HI-FI SHOW ISSUE

The Authoritative Magazine About High Fidelity

AUDIO

OCTOBER 1969
60¢

FM ANTENNAS: AN EMPIRICAL STUDY

TAPE TRANSPORT MAINTENANCE

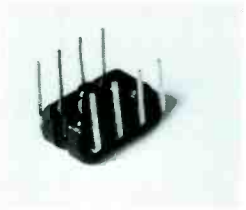
EQUIPMENT/RECORD/TAPE REVIEWS

ELECTRONIC MUSIC STYLES

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

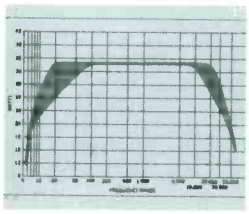
The billions of research dollars expended towards America's race to the moon helped foster the development of many entirely new electronic devices. Alert Scott engineers realized that the adaptation of some of these devices could result in significant advances in the performance of high fidelity components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

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



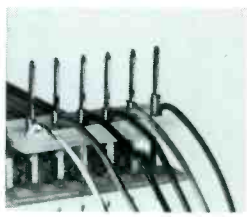
There are 7 ultra-reliable Integrated Circuits in the 386 . . . more than in any other receiver now on the market. These 7 circuits include a total of 91 transistors, 28 diodes, and 109 resistors!

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



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

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



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

386 Specifications

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

H SCOTT®

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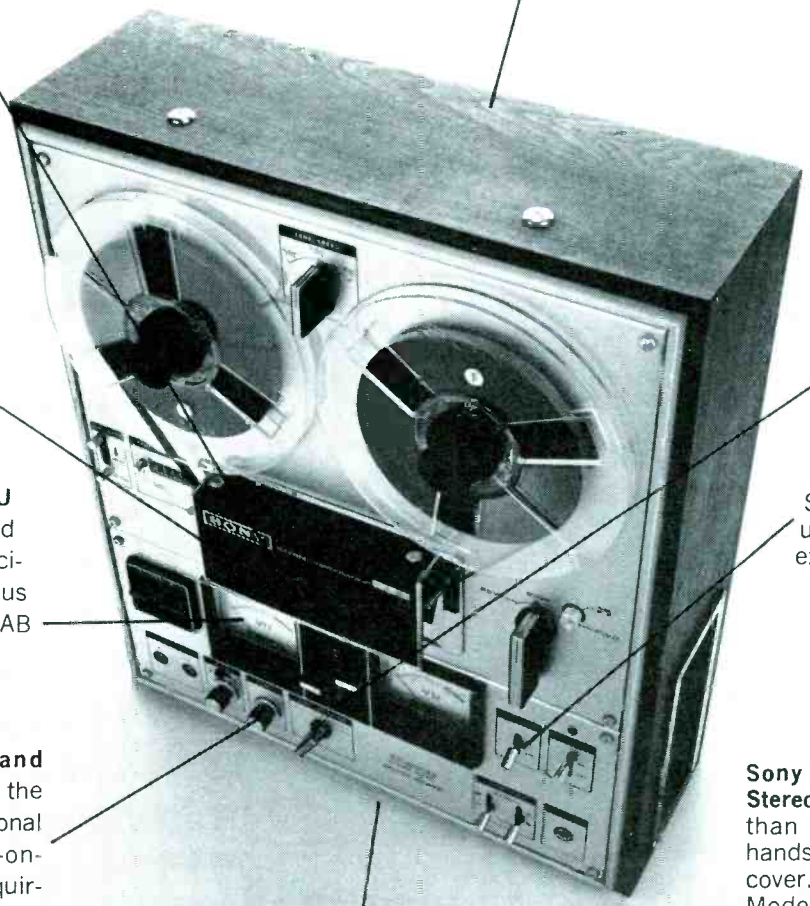
Music lovers, take control!

Specs You Can Brag About. Frequency response: 20-22,000 Hz @ 7½ ips, 20-17,000 Hz @ 3¾, 20-10,000 Hz @ 1⅞. Wow and flutter: 0.09%. Signal-to-noise ratio: 52 db.

Three Heads. Allows monitoring of either input source or the actual recording made on the tape.



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

Professional Slide Controls. Two fingertip controls are positioned vertically side by side for immediate precision adjustment of recording volume. Easier to read, easier to establish interchannel volume relationship than with conventional knobs.

Full-Size Professional VU Meters. These internally lighted instruments provide the precision metering for really serious recording. Calibrated to NAB standards.

Noise-Suppressor Switch. Special filter eliminates undesirable hiss that may exist on pre-recorded tapes.

Built-in Sound-on-Sound and Echo. Switching networks on the front panel facilitate professional echo and multiple sound-on-sound recordings without requiring external patch cords and mixer.

Sony Model 630-D Solid-State Stereo Tape Deck. Buy it for less than $299.50, complete with handsome walnut base and dust cover. **Also available:** The Sony Model 630 Solid-State Three-Head Professional Stereo Tape System, with stereo control center, stereo power amplifiers, microphones, and lid-integrated full-range stereo extension speakers, for less than $449.50. For a free copy of our latest catalog, please write Mr. Phillips, Sony/Superscope, 8142 Vineland Avenue, Sun Valley, California 91352.

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October 1969 Vol. 53, No. 10

Successor to RADIO, Est. 1917

AUDIO

FEATURE ARTICLES

EQUIPMENT PROFILES

RECORD/TAPE REVIEWS

AUDIO IN GENERAL

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Coming in November 1969

Layman's Guide to Loudspeaker Specifications — Victor Brociner examines technical specifications of speakers and speaker systems, defining technical terms and providing information about what they mean in terms of speaker performance.

Sound Reinforcement Systems—David L. Klepper discusses practical applications of sound reinforcement systems.

State-of-the-Art Disc Mastering — Lee Hulko discusses modern methods of cutting records.

Tape Transport Maintenance, Part III—H. W. Hellyer continues his series on service and maintenance of the mechanical sections of tape recorders.

. . . and more.

PLUS:

Equipment Profiles (Concord Mark III Stereo Tape Deck, Scott Q-100 Speaker Systems, Kenwood "Supreme I" Multi-Channel Stereo Amplifier, among others.)

Record and Pre-Recorded Tape Reviews.

. . . and other regular departments.

ABOUT THE COVER:

Here's a trick photographic shot of the audience attending the performance of the John Cage-Lejaren Hiller composition, HPSCHD, presented at the University of Illinois. The four-hour performance was played on 51 Wollensak tape recorders, with 6,000 color slides and films projected on translucent screens suspended from the ceiling over the audience. A record version of the computer-generated tapes and seven harpsichords, with a "knobs" program for listener playback control is reviewed by Edward Tatnall Canby on page 34.

Audioclinic

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.

JOSEPH GIOVANELLI

Dynamic Speakers

Q. I'm writing to inquire about the use of a loudspeaker which does not have a permanent magnet, but instead uses what appears to be an electromagnet. It is a very old 15-inch speaker, made by Stromberg-Carlson.

Can you tell me how to hook up this speaker so that I can try it out with my equipment? There are two sets of connections on it: One set is similar to that found on PM speakers for connection to an amplifier's output. The other connection presumably supplies the current for the magnet. Can I hook it up some way to an a.c. outlet?—Max Prola, Jackson Heights, N. Y.

A. Speakers employing electromagnets were common many years ago before the development of really strong permanent magnets. They were hard to use in comparison with present speakers. Hence, when the speakers we now know reached their present state of refinement, we dropped the use of electrodynamic speakers, as they are called.

Because such speaker fields have inductance, they often were used in the power supplies of the equipment just as one would use a choke. Thus, the field was placed in series with the load. When the field was to be used for that service, its d.c. resistance was low, of the order of 200 or 400 ohms. This is about the resistance of the chokes you will find in many high-quality radio receivers, television sets, or amplifiers even now. If you were to substitute the speaker field-coil winding for the choke in such a piece of equipment, you could energize the magnet and obtain sufficient excitation to allow the speaker to operate.

There are other speakers whose electromagnets, or fields, have high resistance. These were designed to be connected directly across the d.c. power source. You should expect to find resistances of the order of 5000 to 10,000 ohms or so under these conditions.

Note that in both instances the field must be supplied with d.c. This is a reasonable requirement when you consider the matter. After all, if the polarity of the magnetizing source were to change rapidly, this change would pull the voice coil inward and outward. The result would be a hum frequency equal to twice the power line frequency. Therefore, if you wish to supply the speaker with power from the a.c. line, you can do so, but you will require a rectifier-filter system which is capable of delivering smooth d.c. to the speaker field. You may need a resistor in series with the field to limit the current to some value of the order of 100 mA or so for the low-resistance types, and about 30-50 mA for the high-resistance models.

Normally the field coils should get lukewarm, but never too hot to touch.

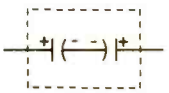
Non-Polarized Capacitors

Q. I have read that only non-polarized capacitors should be used in the crossover networks of speaker systems. In my present system, which I built in 1957, I used standard, polarized electrolytics. They sound fine, but should I replace them with non-polarized units? —Edgar R. Emery, Winchester, Mass.

A. An electrolytic capacitor is a capacitor only when there is a voltage present to polarize the material of which it is composed. A.c. voltages cannot be used to polarize such a capacitor because, by their very nature, they are non-polar.

Further, voltages which tend to polarize such a capacitor in the wrong direction will destroy that capacitor. The electrolytic film which serves as the dielectric material will be dissolved, and the capacitor will be shorted out.

The so-called non-polarized electrolytic capacitor is nothing more than two electrolytic capacitors connected in series in such a way that when the a.c. flows in one direction, capacitor A is properly poled. When the direction of current flow reverses, the opposite



capacitor, B, is then polarized, even though capacitor A is not. Because one capacitor is polarized at a time, there is a limit to current flow. Capacitor action is still maintained. The circuit for this is illustrated here.

Mode Switch

Q. I wish to install a Mode switch to my amplifier (inserted between pream-

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SA-900 PRE/MAIN AMPLIFIER — Its IHF music power rating of 200 watts (at 4 ohms) is just part of its magnificence. The solid state preamplifier is designed to give exceptionally low noise level . . . better frequency response . . . decreased distortion . . . improved tonal quality. Unlike other units at this price, it offers stepped tone controls for the finest precision adjustments. The pre and main amplifiers can be used independently. Maximum flexibility with inputs for 2 phono, tape monitor, microphone outputs for two sets of speakers. $259.95.

TX-900 AM-FM TUNER — All solid state. Excellent selectivity and sensitivity from three FET's and two RF amplifier stages in the front end plus two crystal filters and four IC's in the IF section. Interchannel noise is completely muted. A variable muting switch accommodates weak signals while suppressing noise at any level. Tuning is precise. A bright spot indicator as well as twin meters tune for maximum signal strength . . . minimum distortion . . . optimum fidelity and channel separation . . . best signal to noise ratio. $239.95.

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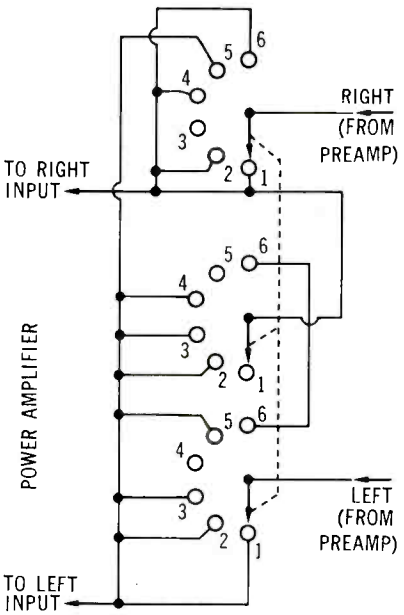
plifier and power amplifier)—outside the amplifier, which I would like to perform the following functions:

1. Stereo
2. Mono
3. Left input to both outputs
4. Right input to both outputs
5. Left plus right inputs to left output
6. Left plus right inputs to right output

I would appreciate it very much if you can give me the switching arrangements for the above.—O. Phiendhum, Topeka, Kansas.

A. To implement the schematic shown here you will need a three deck, 6-position rotary switch such as Centralab 1008 or the simpler and less expensive Mallory 3136J. I made no note of ground connections, assuming that many users will have integrated amplifiers in which these ground connections are already made. When dealing with



SWITCH SHOWN IN POSITION:

#1 STEREO	#4 R TO L & R
#2 MONO TO L & R	#5 L & R TO L
#3 L TO L & R	#6 L & R TO R

separate preamplifiers and amplifiers, ground connections will have to be made. In either case mount the switch in a shielded box, with the shield, or box itself returned to a common ground of your preamplifier.

The use of an integrated amplifier poses difficulties which you might not anticipate. Be sure when you work with this amplifier that you do not place your switching inside a feedback loop. The feedback would change, depending upon the switch position involved. This would result in faulty operation of your system. You would also want to make sure that the circuit you interrupt in order to insert this switch does not have a d.c. potential, as would be true of direct-coupled transistor circuits. There would be very likely damage to components in some of the mono switch positions. Further, there would be a tremendous number of transient clicks when the switch is moved from one position to the other.

Directional Microphones

Q. My question is: How do the directional or long distance, microphones work?—Donald J. Francis, Lowellville, Ohio.

A. The highly directional microphone works by cancelling sound from different directions, other than the desired one. A microphone of this type is made so that sound can enter it from more than one opening. In addition to the main or front opening there are ports at various other places along the side of the mike. Sound entering the front of the mike will be free to strike the diaphragm. However, when most of the sound enters one of the other ports, it is broken up in such a way that it is cancelled (or nearly so) by the time it reaches the diaphragm. The method by which this action takes place is fairly complex and cannot be taken up here.

The thing to note is that the mike does not work by "reaching out" and pulling in signals. Rather, unwanted signals are rejected by the mike, enabling even weak, distant sounds to be heard with relative distinctness.

Thumps in a Record Player

Q. When playing stereo records, I can hear a thump at about one- or two-second intervals. During soft passages the noise is very disturbing. When playing organ records where heavy bass is prominent, it is still audible but not as disturbing. — Benjamin F. Vernon, Plainfield, N. J.

A. Your problem is in the record player. The "thump" probably occurs during each revolution of the record or during each revolution of a drive idler, if there is a drive idler in your machine. Replace the idler and see if the rumble disappears. If the turntable is belt driven, a seam in the belt may be responsible for the "thump." Of course, if the player is still under warranty, have it checked by the manufacturer.

A transient produced by a flat spot on an idler wheel or a bump on such a wheel will result in the production of a wide range of frequencies. The highest of these is likely to be above the cutoff point of the rumble filter. That is why you may have heard the sound even with the filter turned on.

The "thump" is not as evident on organ music because the heavy organ pedal masks it. *Æ*

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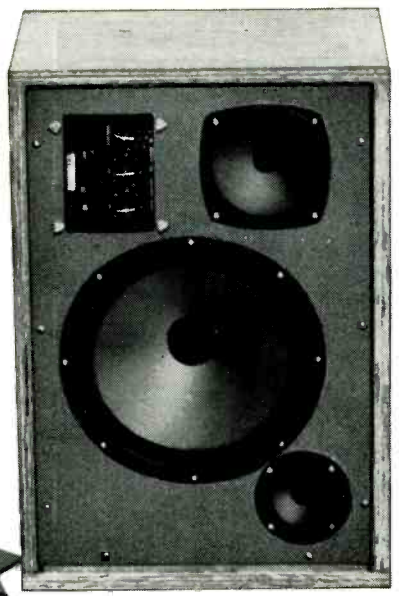

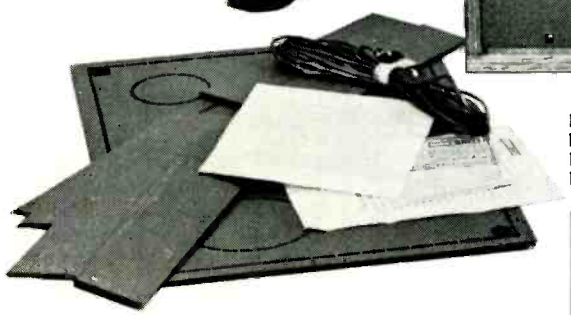

Kit sizes:
LWE I and III, 17″ x 25″ x 12″
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LWE VI, 10″ x 20″ x 8½″.

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Check No. 7 on Reader Service Card

What's New In Audio

Automated Multi-Cartridge Player

Versatility combined with convenience is the key to the Insta-Tape MINI-MATE, which is an automated multicartridge tape player controlled simply by a series of pushbuttons to select and play any one of six cartridges, and follow up immediately afterward with any other which is preset, with or without a pause between them. With the addition of a timer, a

station identification may be inserted automatically at the correct time. An accessory auxiliary cue makes it possible to operate a slide projector along with the cartridge, or a series of TV commercials may be started at the touch of the advance button. The unit can provide background, sound effects, musical intro's, spots, music, or features, interspersed with announcements or other live sound, as desired. The MINI-MATE is a product of Ampro Corporation, Glenside, Pa.

Check No. 125 on Reader Service Card

New Fisher Speaker Systems

Introducing new speaker systems is the usual trend of manufacturers at the beginning of the Fall buying season. Fisher's XP-7B incorporates a 12-in. woofer, two separate 5¾-in. mid-range units, and a 3-in. tweeter, and covers the entire range from 30 to 20,000 Hz.

The XP-9C is the only bookshelf system using a 15-in. woofer. In addition, it employs two mid-range units and two 1½-in. dome super tweeters which extend the range up to 22,000 Hz.

The XP-66B features a 12-in. woofer, a 5-in. mid-range unit, and a 3-in. tweeter, resulting in a smooth response with critical definition up to 20,000 Hz.

The modestly priced XP-60B uses a 10-in. woofer which extends the bass response down to 35 Hz, and crosses over to a 3-in. tweeter at 1000 Hz to provide a wide-dispersion high-end response. All four models are finished in oiled walnut, and range in sizes from 27½ x 16¼ x 13 in. for the XP-9C to 23 x 13 x 10 in. for the XP-60B.

Check No. 126 on Reader Service Card

AM-FM Car Radio

The Robert Bosch Corp. adds the Blaupunkt "Montreal," an economy-model ($69.50), 10-transistor, AM-FM car radio to the line offered in the U. S. It can be used with 6-volt and 12-volt systems. Polarity is convertible to either plus or minus. Other features include push-button wave-band switching; a local-distance switch; tone-control knob; and push-pull audio stage. The unit measures 7 in. x 1⅝ in. x 4¾ in. Custom installation kits are also available.

Check No. 127 on Reader Service Card

Electrostatic Headphones

Koss Electronics introduces two more electrostatic headphones. The model ESP-7, powered by a separate energizer that connects directly to amplifiers and receivers, is lighter than the company's first ESP headphone, the Model ESP-6, which was introduced last year, which has a built-in energizer. The new ESP-7 is priced at $79.00, and offers a frequency response from 35-13,000 Hz ±6 dB. It features fluid-filled ear cushions, sponge foam-lined headband, and a dynamic level indicator light located on the external self-energizer box.

The second new model, the ESP-9, at $150.00, is designed as a studio monitor headset. It is also supplied with a separate energizer unit, with additional provisions to use an a.c. power line for energizing purposes. It is said to cover ten octaves; 15-15,000 Hz ±2 dB.

Check No. 128 on Reader Service Card

Allied Radio has a $29.95 car stereo reverberation system for use with car stereo tape players or stereo FM radios. The 8″ W x 1¾″ H x 5¾″ D unit is supplied with a 6″ speaker/adapter board and chrome grille for rear mounting. It operates from an automobile's 12 volt battery.

Check No. 129 on Reader Service Card

Component Cabinetry

Audio Originals' Model 303D component equipment cabinet features two adjustable component shelves and a turntable shelf on ball-bearing slides for pull-out record-playing convenience. Below these areas are two sections that can accommodate records and/or additional equipment, such as a tape deck. Open ends are designed to

accept speaker systems (each compartment measures 25¾″ H x 16½″ W x 14″ D). The unit includes bifold doors, as illustrated.

Overall dimensions of the hardwood, oiled-walnut cabinet are: 32⅝″ H x 77″ W x 18″ D. List price is $182.50.

Check No. 130 on Reader Service Card

Low-Cost Wireless Microphone

Distributed by Mura Corporation, a new Piezo wireless microphone enables anyone to talk through any FM radio located up to 200 feet away. The Model WX-127 conforms to all FCC requirements, is static and drift free, and is powered by two mercury cells. It measures only 4¾ x 1 x 1 in. and weighs 3½ oz. It has many useful applications from professional entertainment and public address through uses in industrial plants to plain party-fun occasions—even remote-control baby sitting. It is priced at only $17.50.

Check No. 131 on Reader Service Card

Irish Recording Tape introduces two new long-play cassettes: a 90- and a 120-minute cassette, Model 261-C90 ($3.95) and 261-C120 ($4.95), respectively. Both cassettes use the Irish 200 series professional magnetic tape. The cassettes are supplied in a molded plastic case for storage or mailing purposes.

Check No. 132 on Reader Service Card

Shure Brothers introduces a new four-channel microphone mixer with adjustable reverberation capability. Called the Model M68RM, the solid-state mike mixer with reverb has four microphone input channels, each with its own volume control and slide switch to select high or low impedance, and a reverb control. One of these channels can also double as an auxiliary high-level input. A master gain control adjusts volume of all inputs simultaneously. $180.00.

Check No. 133 on Reader Service Card

Free Catalogs

The new 1970 Heathkit catalog, featuring over three hundred kits for every budget and interest—116 pages, with 66 in full color—is now available free of charge. The kits listed cover every phase of experimental electronics, stereo-hi-fi components, ham radio equipment, marine gear, test, service & lab equipment, CB radio, SWL receivers, photographic aids, guitar amplifiers, plus a wide range of home and hobby items, including both color and B&W TV's. All are available at up to 50% savings over comparable factory-wired models.

Check No. 134 on Reader Service Card

Lafayette Radio Electronics has also announced the release of its new 1970 catalog. This catalog is a complete buying guide to everything in electronics at money-saving prices, and it serves as a handbook on what's available in hi-fi/stereo equipment, CB and ham gear, optics, tools, books, and a listing of major lines of electronic components.

Check No. 135 on Reader Service Card

JVC Holds the Records

For the best record players. Look at this three-deep line-up: the distinguished Model 5201, the compact 5204 and the combination turntable-tape player 6102.

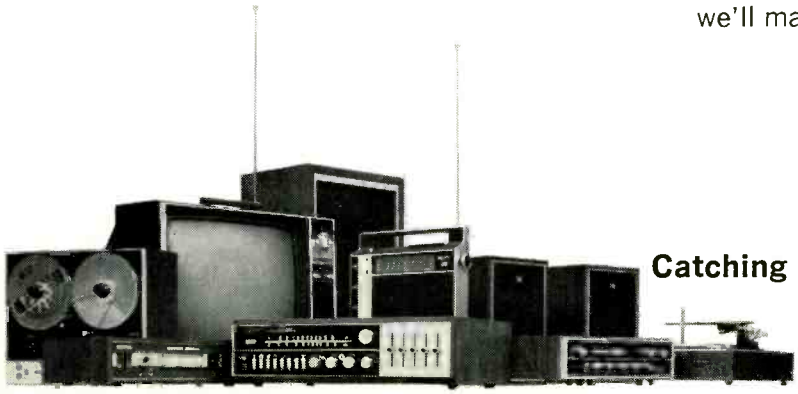
All offering 4-speed versatility. Each capable of handling up to six records automatically. Each equipped with long-wearing diamond stylus.

The 5201, with 4-pole outer rotor induction motor, features a moving magnetic type cartridge. Records can be started or stopped anytime with a turn of the wrist.

The 7.5 lb Model 5204, powered by a 2-pole synchronous motor, is a value and a half, delivering performance all out of proportion to its size.

And the beautifully-styled Model 6102 offers the option of switching from records to equally high performance 8-track stereo tapes. It's part of the same handsome package.

Get more information about JVC record players and the name of the dealer handling JVC products in your area. Just drop us a line and we'll make the introduction.



Catching On Fast

JVC

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BEHIND THE SCENES

BERT WHYTE

How High the Fi?

Here is the scene: you've just finished a demonstration with a superb recording of the Mahler First Symphony. Everything was as perfect as possible. The tape was a one-to-one copy of the master recording. Your playback was at 15 ips, two-track through "state of the art" amplifiers and speakers. The result, to put it succinctly, was sensational sound. Your audience seems entranced, and then we get two divergent reactions. One comes from a callow youth who says, "very impressive, quite an interesting recording. However, er . . . ah . . . I did think your highs were down a bit and I thought I heard some distortion at about 13 or 14 kHz." Well, you grit your teeth. And then a lank-haired character with a score clutched underneath his arm chimes in, "That was an exciting sound, but of course, it bears no relationship to reality . . . you just don't hear strings with those highs in a concert hall . . . the whole thing is larger than life."

The point of all this is that there is probably more nonsense, more fiction, more pure baloney about high frequencies in the art and science of high fidelity than any other aspect of the subject. Let's get a few things straight. No one is going to argue that the partials, overtones, and harmonics in music are unimportant. No one is going to argue about the high frequencies in recorded music *if they can be recorded and reproduced without distortion.* We have to place things in their proper perspective. How high is high, for example? How much high frequencies do we really need?

If I had a nickel for every time a professional recording engineer said to me, "I'd rather have a clean, distortionless 10-kHz top, than a 15-kHz top which is distorted," I'd be rich. Time and again the engineers have brought home to me that, while it is nice to have a recording with response to 15 kHz, they are more concerned with distortion parameters. This may shock some people, but recently the Chief Engineer of one of the largest cassette recorder manufacturers told me that his company was less involved with the extension of frequency response in their cassettes and more interested in the improvement of signal-to-noise ratio and distortion. On the other side of the coin, there are recording engineers who insist on recording at 30 ips, claiming that for the harmonics of cymbals and trumpets, for example, this tape speed is necessary. They claim to hear differences in these instruments, observing that there are losses when the tape speed is reduced to 15 ips.

One skeptical engineer friend said that the 30-ips advocates probably heard an improvement in quality due to transient response and lower scrape flutter, rather than through an extension of frequency response. He went on to state that the amount of sound energy above 10 kHz is very small indeed, especially in music recorded at normal levels, as opposed to recording high-frequency sine waves at levels up to tape saturation. He also noted that the complex musical signals of the symphony I had demonstrated had so much energy between 100 to 4000 Hz that the chances of someone detecting distortion at 13-15 kHz were almost nil. My friend's comments would seem to be in line with the results of experiments made some years ago during the great Bell Telephone experimental era, in which the acoustical output and energy distribution of musical instruments were studied. These tests showed maximum output between 80 and 3500 Hz. When the output of the orchestra (rather than the individual instruments) was studied, the peak energy was found to be in the region of 500-600 Hz! Well, when one considers that 256 Hz is *middle* C, this should not raise too many eyebrows! The top fundamental note of the piano is around 4000 Hz. Thus, a frequency response to 16 kHz would reproduce the fourth harmonic. With the highest fundamental frequencies of other instruments (excepting the violin and piccolo) well below 4000 Hz, third harmonics and many higher harmonics could be accommodated within a 10 kHz bandwidth.

Please understand that I am *not* against wide frequency range in recorded music. And I am *not* advocating that response be limited to 10 kHz. However, I *am* against most of the pretentious piffle and the "mystique" concerning frequencies much above 10 kHz. Spectrum analysis of disc recordings, for instance, shows that many of them roll off quite rapidly at 11 to 12 kHz. Even assuming the recordings were flat out to 15 kHz (the high-frequency limit of FM broadcasts, by the way), with the encroachments of age and with noise pollution, most adults are incapable of evaluation or analysis of the minute energy of these high frequencies. The fact is that most lay people delude themselves in this matter of hearing very high frequencies, possibly a large portion of which is due to sheer vanity.

It is easy to convince the relatively unsophisticated listener that he is hearing wide-range music with plenty of high frequencies, when in actuality he is not hearing this quality of program at all. There are a number of ways of accomplishing this, the easiest being through spatial presentation (as in stereo) and by selective equalization of program material. One should also add that the type of music in itself can have an influence on what our subject thinks he is hearing in terms of frequency response.

Many years ago when I was associated with "Magnecord," I conducted one of the earliest binaural and stereo experiments. I used a couple of my friends, who were experienced hi-fi enthusiasts, as guinea pigs. I asked them if they would like to hear some wide range 15-ips tapes of the Chicago Symphony. Of course they were eager for such an opportunity, and I took them into a listening room where all they could see were two large speakers stereophonically disposed left and right. The tape recorder and amplifiers were hidden behind curtains in the rear of the room. I started the playback of my stereo recording of Hindemith's "Symphonic Metamorphosis," and in a few minutes they were uttering "oohs and ahs" and commenting that "there is nothing like real 15 ips material . . . this is the real McCoy." You can imagine their chagrin when I directed their attention to the rear of the room, pulled back the drape in front of the recorder, and revealed the unit with the reels slowly revolving at 3¾ ips! Now, believe me, with the tape oxides in those days, the best you could expect from 3¾-ips speed was about 7000 Hz, and here were my friends who were enthusing about the "fabulous highs." Naturally they cried "Foul," and asked that I play the same piece from the master at 15 ips. Then they claimed that there was no comparison . . . that the 15-ips tape was infinitely better, and so on. Well of course it was, but they could tell the difference mainly because there was less tape hiss on the master. When I made A/B com-

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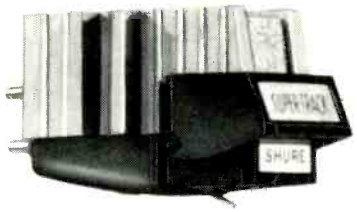

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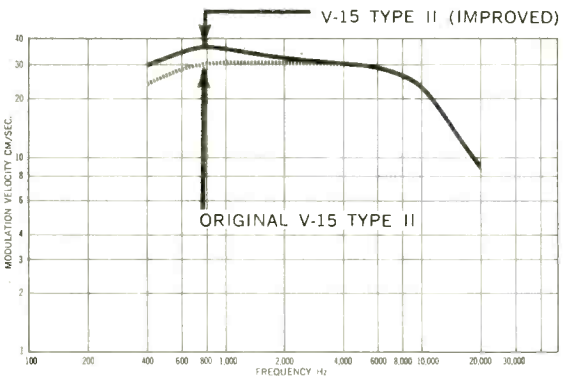

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parisons between the 3¾ ips and the 15 ips on two different machines, switching between them at random, they had to admit that except for the tape hiss and the better transient response of the 15-ips tape, the spaciousness of the stereo presentation made a choice based on frequency response very difficult. This spatial property of stereo is why the cheap little stereo phonographs and the small compact systems sound as well as they do, though they cannot stand up against good component stereo equipment by any means.

As I pointed out, it is easy to fool the ears of the uninitiated by selective equalization, or combining this with certain types of speakers. You hear music lovers exclaiming that a certain record they are listening to has "a lot of presence" with "plenty of highs." Much of the "presence" they are alluding to is due to a boosting of the so-called *middle range* frequencies. This boosting can be "built-in" to the recording when it is cut, the boost can be a permanent property of a specific kind of speaker, or the boost can be accomplished by equalization during the playback. Needless to say, it can happen that a recording with a peaked middle range will be played on a speaker with a peaked middle range, with disastrous results. Because the ear has maximum sensitivity around 3000 Hz, many of the cheap stereo systems have peaked mid-ranges to take advantage of this, although one quite famous speaker, which is far from inexpensive, has an approximate 11-dB peak between 1000 Hz and 3500 Hz. It is probably safe to say that mid-range peaking is the most widespread practice that is used to foster the illusion of "hi-fi sound." One significant thing that I have proved to my own satisfaction on a number of occasions is this: Take one reasonably intelligent listener, but one who has had no experience with good component stereo systems, seat him in a room with stereo speakers in front of him, furnish him with an equalizer such as a Pultec, explain its functions and the method of operation, and then ask him to adjust the playback of some music to his personal tastes. Invariably I have found that the Pultec is set so that the high frequencies are attenuated, there is quite a bit of boost in the mid-range, and a moderate boost in the bass. This is the result with all amplification controls set flat, with wide range, relatively flat speakers, playing in a room with no pronounced peaks or resonances, and with a high-quality copy of a tape master running at 15 ips. I changed the speakers for a pair with boosted mid-ranges and asked my friend to repeat the experiment. This time he left the high frequencies at their previous attenuated setting, but the mid-range was either boosted very slightly or not at all and the bass was boosted slightly more than in the first test. It would seem that those manufacturers who build in mid-range peaks in their low-cost equipment slanted toward the "average man" know what they are doing.

Tape Bias

No discussion of high frequencies would be complete without a look at the problems of tape bias. It has long been a habit of professional recording engineers to adjust the bias of their recorders to the specific kind of tape they are using. Whether the tape is a standard oxide, or a special low noise/low-print-through oxide, the engineer wants to optimize his bias settings. This always involves a compromise between the parameters of high-frequency response, signal-to-noise ratio and tape distortion. Today, no self-respecting professional recorder is without bias-setting facilities on the front panel of his electronics. In marked contrast is the consumer recorder, where the bias controls are usually deep in the vitals of their electronics and generally inaccessible to the owner without removing at least the back panel or more. It is hard to fault the reasoning of the manufacturers on this point. They feel that the average person using their machine has neither the equipment nor the knowledge to adjust the bias properly for specific tape oxides. Further, they feel that to make such controls freely accessible is to ask for trouble and that, in any case, the consumer is not that critical. Thus, a manufacturer will adjust the bias on his recorder for a specific tape, usually an oxide that is a standard type which is easily available. They feel that the differences in high-frequency response between this tape and other types and brands of tape the consumer is likely to buy is not significant enough to be heard by the consumer. Or is it? Here, I thought, is an excellent opportunity to run an experiment to assess just how sensitive certain consumers are to differences between various tapes without changing the bias settings.

