current standards. I like it.

Performance: B+ *Sound:* B—

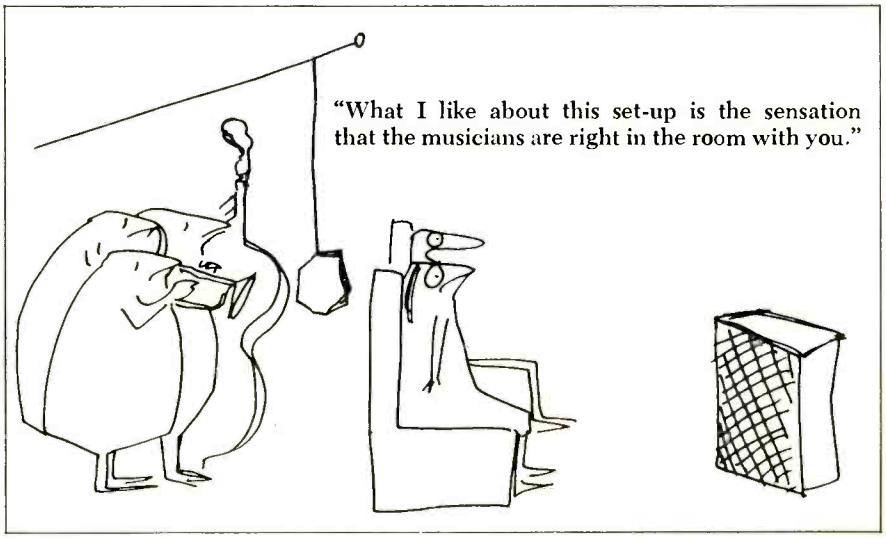
Vivaldi: The Four Seasons. New Philharmonia Orch., Stokowski. **London SPC 21015 stereo**

Stokowski conducting Baroque music? Yes—and it's not bad at all. The old man can adapt remarkably when he has a mind to. And in this performance the suave, British polish of the orchestra helps him avoid the excesses some of us remember in his earlier and very juicy "arrangements" of Bach, among others. Only a rather over-thick sound, and those tell-tale end-of-the-movement ritards (slowing-down), give him away.

The Four Seasons, four concerti out of a larger Vivaldi publication, became popular only recently as modern playing style made their music listenable and enjoyable. (It is dreadfully turgid music when played by an old fashioned full "symphony orchestra.") There are dozens of really good recorded versions —you'd better sample elsewhere before you topple for Stokowski.

London's mildly controversial *Phase 4* stereo technique, though some British critics dislike it intensely, has an American-style sonic impact that will please a lot more of us than it will shock. I find it both reasonable and forward-looking.

Performance: B— *Sound:* B+



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JAZZ REISSUES

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WHOEVER FIRST CALLED a gramophone disc a *record* picked an apt name for a medium that does such a fine job of storing aural information for re-hearing at later times. In the world of jazz there is a special interest in old performers and performances that makes the archival function of the sound recording particularly precious.

The first jazz recordings were made in 1917, and among the recent reissues there are new transfers of those first waxings, *Livery Stable Blues* and *Dixie Jazz Band One-Step* by The Original Dixieland Jazz Band. But not only are the early origins of the jazz phenomena re-created on new pressings, each decade from the twenties to the sixties has benefited from a welcome welter of long-playing reissues that has come along recently.

In addition to the continuing series of RCA Victor Vintage releases, Epic has launched an Encore series of LPs taken from old Brunswick, Okeh, Vocalion, Variety, and Columbia 78s; ABC has released a dozen LPs recorded in the Fifties and early Sixties on Riverside, and Verve continues to repackage and release its series of "best of" albums consisting of recompilations of material from sets that are in most cases still current.

Naturally there are differences in the sound qualities of these reissues, just as there were in the sound of the original discs, but there are also some new variations that have cropped into a few of these releases. Some of these variations have proved beneficial, such as the elimination of extraneous surface sounds that plagued the originals or the balancing of levels so that each of the up to eight sides on a platter is uniformly loud. Less desirable, from this listener's viewpoint, is the tendency for some labels to bring out what was originally monophonic material in pseudo stereo form. At their best, these "electronically rechanneled for stereo" versions do nothing to deteriorate the sound of the old mono discs. When the gimmickry gets a bit out of hand, however, there can be a deterioration of the crisp presence of the original or a distracting splitting up of frequency bands. One assumes that record companies go to all of the trouble and expense to recreate, a lacking spatial ambience because there is a public demand. Just why the public that wants sounds of the past can't accept those sounds in the only recording technique available when those sounds were cut is a bit of a puzzlement.