To make the test fair, I chose two friends who are music lovers and who attend concerts on a fairly regular basis, but have neither interest nor abilities in audio per se; and two other friends who are best classed as knowledgeable audiophiles. I used three different tapes: 3M Type 203, Audiotape Formula 15, and BASF/Computron. My procedure was as follows. On a Revox HS77 which is set for 3M's 203, I played back a 15-ips, two-track copy of a master which had been recorded on the Revox using 203 tape. I also played back a series of high-frequency test tones from 9 kHz to 15 kHz in increments of 1 kHz. This too had been recorded on 3M's 203. The output of the Revox was fed into four tape machines, which represented a reasonable line-up of recorders ranging from low to medium to high priced. If any of the recorders was biased for one of the three tapes I was using, I used that tape. However, I also mixed the tapes between the various machines and kept a record of which was where. I also made up a real sneaky tape which consisted of 10-sec. segments of each tape spliced together in more or less random fashion for a total running time of two minutes. Both the music and the signals were recorded at 0 VU on the various tapes on the various machines.

Then came the moment of truth with the playback of these recordings. All I was asking both the music lovers and the audiophiles was whether they could detect a *difference* in high-frequency response between a recording made on a recorder using the tape for which it was biased and the same recorder using a different tape. On the recording of the test tones, the audiophiles and music lovers alike could tell the difference between tapes, not because of high-frequency differences, but to differing levels of tape hiss. On the composite tape, both groups were hopelessly lost. I should note here that the auditors were in their late thirties and mid-forties in age. Perhaps some younger ears would have been better able to differentiate between the various tapes and recorders. Most significantly as far as I was concerned, was that on the music recordings, both groups failed completely to detect audible differences between recordings made on the machines with tape for which they were biased, and the same recorders with different tape. All thought the sound of all the recordings was very good and completely acceptable as copies regardless of whether there was a proper mating of tape and recorder. The music I used was Britten's "Young Person's Guide to the Orchestra," and I chose a section with a fairly even distribution of dynamics between mezzo piano and triple forte. Perhaps on some low level and sustained string passages, it might have been easier to detect differences be-

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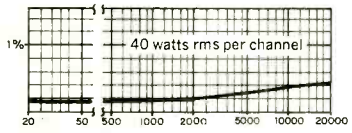

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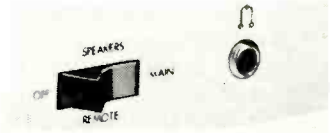

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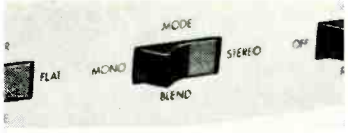
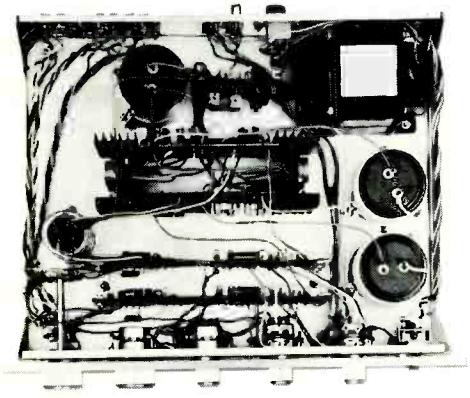


Center channel speaker can be driven without an auxiliary amplifier with mode switch in BLEND, which also reduces unrealistic stereo separation when using headphones.



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tween the various tapes and recorders, but then I don't think that could truly be called "average" conditions.

Ideally, of course, it would be great to have recordings of music with harmonics and overtones preserved right out to 15 kHz and with correspondingly low distortion. There are recordings like that, but one must also remember all the variables of equipment which may not necessarily permit you to hear the full undistorted frequency spectrum. As so often stated by the professionals, it is better to have a clean, low-distortion recording at the expense of some of the higher frequencies, than a recording that has extended high-frequency response, but is distorted. It is best, naturally, to have the higher frequencies together with very low distortion. To achieve this demands equipment that has a flat, low-distortion, high-frequency range that extends beyond audibility in order to assure excellent highs within hearing range.

The Missing N.Y. Hi-Fi Music Show

The New York High Fidelity Show was to have been held a scant month after the Los Angeles High Fidelity Show (October 1 through 5). For the first time in memory, however, there isn't going to be a major fall hi-fi show in New York. To state that this has caused consternation and dismay among many people is to put it mildly. To state also that the news was greeted in certain quarters with a sigh of relief, may come as somewhat of a surprise. I think it is worthwhile to examine the reasons for the cancellation of the show and to discuss some highly divergent opinions expressed as to the value of hi-fi shows in general.

For some years now there has been a certain faction within the Institute of High Fidelity that has complained about the general complexion of the New York High Fidelity Show. They have objected to when it was held, where it was held, and the poor facilities at the particular location. They have argued as to the appeal of the show, if the approach were right, if their goals were too high or too low. They castigated those who handled the publicity for the show and blamed them for poor attendance. In short, there was a highly vocal group who felt that the hi-fi shows of recent years were lacking in many respects and that it was time for a change.

One of the most frequent complaints about the show was that the usual locations of either the New York Trade Show Building or hotels such as the Statler Hilton couldn't handle really large crowds, even if publicity had been effective enough to attract such crowds. It was stated that the show was becoming insular, and not attracting the "right kind of consumer." There were many comments that it was "time that the hi-fi business grew up," that merchandising practices today required a different kind of show, that the time was ripe to move into the "big time." After much soul-searching (one presumes) a decision was made to hold the 1969 show at the huge New York Coliseum. Well, there is no denying that this monstrous convention and exhibition complex is equipped to handle enormous crowds. The annual boat show, for example, attracts more than 250,000 people! However, there is also the inescapable fact that exhibit spaces that can display 45-ft. cabin cruisers are not very suitable for demonstrating stereo hi-fi equipment. Recognizing this, a decision was made to investigate the use of special pre-fabricated rooms that would reasonably simulate living-room conditions.

In due time, members of the Institute and the hi-fi press were invited to a meeting at a hotel where, in a large exhibit space, the pre-fabricated rooms had been set up as typical hi-fi show rooms. With the high costs of union labor in most convention halls in mind, the rooms had been designed with easy, rapid assembly and dismantling. The rooms were completely self-contained; that is, they had four standing walls, a ceiling, and entrance and exit doors. The walls were made of plywood, in a sandwich configuration with insulating material as the filler. The ceiling was made of two-inch slabs of compressed fibreglass. For this preview, the rooms were equipped with modest stereo systems which were playing music at what I would describe as moderately loud levels. The amount of sound isolation afforded by the walls was fairly good, but it was evident that with the larger, more powerful stereo systems played at the higher levels one usually encounters at a hi-fi show, sound leakage through the walls would be a problem. A much more serious sound problem was presented by the fibreglass ceilings. Here the sound leakage was very audibly evident, especially in the low frequencies. Several knowledgeable engineers who were present and an acknowledged expert acoustician stated that the fibreglass ceilings were acoustically transparent below 200 hertz, and that with those stereo systems which produced really low frequencies, there would be great leakage and attendant confusion.

There were many opinions freely given, and the arguments were loud and long. I don't believe the Institute officials had anticipated such a reaction to these rooms, nor the vehemence of some of the denunciations. To compound the misery, costs were discussed and it was obvious that they would be substantially higher than the rates for previous shows. In addition to higher space rates, some pointed out that the rooms had no carpeting, which would cost extra. Others claimed that union labor at the Coliseum was astronomically high, although an official of the Coliseum who was present refuted this statement. The meeting was opened to formal discussions on the advisability of using the pre-fab rooms and holding the show at the Coliseum. There were eloquent and persuasive arguments both pro and con. When a vote was finally taken, it went against the Coliseum move. The vote was challenged, and there was subsequent polling of the membership through the mail, but the end result was the same. It was announced that the Coliseum plan was to be abandoned and that, due to lack of time, there would not be a 1969 New York High Fidelity Show.

The whole idea behind the move to the Coliseum was basically the desire for higher attendance, an appeal to a new kind of consumer and an attempt to broaden the component hi-fi market. Those who supported the Coliseum plan were of the opinion that, as previous hi-fi shows were constituted, they were largely attended by a "hard core" nucleus of hi-fi nuts who already owned much equipment, and didn't represent much new business. The contention of this group was that the number of "newly minted" hi-fi people resulting from the shows was quite limited and hardly worth the trouble. It seemed obvious that they were interested in a more mass-market approach, and the way to the type of customer this approach would appeal to was to hold a "big time" show at the Coliseum, with presumably a much healthier publicity budget. Naturally the bigger manufacturers are in a better position to afford the higher expenditures of such a show, yet there was a surprising plan offered by one of the biggest manufacturers, which urged outright abandonment of the traditional hi-fi show! The alternative suggested was a number of regional shows throughout the country in places that had never

(Continued on page 86)

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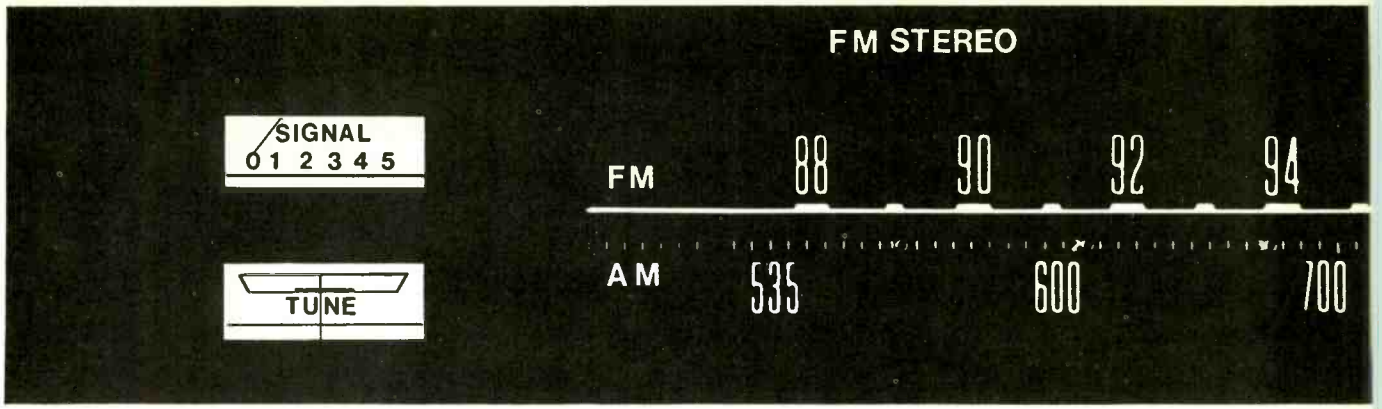

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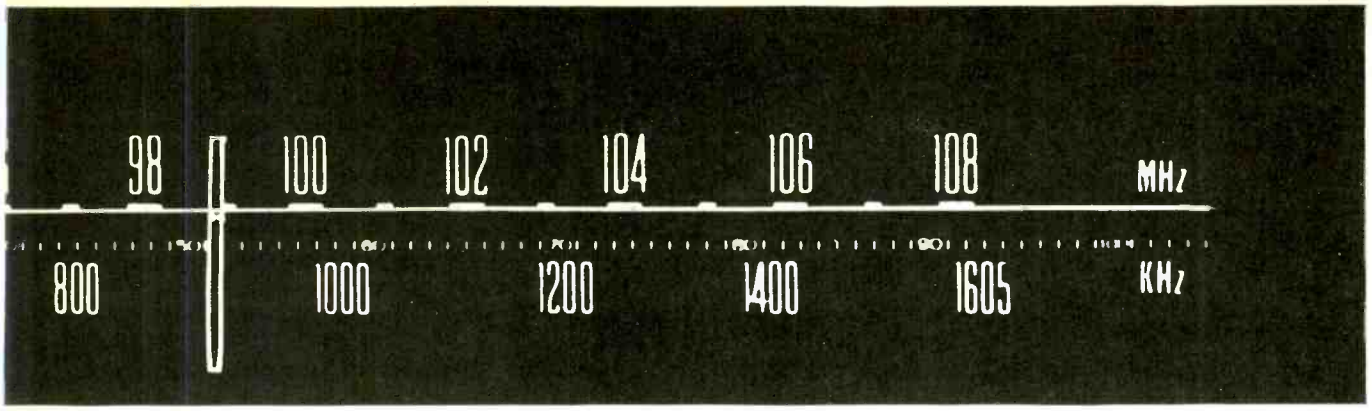

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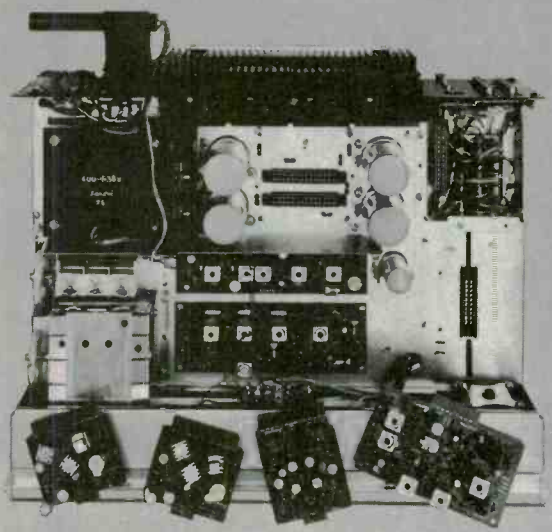

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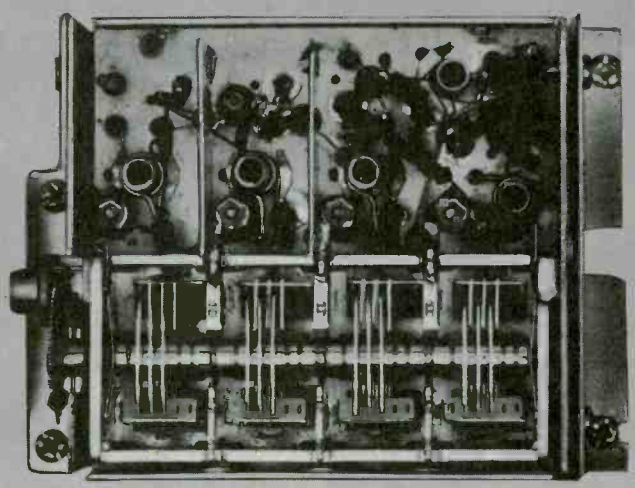

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Long-Life Tape

Q. I am recording spoken material from TV and records. I want good master tapes to duplicate for classroom and student use; these will be stored for several years. What kind of tapes would you suggest? What tape speed would you suggest?—Jean Boyle, Oklahoma City, Okla.

A. For long storage and durability, I suggest that you try 1½-mil Mylar tape—either conventional or low print. Inasmuch as you plan to store tapes for a long time, which brings out print-through, you may be interested in a low-print tape. Do not use high output tape as this has greater tendency to print-through than does conventional tape. Possibly 1-mil Mylar tape, which permits more recording time on a reel of tape, will give you sufficiently satisfactory results. The disadvantage of 1-mil tape, however, is that it is more susceptible to print-through. If a tape has been stored a long time, you can reduce print-through by winding it and rewinding it one or two times before use. Also, it helps to store a tape tail out—that is, with the last part of the program material on the outside of the reel; then you must rewind the tape just before use.

Many recorders will give excellent results on speech (and music) at 3.75 ips. A number will give quite satisfactory results on speech at 1.875 ips. It depends on the recorder. With a 7-inch reel of 1-mil tape, you can get about 1½ hours of program material on one track at 3.75 ips, and about 3 hours at 1.875 ips. If you record four mono tracks at 1.875 ips on a 7-inch reel of 1-mil tape, you can get well over 12 hours of program material on this one reel.

Erase Head

Q. Is the following statement correct? An erase head basically records on the tape a high frequency (inaudible—about 100 kHz) tone. Now, if this is true, when you bulk erase a tape, and then record on the tape, would it be better to slide the erase head back so that it doesn't "erase" the bulk-erased tape? — Michael Sykora, Ascension Island.

A. To my knowledge, the erase head does not record a tone on the tape. It destroys the existing magnetic pattern (if any) on the tape by successive heavy magnetizations of alternate polarity, gradually dwindling in intensity as the tape leaves the head and ultimately dwindling to zero. There is no need to deactivate the erase head when using a bulk-erased tape.

External Amp

*Q. Is there a simple method for utilizing the *** tape recorder as an external amplifier in conjunction with a record player equipped with a magnetic cartridge without actually recording and monitoring the source?*—Michael Grimes, Kotzebue, Alaska.

A. Does your tape recorder have an input specifically designed for a magnetic cartridge? If not, then the answer to your question is no. If the machine does have a magnetic input, the answer to your question *might* be yes. Some machines can be used as public address systems, and this would serve your purpose. Consult the instruction manual.

Ceramic Cartridge

Q. I am interested in equipping my turntable with a ceramic or crystal cartridge so that its output can be fed directly into the auxiliary input jack of my tape recorder. Please advise.—David Simon, Kanehoe, Hawaii.

A. Ask your dealer for a cartridge that requires a load impedance nearest to the one presented by your tape recorder. If your tape recorder presents an impedance of 500,00 ohms, which is quite typical, then the cartridge should be one designed to work with this kind of load. If, however, the cartridge requires a load of 1 megohm or more, as many do, and if the load impedance of the tape recorder is much less, then there will be some loss of bass response. The loss of bass response in such a case can be overcome by wiring a suitable capacitance across the output of the cartridge—either at the turntable or at the tape recorder. The value of the capacitor depends upon capacitance of the cartridge, upon the load required by the cartridge, and upon the load presented by the recorder; the cartridge manufacturer can help you determine the correct value of capacitance to wire across the cartridge output. If you are using a fairly long cable between the turntable and the tape recorder, this may present some or all of the additional capacitance required to maintain good bass response in the face of insufficient load resistance.

Impedances

*Q. I have a *** tape deck with record and play preamps, and a high-impedance stereo headphone jack. Why do some tape recorders have a high-impedance headphone jack, whereas others have an 8-ohm headphone jack? In the matter of headphones, what is considered high impedance?*

I have a second tape recorder with a 600-ohm output. I have tried dubbing from this, but do not get any sound. Do I need a transformer to boost the 600-ohm output up to the level required by the high-level input of my first tape recorder? If this is possible, would it give better results than using the 8-ohm output of my second recorder? What is the 600-ohm output normally used for?—Gary Rogers, New Orleans, Louisiana.

A. Use of a high-impedance output for headphones may be simply a matter of convenience for the manufacturer in simplifying circuit requirements and lowering the cost. Your first tape recorder contains no speakers and therefore does not already have a low-impedance output available, namely the secondary of the speaker transformer (about 8 ohms). High impedance in headphones would be in the region of 10,000 ohms and up. Six hundred ohms is medium to low impedance.

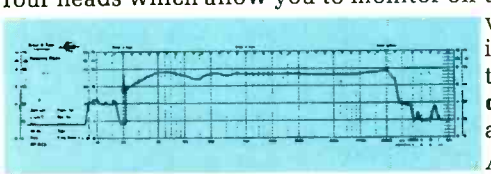
Your 600-ohm output may be providing much too small a signal voltage for the purpose of the component into which you are feeding the signal. Yes, you would need a stepup transformer to boost the signal sufficiently. Another possibility is to feed the signal from the 600-ohm output into the low-level (microphone) input of your first recorder. I don't know whether there will be a difference in quality of results according to which output of your second recorder that you use. And if there is a difference, I don't know which would be the superior output.

Six-hundred-ohm output usually meets the needs of professional equipment. Six hundred ohms is more or less of a standard, and since it is of relatively low impedance it permits a fairly substantial cable run between components without significant treble loss due to cable capacitance. Æ

a soft touch...

That's all it takes, a gentle touch of the solenoid operated controls of the new Model 407 by Astrocom/Marlux to make you a soft touch for this outstanding new tape recorder.

No wonder, with such features as two reel drive motors plus a hysteresis synchronous capstan motor, four heads which allow you to monitor off tape and gives you automatic reverse play as well; calibrated vu meters; speed change is at the touch of a button and there is a tape tension control for proper playback of the very thinnest tapes. **And a special feature unique in the entire industry:** every **Astrocom/Marlux 407** is delivered with its own actual graphic laboratory read-out of its frequency response.* Ask your **Astrocom/Marlux** dealer for a demonstration of the **Model 407,** the recorder you'll want to buy—today.



*all laboratory equipment calibrated to National Bureau of Standards.

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Letters

Author's Addenda

• Here are several very minor "corrections" to my article, "Layman's Guide to Microphone Specifications" (AUDIO, August 1969):

Page 23: (1) The second column discusses high-frequency losses due to cable capacitance. The example holds only for 50pF/ft. cable, a typical value. (2) At the end of the third column, "C_c" should read "C_g." (3) The third column discusses resistive loading of resistive-source microphones. In general, only output level is affected as the load is decreased. The segment (under Fig. 16) beginning, "Thus, in accordance with the preceding . . ." refers to an exception to this rule for microphones whose impedance is in reality increasing at low frequencies. To clarify this, it should be noted that loads far below nominal impedance for some directional microphones *will* result in a roll-off of bass response. This occurs because many directional microphones have an impedance characteristic that is not a constant resistance, but rather one that rises at low frequencies.

Page 61: (1) At the end of first column on "Resistive Loading" "C_c" should read "C_g." (2) At the end of the third column, the statement of a typical maximum power rating should be "—60 dB" rather than "60 dB."

JIM LONG
Electro-Voice, Inc.
Buchanan, Mich.

Thanks for bringing the above to our attention. A reader also observed that the frequency-response semi-log grids of the graphs in Figs. 1 through 4 are reversed (printer's error, not author's). —Ed.

Transients

• In the May, 1969 issue of AUDIO, a Mr. C. Witherspoon asked a question concerning power line problems and their effect on his equipment. The filter capacitors referred to in *Audioclinic's* answer do offer a low impedance to phenomena at line frequencies. However, the spikes constitute substantial energy at much higher frequencies due to their rise time. These same capacitors also exhibit considerable inductance at these frequencies. The result —considerable chance of these spikes causing current concentration in driver

(Continued on page 106)

Erich Leinsdorf has directed symphony orchestras and opera companies all over the world. He uses AR high fidelity components for home listening.

Music Director of the Boston Symphony Orchestra, Erich Leinsdorf is intimately acquainted with the sound of the world's great orchestras and the concert halls in which they perform. His recorded performances with the Boston Symphony Orchestra on RCA Victor Red Seal Records, which now consist of nearly 80 works, represent a major contribution to the classical and contemporary recorded musical literature. For his private listening, Mr. Leinsdorf uses AR-3a speaker systems, an AR turntable and an AR amplifier.

Acoustic Research makes AR speaker systems, amplifiers and turntables. All are described in our catalog, obtainable for the asking.

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EDITOR'S REVIEW

GUEST EDITORIAL

by John C. Koss, President,
Institute of High Fidelity, Inc.

The high fidelity components industry is emerging as the fastest growing segment of the home electronics world, and one with unlimited growth potential.

The Institute of High Fidelity (IHF), dedicated to maintaining and accelerating this vigorous growth, is equally concerned that it proceed upon a solid and lasting foundation for continuing benefits to the industry, to each of its members, and to its consumers.

Our activities this year, therefore, moved ahead on a planned basis towards two overall objectives: (1) to expose more consumers to the enjoyment benefits of the fine sound-reproducing components now available, and (2) at the same time, to enhance consumer confidence in our products through establishment and publicizing of reliable standards and measurements.

Some of the specific steps undertaken include:

1. A uniform and accurate measuring system for the wattage power question was initiated. IHF expects that high fidelity component manufacturers, without exception, shortly will end confusion at both manufacturing and consumer levels.

2. IHF's standards program was projected to encompass cartridges, turntables, and speakers, as well as amplifiers and tuners. Plans are that conformity with these authenticated standards will be attested by an independent laboratory affiliated with the IHF within the next five years.

3. An institutional identification campaign was introduced. At the core of this is the IHF's continuing work in the area of standards and the interpretation of it to the consumers in clearly understandable terms. A product "hangtag" was developed as assurance to the buyer that the product has met basic reliability standards. Member companies are utilizing this tag in their advertising as well as at the point of purchase.

4. During this same period, IHF's first institutional ad in many years was developed to explain both the power-rating and the "hangtag" as guides for buying decisions.

5. To further interest consumers and expose them to the products of our industry, IHF has undertaken a major revamping of its show policy. Its suggested elements would consist of consumer shows in major markets, stressing the component idea, but also involving other product groups. Such an orientation would further acclimate the general public to thinking about quality components rather than the packaged products. At the same time, thought is being devoted to co-sponsoring "mini-shows" in smaller markets, thus combining both national and grass-roots approaches to reach the largest possible audience.

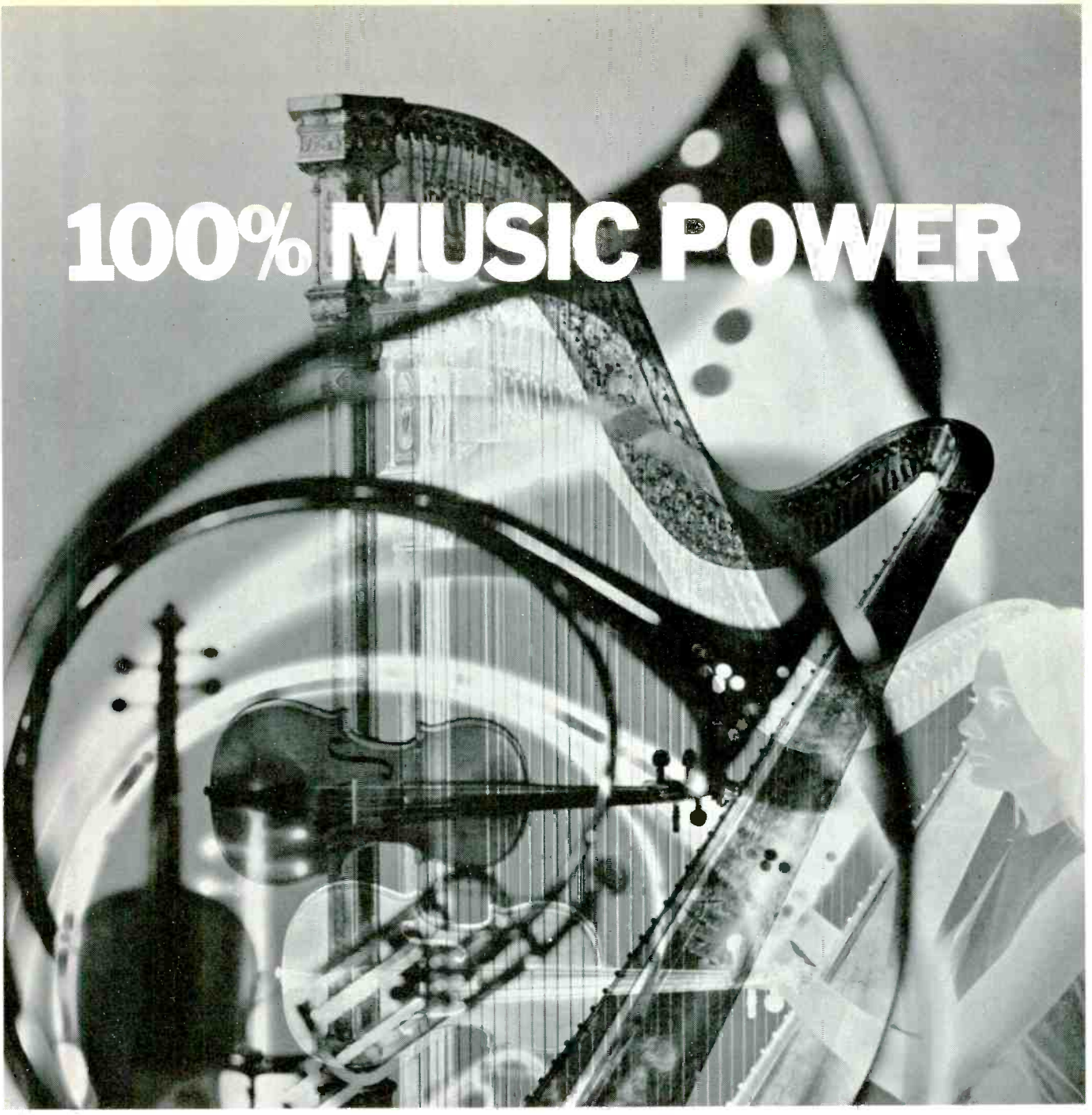
6. IHF is centering special attention on the youth market, whose influence on adult (parent) purchases is great today and who are shortly to be adult consumers themselves. A far-reaching education program on behalf of the industry is being developed for presentation at schools around the country.

7. The first national industry convention of manufacturers, dealers, and representatives will be held in January, 1970, marking another step forward for IHF. We are planning to supplement this national event with a series of national and regional management seminars for industry members.

8. IHF will take the lead in 1970 in a much-needed industry statistical program, which will develop accurate figures reflecting unit and dollar sales of our products, as a means of pinpointing merchandising, promotional and educational opportunities in the future.

9. An intensified national publicity and promotion effort will be undertaken by IHF. Generic to the industry, it will utilize various avenues of communicating with the public to acquaint them with our products, what to look for, how to buy and use them. Newspapers will be encouraged, for example, to publish special sections devoted to component high fidelity which will be informative and of service to their readers. We anticipate cooperation from other segments of the economy who will derive mutual benefits.

We envision continuing greater growth for the high fidelity components industry, and a most exciting future. At IHF, our role is to nurture this expansion to achieve our goal of quality high fidelity components in every home.



PHOTOGRAPH BY FRANZ EDSON

Words are inherently limited in stimulating the emotions aroused by music. This is especially so in describing how high fidelity components perform.

With cartridges, for example, we speak of flat frequency response, high compliance, low mass, stereo separation. Words like these enlighten the technically minded. But they do little or nothing for those who seek only the sheer pleasure of listening.

We kept both aspects in mind when developing the XV-15 series of cartridges. We made the technical measurements. And we listened.

We listened especially for the ability of these cartridges to reproduce the entire range of every instrument. With no loss of power. That's what it takes for a cartridge to recreate the most subtle nuances that distinguish one musical instrument from another. An oboe from an English horn. A trumpet from a cornet.

We call this achievement "100% music power."

When you play your records with an XV-15, you won't be concerned with even that simple phrase.

Instead, you'll just feel and enjoy the renewed experience of what high fidelity is really all about.

PICKERING

THE NEW PICKERING XV-15/750E.
PREMIER MODEL OF THE XV-15 SERIES. TRACKS AT ½ TO 1 GRAM. DYNAMIC COUPLING FACTOR OF 750 FOR USE IN FINEST TONEARMS. $60.00. OTHER XV-15 CARTRIDGES FROM $29.95. PICKERING & CO., PLAINVIEW, L.I., N.Y.

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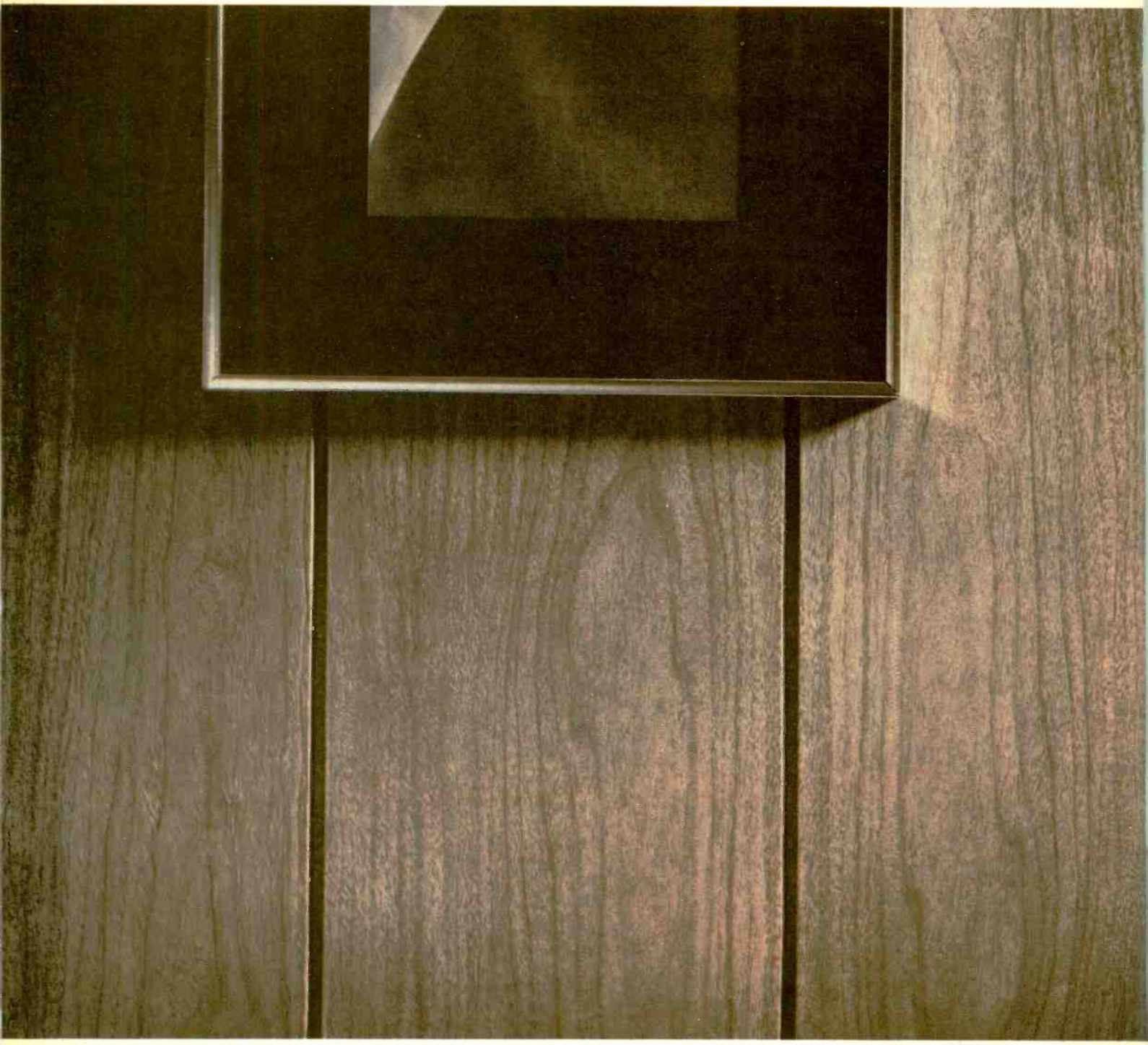
Voltage supply in your city can vary as much as 10%. And even a 2% variation causes a significant tape speed change in tape decks with induction motors and a difference in reproduced sound that is intolerable.