Guitarist Montgomery is really at his best in his collection from four previous Verve sets. On them he plays with brothers Buddy on piano and Monk on Fender bass, with Billy Hart and Carl Bunn on drums. *This Is Wes Montgomery,* with Mel Rhyne, organ, and Jimmy Cobb, drums, offers only slightly less close collaboration and less perfect sound, while *Wee Small Hours* serves up the Montgomery magic to the accompaniment of a Jimmy Jones led group of strings and woodwinds.

The Best of Wes Montgomery. Verve Stereo V6-8714

Performance: A *Sound:* A

This Is Wes Montgomery. Riverside Stereo RS 3012

Performance: A *Sound:* A

Wes Montgomery: In the Wee Small Hours. **Riverside Stereo RS 3002**

Performance: B *Sound:* A—

Three very worthwhile platters by Monk, whose return to the active list is well deserved. Particularly important is the *Monk's Music* collaboration with Coltrane, Coleman Hawkins, Art Blakeley, Gigi Gryce, Ray Copeland, and Wilbur Ware. The original sound is hardly altered in this re-mastering. The Terry-Monk collaboration brings out Monk's lighter side as Terry ambles through a set of fluegelhorn improvisations.

Thelonious Monk: Mighty Monk. **Riverside Stereo RS 3000**

Performance: A *Sound:* B

Thelonious Monk with John Coltrane: Monk's Music. **Riverside Stereo RS 3004**

Performance: A+ *Sound:* B

Clark Terry and Thelonious Monk: C.T. Meets Monk. **Riverside Stereo RS 3009**

Performance: A *Sound:* A

Johnny Hodges and his Orchestra: Hodge Podge. **Epic Mono EE22001**

The seven-man group heard on these 16 re-issues of Vocalion 78s was not only drawn from the front ranks of the Ellington orchestra, it had as its pianist and arranger the Duke himself (replaced on two numbers by Billy Strayhorn). Recorded between March 1938 and October 1939 they offer a batch of clean, bright, Ellington and Hodges compositions in impeccable performances.

Performance: A *Sound:* B

The Duke's Men. Epic Stereo* EE22006

Like the preceding set of Hodges-fronted recordings, the four groups on this platter all include Duke Ellington as pianist and arranger and consist of small units made up entirely of members of the Ellington band. Four numbers each are offered by Rex Stewart and his 52nd Street Stompers, Barney Bigard and his Jazzopators, Johnny Hodges and his Orchestra, and Cootie Williams and his Rug Cutters. These collector's gems stem from 1936 to 1938. The only stereo effect seems to be a bit of bass boost on the right channel.

*Electronically rechanneled for stereo.

Performance: A *Sound:* C

BATTERIES FOR TAPE RECORDERS

(Continued from page 22)

1.2 volts, so once again this device may not be fully interchangeable with carbon-zinc type cells in some kinds of equipment.

Prices for rechargable batteries are understandably much higher than for the more common non-rechargeable types. Typically, a size D nickel-cadmium cell will be priced at $3.50 to $5.50 each, although some newer types with lower ampere-hour capacity are just now hitting the market at about $2.50 each. Batteries of this type raise still another question: what to use for a charger? Many tape recorders have built-in a.c. adapters and charging capabilities. Some tape recorders do not have this or can operate on an optional accessory adapter and charger combination. With many of the lower-cost machines, you'll simply have to remove the batteries and put them into a separate charger. These chargers are commercially available, or can be constructed inexpensively from readily available parts. A simple battery charger can be built using a filament transformer, a single semiconductor rectifier and a limiting resistor, as illustrated in an accompanying drawing.