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

Don't get the idea the hysteresis motor is all the Concord Mark II has to offer. It also has just about every other professional feature. Three high-quality heads: ferrite erase head; wide gap Hi-Mu laminated recording head for optimum recorded signal and signal-to-noise ratio, narrow gap Hi-Mu laminated playback head for optimum reproduced frequency response. No compromise combination heads. The three heads and four preamplifiers also make possible tape source monitoring while recording.

The tape transport mechanism assures a fast startup—you don't miss a note. Supply and takeup tape tension arms eliminate startup burble. A special flutter filter eliminates flutter due to tape scrape or cogging action. A cue control provides instantaneous stop and start operation. Other important conveniences: the flip-up head



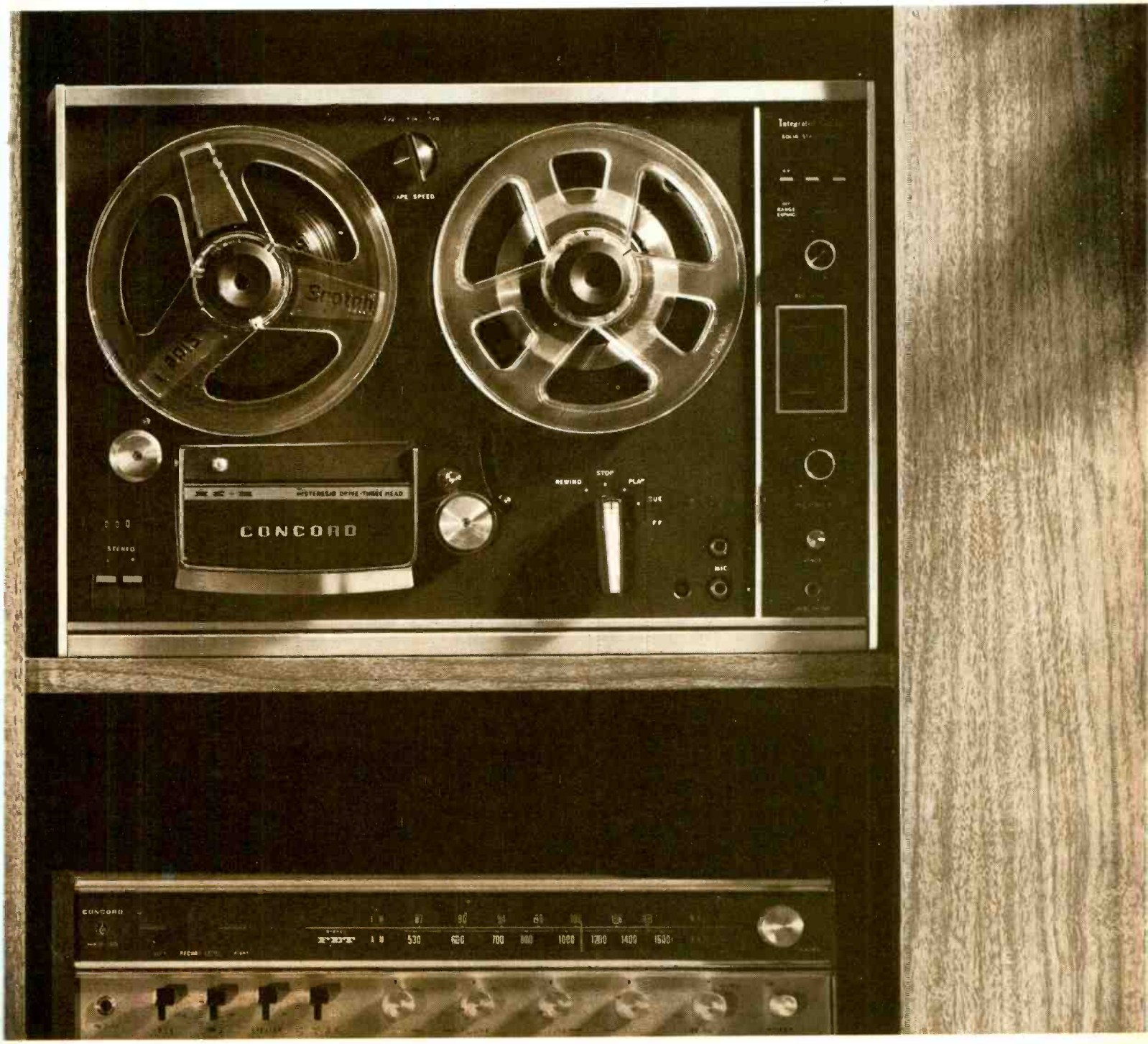
NEITHER AIR CONDITIONERS, TV SETS, WASHERS, NOR HYSTERESIS-DRIVE CONCORD MARK II

cover permits you to see the head gap position markings for professional editing; 3 speeds; automatic sound-on-sound with adjustable level controls; variable echo control for reverb recording; calibrated VU meters with individual record indicator lights; stereo headphone jack; electronically controlled dynamic muting for automatic suppression of tape hiss without affecting high frequency response. All this, for under $230.

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

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

For copy of Concord Mark III instruction book, mail 25¢ in coin



ANY OTHER ELECTRICAL APPLIANCE CAN KEEP THE FROM ITS PRECISELY APPOINTED SPEED.

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An Empirical Study of FM

A detailed analysis of FM reception with different antenna types

LEONARD FELDMAN

FOR A GOOD MANY YEARS, this author (and just about every one else who has ever discussed FM radio in print) has been repeatedly stressing the need for a "good outdoor FM antenna." Stereo FM, we emphasize, has an inherently poorer signal-to-noise ratio than monophonic FM and, to make matters worse, is subject to problems such as "multipath" reflections. Further, with FM channel space at a premium, less selective sets and those not having a good "capture ratio" may have trouble differentiating between adjacent stations or may even receive double signals at the same frequency if a simple nondirectional antenna is used.

Intuitively, we all sense the truth of these problems, but to my knowledge, no one has set about collating quantitative data. Antenna manufacturers, of course, give plotted data of gain "lobes," forward-gain figures, and the like. Tuner and receiver manufacturers, in addition to listing the usual IHF sensitivity figures, specify selectivity as well as capture ratio, adjacent- and alternate-channel selectivity, and a host of other related specifications. No one, though, has actually correlated all these inter-related data with actual "listening" results obtained in a given location, using progressively

Fig. 1—Location of receivers and antennas in this study is at right center of map as denoted by point "X." The Empire State Building is at point "Y," and the Municipal Station, WNYC, is at point "Z."

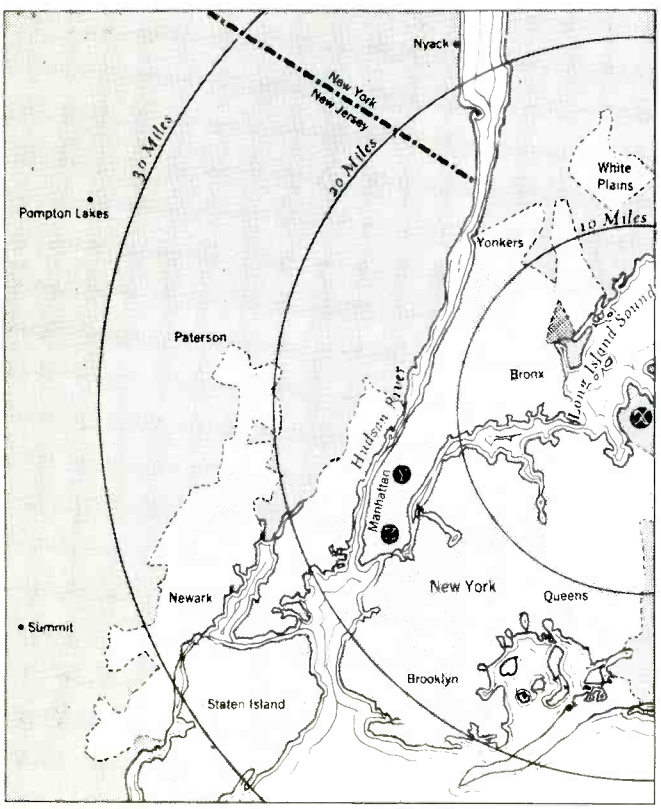
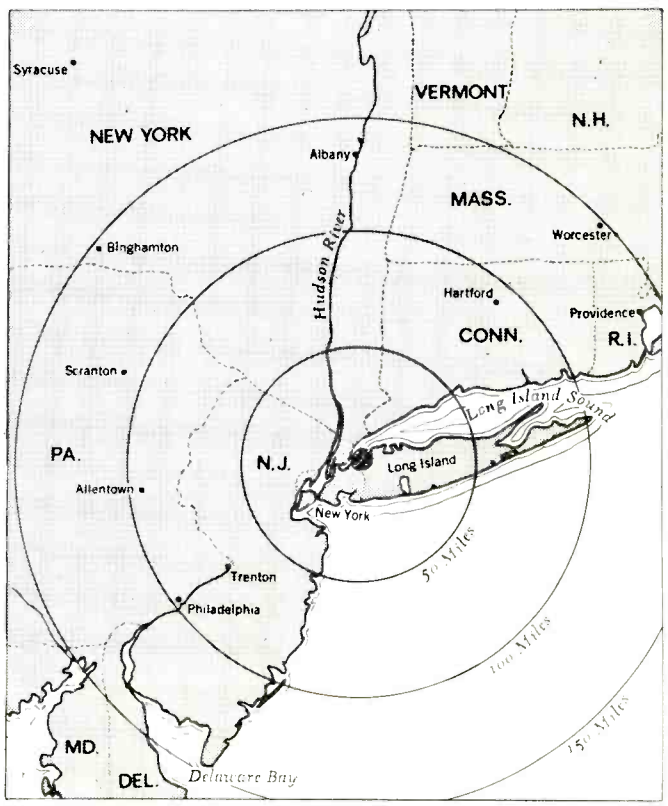


Fig. 2—Distances up to 150 miles from receiving antenna are shown on this map of greater area.



better and better antenna installations. That is the purpose of this study.

Location and Terrain

Our listening locale is not unlike that of a great percentage of the suburban population of the United States. We are located in Great Neck, N. Y., some seventeen miles from the Empire State Building in New York City where most major New York City FM stations have their transmitting antennas. Great Neck has an elevation of about 200 feet above sea level, and in that respect has somewhat of an advantage over the rest of Long Island. The map of Fig. 1 details our immediate vicinity and "x" marks our spot in that map, while "y" indicates the Empire State Building, and "z" the location of WNYC's transmitter. Circles denoting 10, 20, and 30 miles have been drawn on the map as an aid in scaling distances. While this map does not show areas to the east of us, the map of Fig. 2 (drawn to a much smaller scale) encompasses all land areas within at least 150 miles of our location. Again, "x" marks our spot, and the circles this time denote 50-mile distances from our receiving antenna.

Measuring Techniques

We realized at the outset that to try to take in *all* factors, such as multi-path, phase cancellation, and so on, would involve measurements of interminable length and complexity. Accordingly, we settled for sensitivity measurements *only*. That is, our primary measurement is "number of microvolts" appearing at the antenna terminals of the receiving apparatus. We had access to a Rohde and Schwarz signal-strength receiver, Model HUZ-BN-15012/2, which is directly calibrated in microvolts and can be used at any frequency in the 88- to 108-MHz spectrum. Calibration is a bit tedious for the number of measurements which we knew would be required, so we set up a secondary standard, using a receiver of medium sensitivity and calibrating its a.g.c. voltage against antenna microvolts input. Our calibration curves, taken at 88, 98, and 108 MHz are shown in Fig. 7, as a matter of interest, and to show that accuracy of measurement was extremely good at low-microvolt readings but tended to be a bit difficult to interpolate at higher signal levels. We did not regard this as a serious drawback, however, since it matters little in our results if a signal strength that we read as 6000 microvolts is really 6500 microvolts.

The first series of measurements, then, was intended to show what happens to the signal strength of about twenty easily received stations under three sets of antenna conditions:

Indoor Folded Dipole: We mounted a simple folded dipole antenna at "first floor level" in the first part of the test. This antenna consists of a length of 300-ohm twinlead, with ends shorted and another piece of the same material spliced to the center point of one of the leads, to form the familiar "T" configuration given away with many receivers and tuners. Figure 3 should be recog-

TABLE I

High-Gain FM Receiving Antenna Sampler

Manufacturer	Model	Description	List Price
Finco	FM-3	4-Element Yagi	$14.25
Finco	FM-4G	6-Element Geometric	25.95
Finco	CX-FM-4G	Same as above, but for 75-ohm	34.95
Finco	FM-5	10-Element, Geometric	37.95
Finco	CX-FM-5	Same, but for 75-ohm Co-Axial	46.95
Finco	FMSL-12	12-Element Geometric	52.50
Finco	CX-FMSL-12	Same, but for 75-ohm Co-Axial	61.25
JFD	LPL-FM-4A	4-Element Log-Periodic	19.95
JFD	LPL-FM-6A	6-Element Log-Periodic	29.95
JFD	LPL-FM-8A	8-Element Log-Periodic	39.95
JFD	LPL-FM-10A	10-Element Log-Periodic	49.95
Apparatus Dev.	FM/Q Jr.	5-Element Yagi	19.95
Apparatus Dev.	FM/Q Dynaplex	8-Element Yagi	32.50
Apparatus Dev.	FM/Q Super Mk I	12-Element Yagi	54.96
Winegard	SC-60	7-Element Yagi	24.95
Winegard	SC-65	11-Element Yagi	36.95

Antennas for tests:

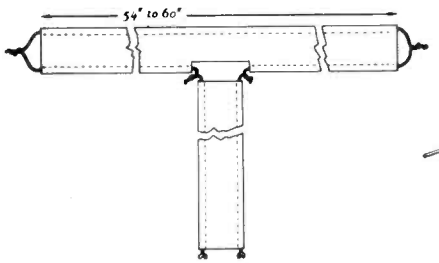


Fig. 3 – Typical "Folded-Dipole" antenna given away with most tuners and receivers.

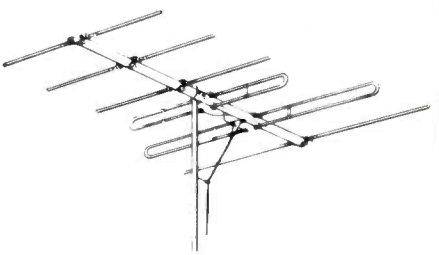


Fig. 4–Line drawing of Finco FM-4G antenna.

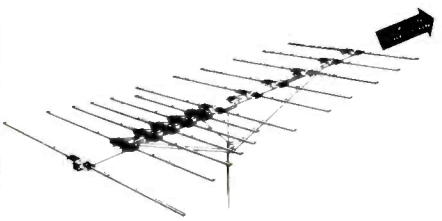


Fig. 5–The Finco FMSL-12 antenna is considerably more elaborate.

Fig. 6–Control box of Alliance C-225 rotor.

FM Antennas (Continued)

nizable to just about every reader as the most rudimentary form of antenna possible (short of just using a length of wire, which we didn't even consider—though sadly enough, we know of some listeners who even resort to that!).

Better Quality Directional FM Antenna: Here we wanted to duplicate conditions that might exist in the home of a fairly knowledgeable FM fan who has taken the trouble to install a well-designed, directional FM antenna. There were many commercially available units available. Table I, which is by no means a complete survey of the field, lists FM antennas with a brief description of each. Note that prices range all the way from $14.25 for the simplest 4-element Yagi, up to over $50.00 for the more elaborate, multi-element Yagi and Log-Periodic types available from each manufacturer. We used a FINCO FM-4G antenna for this second category. A line drawing of this antenna is shown in Fig. 4, and we shall discuss its installation shortly.

Top-Grade Multi-Element Directional Antenna: The FM-4G would probably be all we would need for excellent reception in our location. However, we also installed the Finney Company's top - of - the - line model FMSL-12. This unit is de-

TABLE II

Measured Signal Strength from Various Antennas (All models oriented West)

Freq. MHz	Station Call Letters	Indoor Folded Dipole μV	6-element Yagi μV	12-element Yagi μV
88.1	WCWP	25	40	70
88.7	WVHC	4	23	45
89.9	WKCR	300	4000	2500
90.7	WFUV	2000	3000	3000
91.1	WFMU	37	300	500
92.3	WHOM	500	3500	5000
92.7	WLIR	500	2000	5000
93.9	WNYC	500	5000	8000
95.5	WABC	150	4000	6000
96.3	WQXR	200	3000	5000
97.1	WNBC	200	3500	6000
97.9	WEVD	40	4500	6000
98.7	WOR	200	5000	5000
100.3	WVNJ	75	1000	1000
101.1	WCBS	200	4000	10000
101.9	WPIX	25	5000	6000
102.7	WNEW	30	5000	6000
104.3	WNCN	150	1000	1000
105.1	WRFM	100	1000	2500
105.9	WHBI	100	2000	5000
106.7	WRVR	200	350	300

TABLE III

Comparison of Electrical Characteristics of the Two High-Gain Antennas Used in This Study

Model	Freq. MHz	Forward Gain dB	Front/Back Ratio dB	Standing Wave Ratio
FM-4G	88	6.8	16.5	1.2
FMSL-12	88	9.1	24.0	1.58
FM-4G	100	8.8	22.5	1.3
FMSL-12	100	11.0	18.8	1.35
FM-4G	108	9.6	19.0	1.35
FMSL-12	108	11.4	23.0	1.35

Table IV—STATION LOG

Channel MHz	North	East	South	West
88.1	*WCWP (Greenvale)	WCWP	WCWP	———
88.3	*WBGO (Newark, N. J.)	———	WBGO	WBGO
88.5	———	———	———	———
88.7	WVHC (Hempstead)	WVHC	WVHC	WVHC
88.9	———	———	———	———
89.1	———	———	———	———
89.3	———	———	———	———
89.5	*———	———	WSOU (S. Orange, N. J.)	WSOU
90.1	*———	———	WRTI (Phila., Pa.)	WRTI
90.3	———	———	———	———
90.5	———	———	———	———
90.7	WFUV (Bronx)	WFUV	WFUV	WFUV
90.9	———	———	———	———
91.1	*———	———	WFMU (E. Orange, N. J.)	WFMU
91.3	———	———	———	———
91.5	*———	WNYE Brooklyn)	WNYE	———
91.7	*WICB (Ithaca)	WICB	———	———
91.9	*———	WAIC (Springfield, Mass.)	———	———
92.1	———	———	———	———
92.3	WHOM (New York)	WHOM	WHOM	WHOM
92.5	———	———	———	———
92.7	WLIR (Hempstead)	WLIR	WLIR	WLIR
92.9	———	———	———	———
93.1	WPAT (Paterson, N. J.)	———	WPAT	WPAT
93.3	———	———	———	———
93.5	WVOX (New Rochelle)	WVOX	———	WVOX
93.7	———	———	———	———
93.9	WNYC (New York)	WNYC	WNYC	WNYC
94.1	———	———	———	———
94.3	†WGSM (Huntington)	WGSM	WJLK (Asbury Pk., N. J.)	WJLK
94.5	———	———	———	———
94.7	WFME (W. Orange, N. J.)	WFME	WFME	WFME
94.9	*———	———	———	———
95.1	———	———	WGPA (Bethlehem, Pa.)	WGPA
95.3	———	———	———	———
95.5	*WABC (New York)	WABC	———	WABC
95.7	*WBMI (Meriden, Conn.)	WBMI	WBMI	———
95.9	———	———	———	———
96.1	*———	———	———	WEST (Easton, Pa.)
96.3	WQXR (New York)	WQXR	WQXR	WQXR
96.5	———	WSTC	———	———
96.7	*WSTC (Stamford, Conn.)	———	———	———
96.9	———	WNBC	———	———
97.1	WNBC (New York)	———	WNBC	WNBC
97.3	———	WALK	———	———
97.5	*WALK (Patchogue)	———	WALK	———
97.7	———	WEVD	———	———
97.9	WEVD (New York)	———	WEVD	WEVD
98.1	———	WHLI (Hempstead)	———	———
98.3	†WLAD (Danbury, Conn.)	———	WHLI	WCTC (N. Brunswick, N. J.)
98.5	———	———	———	———
98.7	WOR (New York)	WOR	WOR	WOR

picted in Fig. 5 and consists of five driven elements, six directors, and one reflector, for a total of twelve elements. Normally it is intended for "deep fringe" work, but our objective was to see whether any further increase in signal strength would be obtained through its use.

Antenna Installations

We installed the two antennas at a height of approximately 30 feet above average terrain, using a 10-ft. mast atop the chimney of our home. We included a rotor, about which we shall have more to say shortly. For this first experiment, however, we simply oriented both the FM-4G and the FMSL-12 in a westerly direction, very much in line with all the TV antennas in our neighborhood.

Since the input impedance of our medium-grade calibrated tuner as well as that of the later-used top-quality unit is 300 ohms, we decided to forego 75-ohm co-axial transmission line in favor of the new "shielded" 300-ohm twin lead. This material has the advantages of 300-ohm impedance (better match to the antenna inputs on most tuners and receivers) while, at the same time, affording electrostatic shielding by means of a sheath which surrounds the twin lead and which should be grounded to a good "earth" ground at its termination inside the house. An adequate number of stand-off insulators was used, and the length of run amounted to about 60 ft. in all. There are no splices in either of the transmission lines (separate lines were used, of course, for the two antennas). The FMSL-12 was in a slightly favored position in that it's height above average terrain was, perhaps, 5 ft. greater than that of the FM-4G.

Stations received, using 12-element FM antenna and a Rotor

Channel MHz	North	East	South	West
98.9	———	———	———	———
99.1	*———	———	WAWZ (Zarephath, N. J.)	WAWZ
99.3	———	WBAI	———	———
99.5	WBAI (New York)	———	WBAI	WBAI
99.7	———	WKCR	———	———
99.9	WKCR (New York)	———	WKCR	WKCR
99.7	———	WJZZ	———	———
99.9	†WJZZ (Bridgeport, Conn.)	———	———	WEEX (Easton, Pa.)
100.1	———	WVNJ	———	———
100.3	WVNJ (Newark, N. J.)	———	WVNJ	WVNJ
100.5	———	WLNA	———	———
100.7	*WLNA (Peekskill)	———	———	———
100.9	———	WCBS	———	———
101.1	WCBS (New York)	———	WCBS	WCBS
101.3	*———	WEOK	———	WGBI (Scranton, Pa.)
101.5	*WEOK (Poughkeepsie)	———	———	WEOK
101.7	———	WPIX	———	———
101.9	WPIX (New York)	———	WPIX	WPIX
102.1	———	———	———	———
102.3	*WBAB (Babylon)	———	WBAB	WBAB
102.5	———	WNEW	———	———
102.7	WNEW (New York)	WDRC (Hartford, Conn.)	WNEW	WNEW
102.9	*———	———	———	———
103.1	*WFMN (Newburgh)	———	———	———
103.3	*———	———	WPRB (Princeton, N. J.)	WPRB
103.5	WTFM (New York)	WTFM	WTFM	WTFM
103.7	———	WHRF (Riverhead)	———	———
103.9	†WFAS (White Plains)	———	———	———
104.1	———	WNCN	———	———
104.3	WNCN (New York)	———	WNCN	WNCN
104.5	———	WKIP	———	———
104.7	*WKIP (Poughkeepsie)	———	———	WKIP
104.9	———	WRFM	———	———
105.1	WRFM (New York)	———	WRFM	WRFM
105.3	———	WDHA	———	———
105.5	WDHA (Dover, N. J.)	———	WDHA	WDHA
105.7	*WKOX (Framingham, Mass.)	WHBI	———	———
105.9	WHBI (Newark, N. J.)	WPAC (Patchogue)	WHBI	WHBI
106.1	*———	WVIP	WPAC	———
106.3	*WVIP (Mt. Kisco)	———	———	WVIP
106.5	———	WRVR	———	———
106.7	WRVR (New York)	———	WRVR	WRVR
106.9	*WCCC (Hartford)	WRLB	———	———
107.1	WRLB (Long Branch, N. J.)	———	WRLB	WRLB
107.3	———	———	———	———
107.5	*WLIB (New York)	———	WLIB	WLIB
107.7	———	———	———	———
107.9	*WMMM (Westport, Conn.)	WMMM	———	WMMM

* Stations received with antenna pointed in specific directions and lost at certain antenna orientations.

† More than one station received at this frequency, depending upon antenna orientation (all stations "listenable").

——— No satisfactory reception at these frequencies.
Grand total of stations logged under these conditions: 63 (usable).

First Test Results

Table II lists the 21 stations that we were able to receive using the indoor dipole. The weakest station which could be identified was WVHC, run by Hofstra University. A low-power station to begin with, it was further handicapped in this set-up because it is almost due south from us (though no more than a few miles away). The three strongest stations all measured about 500 microvolts, but not all for the same reason. WLIR is located in Garden City, just a few miles southeast of our location. The folded dipole does not make any distinction between east and west when it is oriented west, since it is bi-directional. WHOM and WNYC, though located in New York City, did as well, and better than any other New York City stations. In the case of WNYC, this may be because their transmitter tower is *not* located atop the Empire State Building, and may therefore have a better or clearer path to our antenna.

The First Revelation

We knew (and most probably you did too) that the transition from "indoor dipole" to "good outdoor antenna" would be startling, but we were hardly prepared for some of the amazing readings we obtained using the FM-4G outdoor antenna. Notice, for example, what happened to WVNJ (in New Jersey) at 100.3

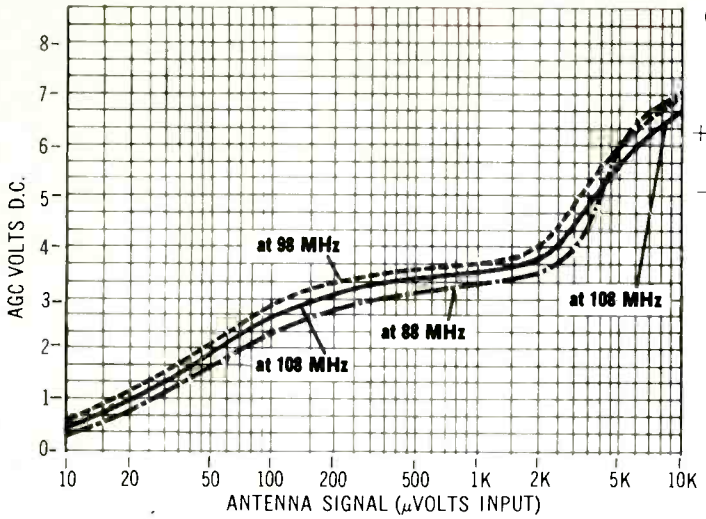


Fig. 7—Calibration of a.g.c. voltage vs. microvolts input for tuner used as field-strength meter.

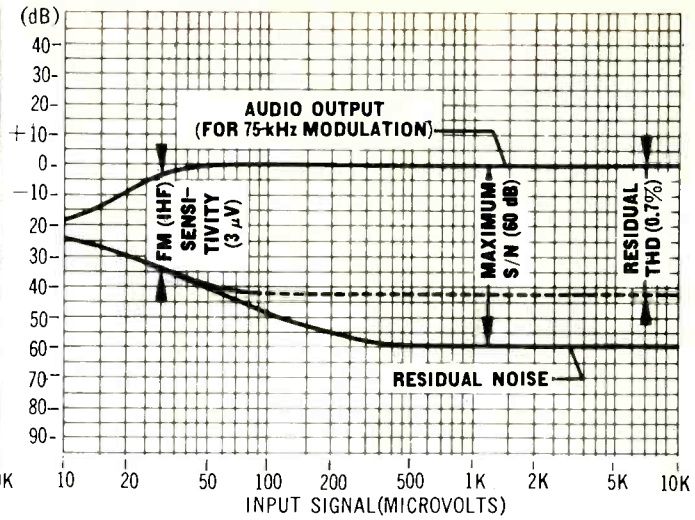


Fig. 8—Typical quieting characteristics of FM tuner or receiver.

FM Antennas (Continued)

MHz on our dial. Look at WEVD—from 40 to 4500 μV. Even "marginal" WVHC at 88.7 went from 4 μV to a fairly respectable 23. Note, too, that those stations showing the least improvement are generally those in which the orientation of both the indoor dipole and the 4-element Yagi were all wrong to begin with. In such cases, the added gain of the better antenna was partially offset by the directionality characteristics of the better antenna. For those interested in specifics with regard to the antenna specifications, Table III lists the important characteristics of both the FM-4G and the FMSL-12 used in these experiments.

Signal-to-Noise Ratio and Dynamic Range

In stressing IHF or "least usable" sensitivity, most tuner and receiver manufacturers are perpetrating an indirect injustice on the buying public. Figure 8 will help explain why. It is a plot of FM tuner characteristics similar to those you have seen time and time again in AUDIO': Equipment Profiles. Notice that IHF sensitivity is a mere 3 microvolts for this "brand X" tuner. Let's be clear on just what this means. It means that with a 3-μV signal, the noise and distortion will be just 30 dB below the *loudest* signal of audio ever transmitted by the station. Now, because of the nature of most music and speech programming, that *loudest* sound is hardly ever broadcast, for the station engineer must "ride" gain so that his meters indicate an average of 10 to 15 dB below maximum modulation. This is done so that peaks (which occur in a random manner) will not overmodulate the transmitter and incur the wrath of the FCC. Thus, if we were to be more realistic, the noise and distortion level *most* of the time is only 20 or even 15 dB below desired program material. Lowly AM manages to do better than that most of the time.

Perhaps the specification title should be changed to "Least Listenable FM Sensitivity," for 20 dB of S/N is a poor listening experience indeed. If we trace further along the plot of Fig. 8, however, we see reception soon begins to get much better. At about 200 microvolts, we achieve our best signal-to-noise ratio of about 60 dB (more like 50 if you take into account average program modulation and safeguards at the studio). Now that is a fairly good S/N, about the same as most good tape recorders and disc reproducing equipment you're able to buy—but remember, it only gets that good (in this instance) when signal strength reaches 200 μV or better!

Referring back to Table II you will be astounded to see that only 10 out of the 21 stations received provided signal strengths of 200 microvolts or better. In other words, the dipole antenna "under the rug" prevented this tuner from providing its best S/N for 12 *local metropolitan area* stations.

Consider this: Dynamic range of your hearing apparatus is about 120 dB! Ambient noise in an average living room is, perhaps, 30 dB above the quietest situation measurable, which leaves an available dynamic range of about 90 dB. Most good integrated amplifiers are capable of a dynamic range (above hum and noise) of at least 70 dB. In light of the foregoing, why should you settle for 20 or 30 dB of S/N from your "noise free, static-free, distortion free" FM equipment? That's what you are doing if you're still using a piece of twin-lead thrown casually behind the set! Using the outdoor FM antenna, 18 of our reference stations now provided maximum S/N ratio, in terms of the typical characteristic depicted in Fig. 8.

Second Revelation

When the measurements were repeated using the more elaborate FMSL-12 antenna, many of the reference stations showed further considerable increase in signal strength at the antenna terminals. In particular, stations WCWP and WVHC were received at signal strengths of 70 and 42 microvolts, respectively, as opposed to 40 and 23 microvolts with the FM-4G. Note, too, in Table II, that most of the high-level signals received with the FM-4G increased when the FMSL-12 was used. One notable exception is WRVR (106.7 MHz) which actually *decreased* in signal strength from 350 to 300 microvolts. The only explanation that can be offered here is that we still had all antennas oriented in a westerly direction. The rotor, used in later experiments, was not brought into play as yet. As a result, with WRVR located northwest of our location, the narrower

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pattern or lobe of the FMSL-12 actually "saw" less incoming signal than the somewhat broader-patterned FM-4G.

"DX"-ing on FM

Over the years, we've heard tales of long-distance FM reception which rival some of the tall tales fishermen delight in recounting. We have heard of reception at distances of 150, 175, and even 200 miles. While we don't doubt these stories for a moment, the facts of VHF propagation are these:

1. VHF (the frequencies we're talking about for FM) is a line-of-sight communications system, and is affected but slightly (if at all) by so-called ionosphere "bending" effects.
2. A good approximation of "reliable" reception distance limitations based upon the horizon is given by the formula:

$$d = 1.41\ (\sqrt{H_t} + \sqrt{H_r}),$$

where d is distance, H_t is height above local terrain of transmitter tower and H_r is height of receiving antenna. Heights in this formula are expressed in feet, while "d" is in miles. If a transmitter has an antenna tower 1000 ft. high, and our receiving antenna is at 230 feet (we're adding 200 feet to our 30-foot mast and chimney height, because of our "hilltop" location; this isn't completely valid, but will do for the purposes of this discussion), the greatest distance at which we might expect *reliable* and *repeatable* reception would be:

$$\begin{aligned} d &= 1.41(\sqrt{1000} + \sqrt{230}) \\ &= 1.41(31.6 + 15.2) \\ &= 1.41(46.8) \\ &= \textit{approximately 65 miles.} \end{aligned}$$

Still, our head filled with stories of reception way beyond this limit, we decided to devote the rest of this experiment to "station logging," using only the Finco FMSL-12 antenna this time. We switched to a top-quality receiver for these experiments, because we now needed a receiver that was excellent in sensitivity and selectivity, and which exhibited a good capture ratio. The important point here is that a "lesser" receiver would never have been able to distinguish properly between stations only one channel (200 kHz) apart—and we were out to prove that one *could* receive stations one channel apart if antenna and receiver were adequate for the job. Now, however, we require one more "aid" for our otherwise fine equipment—an antenna rotor.