You may also run across rechargeable alkaline batteries. These are fine for limited cycling, a maximum of about 60 charge-discharge cycles with voltage-regulated charging in their useful lifetime. As secondary batteries go, this isn't very impressive, but alkalines have several advantages over the nickel-cadmium rechargeables. For one thing, they're much cheaper (at the outset.) They don't lose their charge during idle time as do the nickel-cadmiums. They have an enormous power reserve, especially when they're new—as much as 200% of the battery's normal rated capacity! Another plus—they continue to work well at low temperatures, an important feature if you plan to use your recorder outdoors in cold weather.

We've heard from reliable sources that even primary batteries can be recharged. This is true to some extent. Carbon-zinc and alkaline batteries can be made to operate far beyond their expected expiration. This is done simply by reversing some of the chemical action and deterioration that has taken place—in a word, recharging them. It's not recharging in the way it occurs in a secondary cell, since these primary cells can never be brought back to fresh, brand-new condition; the "recharging" does not bring back or put back the full ampere-hour capacity of a fresh battery. It's not a very good idea to use the "recharged" primaries in a tape recorder, since they have an uncertain operating life and might give up the ghost at a crucial moment.

Basically, the same charging circuits used for secondary batteries will work with these, although there's a theory that a small amount of reverse current (or a small a.c. component) will help provide a more even re-deposition of zinc on the Leclanché's negative electrode. The moral of the story is, don't throw them away when they quit in your tape recorder. Recharge them and throw them into your kid's power-hungry toys. Æ

Pre-recorded Tapes

BERT WHYTE

Bernstein plays Mozart

Mozart: Piano Concerto #15 in B Flat, K. 450; Symphony #36 in C, K. 425 "Linz." Leonard Bernstein, piano; Leonard Bernstein conducting the Vienna Philharmonic Orchestra. **London/Ampex LCL80199,** 4 tr.-7½ ips open reel ($7.95)

The London/Columbia recording collaboration inspired by Bernstein's guest stint with the Vienna Philharmonic continues to bear fruit, as evidenced by this generally excellent tape. Bernstein, as pianist and conductor in the K. 450 concerto, is eminently successful, something which is quite rare in recordings of this genre.

This is not a performance for the purist . . . not for devotees of the Lilli Krauss brand of Mozart. Bernstein is not a piano virtuoso in the accepted "concert tour" concept, although his playing is amazing considering how rarely he performs. No doubt conducting at the same time as playing imposes special demands on the artist, and one can only speculate how different the performance might be in normal circumstances. As it is, Bernstein has given us a performance that is tremendously exciting. His pace is headlong, the playing full of vitality, a wholly ingratiating approach that is fresh and attractive. The outer movements are played with great brio, yet he essays the *andante* with considerable warmth and poetry. All in all, I found Bernstein's way with this work quite enjoyable.

My appreciation of his playing was heightened by the good quality of the recording. The piano was very clean, with a brilliant tone and nicely centered in the phantom central channel. The piano was projected well forward, in fact at times a little too much, slightly upsetting the piano/orchestral balance. Lateral directionality was just right, the acoustic perspective moderately wide and orchestral detail quite good except for an occasional tubbiness in the contrabassi. Transient response was excellent, affording the piano good articulation. Dynamic range was quite wide, but in spite of the fact that this is an EX-Plus processing, there was moderately obtrusive hiss in the quiet sections of the work. Some fairly low crosstalk and print-through was occasionally encountered. Overall, the faults were minor and were outweighed by the generally good clarity and liveness of the recording.

In contrast to the concerto, Bernstein's reading of the "Linz" symphony was rather heavy, although the playing he elicited from the Vienna Philharmonic was superb. His tempi seemed rather fast and the Andante and the Menuetto seemed to lack cohesiveness. This is a powerful performance and fine if you like your Mozart with a lot of orchestral weight. All sonic attributes here quite good . . . wide range dynamics, good left/right directionality and phantom middle, moderately broad acoustics, yet plenty of definition for presence. Balances between orchestral sections quite good, with woodwinds a little greater in depth and slightly covered at times. Played at a good room-filling level, the EX-Plus-processed tape had low hiss, infrequent low-level crosstalk and print-through. All things considered, this is one of the better Mozart tapings in recent months and worth your consideration. B.W.