An antenna rotor, for those not familiar with it, is nothing more than a low-speed 12-V motor in a weatherproof housing and a remote control box (which incorporates a step-down transformer) connected to it by means of four or five-wire cable. Its sole purpose is to rotate a section of mast, on which the antenna is mounted. The Model C-225 Rotor used here, manufactured by The Alliance Manufacturing Company, retails for about $36.00. The control box is shown in Fig. 6. The unit's control circuits are transistorized, and one merely turns the pointer to the desired antenna direction and the motor continues to rotate until that orientation is achieved, whereupon it stops automatically.

If you've gone as far as installing a directional, high-gain antenna for use with your stereo FM equipment, Table IV, which we are about to discuss in detail, should prove to be an eye-opener to anyone skeptical about adding a rotor to an otherwise carefully assembled system.

Station Log

Table IV represents the culmination of our work in these experiments. A line-by-line study of this table, in combination with frequent referral to the maps of Figs. 1 and 2, will disclose some really startling results. Cities listed in parentheses are located in New York State, unless otherwise indicated. Note that in several instances we *were* able to receive stations just one channel apart (examples: 88.1-88.3, 95.5-95.7, 105.5-105.7-105.9, 106.7-106.9-107.1). In all fairness, reception at 105.7 (Framingham, Mass.) was only marginally acceptable, and is probably a result of one of those "freak" curvature effects which take place periodically but which cannot be relied upon consistently. After all, Framingham is about 165 miles from our location! (Here we go, joining the "DX" crowd—all formulas notwithstanding.) On the other hand, Easton, Pa. (96.1) is well over 100 miles away, and reception was and is consistently listenable when the antenna is rotated westward, with little or no fading. The same holds true of Ithaca, New York (91.7) when we rotate antennas northward.

Proof of the excellent directional characteristics of our multi-element antenna was evident throughout the experiments. The frequencies marked with a single asterisk are those at which a station was received over only part of the 360-deg. rotation pattern of the antenna. In some cases a station was receivable only for a few degrees of rotation—reception changing to "interstation noise" for the balance of rotation. Bear in mind, too, that we only used the four major points of the compass (N, E, S, W) and did not stop at intermediate points, such as northeast, southwest, and so on. To have done so would have undoubtedly yielded even more listenable signals, but the measurements we did make consumed the better part of every evening for nearly two weeks. We are quite content with the 63 perfectly listenable stations which we were able to log.

Undoubtedly, many readers in other metropolitan areas will report even greater success and we accept their reports humbly, and with the greatest respect for their patience and stamina. We feel, however, that the points we've been trying to make are "made"—especially when you consider the fact that with a stationary, indoor dipole facing west, this same receiver pulled in some 39 stations, of which about 35 might be deemed suitable for serious listening! Thus we were able to gain 28 stations.

Conclusions

This study was deliberately confined to empirical results and treatment. Mathematical analysis of antenna configurations was purposely omitted, as were questions of transmitter power, transmitter radiation patterns, vertical vs. horizontal polarization (or combinations of the two), and many other factors which most assuredly are related to the problem of good FM reception. Had we considered the "multipath" factor alone, the study might have taken many more months before it appeared in print. Still, it stands to reason that a highly directional antenna will minimize "multipath" when properly oriented, and at least, subjectively, we can report that the many stereo stations logged certainly exhibited less of a multipath problem than they had prior to this installation. Æ

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Electronic Music Styles

HPSCHD

Edward Tatnall Canby

IS MUSIC STILL MUSIC? An interesting question, and it is not answered by Nonesuch's sensational John Cage piece, called in computer language HPSCHD. Does it really matter whether HPSCHD is music or not? I rather doubt it. Like all of Cage's works, it challenges the mind even more than it outrages the ear, whatever you may want to call it.

Where *is* music going? We have pop art and pop music, each raising challenging thoughts among the curious. Then we have what used to be called "serious" music, our contemporary classical (though that term would have been meaningless to Bach or even Beethoven). Here is where the sonic avant garde *really* is at—and a vast outflow of sound spills over 'way beyond the "classical" locale into happenings, films, dance, every sort of entertainment. How far can we go, here, with the old term *music*? Wouldn't it be better, with Edgar Varèse, to speak of *organized sound*? An excellent modern definition for music, up to a point, safely dodging all sorts of old fashioned attributes that were once taken for granted in music — harmony, keys, chords, counterpoint, scales, and so on.

But what is "organized"? Are we moving even beyond that relatively helpful term? Now we are hearing an astonishing new ouput of sound-works (how's that) which deliberately never sound twice the same, depending on carefully controlled chance for each performance event via ingeniously specified "tolerances," somewhat like those plus-or-minus specs we use in audio. The limits are what count. Sometimes pitch is indicated by limits as we might describe a pink-noise bandwidth—any pitch within the specified area is OK. Rhythms may be specific in pattern but totally random in the sound itself—like John Cage's thirteen radios, tuned to any old station but producing a designated rhythmic pattern. (Not really as radical as it sounds; "shave and a haircut" is a rhythmic pattern every one of us recognizes, yet it can be sung, played, beeped on an auto horn, or banged on a tom-tom with equal validity.)

Often, compounding the chance element, there are choices of specific patterns, to play or sing, or to reproduce from tape. You (the human performer) may be given a whole group of concrete sound effectives, neo-melodies, from which you choose as you wish, or perhaps play frontwards or backwards to taste. Often, these are highly specific sounds, precisely pre-recorded, or notated, which are random only in the time sense; you start them according to random patterns, always different. Stopwatch schedules are everywhere in the new sound works, many of which could not be put into sound without the stopwatch's aid.

We will say little about those giant twins, the electronic sound generator and the computer, both of which are now inextricably imbedded in our new sound culture along with the tape machine to record and mix the products. One of the things computers do much better than the human mind is to generate randomness—a total *lack* of organization. Not easy to achieve in simple patterns, as we all know who have tried; but the computer has no trouble at all. More and more, today's sound technicians (again, I avoid the word composer) are fascinated by the implications of random orders. With computers at hand all over the place, they are in a position to generate precisely whatever randomness they want, and to impressive proportions. So then, what of *organized* sound?

Not all is random, of course. Much more is simply a radical re-ordering of the total sound material, aided by the marvelous new electronic machines which complement the brain and the hand, if in new ways, as tools have always done. A new tool, a new product. And a burst of new thought.

HPSCHD, for harpsichords and Computer-Generated Sound Tapes, manages, in the usual John Cage style, to embody all of this great ferment into a single outrageously dramatic presentation—that is, if you understand that no two performances of HPSCHD will ever be identical except those from Nonesuch's disc. (And even those may vary, as you'll see in a moment.) No Cage opus is ever dull. Most are tuned to a fine and deadly power of outrage. All will make you think—if you can. This one is no different, just more modern than ever. There are actually two composers, Cage and Lejaren Hiller, and I can do you no better than to quote some (far from all) of the printed account of their combined work, assisted by a brace of computer technicians and engineers.

HPSCHD consists of "51 electronic sound tapes and 7 solo compositions for harpsichord." It can "exist as a performance of one to seven live harpsichords and one to fifty-one tapes." The recording uses three harpsichords and a "composite" of the 51 tapes.

The "solo" harpsichord works are compounded out of a chance-waltz by

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Mozart (via throwing of dice), a "computer-derived numerical system borrowed from the digital principle of *I-ching,*" assorted bits of Beethoven, Schumann, Gottschalk, Busoni, Schoenberg, Cage and Hiller, and—the last solo—any old piece of Mozart the harpsichordist feels like playing (or is able to, amid the incredible noise). Yes—the harpsichords are audible, in his recording, though nine tenths drowned in the vast sonic ocean of sound.

As for the 51 tapes, they contain sound "in equal tempered scales of, successively, 5 to 56 tones to the octave (the "normal" scale is 12 to the octave), each tone deviating over a field of 129 (the half-interval up or down divided by 64 or the equal-tempered tone) Each tape is composed according to a series of programs, *e.g.,* from simple repetitive tones and silences across a field of non-repetitive tones and complexly varied spaces . . . Other computer-formalized programs, for note sequence, time (in units), successive events, melodic "goals" (without cadence) and types (diatonic, chromatic, chordal, arpeggiation), volume, and dynamics, are similarly intermixed. 51 of them—and all played (mostly) together.

"Each solo and each tape lasts slightly over 20 minutes . . . In "live" performance any part can commence at any time and the length is determined by previous agreement." If I know Cage, the first "live" performance surely went on for at least five hours. In this respect, Cage and Richard Wagner have much in common. On the record, necessarily, there is only a single LP side. But what a side! The sound is of a thousand simultaneous sonic happenings all at once including the drowned-out harpsichords, a howling mob of electronic sounds, colored by harpsichord twangs—about as instructive to the innocent ear as a thousand simultaneous speeches shouted in as many languages. Unrelenting, too, until it all just peters out at the end.

The pay-off? You, too, can play random games. A computer-generated read-out (KNOBS), accompanying HPSCHD, gives you a randomized pattern for altering your amplifier controls over four positions *every five seconds* for 21 minutes. Different read-out for each record copy. Dare you to try. But be sure you have a stopwatch.

John Cage and Lejoren Hiller: HPSCHD for Harpsichords and Computer-Generated Sound Tapes. Ben Johnston: String Quartet No. 2.

Nonesuch H-71224 ($2.98)

Switched-on Rock

There is no doubt that the new sequel to "Switched On Bach," titled, with consummate directness, "Switched On Rock" is the most sophisticated and complex of all-Moog works so far, outside of the electronic music field. It is immensely more sophisticated, for instance, than a less heralded opus in the latter area, just previously released, the first all-Moog gropings of one George Harrison. The latest "Switched On" puts Moog to work in the most strenuous fashion, converting ten recent pop hits straight out of their various live (so to speak) formats into a synthesized set of constructions involving the whole orchestration of Moog sounds, from astral swishes and squeals to space-style trumpets, harpsichords, and unnameables of every imaginable sort. The music is sullied — my own term — by only one important foreign interloper, a set of real live drums. (Another live instrument is used, but we are supposed to identify it ourselves and, so far, I have not been able to.) I would have been happier without the unnatural drumminess in such an environment, even if it does provide a standard rhythm.

The expertise, dedication, and sincerity of the new team which produced this Columbia sequel is unique, as one quickly discovers in the amusing liner notes, an account of the incredible trials and frustrations—and in the end, triumphs—of the strange new process of composition that such a recording entails. Mr. Moog's estimable machine, it seems, is quite human in its fallibility; it tends, among other things, to go out of tune even more rapidly than an eighteenth century harpsichord in a damp breeze.

More startling, though, are the newfangled terms which these operators cooked up for sounds and processes unnamed except in longwinded engineeringese. There are, the notes say, 150 different varieties of Moog-sound involved, considerably more than you will find in, say, a Mahler super-symphony. No use calling them, like insects and plants, by their scientific handles. Nor by the old-style sort of musical Italianisms—*stoccatando,* or maybe *appoggiatura quasi piccolamente.* Instead, Moog being strictly U. S. (in spite of the inventor's Dutch name, which is pronounced "Mogue" to rhyme with "rogue"), these technological jokers used the most obviously adaptable terminology around—American double talk. It sounds convincing. And in this case it actually means something.

Quote: "The *Pagwipe.* It sounds like a ferocious leaky bagpipe.... And there is the dread *Moogaboe.* And the *Sweetswoop,* a back and forth roar of harmonic sounds like a jet plane flying through your head . . . or the *Dharmilt,* a mixture of descending harmonies and a sound that reminds you of a little three-inch-high Milt Jackson playing an equivalent size vibraharp."

More delightful are such neo-names (their term) as the *Gworgan,* defined as a Gwirped organ. Gwirping is "the act of sweeping a filter with a high regeneration setting . . . from top to bottom." The inverse of *Gwirping* is *Pweeeing,* i.e., sweeping the same filter from bottom to top. The names, you see, tell you more about the sound than the technical description itself.

The trio of first desk men (the editing desk, that is) who put this thing over and onto tape, out of the Moog Synthesizer, are Alan Foust, the musical arranger, Kenny Ascher, who is noted down as the Finger, and Norman Dolph, Big Twiddler (Producer). Other Big Names at Columbia may be dimly discerned in the background, including engineer Fred Plaut and Top Exec John McClure, a Big Cheese who was once, may it be noted, an operator in the Canby radio program "Recordings, E.T.C.," which will probably run forever on New York's WNYC (23 years to date).

All these gentlemen and more, plus the genial trouble shooter Mr. Moog himself, were evidently involved in this weighty project for more time than they like to think about—do not forget that "Switched On Bach," this record's precursor, was the Record Phenomenon of the Century, to the tune of millions of sales and the most remarkable breaking-down of categories the industry has ever witnessed.

That record was No. 1 in classical sales in no time at all. But what astounded was its total invasion of pop. I forget at the moment how far Johann Sebastian Bach climbed up the dizzy ladder of pop fame, but it was higher than the Angel Gabriel ever made it, and almost equal to the all-time high climb, set by Jack-in-the-Beanstalk. Last I knew, Bach was No. 8 against all comers—*all* comers, Beatles included—and still rising faintly.

And so the all-out question: how does "Switched On Rock" compare with "Switched On Bach"? Is it a worthy sequel to an epoch making first record?

Is any sequel? Rarely. If it's too much like the original, people call it a cynical attempt to cash in on earlier triumphs. If it's too different, they say

it's a betrayal of the original's proven power. So what can you do? And yet, for a zillion bucks . . .

No, frankly, this one is not. But the reason isn't quite what you've been thinking I would say. It is *not* because this second "Switched On" concerns itself with mere pop, where the first displayed such goodies as the Bach Brandenburg Concerto No. 2. I respect Bach and rock equally, each in a different area of musical impact, just as I respect oysters and whipped cream, roast beef and strawberry jam. They don't mix—so what? It isn't a matter of either/or. What matters, I think, is how well each is served, tastefully in context and in terms of its own values; or distastefully.

"Switched On Bach" struck me as a miraculously fine transcribing job, into a new and unprecedented medium but within the boundaries of intelligent sense and meaning that govern Bach's music. I am happy to think that a million people, perhaps with their own various arguments as to why, went along with me in enjoying it, not only as a stunt, which it was, but as a mighty fine presentation of strong, memorable music.

"Switched On Rock" tries the same for the ten wildly differing top numbers that are here transmogrified into the Moog language, as were the Bach items. Included are such diversities as the Beatles' "Hey Jude" and "Get Back," "Feelin' Groovy" from Simon and Garfunckle and the 59th Street Bridge, "Jumpin' Jack Flash" out of the Stones and something called "Yummy Yummy," a species of bubblegum music. The original voices ranged from the suave, intimate sound of "Hey Jude" to the soprano screams of delight that come from Diana Ross and the Supremes. What happens is that all these high powered presentations are filtered and straightened and drawn through a single mold, all urbane, dispassioned professionalism, disquietingly close to mood music. The soul of rock is denatured.

I don't know why it had to be that way. But neither am I quite sure how one sets about selling a million copies of a sequel like this—perhaps it had to be like it is. But rock enthusiasts aren't going to like it (I don't, and I've tried some younger ears on it, too); in every case the original music has a lot more to say, more convincingly. Novelty seekers may buy it; but after the first "Switched On" it isn't really that novel. Classical listeners who hate rock will, of course, stay clear; and those who love or respect rock will feel as I do—better the originals, any day or night. So what is left?

Mood music. Nothing-music. 24-hour radio fare, automatic cartridge music, bank and supermarket background, plane music, restaurant music, sleep music. That is the vast, oily sonic ocean of mediocrity into which "Switched On" No. 2 is likely to slide. Too bad, because it really isn't that kind of music, and its people worked much too hard to deserve such a renumerative fate.

If they had just let themselves go, used more Moog-imagination, spent less time on reproducing synthetic pop sound, this record could have stood up in any chosen market. But, for all its technical sophistication, its arrangements are undistinguished, too snazzy, too smooth and slick for an impact except, again, as a novelty stunt. So the disc will probably reach No. 1 for no more than a few months at best. *Æ*

More Electronic Pop Sounds

Sherwood L. Weingarten

Moog, which rhymes with rogue, is in vogue.

Its electronic bandwagon started rolling with Columbia's "Switched-On Bach," an LP that jangled cash registers to the tune of 300,000 copies. And now the instrument—which can reproduce *any* sound, and create heretofore unheard ones—is being utilized in the pop playground.

Because its use is still in the experimental stage, however, some of the new recordings that emphasize it are not totally successful. Witness Hugo Montenegro's MOOG POWER (RCA Victor, LSP-4170), with 11 cuts that range from the Sinatra ballad "My Way" (with tempo hyped) to the title tune from the smash hippie musical, "Hair" (in medley with "Aquarius"). The LP, spotlighting ordinary instruments from Montenegro's regular orchestra and sometimes normal voices from his regular chorus, is a hit-and-miss offering because of the stress on gimmickry.

Montenegro, previously known for his middle-of-the-road musical efforts, wrote all the arrangements in a week and then recorded on separate tracks (rhythm section, strings, voices, and so on), mixing them ultimately with the often weird sounds of the Moog synthesizer, a space-age monster consisting of a multitude of lights, knobs, and wires assembled by an upstate New York inventor, Robert Moog. The result: "Engineered music" that takes time for the listener to familiarize himself with, much less accept without cringing.

When integrated with what passes for traditional motifs, though, the Moog can be extremely effective, even pleasant-sounding, and particularly meaningful to the sound-stereo buff.

A smooth transition from today's music to tomorrow's is "MacArthur Park (Allegro Part III)," a number orchestrated as if it were a classical piece with rock orientation. The Moog, voices, and everyday instrumentation mesh neatly, all racing in staccato explosions toward a crescendo. Its success is due, in part, to the Moog being heard mostly as an undercurrent, its potential for stealing the stage carefully harnessed. Contrasting, but equally successful (though for a different reason) is "Moog Power," a Montenegro composition. A wild piece, with rhythms seeming to boil over of their own volition, it showcases the Moog's versatility. At one point, twangy guitars stream from the left channel in a frantic effort to escape while wordless voices pour from the right after being distorted shakily by having been run through the Moog. The resultant frenzy is strangely satisfying from a musical standpoint; even the occasional cackling sound of the voices does not create an obstacle to enjoyment.

"Traces" and "Dizzy," a pair of tunes lifted from the charts, are Moog-massacred, however. On the former, the voices are warped as if under water; on the latter, the reverberations are too heavy and the echo-chamber effect excessive. In addition, piercing tones and a shrill noise that climbs the scale add to the confusion on "Dizzy."

"The Greatest Love," another contrast, is a country-based outing that

retains its melodic lines. "Touch Me," on still another hand, contains shouting, yelps, muffled voices, a solo by Gene Morford, and heavy orchestration that becomes exciting in spite of the clutter.

Mike Melvoin, not incidentally, is the Moog player, doing as well as can be expected in this phase of the instrument's development.

Proof of the Moog's *potential* can be found on a second RCA recording, MOOG ESPANA (LSP-4195), that eliminates the gimmickry and comes close to all-around excellence. Eleven tunes are arranged and conducted by Sid Bass so their inherent charm is retained, the "Star Trek" quality of the Moog restrained, and, in the process, the ear of the audiophile retrained. If it just misses complete mastery of the Moog—which costs between $10,000 and $15,000—it may be because the plotting of the melodies lacks volcanic intensity. Whereas the disc by the van-dyked Montenegro plays with singers (led by Ron Hickin in a quasi Mamas-and-Papas style), Bass sticks to instruments; where "Moog Power" hammers with mod-ern beats, Bass takes the low road South of the Border. On both, the stereo effects are superb; on Bass' LP, however, the entire schtick is more palatable.

The Moog in theory can simulate any sound in nature (from strings to chirping birds, for example) and can *combine* them if wanted. It can originate sounds via mathematics. What it cannot as yet do is play chords, necessitating recording overlays. Thus, Bass recorded a six-instrument rhythm section, then two tenor and two bass trombones, and then ran it all through the Moog circuits ("patch-chords"). What came out was "Espani Cani," with an exquisite synthesized harpsichord sound; "Playera," with what might be called Baroque-flamenco riffs; "Spanish Flea," a breezy winner that sounds as if someone's playing music on a rubber band, and a bouncy "Malaguena." Imagine Stan Kenton's version, with reverberating bass and quivering trombones added, and you have "Peanut Vendor." Think of the sunny coast of that country, and forget the Moog, and you have "Lady of Spain."

Only two minor flaws exist: "Granada" overemphasizes the right channel, and "Mama Inez" contains one elongated electronic screech.

To find the most imaginative and effective use of the Moog, however, trend-seekers must go back almost a year to an A&M recording, WOZARD OF IZ: AN ELECTRONIC ODYSSEY (SP4156). Braintrust behind the disc was Mort "Moog Man" Garson, who disregarded conventional instruments entirely because, he said, composing with them "became no more of a challenge."

The vinyl, an allegorical spoof on the classic L. Frank Baum fairy tale, contains novel electronic riffs superimposed on sardonic lyrics and narration (that blast mass conformity and seek an end to alienation). Musically, it incorporates pop, rock, and jazz. Most fascinating are "Blue Poppy," a 6:27 psychedelic melange, and a "Big Sur" ballad that proves routine instruments may be obsolete.

"I'd always been interested in and trying to find new sounds for my arrangements but it became a cliche with an orchestra, it was just repeating after awhile," Garson recently told a wire service reporter.

"I don't feel any need for traditional music," he continued. "The synthesizer and other equipment are a self-sufficient facility which can be applied to anything."

Anything? Wonder what the musicians' union will say scale is for a Moog? And, come to think about it, the damn thing's going to be hell on critics: We won't know what's real and what's synthesized.

The Beatles are credited (or blamed) as the storm that turned rock into a musical tidal wave. For the most part, the plaudits are deserved; the sound of the four moptops is shaggy heads and shoulders above the rest of the cacophony. And as composers, John Lennon and Paul McCartney may rank with the pop greats.

But the Liverpool lovers ran into trouble when their off-stage antics intruded on their artistic triumphs. It became a joke when they formed their own Apple label, culminating in the release of "Two Virgins," noted not for what was inside (junk) but for what was on the album's dustjacket (full front and rear nude photos of Lennon and his now-wife, Yoko Ono).

Now the laughter must cease, for they insist on perpetrating a hoax, pretending that they're packaging avant-garde material when they're really selling nonsense. Two current examples present enough evidence. Both are on a subsidiary label, Zapple, and both contain new enigmas, not the least of which is why they bothered.

ELECTRONIC SOUND (ST-3358) may be fine for those under the influence of a hallucinogenic, but the ordinary listener is likely to turn it off rather than turn himself on. Side One contains something entitled "Under the Mersey Wall." Recorded in England, it features noise composed by Beatle George Harrison. About halfway through I gave up, my masochistic urge not being strong enough to finish. What *was* absorbed, at the cost of Excedrin Headache No. 942, were the following simulated sounds: A rhythmic rasping similar to brushes on cymbals, a hissing that resembled steam escaping, a high-pitched trill, a sound imitating water flowing down a drain, wind, air escaping from a tire, birds chirping, a machine going berserk, a short circuit, a radar throb, static, and a calliope gone mad. Music? Hardly!

The flip side, recorded in California, is another Harrison loser. Entitled "No Time or Space," it starts with a dissonant bleat of a simulated horn, moves to a buzzing that mimics a dying electric razor, and passes on to something like someone blowing into a hollow tube. Sporadically, there are sounds that *approximate* music—but not close enough. And Harrison tosses in a few grunts to make the whole thing obnoxious.

Worse yet, however, is UNFINISHED MUSIC NO. 2: LIFE WITH THE LIONS (ST3357), which stars Lennon and his Japanese Beatle. Recorded live at Lady Mitchell Hall in Cambridge, the composition (shudder) includes note-holding screeching in various octaves by Miss Ono and squealing in others by electronic gadgetry. "Cambridge 1969," as it's called, comes off as an amateurish attempt to fiddle with a tape recorder (at the onset, in fact, there's a faltering verbal introduction by the "singer" in true now-don't-be-afraid-mom-it's-only-a-microphone fashion). At times it sounds as if Lennon is jabbing her with his guitar; at others it sounds as though Miss Ono has cramps. At the end of the piece are a few bars of atonal ramblings by saxophonist John Tchikai and percussionist John Stevens), the former being obvious, the latter masked. Most amazing is the liner notation that the work was "published," apparently as sheet music, by Maclen Music Inc. (the Beatle offshoot).

Side Two, recorded on a cassette at Queen Charlotte Hospital in London, contains four tracks. The first, "No Bed for Beatle John," is a rambling vocal counterpoint with the pair obviously making up words as they go along. A pregnant Miss Ono is in the foreground, Lennon improvising his lament in a low voice as a backdrop. "Baby's Heartbeat" is sheer insanity that sounds as if an overseas radio band, marred by interference, couldn't be tuned in properly, or the end of a

(Continued on page 98)

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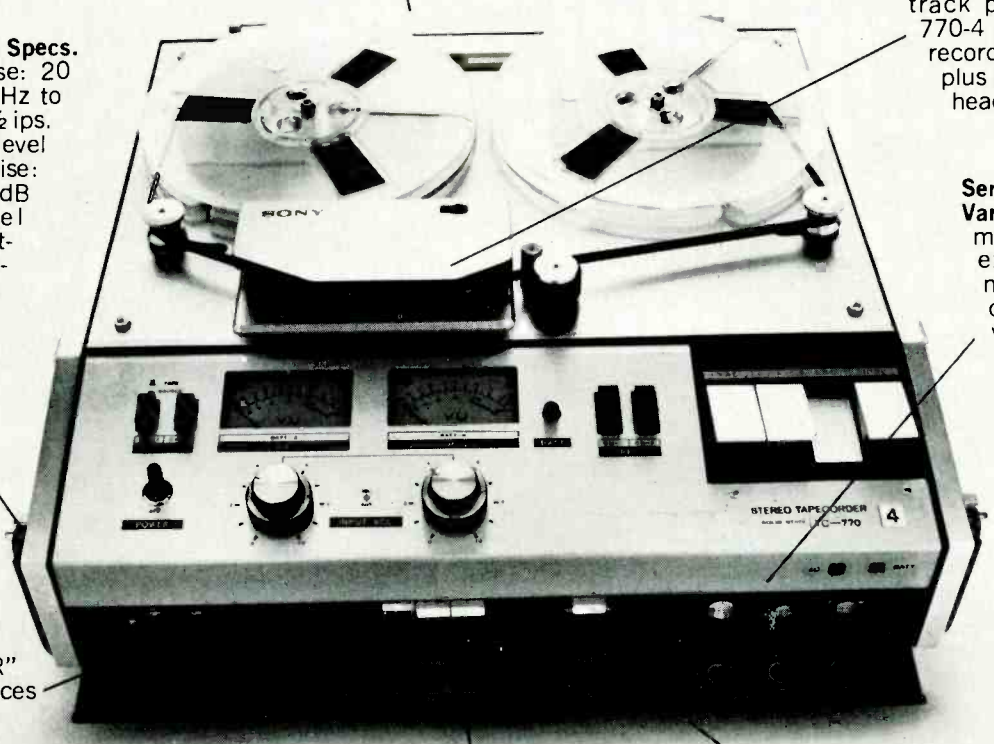

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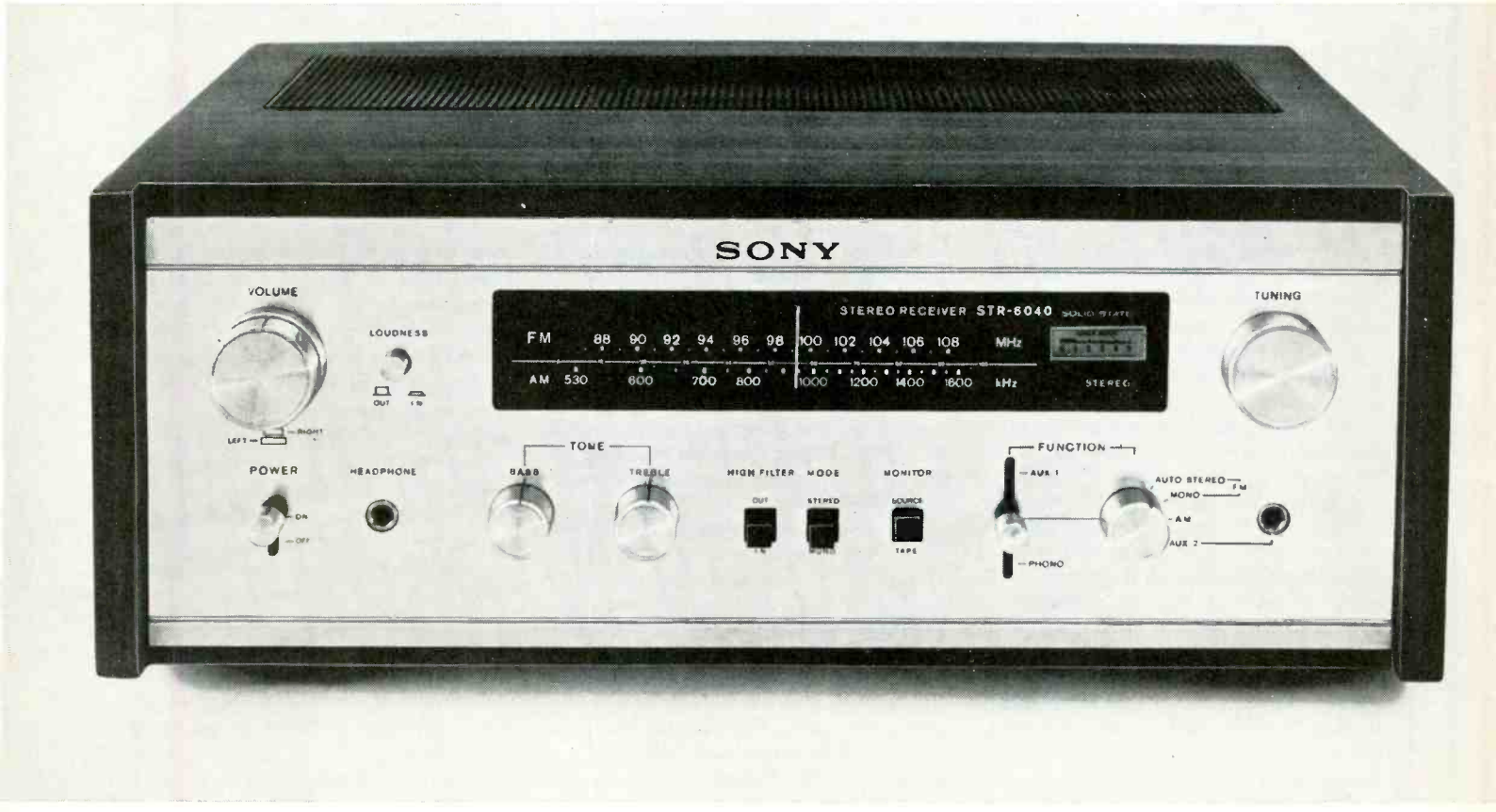


Check No. 41 on Reader Service Card

Tape Transport Maintenance

Part Two—Motor Drive and Speed Selection

H. W. HELLYER

THE HEART OF THE TAPE RECORDER drive system is the motor. Unless this part of the machine runs true, maintenance work done on the rest of the mechanism is wasted. Luckily for us, the motor is the part that needs the least attention.

Several sorts of motors are used in tape recorders. Battery models, and those designed to run on a.c. or battery power have a d.c. motor (direct current) with a rotating commutator and carbon brushes for contacts. The obvious points of wear are the brush ends, where they are continually scraped by the segments of the commutator. An occasional cleaning operation here, plus a touch of grease at the bearings will prolong life. Cleaning with a soft cloth and a drop of alcohol is usually sufficient. It is a mistake to scrape or file a commutator, however encrusted with carbon it may be. The action depends on sequential switching of a relatively heavy current, and any surface discrepancy causes arcing. The fault is cumulative and soon results in a grooved commutator plus eccentric brushes. On some of the heavier-duty motors it is possible to remove the commutator—or complete armature—and skim it down to a new surface with the aid of a lathe, but small motors seldom respond happily to this treatment. Luckily, again, small motors are cheap; it is often less expensive to replace them than to battle on with ineffective repairs.

Speed of rotation of the d.c. motor depends on the supply voltage, which gives us a means of regulation. On some of the newer machines, not necessarily designed for battery operation, this feature is used to advantage. Tandberg and Sony, for example, often employ servo-controlled d.c. motors, making quite ambitious machines independent of line-supply voltage or frequency. But servo control is a separate subject for which we shall have to find space at a later date.

Simpler methods of regulation are purely mechanical. Governors, not dissimilar in principle from the old-fashioned spinning balls of the steam engine, may be found on some of the small motors of battery portables. These work by centrifugal force. As the motor exceeds a limiting speed of rotation, contacts are opened or closed, according to design, and current is reduced by insertion of a series resistor, a diode, or a transistor regulator in the motor supply. The control falls out again as the motor speed comes down to the required figure.

This method alone would be useless, the motor continually varying between the regulator limits. For long-term control, the regulator sets the basic speed and for short-term stability we have to rely on the rest of the design, the damping effect of idlers or belts and the inertia of the flywheel.

When setting regulators or governors of the centrifugal type, always do so with the full load applied, and check overall speed with full and empty spools of tape at each side to ensure that back tensions are not affecting the torque.

Best check of d.c. motor regularity is measurement of the motor current. First the supply voltage should be checked, then minimum load current and finally the maximum current, usually in the rewind mode. This test can often give a clue to mechanical faults, where the unloaded motor draws normal current but the measurement shoots up when one or another drive function is applied.

Most of our maintenance work will be concerned with a.c. motors. The commutator type is ruled out for tape recorders (though not completely unknown). One reason is the cheaper design, with the induction motor, which is subject to some control of speed by mains frequency. Several different types are used.

Induction motors have an air gap between the moving rotor and the fixed stator. When an alternating current is applied to the stator winding, an electro-magnetic flux is set up in the rotor windings by induction. But it is the interaction of the fields of the two windings that starts the motor turning, and some method has to be found to achieve this interaction—apart from giving the motor a physical shove!

The movement of the fields to achieve starting and to keep the motor going is done by "shading" the poles of the windings, or by using an external power-factor capacitor, which provides the initial phase shift. There are other big differences between the types of motors employing these techniques.

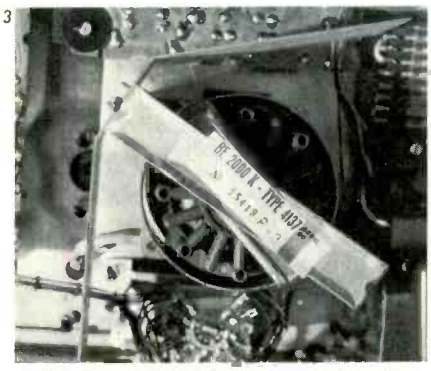
The simple induction motor with shaded poles, easily recognized by the protruding copper shading rings in the lamination structure, will always have some "slip." The magnetic flux is changing at mains frequency (60 Hz) and the rotor is constantly trying to catch up, never quite succeeding. The overall speed is thus tied to the regular mains frequency and is independent of voltage (within wide limits), but the design is vulnerable to load changes. More load causes more slip, more magnetic flux lines are cut, a greater current flows and the torque increases. This makes such motors very useful for reeling, where the rising speed-torque characteristic is an advantage, but reduces their efficiency as capstan motors, especially in single-motor designs where the torque varies with the proportions of tape spooled.

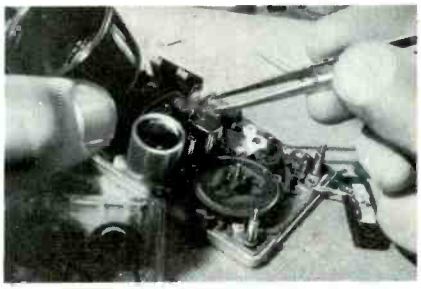
Outside the stability limits, a reduction of supply voltage lowers the full-load torque—the full rotational force that is available at full-load speed. So we can control speed roughly by varying the supply voltage, and this is done in some three-motor machines using cheap capstan motors by inserting a heavy-duty resistor.

These resistors, switched out or changed in total value for different functions, are a vulnerable trouble-point. Look for strained wires at the terminations, for heat-spots and cracked ceramics.

The principal advantage of the shaded-pole induction motor for capstan drive is that its wow-and-flutter figure can be kept low, even though this may be outweighed by other factors of mechanical design. One disadvantage is a tendency to vibration. The motor mountings should be checked for resilience, and cable connections must always be looped to avoid strain. Design of spindle ends and bearings has to be good to keep this vibration effect down, which leads us to the obvious maintenance job of checking spindle truth and cleaning bearings.

Motor bearings, of these and the next type to be discussed, will generally be of the cup or flat-sphere variety. The alignment of the spindle in the lower bearing can be adjusted by gentle tapping (using a wooden mallet, or even a screwdriver handle, not a hammer)





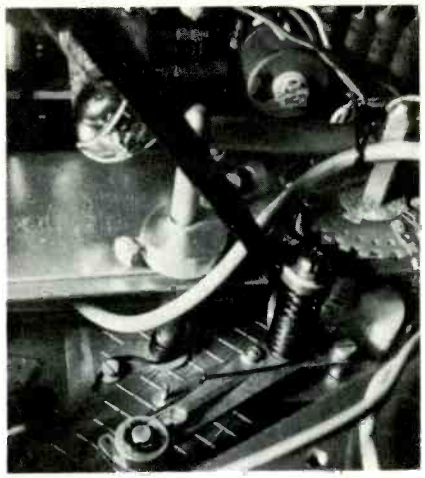


Fig. 1—Typical synchronous motor, viewed from the lower bearing. Start capacitor is adjacent.

Fig. 2—Typical external-rotor type of capstan motor.

Fig. 3—View from below of an outer-rotor capstan motor. The fan-shaped base of the rotor can be seen.

Fig. 4—Speed-change arrangements may include change of start capacitor and some complicated switching, as shown.

Fig. 5—Battery portable motors may require the touch of a watchmaker, including the use of a jeweler's loupe and tweezers.

Fig. 6—A typical d.c. motor for small tape recorders, with suppressor circuit mounted internally on a small printed board and the regulator adjustment accessible through a hole in the shielding.

Fig. 7—Idler engagement for speed change depends on bracket adjustment and springs, as indicated here.

Fig. 8—A touch of oil at the spindle of the speed-change bracket and a clean ramp for easy sliding can make all the difference to smooth running.

Fig. 9—Motor pulley with idlers and left spool carrier shown. Note noise-reducing sponge ring inside hollow "cup" pulley.

while the motor is running. But often, the alignment depends on the upper bearing, which may be allowed some float. Nylon thrust bearings or phosphor bronze spring clamps are widely employed. The trick is to dismantle, disturbing the spindle as little as possible, clean the bearings thoroughly, lubricate lightly, then reassemble with spacers between armature and stator. These need not be exact, so long as they are nearly tight when the motor is clamped. At least three should be used spaced equidistantly, and their thickness should be equal. Then the motor is carefully clamped up, spun by hand as the spacers are withdrawn, tightened to finger-tight degree, then powered. After a few final taps and radial tightening (the way you tighten automobile wheel nuts), the motor should run true.

Mention was made a few paragraphs ago of the "poles" of a motor. These are magnetic strong-points, by the configuration of the windings. Speed of the motor depends on the frequency and the number of poles. A two-pole motor rotates at 60 x 60 revolutions per minute; that is 3600. When alternating voltage is applied the pole faces change polarity with a frequency equal to the supply.

A four-pole motor does not run twice as fast. On the contrary, the field only rotates half a revolution for each mains cycle, so speed is 1800 rpm. But the action is less jerky, and the motor is more powerful and smoother. There is a lower external magnetic field, the slower speed makes capstan drive easier to design (less speed), reduction and a larger rotor can be used, which makes for quieter and smoother running, with less vibration.

The other type of induction motor we have been hinting about is the synchronous motor, whose rotor, instead of slipping, travels at the same rate as the magnetic field.

Because the synchronous motor cannot slip, it tends to "hunt" (vary about

(Continued on page 107)

AUDIO's Guide to the

1969 Los Angeles High Fidelity Music Show

Ambassador Hotel
Los Angeles, Calif.

TIMETABLE:

October 1 (Wednesday)
October 2 (Thursday)
October 3 (Friday)
4:00 pm to 10:30 pm
October 4 (Saturday)
12:00 Noon to 10:30 pm
October 5 (Sunday)
12:00 Noon to 6:00 pm

The upcoming West Coast High Fidelity Music Show, to be held in Los Angeles, California (see schedule), will feature more than 50 exhibitors, "live" entertainment courtesy of Capitol Records and MGM Records recording artists, a "rock" group, and hi-fi seminars, according to reports.

Comparing the number of exhibitors here with the number that appeared at last year's West Coast Hi-Fi Show (held in San Francisco) reveals a gain of six manufacturers. Nonetheless, some major manufacturers are conspicuously absent (for example, Fisher, McIntosh, and Superscope).

Attendees will see (and hear) a myriad of newly introduced component models, as well as many stereo models that were introduced previously. Speaker systems, in particular, promise show-goers an exciting time. Some are of unconventional design, while others are refinements of traditional designs. Of special interest are reflected sound or omnidirectional-type speakers: Bose 901, Harman Kardon HK-50, JVC 5303, Scott Q-100, and Wharfedale "Variflex." Look, too, to AR's line of "bookshelf" acoustic suspension speaker systems, Acoustron's LWE "electronic suspension" speaker systems, Altec Lansing's broad line of bookshelf and console systems, Bozak's speaker-add-on systems, Electro-Voice's "Aires" series of consoles and new bookshelfers, Benjamin's EMI group of bookshelf and console models, Dynaco's Danish bookshelf import, Empire's stylish end-table speaker systems, JBL's long line of systems and speaker mechanisms, Jensen's one-cabinet stereo speaker system (see page 88), Pioneer's new line, Rectilinear's new Model X bookshelfer with a 100-Hz crossover frequency, Sansui's terminal-connection provisions on its new SP-1001 speaker, Tannoy's big ones, Yamaha's piano-sounding board-shaped speaker, as well as a great variety of other speaker systems. Phono cartridge seekers will hear Shure's modified V-15 Type II ($67.50) which features betttr tracking ability than its predecessor, Pickering's new XV15/750E ($60.00), as well as other makes and models that have been on dealers' shelves for some time now.

Turntable shoppers will be delighted by the introduction of many new models. Pioneer, Sony, and Thorens each have manual models. Garrard has a broad new line of six automatic turntables, plus a line of packaged models with cartridge/base/cover. United Audio has a new top-of-the-line Dual 1219 at $159.50; Benjamin Miracord an induction-motor version of its top-line Model 50H; BSR features a trio of models complete with cartridge/base/cover; JVC's record changers will debut here; Elpa's PE-2018, a lower-priced version of its PE-2020, will be shown; and Sherwood's light-beam-trip SEL-100 will attract. Rabco's straight-line-tracking tone arm will no doubt draw many onlookers, too.

An abundance of electronic components—amplifiers, tuners, receivers—will be displayed in Los Angeles. The industry is spreading its wings with widespread introduction of relatively low-priced receivers. Examples: at least one is priced under $100 from a manufacturer that produces equipment in the $200 to $300 range; another will exhibit a $200 model, whereas other models in its line go up to $700. There's a model for everyone, it appears. Integrated circuits and Field-Effect transistors are commonplace now.

There aren't too many tape recorder manufacturers exhibiting at the L. A. Show, though there are enough there to make most tape devotees happy. TEAC will be there with a moderate-to-high-priced line of open-reel tape recorders and a cassette recorder; Tandberg will display its cross-field tape-head units, including its new $250 deck; Panasonic will be displaying its multifarious line of low-cost to moderate-cost tape recorders, both open reel and many cassette and cartridge types. Ditto Craig. Ampex will feature both open-reel and cassette units. Pioneer is expected to premier its $300 open-reel deck. And West Coasters will view Elpa's Ferrograph import. Some of the other manufacturers—Scott and Harman Kardon, for instance—also have cassette units.

As has been usual in recent years, there will be many compact systems on display. Most are record changer/receiver/speaker systems combinations, though some cassette-incorporated compacts are available, too. Benjamin Electronic Sound will be exhibiting its full line of compacts which use EMI speaker systems (some will feature Staar cassette units); Scott will be showing a wide line of systems, too, including consoles and consolettes; Harman-Kardon will feature its music systems, as will Mikado.

David Clark, Koss, Pioneer, and Superex will feature what has become a full-fledged component—stereo headphones. Koss has a new line of electrostatic models.

Some of the product highlights expected to be exhibited at the Show are pictured on following pages.

SEL 200 epitome of the finest in sound

discriminating people always choose receivers, tuners and amplifiers by Sherwood.

Only Sherwood, with almost two decades of precise engineering experience and dedication to quality can produce this top of the industry, SEL 200 FM receiver. It's designed for those who love the definitive instrumentation of natural concert hall sound. The cleanest encompassing wall-to-wall sound with power to spare regardless of the distance from FM transmission or structural obstruction. The SEL 200 embodies every worthwhile technical advancement ever developed with no compromise in quality, manufacturing or design. Regardless of higher prices for comparable receivers nothing made can surpass the superiority of Sherwood's SEL 200.

Some Specifications and Features of the SEL 200

AMPLIFIER POWER (in watts)

Speaker Impedance	±1 dB Power	IHF Power	R.M.S. Power	Distortion
4 OHMS	275	225	85 + 85	0.2%
8 OHMS	175	140	60 + 60	0.2%

• 1.5 μv (IHF) FM sensitivity (for 30 dB quieting at 0.3% distortion) • 0.9 μv FM sensitivity (for 20 dB quieting) • 3 μv (for 50 dB quieting) • EXCLUSIVE new "Legendre" Torroidal FM IF filter—permanently aligned. The industry's most-perfect filter for minimum distortion and superior selectivity • EXCLUSIVE FET Side-band Hush—no "Thumps" when tuning stations—no chance for extra responses. • 4-Gang, 3-FET FM RF front-end tuner. • 3-stage microcircuit limiting. • FM Stereo-only Switch—selects stereo stations, rejects all others • Main/Remote/Mono Speaker Switches—controls 3 independent systems in any combination • 2 Tuning Meters: (1) Zero-Center for pin-point accuracy, (2) Field-Strength for antenna orienting. • Extra Tape Dubbing Jack on front panel. • Extra Tape Monitoring Jack on front panel. • Panel-Light Dimming control on front panel. • Stereo/Mono Indicator Lights; phono/auxiliary source pilot lights. • Three-year Factory Guarantee, Parts *and* Labor. • Handsome Oiled-Walnut Cabinet included (no extra cost). Overall Size in Cabinet (H, W, D): 6¼ x 19⅛ x 14 in.

So Conservatively Priced at only **$599.00**

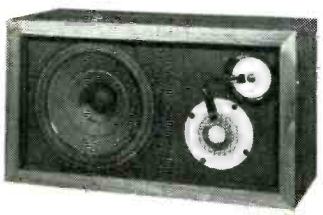
Other Fine Receivers from $299.95 (Write for Catalog)

SHERWOOD
ELECTRONIC LABORATORIES, INC.

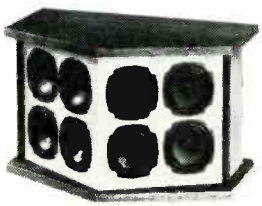
INNOVATORS IN FINEST QUALITY TUNERS / AMPLIFIERS / RECEIVERS / SPEAKERS
4300 North California Avenue, Chicago, Illinois 60618
Write Dept. 10-A

LIST OF EXHIBITORS

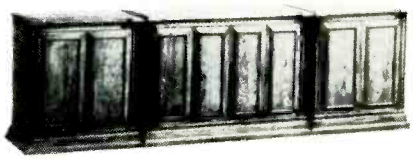
MANUFACTURER	ROOM
Acoustic Research, Inc.	96G, 98G
Altec Lansing	79G, 80G
Ampex Corp.	102G
Astrocom	39D
Benjamin Electronic Sound Corp.	21B 22B,
Bogen Communications	81G
Bose Corporation	100G
R. T. Bozak Mfg. Co.	103G, 105G
British Industries Corp.	82G, 84G, 93G, 94G
BSR (USA) Ltd.	56E
David Clark Co.	51D
Craig Corp.	5A
Crown International	11A
Dynaco, Inc.	106H
EICO Electronic Instrument Co.	86G
Electro-Voice, Inc.	14B, 15B, 16B
Elpa Marketing Industries	33C, 34C
Empire Scientific Corp.	73F, 76F
Harman-Kardon, Inc.	107H, 108H
Hitachi Sales Corp.	9A
Infinity Systems, Inc.	98G
JBL International	92G, 117H, 118H
JVC America, Inc.	10A
Jensen Mfg. Div.	90G
Kenwood Electronics	101G
Koss Electronics, Inc.	59E, 60E
Mikado Electronics	1A
Nikko Elec. Corp.	52D
LWE, Div. Acoustron	97G
The Lee Co.	2A
Panasonic	7A, 8A
Pickering & Co.	57E
Pioneer Electronics	26C, 27C 28C, 32C,
Rectilinear Research	64E
RTR Industries	89G
Rabco	99G
Sansui Electronics Corp.	45D 49D,
H. H. Scott, Inc.	87G, 88G
Sherwood Electronic Labs	85G
Shure Brothers, Inc.	116H
Sony Corp. of America	109H, 115H
Stanton Magnetics, Inc.	72F
Superex Electronics	78G
Tandberg of America, Inc.	91G
Tannoy (America) Ltd.	38D
TEAC Corp. of America	20B
United Audio Products	67F, 68F
Utah Electronics	71F
Yamaha International	12A



Acoustic Research **AR3a** speaker system with 12" acoustic suspension woofer and dome mid-range and tweeter ($250).

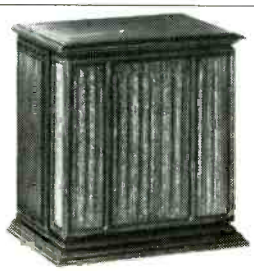


Bose **901**, with separate active equalizer, employs reflected sound principle and nine full-range speakers ($476/pair).



Altec Lansing **Milano** "Voice of the Theatre" ($395) shown with matching equipment cabinet **(885-871)**

Electro-Voice **E-V Four-A** 12" acoustic suspension system ($199.95).

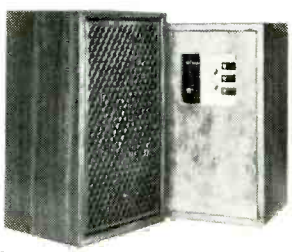


JBL **Sovereign S8R** 217-lb. console ($936).

Cross-section of a JVC **5303** omni-directional speaker system ($199.95).

Jensen **Stereo I** one-cabinet stereo speaker system ($124.95).

LWE I 15" woofer, "electronic suspension feedback" system ($250).

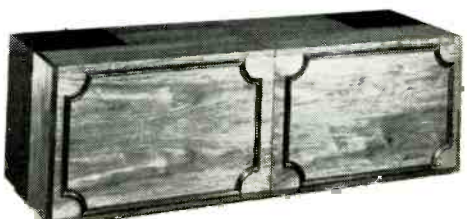


Sansui **SP-1001** bookshelfer with electronic crossover terminals ($139.95).

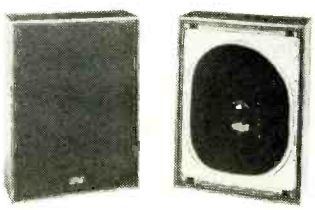
Pioneer **CS-44** 2-way bookshelf system with 8" acoustic suspension speaker ($67.50).

Rectilinear **III** top-of-line six-speaker system ($279).

Scott **Q-100 Quadrant** 360° speaker system ($149.95).



Two Wharfedale **W80 Variflex** speaker systems placed end-to-end on optional base. The user can direct mid and treble frequencies in any direction through means of a built-in, hard-surfaced disc.



Yamaha **NS-15** is shaped like the sounding board of a piano.

Rx Dr. Audio Pro's prescription for healthy recordings

Crown Integrated Mastering System

Rx for On-location Mastering

Modern tape-recording science announces a breakthrough in mastering technique—the Crown Integrated Mastering System with CX822 or CX844 tape recorder. It is a complete mastering system including computer-logic controlled transport, loZ mic input mixers (2/channel), headphone amps, bass and treble equalizer for each channel, built-in echo option, trac-sync, and rugged carrying case, all in one compact unit. The Crown Integrated Mastering System is a "sure cure" for on-location mastering sessions suffering from these ills:

SYMPTOMS

1. Feverish activity, indigestion and hypertension
2. Recordings muffed; clients upset or lost
3. Recording crew discouraged with technical problems

DIAGNOSIS

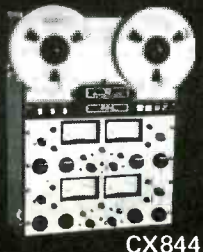
1. Equipment in many separate units, meaning a truck for transportation and cramped, cluttered recording area
2. Complicated setup, needing two or more strongmen, with never enough time to adequately check out each component
3. Innumerable cables which (if you remember them all) work perfectly until two minutes before recording time

CURE

1. One Crown CX822 or CX844 tape deck, each a single unit complete for mastering, easily transported and very compact
2. One-man setup with plenty of time; simply plug in microphones and headphones
3. Relax. With no space, time or cable problems, you can concentrate on creative recording, with superlative Crown quality that will delight your client.

For more information, phone 219 + 523-4919, or write Crown, Dept. B-62, Box 1000, Elkhart, Indiana, 46514.

CX822
Two-channel deck
$2329 complete



CX844
Four-channel deck
$3720 complete

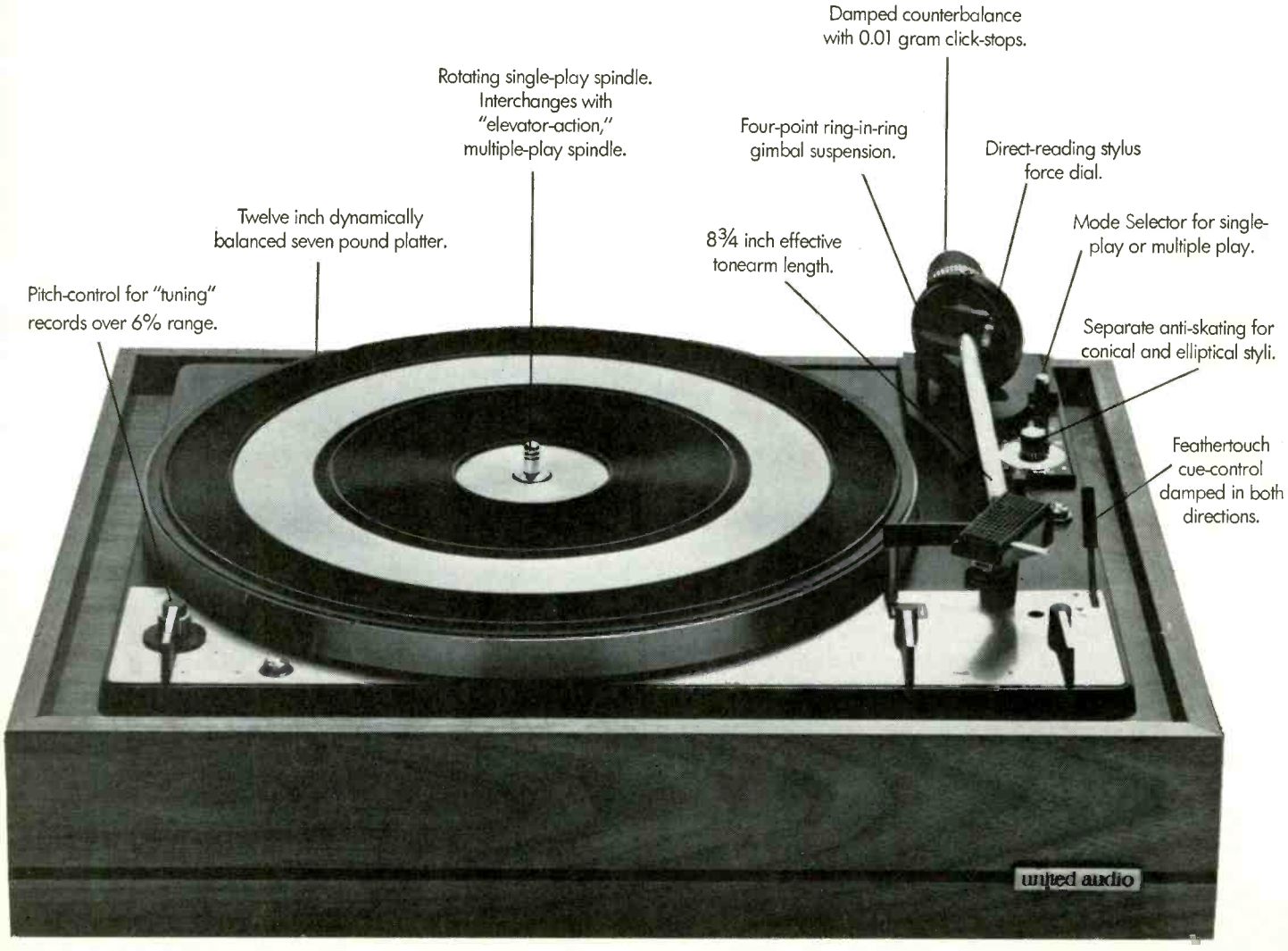
Each an Integrated Mastering System!

D40 2-channel 60w amplifier—$199

Crown

Check No. 47 on Reader Service Card

The Dual 1219: the automatic turntable with more precision than you may ever need.



Before the 1219 came on the scene, the Dual 1019 was regarded as the finest automatic turntable ever made. In fact, most hi-fi professionals had long used a 1019 in their personal systems.

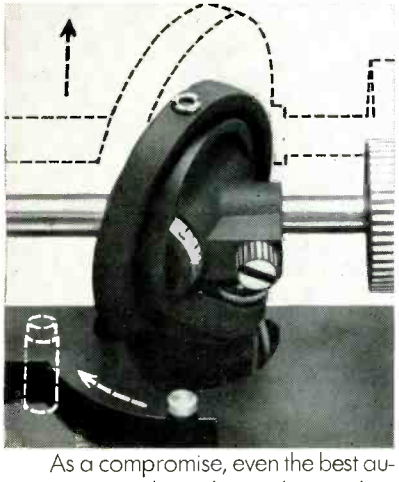
This left new goals for Dual engineers: to overcome, as far as possible, the few design compromises still inherent in automatic turntables.

The new Dual 1219 Professional Automatic Turntable was the result.

The automatic arm that doesn't compromise on single records.

Ideally, every record should be played by a stylus tracking at the same angle as the stylus used to cut the master record (15° from vertical).

With a single-play turntable, that's no problem as the tonearm always tracks at the same angle. But with an automatic turntable, the angle of the tonearm and stylus vary with the height of the stack.



As a compromise, even the best automatic arms have been designed to track at 15° only at the middle of the stack and tilt downward on single records.

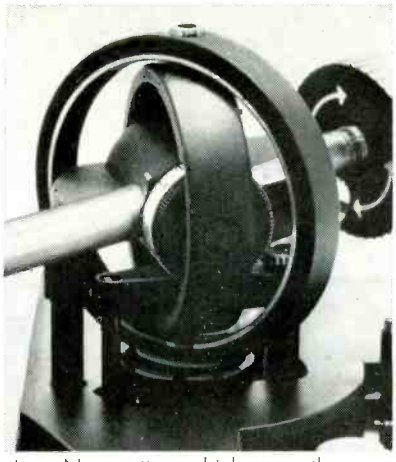
The 1219 eliminates this compromise. In the multiple-play mode, the tonearm tracks at 15° at the middle of the stack. Just like any other automatic tonearm.

But in single play, the tonearm is lowered by the Mode Selector to track precisely at the same 15°. Unlike any other automatic tonearm.

Balanced and pivoted like a precision gyroscope.

Precision gyroscopes must stay balanced and pivot freely in all directions. So should tonearms. That's why the 1219 tonearm is suspended like a gyroscope: centered within a true, four-point gimbal.

The tonearm pivots vertically from an inner concentric ring. Which, in turn, pivots horizontally from a fixed outer



ring. No matter which way the arm pivots, it remains in perfect dynamic balance.

And it pivots freely, on four identical bearings whose friction is so low we had to design and build our own instruments to measure it. Friction is a mere 0.015 gram horizontally, only 0.007 gram vertically. Or less.

Anti-skating: different scales for different styli.

Elliptical styli create more skating force than conical styli do.

It's a very slight difference. But measurable in a tonearm with the 1219's low bearing friction.

That's why the 1219's anti-skating system has a separately calibrated scale for each stylus type. The engineering problem was complex, but the solution isn't. You simply dial anti-skating to the same number you set for stylus force.

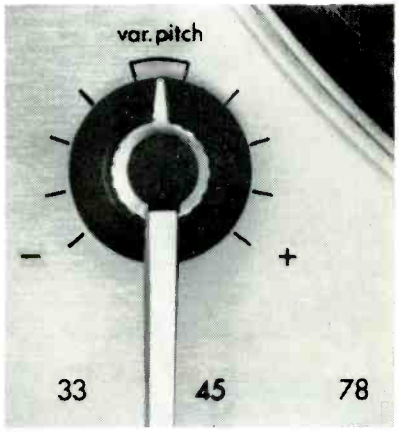
Synchronous speed constancy, plus pitch control.

The 1219's motor has a continuous-pole element that brings the twelve inch, seven pound platter up to full speed in less than half a revolution.

It also has a synchronous element that locks the speed into the line frequency and keeps it there, no matter how line voltage may vary.

Most turntable manufacturers would be glad to offer fast starts and dead-accurate speed and let it go at that.

But there are times when you might not want "accurate" speeds. You might want to match record pitch to a live instrument. Or alter the timing of a record to match that of a home movie. Or play on old, off-pitch record.



With the 1219's pitch control, you have a choice. Because all three speeds can be varied up to 6%, a semitone in pitch. (Sometimes a machine as perfect as the 1219 must adjust to the rest of the world.)

More precision than you need?

There are still more refinements in the 1219. For example: it has the longest of all automatic tonearms, to achieve the lowest tracking error of all automatics: less than one and a half degrees. Its cue control is damped in both directions, so the tonearm moves with equal delicacy whether you're raising or lowering it.

You may well think the 1219 does indeed have more precision than you need. But records and cartridges are being improved all the time. So a turntable can never have too much precision, or too many refinements if it is to stay ahead of them.

The refinements in the 1219 are, however, costly to produce. At $159.50, they may be unnecessary for some music lovers. So Dual offers two less expensive models, at $79.50 and $119.50. With fewer features, but no less precision or reliability.

Our literature will help you decide which Dual you really need.

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

Dual

Check No. 49 on Reader Service Card

HI-FI SEMINAR SCHEDULE

THURSDAY, OCT. 2

8:15 p.m.-9:15 p.m. – "Changers, Turntables, & Cartridges."

FRIDAY, OCT. 3

8:15 p.m.-9:15 p.m.–"Tape Recorders–Reel-to-Reel & Cartridge Machines."

SATURDAY, OCT. 4

3:00 p.m.-4:00 p.m.–"The Stereo Sensation."

8:15 p.m.-9:15 p.m.–"Room Acoustics & the Loudspeaker."

SUNDAY, OCT. 5

3:15 p.m.-4:15 p.m.–"Speakers & Amplifiers."

BSR **500A** automatic turntable ($59.50 plus base).

Garrard "Synchro-Lab" **72B** automatic turntable ($89.50 + base) shares features of new top-of-line model SL95B, including viscous damped tone arm.

Sony **PS-1800** manual turntable/arm/base/cover features automatic stop and servo-control amplifier ($199.50).

Thorens **TD-125** manual turntable with transistor-governed synchronous motor ($185.00 + tone arm and base).

Dual **1219** automatic turntable features tone-arm height for 15° vertical angle adjustment (single disc) ($159.50 + base).

Rabco **SL-8** servo/straight-line tone arm is shown mounted on an AR manual turntable, using an SL-8 adapter kit, MK-101 ($12.00).

Bogen **BR360** AM/stereo FM receiver with "dynamic range" control ($339.95).

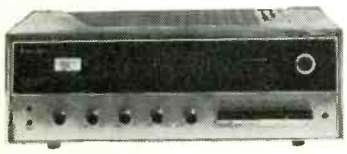
Pioneer **TX-900** stereo FM/AM tuner with frontpanel output and muting levels ($239.95).

Dynaco **SCA-80** control amplifier features 50 watts (IHF)/channel with a preamplifier similar to its PAT-4 ($169.95, kit; $249.95, wired).

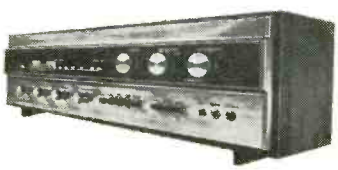
Sansui **4000** 80 watts/channel stereo FM/AM receiver ($379.95).

Kenwood **KA-6000** stereo amplifier with 85 watts/channel ($249.95).

Scott **386** stereo FM/AM 67½ watts/channel (at 4 ohms) receiver ($349.95).



Nikko **701B** 35 watts/channel stereo FM receiver ($239.95).



Sherwood **SEL-200** 140 watts/channel (at 4 ohms) stereo FM receiver with torroidal i.f. filters ($599.00).

Sony **STR-6040** 16 watts/channel stereo FM/AM receiver ($199.95).

Benjamin Electronic Sound **1045** stereo FM/AM compact system features the Miracord **50** automatic turntable with Elac 244 cartridge, and two EMI 62 speaker systems ($449.95).

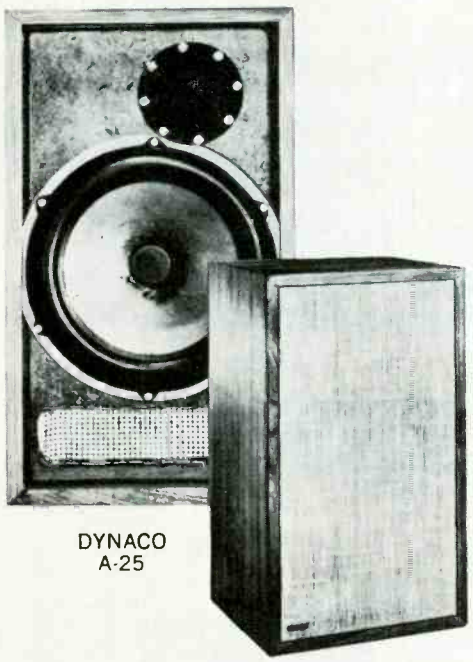
Harman-Kardon **SC2350** stereo FM/AM compact with omni-directional speaker systems ($399.50).