Opera

Verdi: Aida (Opera in 4 acts). Birgit Nilsson/Franco Corelli/Grace Bumbry/Mario Sereni Orchestra and Chorus of the Opera House Rome conducted by Zubin Mehta. **Angel Y3S3716,** 4 tr.-3¾ ips open reel ($17.95)

Aida on one reel of tape! The Prelude and Acts 1 and 2 strung out on side one for 78 minutes and Acts 3 and 4 complete on side two. It certainly would be hard to deny this advantage of 3¾ ips. No one can dispute the desirability of such continuity for operatic recordings. The question is whether this plus can balance out some of the negative values of this medium.

Regretfully, at least for the present, the answer has to be no. I, for one, would rather accept a few breaks in the recording in exchange for a cleaner recording with less noise. Leaving the technical aspects for the nonce, it must be said that this Aida will probably have the most appeal for Nilsson fans. It is a good standard production with the reliable Corelli as Radames and rising star Grace Bumbry as Amneris. But it doesn't "storm any heavens" and

(Continued on page 60)

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☐ Soundtracks ☐ Show Tunes ☐ Jazz ☐ Spoken Word ☐ Ballet

Check No. 59 on Reader Service Card

Pre-Recorded Tapes

(Continued from page 58)

is not likely to displace the Price or Tebaldi recordings in the affections of most opera buffs. Nilsson is very good (she could hardly be otherwise), but although the voice is glorious just for it's sheer beauty and her effortless soaring production, she lacks the warmth and passionate involvement that makes the Leontyne Price performance so compelling and convincing.

The prestigious Zubin Mehta is at the conductorial helm and, while he has excellent control and generally maintains good balances, he seems to be a bit fast-paced in his reading. The recording quality is puzzling. Some sections are quite good, others have a variety of technical shortcomings. Mayhaps it was "over-mixed," or the monitoring not accurate enough (you would be surprised at how easy that can happen, especially if there have been some recent equipment changes). For one thing, I found I had to play the tape at a fairly high level in order to achieve a good vocal/orchestral balance. This, of course, aggravated the already problemsome hiss. In general, the male voices projected better than the female voices, which are in fact covered at times by the orchestra. One certainly needed more articulation from the female voices in ensemble passages.

The acoustic perspective was quite spacious and the "off-stage" depth effects were nicely handled. Good, too, was the stereo interplay and stage movement between various voices. Overall, one gets a feeling of restraint in the vocal passages, even with Nilsson's great power, while on the other hand the Aida trumpets resound brazenly, with fine presence in the "Triumphal Scene." Good bright orchestral sound in the ballet sequence. There was some occasional print-through, but remarkably little crosstalk. In summation, one misses the crisp definition of the orchestra and the clarity of the voices in the 7½ ips tapings of opera. B.W.

Open-Reel Pop

Film Fame: Enoch Light and the Light Brigade. Project 3/Ampex PJC5013, 4 tr.-7½ ips open reel ($7.95)

This is in my opinion the most successful of the Enoch Light *Project 3* albums to date. The programming is the familiar gambit of movie themes dressed up in elaborate orchestrations. The themes were taken from the most recent films (with the exception of "Gone With The Wind) and include "Bonnie and Clyde," "Wait Until Dark," "Live For Life," "Valley Of The Dolls," "To Sir With Love," and others of similar persuasion.

Light has done this before, but this time around the arrangements are more tastefully done, executed with finesse and top playing from top musicians. Mainly, however, this album is better recorded than its predecessors. Light employs his usual spatial and directional exaggerations. He still favors all elements larger than life and twice as loud. But this time there is none of the overload distortion that marred some of the other albums. There is also appreciably less hiss, crosstalk and print-through. This recording has big, bright, clean sound, with a lot of power and wide frequency response, and this time it will sound well on the top quality systems, as it will on the lesser systems of those with impressionable ears. B.W.