Mikado **2425** modular unit has Garrard 40 changer with Pickering cartridge ($250.00).

Scott **Carlisle** "Mediterranean Decorator Stereo," with built-in stereo FM/AM/phono system, and record storage space, with matching S-20M speaker systems.

(Continued on page 86)

WHAT MAKES A GOOD SPEAKER?



DYNACO
A-25

1 Smooth, wide frequency response.

2 Precise transient response.

3 Uncolored, neutral sound.

4 Wide high-frequency dispersion.

5 Value.

We designed the A-25 loudspeaker with these attributes in mind. How well did we succeed?

HERE'S WHAT THE EXPERTS SAY:

1 ". . . the overall response curve (of the Dynaco A-25) was as flat and smooth as can be when measured in a 'live' environment."

Julian Hirsch in Stereo Review, June, 1969.

2 ". . . nothing we have tested had a better overall transient response."

Stereo Review, June, 1969.

3 ". . . we were impressed with the new speakers' honest, uncolored sound."

High Fidelity, July, 1969.

"In our listening tests, the Dynaco (A-25) had a remarkably neutral quality."

Stereo Review, June, 1969.

4 "The highs were crisp, extended, and well dispersed."

Stereo Review, June, 1969.

"An 11 kHz tone could be heard clearly at least 90 degrees off axis . . ."

High Fidelity, July, 1969.

5 "Not the least of the A-25's attractions is its low price of $79.95. We have compared the A-25 with a number of speaker systems costing two and three times as much, and we must say it stands up exceptionally well in the comparisons."

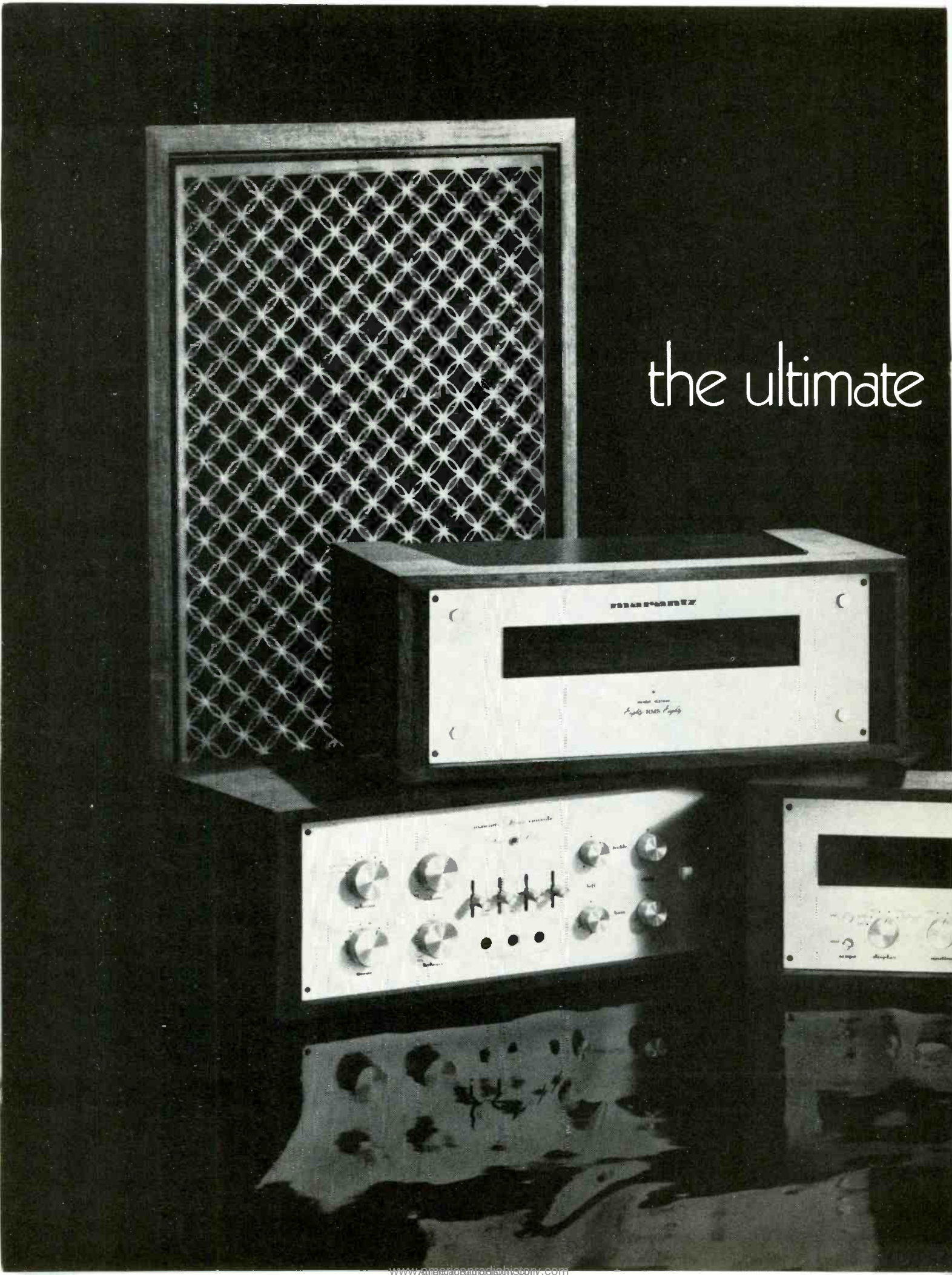
Stereo Review, June, 1969.

Send for literature or pick some up at your dealer where you can also hear the A-25.

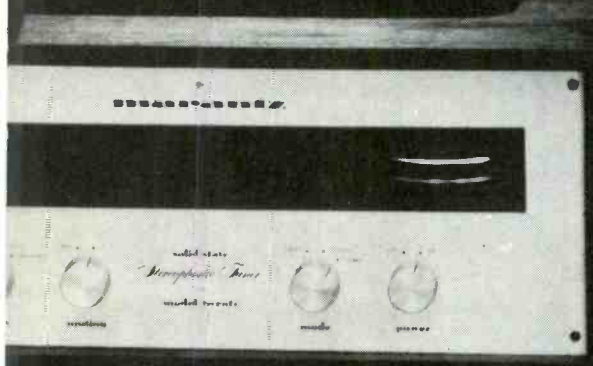
dynaco INC. **3060 JEFFERSON ST., PHILA., PA. 19121**

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

Check No. 51 on Reader Service Card



If you can afford system, this is it. Marantz.



To own Marantz is to own the best. In this case, $2023.00 of it. But in this unique system you'd have the finest FM stereo tuner, preamplifier, power amplifier, and speakers in the world. With the most natural, true-to-life sound.

The **Model 20 Solid-State FM Stereo Tuner** lets you experience the sight of sound—the incoming FM signal is displayed on a built-in oscilloscope. It's the only tuner in the world with this feature, which shows you how your signal improves with the best position of your antenna, shows you whether the FM station is broadcasting in true stereo, and lets you see if the signal is out of phase. It also visually monitors stereo separation and lets you check your other equipment, too. Of course, it has all of the other superior Marantz features and specifications also – that's why it's the world's most precise tuner. $495.00.

With the **Model 7T Solid-State Stereo Preamplifier** you can run the whole show with an extensive array of controls. This unique preamp has an input stage so well designed that it can't be overloaded. Consider, too, distortion so low it can't be measured on conventional test equipment. And—there are many other reasons why the Model 7T costs $395.00.

The **Marantz Model 16 Stereo Power Amplifier** muscles up 160 watts' continuous-power RMS. That's 80 watts' continuous power, at any frequency, from each channel. (If Marantz used the unscientific conventional IHF method, the Marantz Model 16 80-80 RMS power amplifier could be rated as high as 320 watts per channel.) Integrated circuitry ensures absolute reliability and stability, and Marantz' patent-pending Variable-Overlap Drive eliminates any possibility of transistor or speaker blow-out. No wonder it costs $395.00.

Now, to complete the ultimate stereo system. Martial your awesome audio forces through a pair of **Marantz Imperial II Speaker Systems** that have no artificial coloring added. Just clean, natural, full-frequency sound. Each speaker features Marantz-exclusive Quadlinear woofers for bass without boom. Two dome-type midrange speakers and two tweeters provide natural unpeaked midrange and exceptionally silky undistorted highs. Everything elegantly enclosed in decorator cabinetry. The pair: $738.00.

If our Marantz Ultimate System is too much for your budget, don't despair. You can get unmatched Marantz-quality component systems in all price ranges—as low as $199 for a complete stereo receiver. Whichever components may serve your individual purposes best, an instrument bearing the Marantz name represents the ultimate in its price range. To prove that this is more than just an advertising claim, Marantz backs all its products with the same three-year warranty on parts and labor—five-year warranty on speaker components.

Sound out all the facts for yourself at your franchised Marantz dealer's. He'll be happy to demonstrate. Then let your ears make up your mind.

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An AUSTERE Stereo Preamplifier

JOHN L. GRAUER

A low-distortion, economy stereo preamp construction project

THE STEREO PREAMP herein offers a control center having a minimum of controls and switches, for ease of operation. A desire to eliminate all marginal, seldom-used features led to the block diagram at (A) in Fig. 1. The design would contain the minimum number of amplifiers, and by eliminating tone-controls, contour, high-cut and low-cut filters, and elaborate mode switching, a functional simplicity never seen in commercial designs is obtained.

Eliminating Tone Controls

An important feature, the lack of tone controls, may require some justification. The author has for many years built all his own preamps without them for the following reasons:

1. They are rarely used with good material and flat systems.
2. Tone controls do not usually give flat responses in the center position. One company, in fact, has actually trimmed the flat setting (via resistors), while others use defeat switches to achieve this.
3. All except passive tone-control circuits introduce a certain amount of distortion.
4. Tone controls can upset the flat response of good amplifiers, cartridges, and speakers. They rarely boost or cut the precise frequencies where particular correction may be needed.
5. Tone controls of broad range in bass and treble cannot begin to compensate for room reverberation, and other varied defects of room acoustics and program material.

Without tone controls, the following benefits are achieved:

1. The inherently flat system is preserved.
2. There are no adjustments to confuse the user, and there is no possibility of misadjustment.
3. There is no distortion from the tone-control circuit.
4. A cost savings is realized along with better sound.

Output Amplifiers

The conventional approach would have been to use a feedback pair for the output amplifier, having enough gain (4x) to bring the phono sensitivity up to 2.5 mV, and the aux sensitivity to 250 mV. Several circuits were tried for this purpose, but only one was found capable of delivering residual distortion of .01 per cent on a consistent basis, regardless of supply or transistor variations. This was a 3-stage circuit.

An interesting fault noted during related experiments on single-stage preamps was that the IM distortion varied with the source impedance, and could not be made to remain at residual level (.01 per cent) as R_s was varied (equivalent to changing the setting on a volume control), even with an emitter follower circuit. A Darlington 2-stage also behaved poorly in this respect.

Any feedback amplifier will produce some distortion, for the feedback can only divide the distortion down by the feedback factor. Thus the distortion can never reach absolute 0, unless some special distortion-cancelling scheme is used. The standard design aim is to get the distortion down below, say .05%, by careful design and a high feedback factor. This serves well for most applications.

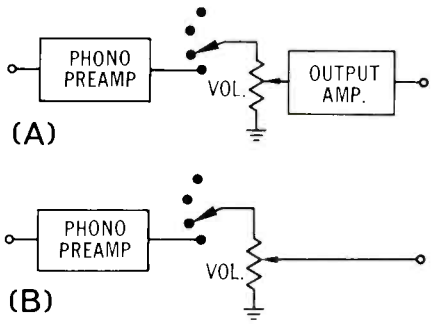


Fig. 1—Block Diagrams—(A) original; (B) final.

Eliminating the Output Amplifiers

As it was definitely desired to do without tone controls, and as the writer does not understand the merit of systems with gain so high that "cracking open" the volume control yields full room volume, it was decided to try to do without an output amplifier. If this could be done, thereby eliminating distortion from this source, it would then be possible to obtain zero (0) distortion on all high-level inputs. The net result would be a lower-gain system where the volume control must be advanced higher than other sets, and may have to be turned more than halfway up for full room volume. This assures: 1) higher resolution of volume control settings (finer adjustment), 2) greater usable range of control, and 3) a reasonable control setting for normal listening levels.

The specification would now be: PHONO sensitivity 10 mV; AUX sensitivity 1 V in for 1 V out. Fig. 1(B) shows the revised block diagram.

The output stage was thus decided by a process of elimination. The tone controls were out. A stage of gain was out. All that was really needed was a volume control and a balance control.

Volume Controls

Stereo volume controls have elaborate tracking specs to ensure equal outputs as the volume is changed. To make up for any errors in tracking, a balance control is usually added. To get good tracking on a volume control, one must be prepared to pay a premium price, or else pay a premium for a balance control, which is merely an extra volume control.

By using two separate volume controls, one avoids both needing a close tracking spec and a balance control with its additional loading and loss of gain. Two standard audio-taper pots suffice. With balanced inputs, and identical channels, these pots will be set to the same point for equal volume.

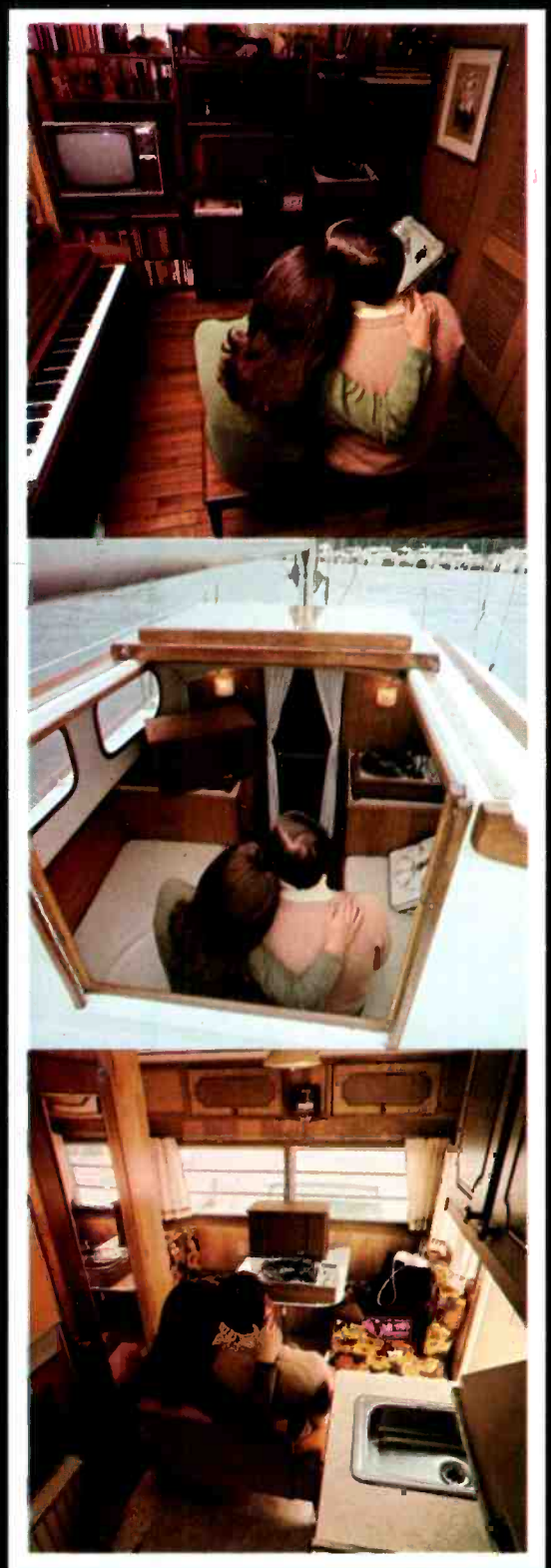
By judicious choice of value, the volume control can give high Z_{in}, and low Z_{out}. Best choice seemed to be this 50,000 ohms, giving a Z_{in} of 50,000 (no load), and a Z_{out} no greater than 25,000 ohms in parallel with 25,000 ohms or 12,500 ohms, thereby keeping the impedance low enough so that reasonably long cable runs can be used without hum pickup. By using a good grade of shielded cable, the hum performance under practical conditions is very low, and the high-frequency rolloff can be kept inaudible by limiting the maximum cable capacitance to 400 pF. This yields a worst-case response down 3 dB at 32 kHz, an inaudible effect even with the finest associated equipment.

A 400-pF capacitance would be equivalent to 22 ft. of standard Belden 8421 audio cable, at 19 pF/ft. This run is ample for most installations.

In order not to load down the volume control, the Z_{in} of the basic amplifier should be 100 K or more. For best gain overall, the basic sensitivity should be 1.5 V or less.

The distortion of the output amplifier having been eliminated (no output amp), whatever distortion remains is that contributed by non-linearity in the

(Continued on page 59)



Mini-room, boat, mobile home . . .
no space is too small for the
big true stereo sound of STEREO 1®

the company that started it all...

From Jensen now comes the greatest advancement in modern sound! Jensen STEREO 1®—a *single cabinet true stereo loudspeaker system!* This new development marks a significant departure—a "first" in two-channel stereo loudspeaker systems and follows an impressive list of Jensen breakthroughs without which stereo today would not be possible.

NOTABLY:

- the first permanent magnetic loudspeaker
- the first direct radiator tweeter
- the first bass reflex enclosure
- the first polystyrene foam diaphragm speaker system
- the first commercial compression driver horn tweeter
- the first articulated horn and diaphragm two-way unitary system

That's a lot of tradition for any new product to live up to. But with that kind of engineering ingenuity behind it, can Jensen STEREO 1® be anything less than revolutionary?

NOW SETS SOUND FREE!

NEW! jensen STEREO 1®

THE FIRST FREE SPACE SINGLE CABINET STEREO SPEAKER SYSTEM

Photography: By Bart Harris
Orchestra: Producer, arranger, composer Dick Shory and His Orchestra (on Ovation Records)

Now-True Stereo From One Speaker Cabinet

JENSEN STEREO 1®
TECHNICAL SPECIFICATIONS

COMPONENTS:
An array of Jensen full-range, high compliance, heavy duty FLEXAIR® loudspeakers, in a specially designed air-suspension enclosure, featuring the Acousti-Matrix System.*

FREQUENCY RANGE:
30-20,000 Hz (each channel).

POWER RATING:
35 watts per channel, integrated program material.

IMPEDANCE:
8 ohms (each channel).

INPUT CONNECTIONS:
Terminals at rear of cabinet for RIGHT and LEFT channel inputs.

FINISH:
Dura-Syn Walnut Veneer.

DIMENSIONS:
13" H, 21¾" W, 11-9/16" D.

SHIPPING WEIGHT:
32 lbs.

*Patents pending

jensen® STEREO

WHAT THE EXPERTS SAY:

"Unbelievable. But it *is* true stereo from one speaker cabinet . . ."

". . . sound is smooth, evenly-dispersed throughout the entire listening area."

"A worthy alternate to the two cabinet stereo speaker system especially where space is limited."

"Unit has remarkably full bass. Highs are silky clean . . . mid-tones are strong, full-bodied."

"Space-saving concept opens new decorating possibilities."

"Jensen's done it again . . . a true breakthrough in stereo."

HERE'S HOW IT WORKS...

The two input stereo signals (LEFT and RIGHT) are combined in a special network so as to provide SUM (LEFT *plus* RIGHT) and DIFFERENCE (LEFT *minus* RIGHT) signals.

These SUM and DIFFERENCE signals are reproduced by arrays of wide range loudspeaker units, carefully chosen and adjusted for *special* directional characteristics.

These arrays are installed in a carefully co-ordinated air-suspension type enclosure configuration, precisely aiming SUM and DIFFERENCE signal components.

The resulting combined radiation patterns provide the real stereo LEFT and RIGHT components, with virtual sources extending well beyond the actual enclosure.

JENSEN MANUFACTURING DIVISION
The Muter Company
5655 West 73rd Street, Chicago, Illinois 60638

Printed in U.S.A.

Stereo 1—®Patent applied for

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Austere (Continued from page 54)

resistive volume control. This is felt to be of such a small magnitude that it probably cannot be measured. Thus this preamp can be said to have 0 distortion on all high-level inputs.

The rest of the design is standard. The power supply uses an existing transformer to provide a relatively high voltage which is dropped-down and well-filtered for the phono circuit. Function switching is conventional, and uses a standard Mallory switch. The unit can be built on a 7 x 11 x 2 aluminum chassis, with a separate bottom plate, and heavy ⅛-in. aluminum front panel. A suggested front panel layout is shown in Fig. 4.

RIAA Phono Preamp

The main element designed was the phono preamp circuit, as shown on the schematic, Fig. 2. This gives a gain of 100 at 1 kHz. By using a PNP transistor at low current (0.1 mA) and voltage (3.5 V) in the first stage, noise is kept to a minimum. The directly grounded emitter of Q_2 allows full swing out, and use of a 50-V supply provides enough extra overload capability for most, if not all, cartridges on the market. The use of d.c. feedback gives good operating-point stability, and a filter reduces any r.f. pickup on the input. By keeping the output coupling capacitor (1-μF/50-V) always terminated, the 1.0-meg. loading resistor prevents any function-switch pops caused by capacitor charge-up through the volume control. The whole circuit was laid-out on a small perforated board, as in Fig. 3. Measured performance is shown in the complete specification of Table I. In actual operation the preamp provides an unobtrusive simplicity of operation and high performance that cannot be obtained on the market today at any price. Æ

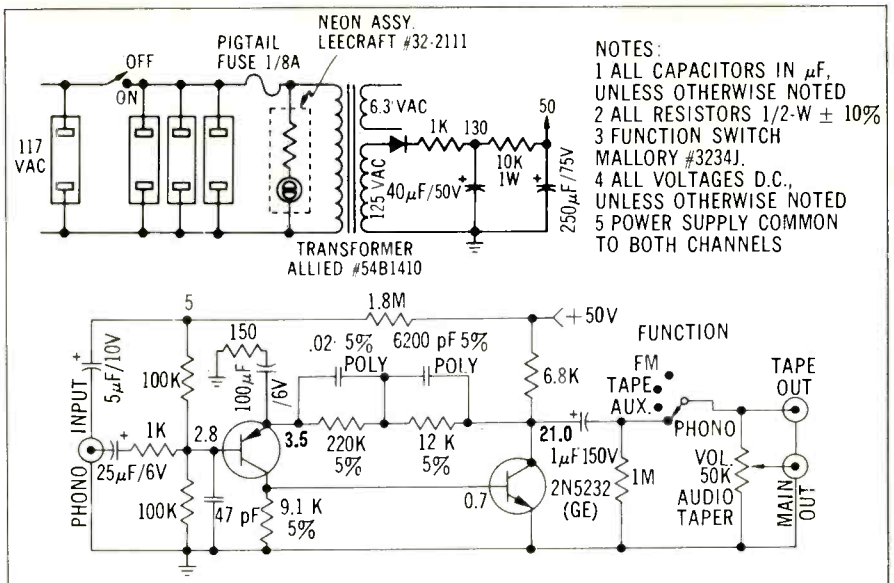


Fig. 2—Schematic of phono preamp (one channel only shown).

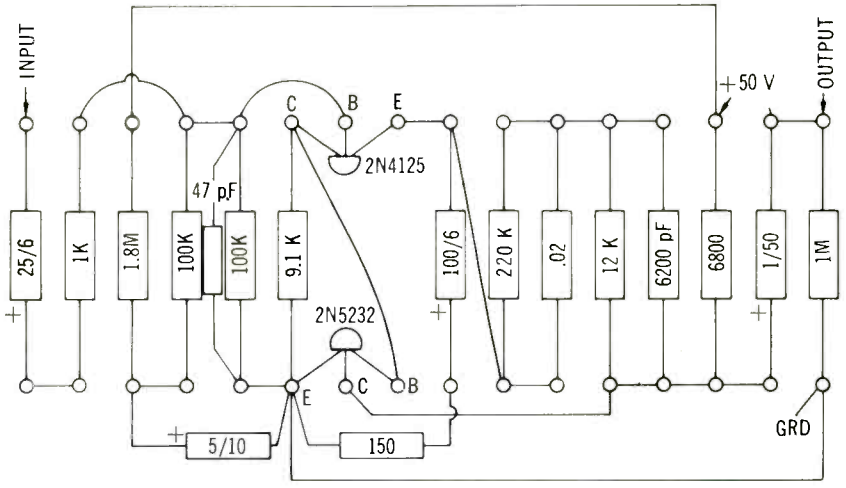


Fig. 3—Phono board layout (one channel only). Built on perforated phenolic board using push-in terminals, as indicated by circles.

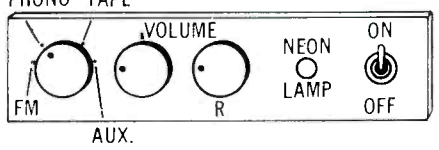


Fig. 4—Suggested front-panel layout (not to scale).

TABLE I—STEREO PREAMP SPECIFICATIONS

PHONO INPUT

Sensitivity:	10 mV for 1 V output
Input impedance:	47,000 ohms
Output impedance:	210 ohms
Overload:	150 mV input
Hum & Noise:	60 dB below 1 V.

Harmonic Distortion:

Freq. Hz	THD-1 V %	THD-5 V %	Generator Residual—%
20	0.1	0.15	.055
50	0.12	.085	.055
1000	.03	.04	.04
10000	.03	.042	.04
20000	.03	.065	.035

HIGH-LEVEL INPUTS (FM, TAPE, AUX)

Sensitivity:	1 V for 1 V out
Input impedance:	50,000 ohms
Output impedance:	0-12,500 ohms (when driven by a low-impedance source)
THD:	unmeasurable
IM Distortion:	unmeasurable
Output Load:	100,000 ohms min.
Hum & Noise:	80 dB below 1 V
Frequency Response:	0 — 32 kHz, +0, —3 dB

FEATURES

Controls:	Volume left, volume right
Power Switch:	10A, 115 V toggle switch
AC Outlets:	3 switched, 1 unswitched
Neon indicator lamp	
Outputs:	Main, Tape

ABZs of Stereo FM

LEONARD FELDMAN

Early Multiplex Decoder Circuits

HAVING EXAMINED THE nature and make-up of the approved composite stereo FM signal, as well as the popularly used switching circuits, let us examine the early circuits employed by the high-fidelity industry to reconstitute the separate "left" and "right" signals required to recreate the stereo illusion in your living room. It is interesting to note that the first "adapter" circuits to burst upon the scene shortly after FCC approval of stereo FM in 1961 were all based upon a design approach which has been just about completely discarded today—the so-called "matrix" circuit. In fact, General Electric Company, one of the proponents of the approved system, specified this circuit in its written proposal to the FCC. Since the formulation of the composite signal involved a series of algebraic manipulations of the "L" and "R" signals, the most obvious method of restoring distinct "L" and "R" signals once more. Thus, as shown in a previous article, if the station is transmitting (and the receiver receiving) L + R (on the main channel) and L − R (via sub-carrier sidebands), once these signals are recovered or detected, electrical networks might be devised to perform the following manipulations:

(L + R) + (L − R) to recover 2L
(L + R) − (L − R) to recover 2R

Before these operations can be performed, however, it is necessary to recover L − R as audio. You will recall that while L + R is recovered intact right after the detector of the FM tuner or receiver (and is, in fact, the "monophonic equivalent program" heard by owners of mono equipment), L − R exists at this point only in the form of dual-sideband information surrounding a suppressed (non-existent) 38-kHz sub-carrier. If L − R consists of a sinusoidal signal, the equivalent recovered signal at the FM detector would appear as shown in Fig. 1. It resembles an amplitude-modulated signal imposed upon a carrier, in which the center portion of the carrier itself is missing. If we were to demodulate this waveform by means of a conventional AM detector (a diode plus r.f. filtering components), we would get audio waveforms such as those shown in Fig. 2 instead of the desired, original, sine-wave. If, however, we re-insert the carrier in exact time and phase relationship to its suppressed counterpart at the transmitter, we *can* subject the resultant waveform (shown in Fig. 3) to conventional AM detection, thereby recovering the desired audio signal, L − R.

Figure 4 is a block diagram of a complete "matrix" stereo decoder. The first block, a wideband amplifier, simply amplifies all frequencies present in the detected composite stereo signal. It also serves to isolate later, low-impedance circuits from the detector to prevent loading of that stage. Frequencies present at this point include everything from 50 Hz to 53,000 Hz. Following amplification, the signal is divided into three paths. The upper path includes a cathode-follower stage (for further isolation and impedance matching) and a low-pass filter. The purpose of the filter is to reject all frequencies but those associated with the L + R signal, so the cut-off point is designed to he at 15,000 Hz. A simple 12-dB-per-octave filter is shown, together with its output response, in Fig. 5. A variable amplitude output is available at the termination of this filter by virtue of the potentiometer which acts as a separation control, as we shall soon see.

Following the central path in Fig. 4,

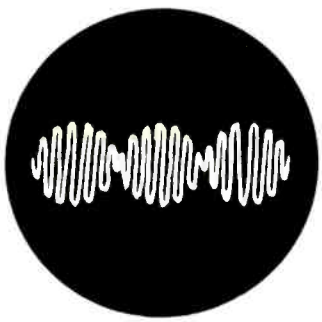
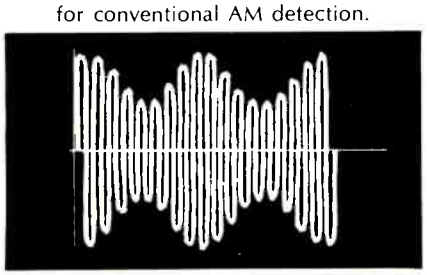
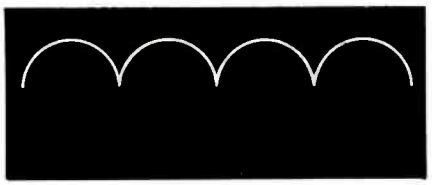


Fig. 1—"L — R" sidebands shown in the absence of the rest of the composite stereo FM signal.

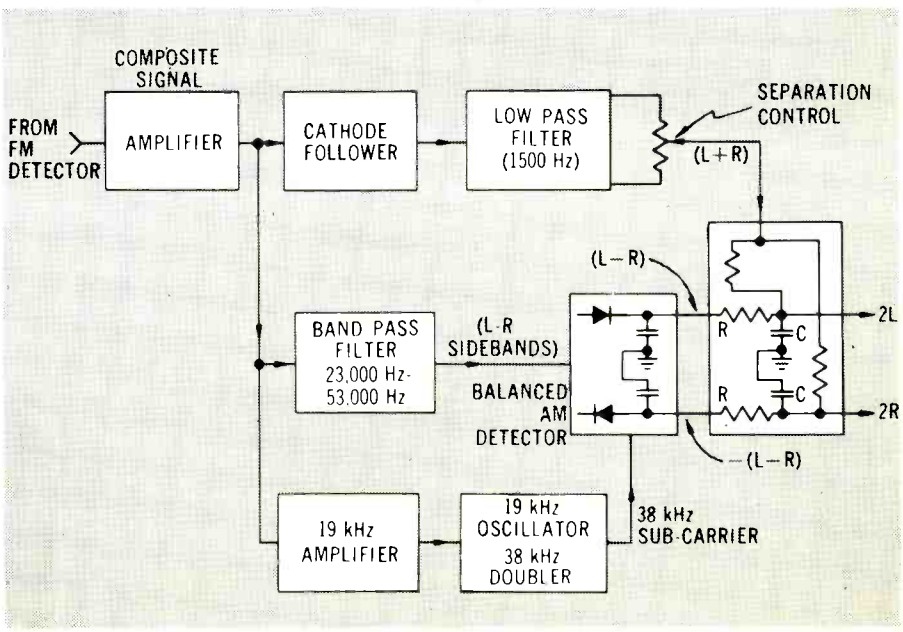
Fig. 3—After reinsertion of the "local" 38-kHz subcarrier to the signal of Fig. 1, the total L — R-modulated subcarrier is ready for conventional AM detection.





← **Fig. 2**—Incorrect L — R audio that would be detected if sidebands only were applied to an AM diode detector.

Fig. 4—Block diagram of an early "matrix" FM stereo decoder. ↓



"The Harman-Kardon CAD4 has a very uniform and extended low end which, in fact, surpasses that of many far more expensive reel-to-reel tape recorders." (ELECTRONICS WORLD, June 1969)

In a recent ad, we stated that our CAD4 Cassette Tape Deck had the guts to talk specs.

Electronics World magazine obviously agrees.

In addition to the above, they also said:

"The flutter was in the vicinity of 0.2% for the Ampex and Sony and 0.3% for the Norelco, but an impressively low 0.12% for the Harman-Kardon."

". . . the Harman-Kardon CAD4 had uniform output to about 10,000-12,000 Hz but the other three began to roll off between 8,000 and 9,000 Hz."

"The CAD4 had 20-12,000 Hz record/playback response with Harman-Kardon tape."

A copy of the *Electronics World* review of the CAD4 is available upon request. It's a review worth reading. And a cassette deck worth hearing. Listen to it. Compare it to the competition. We think you'll agree with *Electronics World* that it is "the best of the group in performance . . ."

For more information, and the complete text of the review, write to Harman-Kardon, Inc., 55 Ames Court, Plainview, N.Y. 11803. Or contact your Harman-Kardon representative.

harman kardon

A subsidiary of Jervis Corporation

Rectilinear is announce the high-fidelity

The time was ripe, to say the least.

High-fidelity amplifiers (i.e., amplifiers whose output closely resembles their input) have been around for more than twenty years. High-fidelity FM tuners just about as long. Even high-fidelity pickup cartridges, capable of producing a reasonably accurate electrical replica of the groove, could be had as far back as the mid-1950's.

But, until Rectilinear did something about it, you still couldn't buy a high-fidelity loudspeaker after all these years. Not if you accept any definition of high fidelity as applied to other audio components. (How would you like, for example, a "high-fidelity" amplifier with the response and distortion characteristics of your favorite speaker system?)

This isn't just academic hairsplitting or a question of semantics. Audiophiles are in universal agreement that there are only the subtlest audible differences among the finest amplifiers or phono cartridges, whereas no two loudspeakers of different design have ever sounded even remotely alike. Both may sound pleasing, or realistic, or musical, or better than last year's model; but in an A-B comparison their outputs invariably disagree about the input. Because, invariably, both outputs are at least partially wrong.

We believe that our new bookshelf speaker, the **Rectilinear X** (that's a ten, not an ex), is the first speaker system whose output is *right* about its input. We further believe that future speaker systems designed with the same basic principles in mind will sound very much alike, just like the best amplifiers or pickups, no matter how different they may turn out to be in actual engineering execution.

The initial concept behind the **Rectilinear X** was to try to isolate what everybody else was doing wrong. Since speakers are undeniably getting better all the time, speaker designers must be doing something (or even a lot of things) right; but is there anything fundamental that everyone has overlooked?

We came to the conclusion that there is. *Envelope delay distortion*. This is a type of time delay distortion having to do with loudspeaker phase characteristics, which has been a rather neglected subject among members of the hi-fi Establishment.

Actually, the phase response of a loudspeaker is at least as important as its amplitude response, although the latter is nearly always accepted as the "frequency response" specification. The matter is a bit too technical to be pursued in detail in this ad, but we'll be pleased to give you additional information if you write to us. For the moment, let it suffice that envelope delay distortion causes an audible coloration of speaker sound.

In terms of practical speaker design, this line of thinking produced, first of all, a highly unorthodox approach to woofers. We realized that in just about all speaker systems the woofer was responsible for envelope delay distortion as well as IM distortion far up into the midrange.

The woofer of the **Rectilinear X** is an entirely new 10-inch unit with a *completely linear* excursion capability of ½ inch in either direction, meaning one full inch of travel from peak to peak. There has never been anything like it. It can move more air than most 12-inch woofers, and of course far less sluggishly. Furthermore, it is crossed over to the midrange driver at the unprecedentedly low frequency of 100 Hz, with an attenuation slope of 12 dB per octave. As a result, it remains virtually motionless without a deep bass input and can't possibly mess up the midrange. But when there's a bass drum or a tuba or double basses in the program material, it produces music instead of mud.

Of course, a 100 Hz crossover with a 12 dB slope would be quite impractical with conventional crossover networks. The **Rectilinear X** network is designed around unconventional iron-core chokes, which will probably upset Establishment engineers, but then so did rear-engine automobiles . . .

The 5-inch midrange driver is equally remarkable. It covers more than six octaves, from 100 to 8000 Hz, in a separate subenclosure and is therefore virtually a full-range speaker system in its own right. This accounts for the completely seamless, homogeneous sound quality of the **Rectilinear X.** The cone structure is of a special paper not available in any other unit, permitting rigid piston behavior at the lower midfrequencies and, at the same time, extraordinary transient detail higher up in the driver's working range.

At 8000 Hz, the midrange is crossed

pleased to world's first loudspeaker.

over to the 2½-inch tweeter. With only a little more than an octave assigned to this driver, its exceptionally light cone and voice coil operate only in their most comfortable range, without the slightest possibility of strain. (Speaker systems that demand too much work of a tiny tweeter are asking for trouble.)

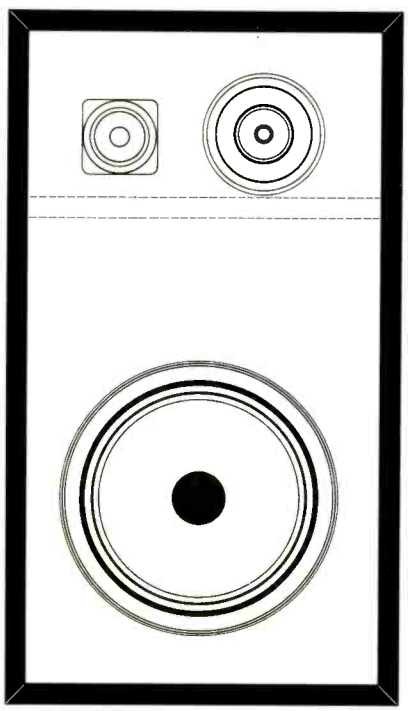
The spacing of the three drivers in the **Rectilinear X** is an important part of the design and is by no means dictated by convenience or visual symmetry, as in many other bookshelf systems. The distance of the midrange speaker from the woofer is particularly critical for the best possible phase characteristics in the crossover region.

The final touch of sophistication is provided by the grill cloth. In other speaker systems the grill cloth is made acoustically transparent, allowing sound waves to pass through unaffected. In the **Rectilinear X** a specially prepared fabric presents a graduated acoustic impedance to the midrange speaker and the tweeter, for greatly improved sound dispersion at the higher frequencies. Stretched on a slightly raised frame open at the sides, the grill cloth actually functions as a superior form of acoustic lens, making the speaker nondirectional over an extremely wide angle. This, combined with a cabinet size of only 25" by 14" by 10¾" deep, opens up new possibilities in speaker placement.

We must emphasize that none of these unusual engineering details are in themselves revolutionary. Perhaps the most gratifying thing about the **Rectilinear X** is that it's still an eminently sensible bookshelf speaker designed around three rugged, reliable drivers of the classic moving-coil principle, rather than a far-out experiment utilizing some exotic new driving system along the lines of, say, ionized air speakers. Our new standard of performance is the result of new insights into the existing technology, not of an unproven new invention.

What does the world's first high-fidelity loudspeaker sound like? It can't really be described in words and you must hear it for yourself. But the few people who have already heard it seem to agree on the following points:

The bass is startlingly clearer and more natural than one is prepared to hear through any electronic medium.



The midrange is so completely neutral and devoid of coloration that all other speakers seem nasal by comparison. There isn't the slightest hint of boxiness or enclosure sound. In fact, the sound gives no indication of the size or even existence of the enclosure.

On complex program material like Wagnerian climaxes or hard rock, the same unstrained clarity is retained as, for example, on solo flute.

Above all, the **Rectilinear X** is supremely *listenable*. Even after several hours of listening at high volume levels, there isn't the slightest aural fatigue or irritation. None of that "I've had enough, let's turn it off" feeling.

We left the price of the **Rectilinear X** for the last. Since it sounds superior to speaker systems selling for up to $2400, the price could have been whatever the traffic would bear. But based on our manufacturing costs plus the normal profit margin, we decided to set it at $199.

You'll have to agree that for a high-fidelity speaker, that's not high.

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

Rectilinear X

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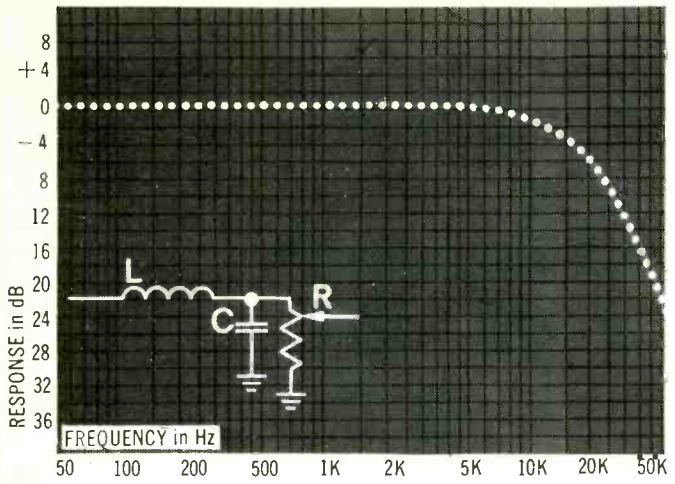

Fig. 5—Low-pass filter used to extract L + R signal. Dotted line is its response.

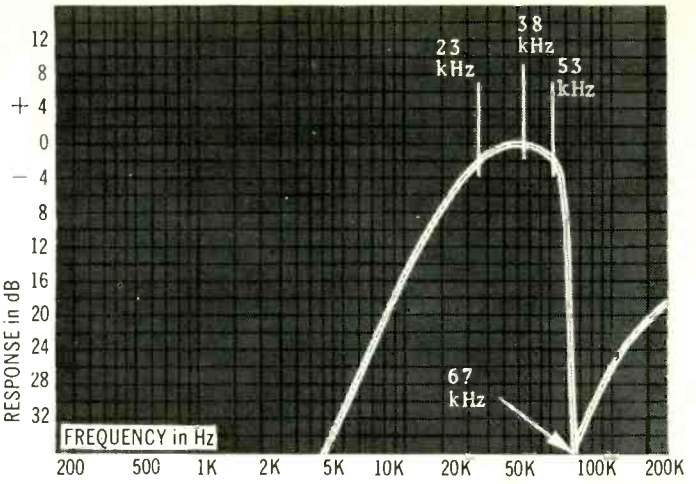

Fig. 6—Response of band-pass filter used to extract L — R sideband signal from the composite signal.

the composite signal is simultaneously applied to a "band-pass" filter whose low- and high-frequency cut-off points are 23 kHz and 53 kHz, respectively. Thus, main channel (L + R) information as well as the 19-kHz pilot signal are rejected from this path and only the sub-carrier sidebands are allowed through.

The response characteristic of a suitable band-pass filter is shown in Fig. 6. Note that the frequency of maximum attenuation in this *m*-derived" filter is chosen to be 67 kHz. This is done to minimize any cross-talk effects from a possible S.C.A. (background music) private sub-channel that might be transmitted to private subscribers along with the normal public programming. In early stereo decoder designs little attention was paid to this needed filtering, since S.C.A. service on the same station as stereo broadcasting was relatively rare. Today, however, with over 500 FM stations authorized to transmit a sub-channel for S.C.A. service, it is not unusual to find stations in an area engaged in both S.C.A. and stereo transmission. In fact, in the New York Metropolitan area the three major S.C.A. stations (WPIX, WNCN, and WRFM) are *all* stereo stations as well.

Getting back to our block diagram, the third signal path includes a 19-kHz tuned-circuit amplifier which boosts the amplitude of the 19-kHz incoming pilot signal. You will recall that the amplitude of this pilot signal, as recovered from the FM detector, is only from 8 to 10 per cent of the total amplitude of the composite signal. The amplified 19-kHz signal is used to synchronize a local oscillator-doubler stage. In some designs, the oscillator is tuned to 19 kHz and its output is doubled by a suitable tank circuit while in other designs the pilot signal is used to synchronize a 38-kHz oscillator directly. The output of this circuit is a high-amplitude 38-kHz signal which is exactly in phase with the original 38-kHz sub-carrier that was "suppressed" at the transmitter. By "adding" this 38-kHz signal to the L — R sidebands obtained at the output of the band-pass filter we accomplish carrier restoration and the waveform applied to the balanced AM detector block appears as shown in Fig. 3—a very conventional-looking amplitude modulated "carrier," similar (except for frequency) to that which might be observed at the input to the detector of an AM radio.

The "balanced AM detector" consists of a pair of oppositely polarized diodes, followed by "r.f." filter capacitors. The use of two oppositely polarized diodes simply saves a step in the algebraic "matrixing" step to follow. One of the diodes will trace the "envelope" as the *upper* edge of the waveform of Fig. 3 while its oppositely polarized companion will trace the "envelope" of the *lower* edge of the Fig. 3 waveform. In this way, + (L—R) and — (L — R) are *both* recovered directly from the detectors. Each of these recovered versions of L — R is then *added* through passive resistive networks, to equal amounts of L + R, fed to the networks from the arm of the separation control potentiometer. Since the amounts of L + R, (L — R), and — (L — R) must be exactly equal in amplitude for the "algebra" to work out, the previously mentioned separation control enables adjustment of the amplitude of applied L + R so that it exactly equals (L — R) or — (L — R) and the output of one resistive matrix turns out to be 2L while that of the other is 2R.

Up to this point, all signals have not been de-emphasized. Obviously, had we taken a de-emphasized signal from the output of the main FM detector we would have "rolled-off" all the required high frequencies of the sub-carrier sidebands and the 19-kHz pilot signal. Accordingly, de-emphasis is introduced after recovery of individual L and R signals by means of R and C shown in each matrix network. These are chosen so that normal 75-microsecond de-emphasis occurs, as required. For example, the R of each matrix might be 75 kohms, while the C might be 0.001 μF.

On the surface, this "direct" circuit approach may seem deceptively simple and you may be wondering why its popularity declined in the first year of FM stereo receiver production. The answer lies in the problem of filter matching. We have mentioned and shown (Figs. 5 and 6) only the *amplitude* responses of the low-pass and band-pass filters. Filters also have a charactertistic phase response (or time delay) and unless the phase response of both filters is matched or perfectly tracked with respect to frequency, matrixing cannot be perfect at every frequency. Thus, while it might be possible to adjust the "separation control" for "infinite" stereo separation at 1 kHz, at other frequencies phase-responses between the two simple filters would differ so much that separation at these other frequencies would be anything but ideal. Now, it is, of course, possible to design low-pass and band-pass filters which have amplitude and phase characteristics that track perfectly, but such filters become inordinately expensive and complicated, involving many more elements of "L" and "C" than we have shown in our simple version.

Almost as soon as the first stereo adapters came upon the scene, engineers and mathematicians were able to show an amazing "equivalence" of the composite signal which led to the new popular and predominant "switching" circuits, discussed last month. Æ

power (rms) per channel (both channels driven) produced 0.8% THD, as shown in the curve of Fig. 6, while IM reached the rated 0.8% at 12 watts, rather than at 15 watts as claimed. With only one channel driven, however, we were able to produce 16 watts at 0.5% THD, which conformed exactly to the IM specification quoted by the manufacturer. Frequency response was very good out to the super-highs (see Fig. 8) but rolled off sharply below 30 Hz. It was fully 5 dB down at 20 Hz.

Tone-control action, shown in Fig. 8, was exactly as claimed, but in use was found to be just marginally adequate, especially in light of the low-frequency roll-off inherent in the preamp-amplifier section to begin with. Loudness-control action provided approximately 10 dB of boost at 100 Hz at ¼ clockwise rotation of the volume control(s) and about 8 dB of boost at the same frequency with the volume controls set at ½ rotation. Again, because of this double-volume-control arrangement, and/or poor tracking of the controls themselves or unbalanced source material, should it ever become necessary to set the volume controls at different positions (relative to each other) while using the loudness controls, this would mean unequal loudness compensation in left and right channels. This condition occurred on several occasions during our extended use of this receiver.

The high-frequency filter, with its 6-dB-per-octave slope, provided about 4 dB of attenuation at 10 kHz and about 8 dB of cut at 20 kHz. For audible elimination of record scratch or FM background noise, it is therefore of little practical use and might just as well have been omitted. Power bandwidth extended from about 45 Hz to 22 kHz, which means that at 45 Hz we were really dealing with only about 7 or 8 watts of available power per channel. As shown in Fig. 7, square-wave response for 100-Hz and 10-kHz signals point up the frequency response problem at the low end. Although there is some evidence of ringing at 10 kHz in the square-wave photo, we could not detect any audible evidence of it in our musical listening tests.

As for listening, the Sony STR-6040 is definitely not meant for low-efficiency speaker systems. Accordingly, we also listened through higher-efficiency units, where performance was fine. In medium-size listening rooms, however, most listeners would not require more power than is available from this unit, providing they choose their speaker systems wisely. Since we were so impressed with the FM tuner performance (the AM was quite good, too), we decided we wanted to listen to this unit through our higher-powered amplifiers and less efficient speakers. Doing so (using the recorder output jacks on the Sony) provided us with many hours of highest-quality FM listening. We logged 49 FM stations on an indoor dipole, 56 usable signals with an outdoor Yagi, and, with the aid of a rotator, were able to up the number to 61. Some 18 stereo signals were received, with switching from mono to stereo taking place noiselessly and effortlessly.

When you really come to think of it, the Sony STR-6040 is well worth the price for the tuner section *alone*, so if the amplifier isn't quite the powerhouse you'd like—why quibble? You're practically getting 32 watts of IHF power FREE! Thus the $199.95 STR-6040 is a tremendously good value for anyone who prefers FM to phono, and just doesn't have the buck for higher power. And as usual for Sony's component line, you'll be getting impeccable workmanship.

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Electro-Voice "Aries" Loudspeaker System

MANUFACTURER'S SPECIFICATIONS: Frequency Response: 25 to 20,000 Hz. Nominal Impedance: 8 Ohms. Power Handling Capacity: 35 watts program, 70 watts peak. Dimensions: 22¼" high, 27½" wide, and 16¼" deep. Style/Finish: Contemporary/Pecan, Traditional/Cherry, Spanish/Oak. Net Weight: 65 pounds. Shipping Weight: 75 pounds. Price: $275.00.

The "Aries" series are the latest console-sized systems from Electro-Voice. The three furniture styles pictured at right should fit most furniture environments since they encompass today's most popular furniture decorating styles. E-V merits an A+ for furniture craftsmanship, as these enclosures are very handsomely designed and crafted. Its performance as a speaker system is equally commendable.

The dimensions of the Aries systems are such that we would classify them as small consoles. Technically speaking, we have basically a conventional 3-way acoustic-suspension system, with refinements. According to E-V, the 12-in. woofer was optimally designed with the aid of a computer; it uses a sealed-foam half-roll surround for improved cone stability while allowing large linear cone throws of as much as ¾-in. peak to peak. A 9½ pound magnet structure drives the "deep dish" cone. The woofer works up to a 400-Hz crossover, at which point the 6-in. mid-range speaker takes over. The resonance of the squawker cone has been designed around 250 Hz, well out of its operating range of 400 to 2500 Hz to ensure smoothness of frequency response. The mid-range speaker has its own sub-enclosure—as do most others in this type of system—which is lined with acoustic damping material to seal it away from the effects of the woofer and vice versa.

The tweeter, which takes over at 2500 Hz, is also a cone-type unit, 2½ in. in diameter, with a dust dome centrally mounted. The dome becomes the principal radiator of sound at the higher frequencies, while at lower tweeter frequencies the dome aids the cone. This assures maximum efficiency and helps dispersion in this type of design. The resonant frequency of the tweeter is again out of its operating range, being just below 2500 Hz, for a rapid rolloff below. A viscous damping material applied to the compliance ring of the cone damps the cone's motion at resonance, eliminating the danger of spurious response and break-up. Thus, E-V has paid careful attention to the design of the speaker elements and enclosure.

A stepped, rear-recess-mounted 5-position "acoustical balance" tweeter-

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A-7030U Unsurpassed sound reproduction at 15 or 7½ ips • Tape tension adjustment for reels up to 10½ inches • Dual-speed hysteresis synchronous motor for capstan drive, with unique electrical speed change • Two exclusive induction motors for reel drive • Effortless operation with solenoid control system • Optional remote control/pause control • Cueing button • Instant off-the-tape monitoring without interruption of recording • Sound-on-sound, sound-with-sound, echo, and built-in mike-line mixer • Automatic rewind and shutoff

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another black aluminum extrusion along its lower edge. Two level controls, and a power on/off switch with adjacent pilot light are all one sees on the front panel. An access door discloses d.c. balance controls and five fuses (two each for left and right channels plus a line fuse). Spare d.c. fuses are thoughtfully provided on the rear of the access door. The most striking fea-

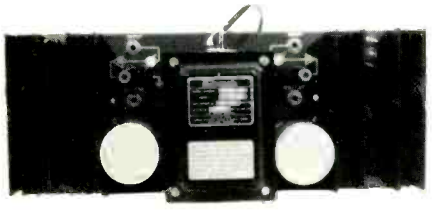


Fig. 2—Massive 1-kW power transformer, oversize electrolytic filters, and large heat sinks are visible from rear of DC-300.

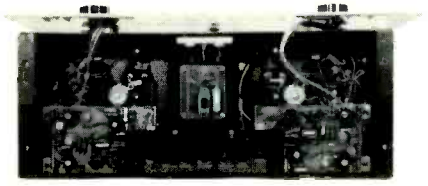


Fig. 3—With front panel removed, individual channel circuit boards are visible inside chassis.

ture of the rear view of this amplifier is the massive, 1 kW power transformer, flanked by a pair of 13,500 μF filter capacitors, as seen in Fig. 2. Inputs, also located at the rear of the unit, are in the form of standard phone jack connectors, while outputs are taken from either color coded binding posts or phone jacks. The two massive black-anodized heat sinks to which output transistors are mounted are thermally joined to the main chassis so that the entire amplifier acts as a heat sink. Internal circuit-board construction is shown in Fig. 3, in which totally separate treatment of channels can be seen.

As for circuitry, a total of 38 discrete transistors, 2 dual transistors and 6 Zener voltage-regulating diodes are used. The output transistors are units having a peak current rating of 60 amperes. Input voltage amplifiers are powered by two independent voltage regulated supplies per channel, affording channel-to-channel isolation and independence from line-voltage variation. Each amplifier channel is totally direct coupled from input to output, which results in minimal phase shift at all audio frequencies (0 deg. phase shift up to about 3 kHz and only about 9 degs. at 20 kHz when used with an 8-ohm load). According to the manufacturer, the output stage of each amplifier is a quasi-complementary circuit in which no bias current is required for the output transistors. In this circuit, the driver transistors carry the bias current while the output transistors serve only as boosters, sensing when the driver transistors are delivering significant current to the load and taking over to deliver larger load currents when required.

The output circuit is protected by a volt-ampere limiter which limits the drive to the output circuit whenever the output transistors are overloaded.

Measurements

As mentioned earlier, the specifications of this amplifier are substantially better than most test equipment used to measure them. For example, our laboratory audio oscillator has its own residual distortion (measured at 1 kHz) of about 0.05%, while our IM Distortion analyzer (because of the make-up of the two internally generated and mixed frequencies of 60 and 7000 Hz) has a residual of about 0.1%. According to the manufacturer, these figures almost correspond to distortions produced by the DC-300 at very near its full output! Accordingly, we interposed a series of low-pass filters between our audio generator and the input to the amplifier. These filters provided a roll-off of 12 dB per octave above the chosen cut-off frequency. Thus, an 800-Hz cut-off frequency was chosen for making all 1-kHz measurements. Since 2 kHz (2nd harmonic) was therefore attenuated by approximately 12 dB, this rendered potential measurements of about 0.012% possible (considering only the second harmonic—for higher order harmonics the residual distortion of the generator-plus-filter was, of course, even better).

As for the IM measurements, instead of relying upon the built-in low and high frequencies required, we used two separate audio oscillators, each equipped with filters as described above, and passively mixed the two, in proper 4:1 proportions, using the IM analyzer only for reading the output of the amplifier itself. Our capability was thereby improved down to a residual of about 0.01%.

Measurement Results

Harmonic distortion curves are shown in Fig. 4. Note that these curves are presented in an entirely new man-

Fig. 4—Total Harmonic Distortion at various power levels and over entire audible frequency spectrum.

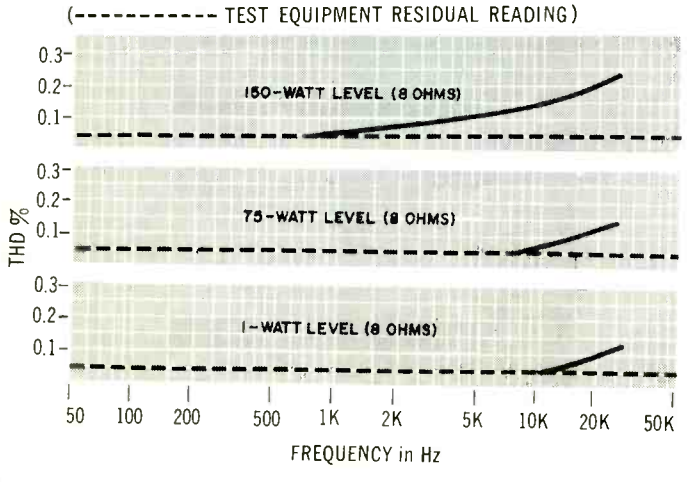
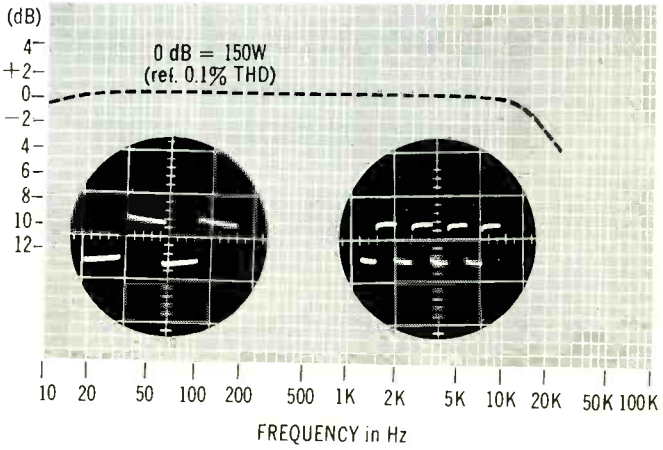


Fig. 5—Power bandwidth curve for DC-300 amplifier. Inset shows square-wave response at 50 and 10,000 Hz.



ner, taking into account both frequency and power level. In addition, the scale has been greatly expanded (highest reading is only 0.3%) to present a clear picture of just how low the THD really is. Readers are cautioned not to compare these curves with previously published THD curves in AUDIO Equipment Profiles, for their scales are much more compressed. The same expanded-scale approach has

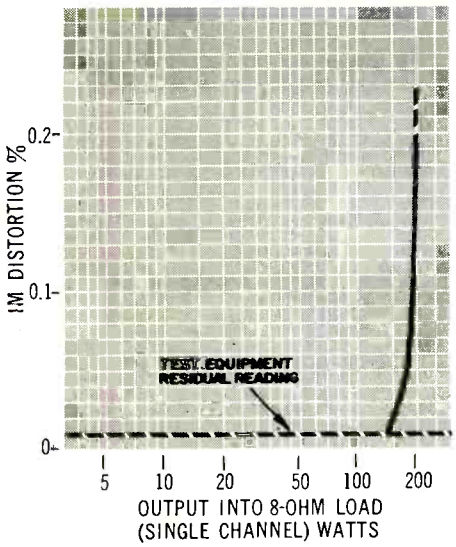


Fig. 6—IM distortion is unmeasurable below 135 watts.

been used in the IM curves of Fig. 6, where total IM of 0.1% is reached at an incredible 190 watts, *per channel,* using an 8-ohm load. To present a frequency-response curve for this amplifier would be rather meaningless since, between 10 Hz and 100 kHz the line would be ruler-straight and below 10 Hz our a.f. meters begin to undulate too severely to take an accurate reading. Actually, with the d.c. coupling employed, there is no reason why the response of this amplifier should not be "flat" right down to "d.c.," as the manufacturer claims. Damping factor measurements were attempted, but these were observed to exceed 100 (the limit of our test-equipment capability), so it is fairly safe to presume that the figure in excess of 200, as claimed, is perfectly true.

Figure 5 shows power bandwidth, using 0.1% THD for reference, and indicates extremes from below 10 Hz to 20,000 Hz based on a zero-dB level corresponding to 150 watts per channel. Excellence of square-wave response at 100 and 10,000 Hz is also shown.

Listenability

Before attempting to listen to this amplifier subjectively, we were careful to put line fuses in series with our speaker lines (not to protect the amplifier, which is short- and overload-proof, but to protect our speaker voice coils, in case we "went overboard" with all that clean power).

We fed source material into a custom-built, one-of-a-kind preamplifier known to produce less than 0.01% distortion at up to 1 volt out. Speakers used included low-efficiency types, as well as full-range electrostatics which were borrowed for these tests. Tests were confined to disc recordings only, since no tape reproducer on hand had low enough orders of IM distortion to allow us to "hear through" to the amplifier itself. As it was, we are not completely sure that all we were hearing was the distortion of the amplifier (or, actually, the lack of it). This much we are certain of, however—the DC-300 could *not* be overdriven into noticeable distortion of any kind—and we were producing enough sound (often using two sets of low-efficiency speakers per channel—just to be sure) to fill Carnegie Hall, with enough left over for a couple of stadia. From the standpoint of noticeably lower distortion, we are hesitant to make positive statements. In previous tests, we could not discern the difference between 0.2% and 0.4%—so how could we be expected to hear an improvement at 0.01% or the like? On the other hand, for power handling, transient response, transparency of sound, and utter faithfulness and musicality, we can honestly say we've never heard anything better.

If you crave the most powerful of amplifiers and are willing to surround your amplifier with comparably superb associated components, regardless of price, the Crown International DC-300 is one not to be overlooked.

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Dynaco Model A-25 Speaker System

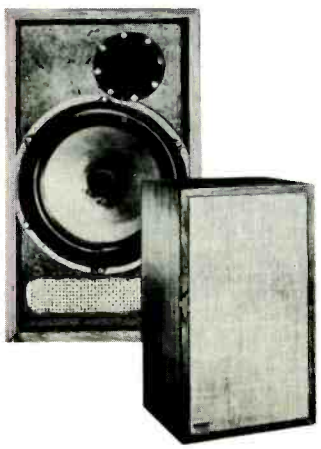

Fig. 1—Dynaco A-25 Loudspeaker System.

MANUFACTURER'S SPECIFICATIONS: Two-way System—10-in. woofer, friction loaded; 1½-in. dome tweeter. Frequency Response: 47-20,000 Hz ±5 dB; Power Handling Capacity: 35 watts; Crossover Frequency: 1500 Hz; Impedance: 8 ohms. Grille Material: linen beige; Weight: 20 lbs. Price: $79.95 in oiled walnut; $89.95 in teak or rosewood.

The A-25 marks Dynaco's entry into the speaker field. Until now, Dyna Company has manufactured amplifiers, preamplifiers, tuners and has marketed a tape recorder made in Denmark. All of their products have had one thing in common: high-quality of performance, at moderate cost. The A-25, also made in Denmark, turns out to be an addition to Dyna's successes, being an outstanding performer for under $80.

A 10-in. acoustic suspension woofer, operating in a damped, ducted-port enclosure, provides bass frequencies right up to 1500 Hz, at which time a soft dome tweeter takes over and goes on up to the top of the audible range. The port at the bottom of the cabinet is stuffed with fiberglas, which offers some resistance and causes more of an infinite-baffle-type acoustic suspension than a ducted port, as we know it. The crossover network is a two-section filter with a stepped attenuator control, recessed in the rear of the speaker cabinet, which provides five steps of treble operation. Each step is just under 3 dB at 10 kHz, so that the ±2 steps around the "normal" setting offer just under ±6 dB of high-frequency change. This should be enough to adapt the speaker to most listening environments, which is the manufacturer's intent. Its nominal impedance is 8 ohms.

The speaker system is legitimate bookshelf size: 20-in. wide by 11½-in. high, by 10-in. deep. Or it can be used in an upright position just as well. A nice mounting convenience feature is the built-in mounting brackets which

allow for either horizontal or vertical wall mounting of the unit on either the #6 screws (supplied) or small hooks. This beats drilling in order to mount eyes in the speaker cabinet. The speaker elements are mounted from the front and covered by a tightly woven, beige grille cloth on a wooden frame (glued to the baffle). The cabinet is finished in a dark oiled walnut on all four sides.

While the A-25 exhibited an excellent frequency response of 60 to 15,000 ±6 dB in our averaged room tests, it was its outstanding transient response which really impressed us. Tone bursts throughout the meaningful frequency range showed up its excellence. In truth, the A-25 produced the finest tone-burst response of any speaker tested in this manner, regardless of price. A clue to the smooth response was found when we examined its impedance through the audible range and found it to be nearly constant. It never went below four ohms. Among other things, this means that several units can be paralleled and successfully driven by a power amplifier that likes to look at loads greater than two ohms in order for it to produce significant power, safely. For example, three A-25's per channel, operating in three rooms, lets say, could work well off a 60-watt (rms) power amplifier. Thus, series/parallel switching arrangements are not necessary for a multiple-room speaker setup.

We found the system to be at the efficient end of low-efficiency systems. We recommend an amplifier of 25 watts continuous power per channel (rms) as a good match for average conditions. Many applications could be found, however, which could make this figure go either way by two (halving or doubling). The A-25 can handle hefty amounts of power and certainly doesn't sound like a small box.

The high frequencies are widely dispersed, which also significantly contributes to its overall smoothness, despite a small peak at 9 kHz. The bass rolls off sharply below 60 Hz, while the harmonic distortion is very low all the way down to 50 Hz, increasing gradually below that frequency. In extended listening tests, the smooth measured response and excellent transient response showed up as a relatively uncolored, neutral sound. With one click up on the high-frequency attenuator, the speaker sounded a little more open or brighter of sound, especially on clean source material. On not-so-clean material, a slight harshness of sound developed. Except for the deficiency in the lowest audible octave, it is difficult to fault the moderately priced Dynaco A-25 speaker system.