Sound & Decor Styles

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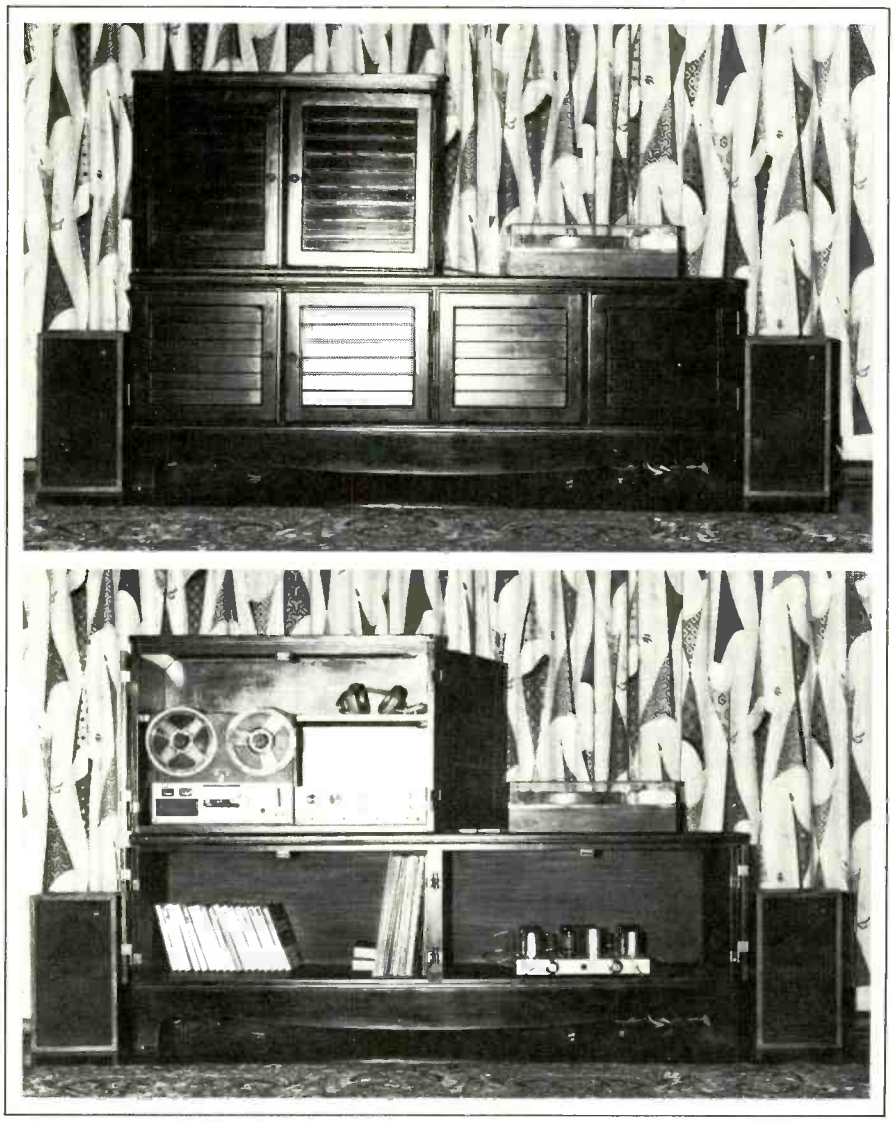


Raymond E. Mendenhall, Jr., Union City, Ind.—The stereo installation pictured here isn't an elaborate one, but it has proved to be ideally suited for apartment dwelling, says stereo enthusiast Raymond Mendenhall. A mechanical-engineering student, he purchased an unfinished aspen cabinet, which he stained dark walnut, to house his stereo components.

The 20 watts/channel amplifier is a home-built one, given plenty of breathing space due to its vacuum-tube construction. The engineering student also put together a Dynakit PAS-2 preamplifier, which can be seen in the upper cabinet section. An AR manual turntable and Shure M3D stereo cartridge round out his record-playing equipment, while a Sony TC-250A tape deck and two Electro-Voice 676 microphones handle his magnetic tape recording/playback needs. Two Electro-Voice "E-V Eleven" speaker systems and Sony DR-3A stereo headphones serve him well on the sound-output end.

ABZ's of FM

(Continued from page 11)

equal to mono. This is not the fault of the receiver; rather, it is an inborn characteristic of the transmitted signal itself. In addition, reflected waves reaching the antenna are apt to cause phase shifts in portions of the received signals which can not only cause distortion (identified by hissing or sibilant "s" sounds in speech) but, in extreme cases, can all but destroy the stereo separation effect.

It is obvious, therefore, that for all but ideal conditions, the half-wave folded dipole should be discarded in favor of a more *directional* type of antenna array.

Folded dipole with reflector

This simple form of receiving antenna, illustrated in Fig. 2, has a more unidirectional pattern since it receives stations best from in front of the dipole. It is most useful in situations where most stations desired are in the same general direction. This might be true for the "near-suburbanite" who wishes to receive stations from his nearby, metropolitan location.

Conical, turnstyle and "S" types

The antenna configuration shown in Fig. 3 has the same directional response as a simple dipole. It is useful, however, when stereo stations are located at both the low and high ends of the FM dial since its frequency response is somewhat broader than that of a simple dipole. Of course, if multipath (reflection) problems are present in a particular installation, it is insufficiently directional to counter these effects.

Turnstile antenna

The antenna shown in Fig. 4 is also called a cross-dipole antenna because it consists of two bi-directional elements mounted at right angles. The omnidirectional pattern obtained allows reception from local stations in various directions. This antenna is particularly useful when the user is located in "close-in suburbs" *between* two cities and is not plagued by the presence of multipath-causing high steel structures, mountainous terrain, etc.

The "S" type of antenna is another variant of the simple folded dipole, designed to make it more omnidirectional. Again, its usefulness will be limited to reception of nearby stations where multipath is not a serious problem.

Unidirectional FM antennas

For fringe area reception of FM and Stereo FM, a high-gain, directional antenna is imperative to enjoy excellent

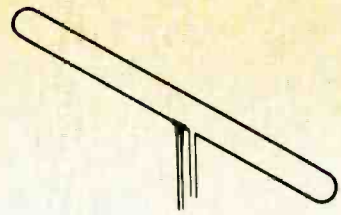


Fig. 1—Simple, half-wave folded dipole.

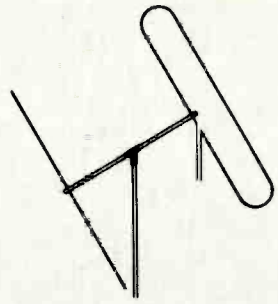


Fig. 2—Folded dipole with reflector.

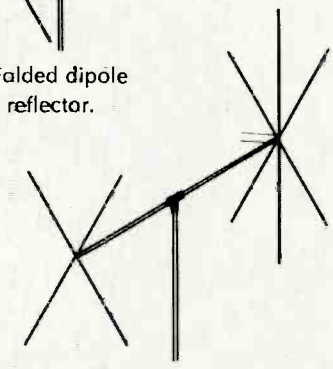


Fig. 3—Conical antenna.

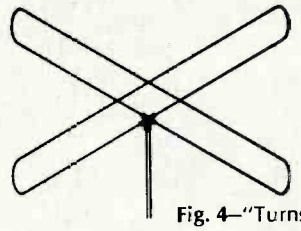


Fig. 4—"Turnstile" or cross-dipole antenna.

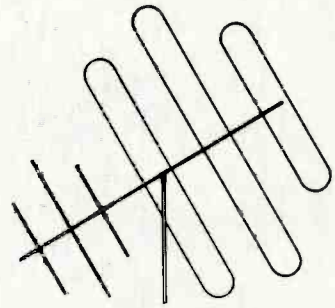
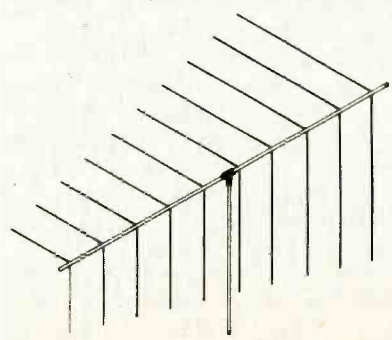


Fig. 5—Multi-element Yagi antenna.

Fig. 6—"Log-periodic" FM antenna.



reception. The two most popular types in this category are the multi-element Yagi and the newer, Log-Periodic. A diagram of the Yagi is shown in Fig. 5, while a typical Log-Periodic antenna is illustrated in Fig. 6. Both of these antenna types feature high-gain and a very narrow angle of directivity. Stereo reception at distances up to 75 miles is not uncommon with a sensitive FM receiver and a properly installed antenna of either of these two types. Of course, the narrow angle of reception means that the antenna must be well oriented during installation and, if stations are located in various directions, antennas of these types must be installed with one of the many electrically operated rotators currently available.

Boosters

In addition to directional high gain antennas, some experts recommend the use of a booster or preamplifier for extreme fringe-area reception of stereo FM. A booster is really nothing more than a preamplifier. Most of the commercially available units employ one or more solid-state devices to act as the amplifying elements (sometimes Field-Effect Transistors). On the surface, one would think that more amplification in the form of such a pre-r.f. stage would always enhance performance, but this is not true. Today's receivers (at least the more sensitive ones) have "noise figures" which are often *lower* than the inherent noise figures of the store-bought boosters. In FM it is the signal-to-noise ratio that counts, not just the number of signal microvolts available at the input to the receiver. Thus, if a given booster amplifies noise as well as signal, nothing is really gained in overall performance. On the other hand, a well designed r.f. preamplifier or booster can work wonders if used in conjunction with a less expensive or less sensitive receiver that has an inferior noise figure to begin with.

Summary

All too often, we encounter stereo installations in which the FM tuner or receiver is a high-priced, quality unit capable of excellent performance, but denied a satisfactory signal through inadequate consideration of antenna needs. The cost of even a good antenna is quite moderate compared to the cost of a fine tuner or receiver. It is not unusual to measure improvements of ten-to-one in signal strength reaching the receiver once an adequate antenna is used, compared with the "hunk of wire under the rug" approach—so why deny a good piece of equipment a decent input signal (and yourself optimum reception)? Æ

AUDIO CLINIC

(Continued from page 4)

each channel, with the plate of the first half feeding a cathode follower—the second triode. The cathode follower is necessary not only to obtain a better impedance match to the meter, but also to avoid the meter's being pinned when power is first applied to the preamplifier. This pinning action would occur when the meter is connected in the plate circuit of the first triode because the plate voltage would charge the meter's coupling capacitor. It is this charging action through the meter which would cause the meter to pin momentarily, and then return to its zero, or resting position. When the cathode follower is used, this sudden pinning of the meter is avoided because the meter's coupling capacitor is charged slowly as the tube warms up.

Power for the circuit of Fig. 1 may be derived directly from the preamplifier's own power supply, B+ being provided through a 10K-ohm, 2-watt resistor. The end of the resistor which feeds B+ into the amplifier should be bypassed to ground with a 40 μF electrolytic capacitor whose breakdown voltage is higher than that of the preamplifier.

Of course, such a metering circuit could have been transistorized. However, I saw no need to detail this because the preamplifier with which this metering circuit is to be used is a tube-operated device.

The potentiometer at the input of each meter channel is designed to enable you to adjust the meter to indicate zero when the desired loudness of sound is obtained. Æ

NEGATIVE FEEDBACK

(Continued from page 32)

So an amplifier's feedback, under practical operating conditions, is never anywhere near constant. Its effect on the things it is supposed to affect cannot be constant either.

We have already mentioned change of operating conditions that may occur due to change of signal level. Such changes have been related to steady states because we think of testing with steady tones of various levels. Programs can produce sequences of signal change—level, frequency content—that no normal test signal contains. These may result in unpredicted variations in operating conditions, consequent variations in gain, and departure from predicted feedback behavior.

(Continued next month)

AUDIO NEWS

Edison Records & Cylinders

Over 40,000 phonograph records and 5,000 cylinders manufactured by Thomas A. Edison, Inc. early in the century have been made available to Syracuse University for transcription onto magnetic tape, which will be preserved in its Audio Archives.

The recordings, discovered in Salt Lake City, Utah, include excerpts from campaign speeches by Theodore Roosevelt, and a rare public statement by Edison. Artists whose voices are preserved on the old discs and cylinders include: Lucrezia Bori, Giovanni Martinelli, Alessandro Bonci, and the Golden Gate Orchestra featuring Tommy Dorsey.

With the unplayed recordings found to be in original condition, it is thought that Utah's dry climate might take credit for this state of preservation.

IHF Officers Elected

Officers elected recently by the Institute of High Fidelity are: President, John Koss (Koss Electronics, Inc.); Vice President, James J. Parks (Fisher Radio Corp.); Treasurer, Walter O. Stanton (Pickering & Co., Inc.).

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