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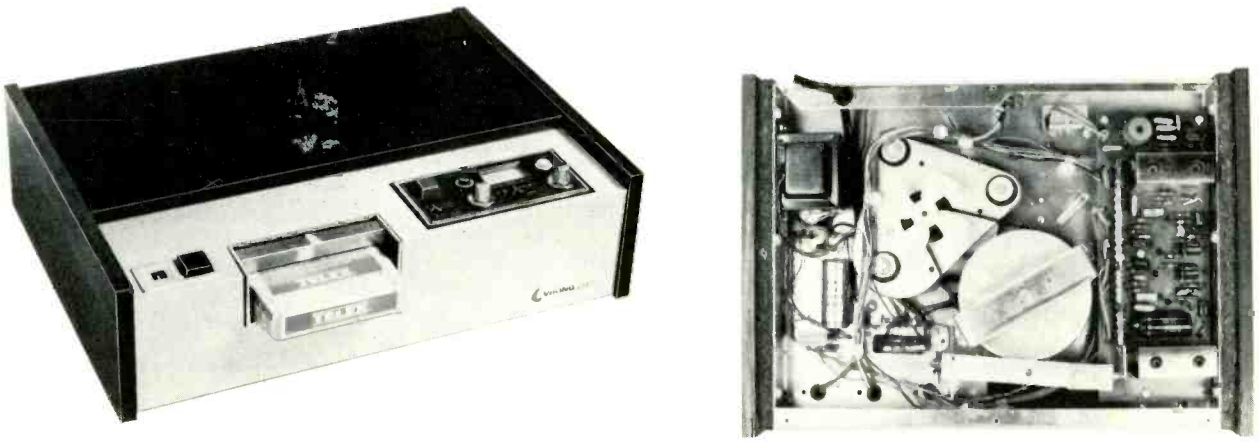


Fig. 1—Telex 811-R Cartridge Recorder/Player, with open-chassis bottom view at right.

Telex Model 811-R 8-Track Stereo Cartridge Recorder/Player

MANUFACTURER'S SPECIFICATIONS:
Tape Speed: 3¾ in./sec. Frequency Response: 40-15,000 Hz; Track Selection: Manual & automatic with auto-stop provision; Signal-to-Noise Ratio: 50 dB. Flutter and Wow: 0.3% rms; Playback Output Level: 0.75 V, low impedance for any stereo music-system amplifier. Record Level: 100 mV input for "0" level. Power Requirements: 110-120 V, 60 Hz, 40 W. Auto Stop: Continuous or after track 4 in playback mode; in the record mode at end of each program or after program #4 only. Dimensions: 15 in. W, 11 in. D, 4¾ in. H. Weight: 25 lbs. Price: $189.95

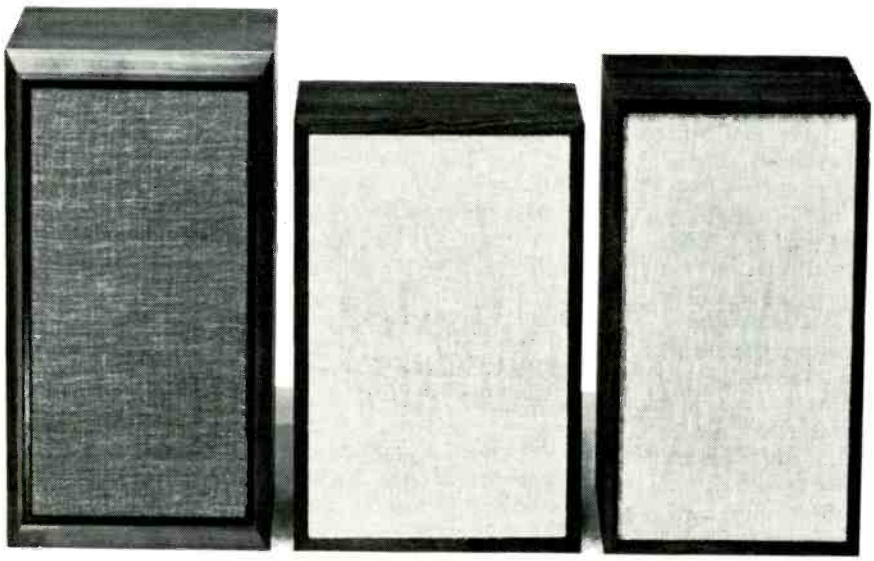
The joy of the cartridge tape player is likely to turn to frustration when the user is not a casual listener but a serious audio buff, because of the cost of the recorded cartridges. At list prices, they are somewhat over $6.00 each, and the total playing time is usually in the vicinity of 30 minutes. Yet a blank cartridge which will play for a half hour costs only $2.51 for the required 150 feet of tape, and full-hour blank cartridges run about twice that. Thus the only thing the audio buff needs to be able to make his own recorded cartridge tapes is the recorder.

Only a few such recorders have yet appeared on the market, but the current Telex 811-R is one of them which can also serve as a playback deck for the ubiquitous cartridge. Cassette recorder/players abound in great numbers, but few cartridge recorders are around.

The Telex 811-R in one of a complete line of players and recorder/players in a number of configurations—some are players only, and require external amplifiers to produce sound from the loudspeakers; others have built-in amplifiers and can drive speakers directly, and still others are complete with their own speaker systems in matching housings. We were interested only in the recorder/player "deck," which must be used with external amplifiers.

This unit is a neat package with walnut-finished end panels, a black metal cover on the back and part of the top, and with necessary controls, switches, and meter along the front of the top of the device. At the left is the program indicator, followed by the program selector button. Next is the cartridge door and slot. To their right is the red RECORD button and below it the "logic" switch which controls whether the mechanism will stop after the current program or after the completion of all four programs while in the record mode, or whether it will play continuously or will stop at the end of the fourth program.

Which of these comparably priced, top quality speakers offer you Electronic Suspension?



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Next is the left-channel record-level pot, the meter switch which selects which channel recording level is being monitored on the meter. Above this switch is the meter, which is flanked by a red light indicating RECORD on the left and by a white one indicating the a.c. power is on at its right. Next is the right-channel record-level control. In all, a neat configuration well laid out for the convenience of the user. Inputs and outputs are accessible on the rear apron, where two pairs of phono jacks are located.

In the usual type of 8-track cartridge player, the head moves through its four positions to produce four pairs of tracks. In the 811-R, the head is on a long arm which is positioned by a series of steps on the side of a ratcheted wheel. The wheel is turned through its eight positions by the action of the solenoid which steps it from one position to the next, lowering the head from the position for tracks 1 and 5 in three steps to tracks 4 and 8, then starting over again on tracks 1 and 5. This means that there is a repeating of the cycle, and each revolution of the wheel provides two complete playings of the cartridge. Projecting pins on the wheel actuate a pair of contacts to provide for the stopping at the end of the fourth program when the logic switch is set for that action. Two relays are used to control the action—one for the stepping movement of the solenoid, and the other to stop the motor when the desired part of the program has been completed.

Each channel employs three transistors, two in the grounded emitter configuration, and the third as an emitter follower. Feedback from the output emitter to the emitter of the first stage provides the required equalization, both for the playback and recording, with a switch shorting out a series capacitor which provides the low-frequency boost in the playback mode. The collector supply for the first stage is fed from the output collector, which is at a potential of 12.5 V, through a series resistor and a filter capacitor to provide 12 V to the collector load resistor (100 k ohms) resulting in a collector voltage of 1.25, which ensures a low noise level. The first stage is coupled directly to the base of the second stage, and its collector, at a 12-V potential, is connected directly to the base of the output-stage emitter follower.

The bias oscillator requires two more transistors in a push-pull arrangement, with the erase/bias current being fed to the combination erase/record/play head. The power supply consists of a 25.5-V secondary on the power transformer, and a bridge rectifier feeding an RC filter circuit. The relays and the solenoid are operated from the 32-V output from the rectifier directly, ahead of the filter. All switches and relay contacts are adequately bypassed to eliminate noise in the output when they are actuated.

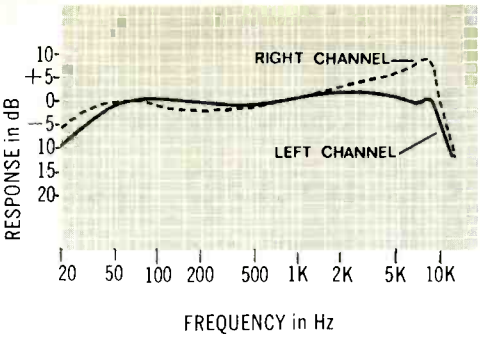

Fig. 2 — Record/playback frequency response curves for the 811-R. The rise in the right-channel output is presumed to be due to a misadjustment of the record or playback equalization.

Operation

To operate the unit, one simply inserts a cartridge into the slot, and as the cartridge reaches the play position, it actuates a switch turning the unit on. To record, the cartridge must be removed, the record button depressed, and the cartridge reinserted. To return to the play mode, remove the cartridge and reinsert it.

While recording, the program can be monitored by feeding the playback output to a pair of Telex "Amplitwin" phones, or into the microphone input of the amplifier, if one is available. Proper recording level is maintained when the meter fluctuates near the "0" (the beginning of the red line on the meter face) on the loudest portions of the program material being recorded.

In playback, the level is controlled by the external music-system amplifier, since there is no control on the 811-R for playback level.

Performance

Since we do not have a "Standard Cartridge Test Tape" (in fact, we are not sure that any such tape is available), we purchased a recorded cartridge with which to make our tests. This gave us an opportunity to listen to a typical recorded cartridge for awhile before bulk-erasing it and conducting the usual frequency-response, wow-and-flutter, S/N, and channel separation measurements. As to the reproduction from the recorded cartridge, we must admit that it was somewhat better than we had previously experienced in other cartridge players to which we have listened in automobiles. There was a minimum of observable wow and flutter—always heretofore our main objection to the cartridge player — and a pleasant balance of highs and lows in each channel. Finally we gave up listening to the recorded cartridge, dubbed its contents off to an open-reel machine, and erased the cartridge.

We next made our usual tests for frequency response, wow-and-flutter, and so on, so we could report numbers. The results of the frequency response measurements are shown in Fig. 2. It will be noted that the left channel was within ±5 dB from 40 to 12,000 Hz, while the right channel was considerably brighter in the high-frequency range, rising as much as 7½ dB over the left channel at the 8000-Hz point. We attribute this to minor misadjustment, since it is highly unlikely that the head could be that much off. In accordance with our usual testing methods, however, we made no effort to effect a correction. Levels were within 0.5 dB on both channels at 1000 Hz, however, which bears out our belief in a misadjustment of the equalization. Since we had no "standard" tape, we are unable to say whether the difference was in the record equalization or in the playback correction.

Wow and flutter measured a mere 0.23%, which is well below specification, and we measured a signal-to-noise ratio of 46 dB, which is close. The same measurement was found for channel separation, as well as between adjacent tracks. The required input signal for "0" recording level was found to be 62 mV with the record-level control at maximum, and the output signal for the same recorded level was measured at 0.8 V.

On the whole, the 811-R should serve well for the enthusiast who has a cartridge player in his car but who wants a different type of music than that usually available on the usual "pre"-recorded cartridges, which seems to be restricted to pop and folk music, and with an almost complete dearth of classical or semi-classical material, which some of us still prefer. With the recorder safely at home, however, it is possible to put any desired music on blank cartridges at a considerable saving in cost and a definite increase in enjoyment of the recorded material.

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MODEL ESP-7 ELECTROSTATIC STEREOPHONES at $79.00

Now get the thrilling reproduction of super-wide range, fatigue-free music at even lower cost than some conventional dynamic headphones. The latest addition to the breakthrough development of electrostatics by Koss is the lightweight Model ESP-7 at only $79.00. Better than any speaker system, you feel, as well as hear, the thunder of the 64 foot pipes of an organ. You experience the living, breathing reality of your favorite vocalist, the sparkle and tinkle of the celesta, crystal-like clear, with veritably measureless distortion.

MODEL ESP-7
Electrostatic Stereophones complete with SE-7 energizer and individual machine-run response curve.
$79.00

The ESP-7 connects to the speaker terminals of any good amplifier easily, quickly. It is self-powered by a small energizer in line with the cord containing convenient switch to mute the speakers, containing the matching transformers, and provision for a second headset (Model ESP-A, $59.00) for simultaneous listening by two people.

As with all Koss Electrostatic Stereophones, the frequency response is so outstanding that each headset comes with its own individual, machine-run response curve. Write today for catalog of Electrostatic Stereophones containing full information on the new ESP-7, ESP-6, and astounding new ESP-9 Studio Monitor Stereophones. Or better yet, visit your hi fi dealer and ask for a demonstration of The Sound of Koss.

SPECIFICATIONS

Frequency Response Range, Typical: 35-13,000 Hz ± 6 db (8½ octaves) 30-15,000 Hz ± 8 db. An individual machine-run response curve accompanies each headset attesting to subscription to specifications.

Sensitivity: 90 db SPL at 1 kHz referred to 0.0002 dynes/cm2 with one volt at the input. **Total Harmonic Distortion:** Less than ¼ of 1% of 110 db SPL. **Isolation From External Noise:** 40 db average through the audible range. **Source Impedance:** Designed to work from 4-16 ohm amplifier outputs. **Power Handling Capability:** Maximum continuous program material should not exceed 10 volts (12 watts). **External Power Requirements:** None.

KOSS

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AES Convention Papers

(Continued)

D6 Derivative synthesis of musical tones

Eric Gschwandtner, Radatron, Inc., North Tonawanda, N. Y.

(1:30 p.m.)

AUDIO AIDS TO MEDICINE

Chairman: Philip Kantrowitz, Sonotone Corporation, Elmsford, N. Y.

E1 Stethoscope acoustics and the physician

Paul Y. Ertel, M.D., Assistant Professor, Department of Pediatrics, Children's Hospital, Columbus, Ohio

E2 Ulstrasound in retinal-detachment surgery

David B. Karlin, M.D., Department of Ophthalmology, Mt. Sinai School of Medicine, New York, N. Y.

E3 Brain waves made audible: Encephalaphone, an electronic stethoscope for the brain

Horace T. Castillo, Eastern Research Support Center, V. A. Hospital, Yale University School of Medicine, New Haven, Conn.

E4 Signature analysis of heart sounds and murmurs

Benedict Kingsley, Hahnemann Medical College and Hospital, Philadelphia, Pa.

E5 Auto correlation and crosscorrelation applied to phonocardiograms

Samuel Litman, University of South Carolina, School of Engineering, Columbia, S. C.

E6 The effect of sound on plant growth

Paul E. Newton, Institute of Environmental Research, Kansas State University, Manhattan, Kan.

E7 The electronics of nervous transmission

Marvin D. Weiss, New Haven College, Woodbridge, Conn.

(7:00 p.m.)

A SPECIAL EVENING

SOUND REINFORCEMENT FOR THE PERFORMING ARTS

Chairman: William E. Windsor, D.B. Audio Corp., New York, N. Y.

The New York Section of the Audio Engineering Society presents this applications seminar as an educational service to all members and guests of the Society. All those professionally engaged or active in any aspect of sound reinforcement for the performing arts are invited to attend. There will be no fee for registration for this Session.

F1 Operational aspects of sound reinforcement at the Saratoga Performing Arts Center

Stanley Hanna, Saratoga Peforming Arts Center, Saratoga Springs, N. Y.

F2 Sound Reinforcement in the theatre

T. Richard Fitzgerald, Sound Associates, Inc.

F3 Sound Reinforcement in the music pavilion

Christopher Jaffe, Christopher Jaffe, Inc., San Francisco, Calif.

An informal question and answer period will follow each of the speaker's presentations.

Wednesday, October 15:
(9:00 a.m.)

DISC RECORDING

Chairman: John M. Eargle, Mercury Records, New York, N. Y.

G1 Straight-line phonograph arms and devices

Jacob Rabinow, RABCO, Silver Spring, Maryland

G2 Frequency response analysis of phono pickups on calibrated test records

Bernhard W. Jacobs, Shure Brothers, Inc., Evanston, Ill.

G3 The second-generation dynamic recording correlator

E. C. Fox, RCA Laboratories, Princeton, N. J., and Michel Pradervand, RCA Records, Indianapolis, Ind.

G4 Development and application of a new "Tracing Simulator"

Stephen F. Temmer, Gotham Audio Corporation, New York, N. Y., and Dieter Braschoss, Georg Neumann, GmbH, Berlin, Germany

G5 Improvements in performance of the Westrex 3D Stereodisc Recorder

Frank E. Pontius, Westrex, Hollywood, Calif.

G6 Octave-band power distribution of recorded music

Banjamin B. Bauer, CBS Laboratories, Stamford, Conn.

G7 An experimental study of groove deformation in phonograph records

James V. White, Acoustics Research Laboratory, Harvard University, Cambridge, Mass.

(1:30 p.m.)

AUDIO ABROAD I

Chairman: J. L. Ooms, Philips' Phonographic Industries, Baarn, The Netherlands

H1 Psychological evaluation of nonlinear distortion

H. Yahiro, A. Kameoka, and M. Kuriyagawa, Toshiba Research and Development Center, Kawasaki, Japan

H2 Phenomenological interpretation of the print-through effect by means of the Preisach diagram

Jiri Struska, Research Institute of Sound and Picture (Vuzort), Prague, Czechoslovakia

H3 Correct spatial sound perception rendered by a special 2-channel recording method

R. Kurer, G. Plenge, H. Wilkens, Technical University, Berlin, Germany

H4 Loudspeakers for model investigations

Ales Boleslav, Research Institute of Radiocommunications, Prague, Czechoslovakia

H5 Where is recording going?

Peter K. Burkowitz, Deutsche Grammophon Gesellschaft mbH, Hannover, West Germany

H6 Music and recording in the Soviet Union

John M. Woram, RCA Record Division, New York, N. Y.

H7 Means for visual indication of the overload limit for audio power amplifiers

Luciano Foa, Voxson, Rome, Italy

(6:00 p.m.)

SOCIAL HOUR

THE MERCURY ROTUNDA

(7:00 p.m.)

AWARDS BANQUET

MERCURY BALLROOM

Guest Speaker: Dr. Frank Stanton, President, The Columbia Broadcasting System

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Thursday, October 16:
(9:00 a.m.)

AUDIO ABROAD II

Chairman: P. K. Burkowitz, Deutsche Grammophon GmbH, Hannover, West Germany

I1 The electro-acoustic transducer for the measurement of acoustical impedances

Tomas Salava, Research Institute of Radiocommunications, Prague, Czechoslovakia

I2 Amplification of sound fields without instability

N. V. Franssen, Philips Research Laboratories, Eindhoven, The Netherlands

I3 Modern electro-acoustics in the theater

A. A. Freund and W. Sziemer, Wiener Schwachstromwerke GmbH, Vienna, Austria

I4 A system approach to stereophonic recording

V. Zugio, Radio-Televizija Beograd, Belgrade, Jugoslavia

I5 Low-distortion loudspeaker system

T. Sugimoto, S. Kawamura, and A. Ema, Hitachi Ltd., Yokohama, Japan

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"In 1947 we developed a cutter system which enabled us to issue the first wide-range 15 kHz recordings, known as ffrr, which really revitalized the gramophone industry. In 1957 we also offered the first available catalogue of 45-45 stereo recordings. And in November 1965 we had the opportunity of first evaluating and adopting the Dolby System; we purchased the entire first five months of Dolby production. With over fifty A301 units in service in our recording facilities in London, Rome, and Vienna, we have since May 1966 recorded all of our major productions using this new technique. We have an enormous classical catalogue of immense value, both financially and artistically; with the problems of tape hiss and print-through, we think that the Dolby System is an insurance on the future."

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AES Convention Papers

(Continued)

I6 Hi-fi and studio engineering: Notes on quality of sound transmission

Ernst-Joachim Volker, Hessischer Rundfunk, Frankfurt/M, West Germany

I7 An electronic forward drive in transcription turntables

Frank Hirsch, Thorens-Franz AG, Wettingen, Switzerland

(1:30 p.m.)

MAGNETIC RECORDING

Chairman: R. C. Moyer, RCA/Record Division, Indianapolis, Ind.

J1 The design of a high-performance tape-duplicating system

Peter F. Hille, Ampex Corporation, Special Products Division, Redwood City, Calif.

J2 Musicassette interchangeability: The facts behind the facts

E. R. Hanson, North American Philips Corporation, New York, N. Y.

J3 Performance characteristics of commercial recorded tapes

John Eargle and James Ward, RCA Records, New York, N. Y.

J4 Beamed-bias synchronous record-reproduce head using multiple-aperture, multiple-winding construction

Keith O. Johnson, Gauss Electrophysics, Inc., Santa Monica, Calif.

J5 A d.c. servo-controlled magnetic tape transport

Gerald S. Macdonald, Magnetic Recording Systems, Inc., Westbury, N. Y.

J6 Signal conditioning for slow-speed tape recordings

James B. Wood, GRT Corporation, Sunnyvale, Calif.

J7 Optimizing the subjective signal and noise levels in commercial tape records

J. G. McKnight, Ampex Stereo Tape Division, Redwood City, Calif.

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Martin Audio equipment doesn't do a single thing for sound men

(2 or 3 or 4 things is more like it.)

If there's one thing audio men have in common, it's the unpredictability of their jobs. One day they're working with a string quartet, the next it's a rock group with their electric-this and synthesized-that. No sooner have they equipped their sound studios than they're asked to do a concert in the park. So we've designed our line of equipment to do a bit more than most—if it doesn't let you predict the unpredictable, at least it helps you cope. For example:

Varispeed III—varies recorder speed for creative/corrective uses

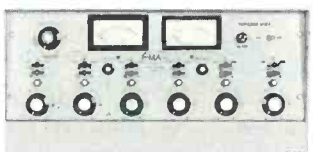
Most of our Varispeed III customers started off with just one use in mind . . . and then discovered all the things continuously-variable recorder speeds can accomplish. Like correcting tapes recorded off-speed. Or doubling recording time by half-speeding the recorder. Or creating sound effects and electronic music. Or driving American (60-cycle) recorders on European (50-cycle) AC, or vice-versa. Or transferring motion picture tracks from 50- to 60-cycle standards. Or taking the sharps and flats out of a singer's solo, or assisting his achievement of an ultra-high (or low) note. Varispeed III does all these things—and more—by simply acting as a variable frequency power source for the recorder's capstan motor. Frequency can be swept from 25 to 80 cps, or synced at 30, 48, 50 and 60 cps; exact calibration is read from a large meter. Plugging directly into most professional recorders without modification, rack-mountable or transportable, the Varispeed III is, as you can see, the answer to a lot of problems.

Sonomix 602—portable stereo console with echo mixing

Designed for stereo recording with echo facilities in both studio and field, the 602 offers the best of both worlds: the specifications and versatility required by studio applications, plus the portability and ruggedness essential on location. All six channels have line-mike input keys, left-center-right output keys, and echo send pots. Solid state, modular construction; powered by AC or nicad pack. Special models suit requirements of recording, broadcast studios.

Sonomix 601—most versatile six-channel mono mixer

Like our 602, the 601 is intended to serve the audio engineer who requires the highest-quality performance both in the studio and on location; it fulfills its purpose by combining studio specifications with the light weight, compactness and exceptional durability necessary for reliable field use. The unit may be driven by AC, or by its own ni-cad battery pack for more than thirty hours on a single charge. All inputs are instantly switchable between line/mike.



So there you have it—multi-purpose gear with more uses than you'd expect, so you can master the unexpected. A handy formula, yes? Write for complete details on the units that will do the most for you.

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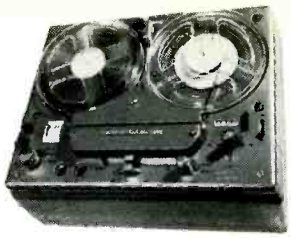
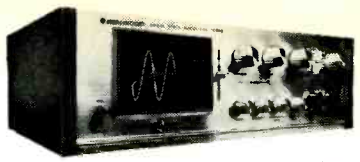
Panasonic **RS0790S** automatic-reverse tape recorder ($329.95).

Pioneer **T-600F** tape deck with automatic reverse ($299.95).



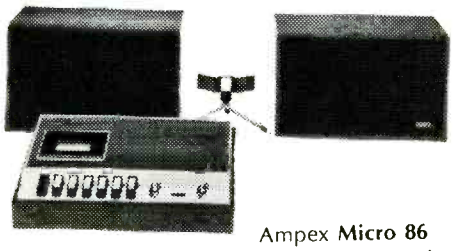
Tandberg **1200X** tape recorder with Cross-Field head ($485.00).



Kenwood **KC-6060** "Audio-Lab Scope" includes stereo display and FM multipath viewing facilities (under $200.00).

Koss **ESP-9** self or a.c.-line energized electrostatic stereo headphones covers 10 octaves ±2 dB ($150.00).

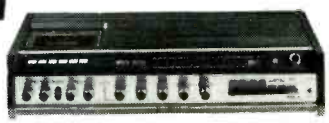
TEAC **A-7030** 15 ips/7½ ips tape deck can use up to 10" reels ($749.50).



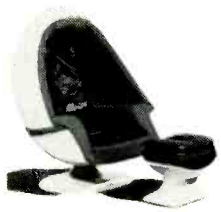
Ampex **Micro 86** stereo cassette player/recorder with 516 speaker systems ($199.00).

Harman-Kardon **CAD-4** stereo tape cassette deck ($159.95).

Craig **3302** 8-track record/playback deck ($139.95).



Scott **3610** stereo FM/AM receiver with built-in cassette recorder ($399.95).



The LEE "Music Chamber" contains two speaker systems formed into a partially enclosed lounge chair.

BEHIND the SCENES

The Missing N. Y. Hi-Fi Show

(continued from page 14)

had such an event. When possible, these would be co-operative events with local dealers. Unquestionably, there is much merit in such shows. You may remember some years ago that Electro-Voice hired a huge tractor-trailer which they had outfitted as a living room, with the facility to run A/B tests between various speakers in the "room." This truck criss-crossed the country for several years and brought real high-fidelity sound to small towns and hamlets for the first time, most of them being many miles from a hi-fi dealer. This was a successful idea, but as can be imagined, quite expensive.

As you might expect, the "little" hi-fi manufacturer (some of whom have been little a long time) was highly incensed with the idea of the Coliseum, and staunchly defended the hi-fi shows as we have known them. One manufacturer made an impassioned speech in which he accused the "big boys" of forgetting who was responsible for the hi-fi industry. He decried the practice of making the hi-fi "nut" the whipping boy. He went on to remark that much of the early excitement of the hi-fi business was lacking now due in large part for this mania to expand into the "mass market."

Well, there are two sides to every story, but I personally am inclined to sympathize with the smaller, more traditional hi-fi manufacturers. Without being blind to a certain amount of progress, it is very difficult for one reared in the high-quality aspects of hi-fi to envision these products in a true mass-market situation. Hi-fi equipment almost by definition is unique. Certainly a lot of it is built by modern methods, which can increase production without sacrificing quality. There is understandably very little left of manufacture by the "craft guild" ("made in der voods by elves") methods. Nevertheless, a good component hi-fi product has a certain cachet of being better and of a different level of quality than the products of the mass market.

As to hi-fi shows in the traditional presentation, it is largely true that there is a great deal wrong with them. They are usually overcrowded, it is always stiflingly hot in the rooms, and with rare exception the judgment of sound in these rooms is often misleading. Balancing this, however, is that we get a chance to see the various new equipment and are at least able to decide whether we want to hear the equipment later under better conditions at a hi-fi dealer's salon. And the one priceless element that makes a show worthwhile is the chance to meet the manufacturers . . . your ultimate expert . . . in the flesh. To be able to discuss your hi-fi problems with the man who is thoroughly familiar with your amplifier, for example, is a unique experience. I don't say that we should automatically rule out Coliseum-type hi-fi shows. Given pre-fab rooms that are truly effective in isolating sound and affording attractive displays, it would at least give us the chance to find out whether there is or isn't a mass market for hi-fi components. To assure success (from an attendance and cost view) in a large exhibit area, there is always the possibility of combining a component hi-fi show with another show, say, household furnishings, photographic equipment, etc. Too, there have been rumors that the sprawling Consumer Electronic [Trade] Show will have a "consumer day" next year. Other alternatives include Metropolitan New York City suburban shows, and regional shows. Or no shows at all. As it is, we can only lament the cancellation of this year's New York show, and hope that in some format it will be back with us next year. Æ

Make Music Not War.

RCA's Red Seal Tape ends the conflict between the real and the reel.

Sometimes a music tape you make at home sounds like there's a battle going on in the background.

Banging and clunking and popping like machine-gun fire.

But leave the recording of battles to newsmen.

When you want music you don't want war.

So the first thing you should do is check out your equipment.

If everything checks out it might be your tape.

To record beautiful music you have to use a tape that doesn't cut off the highs or the lows.

Like RCA's Red Seal.

It's made under white room conditions so it won't distort or blur or fight with whatever you record.

Red Seal is formulated with special lubricants that make it track easier—with less friction.

Which means your guides and heads last longer.

Even if you're making a demonstration tape or whatever, you'll be pleased to find out Red Seal's signal-to-noise ratio meets professional standards, too.

It's easy to spot Red Seal. Its bright red box stands out like a flare.

Strike for peace. Use Red Seal for your recordings at home.

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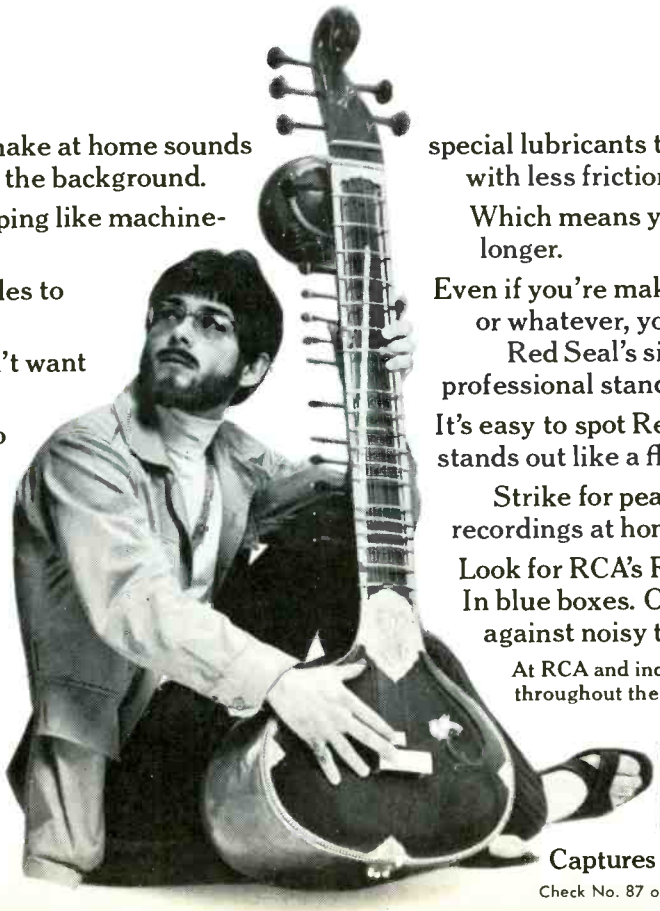

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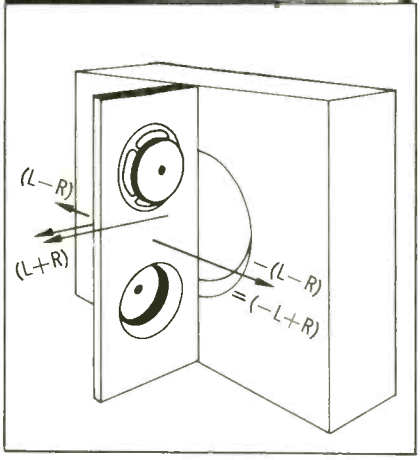
SINGLE-SPEAKER-ENCLOSURE STEREO

C. G. McPROUD



← Fig. 1—The "insides" of the new Jensen Stereo-1® single-cabinet stereo speaker system. All speakers are full-range models.

THE OLD SAYING that "it takes two to stereo" has just been repealed. Jensen's new "Stereo-1"® eliminates the need for two separate cabinets to re-create the right and left channels. That is, two *small* enclosures, since single eight-foot-long enclosures with separate speaker systems at each end do exist.

The new system, first previewed to the press on August 18, actually involves three separate loudspeaker mechanisms, but they are all in *one* cabinet. Jensen engineers took a page from the microphone art and resurrected the "M-S" mike technique, reversed it, and ended up with a stereo signal in the air from one cabinet.

In the M-S (mid-side) microphone, one cardioid unit faces the performers directly. A second unit, of the Figure-8 pattern, is arrayed so that its plane of *minimum* signal is in the same direction. When the two outputs of these microphones are matrixed, two separate signals result—the familiar right and left.

In the "Stereo-1," one full-range 8-inch speaker faces directly forward and provides the "L + R" signal, as shown in Fig. 1, while two smaller full-range units are mounted perpendicular to the first one, facing in opposite directions. These are fed the (L − R) signal *out of phase*, so that both cones are moving in the same direction. The outputs of the larger L + R cone and of the two smaller L − R cones matrix acoustically in front of the cabinet and we have stereo! Of course, all of this requires a nice balance between the efficiencies of the speaker mecha-

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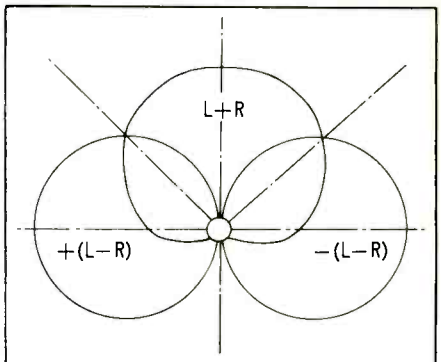

Fig. 2—Polar diagram of the action of the speakers in the M-S configuration.

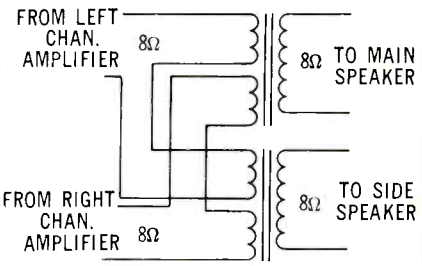

Fig. 3—Electrical sum and difference formation with matrixing transformers.

nisms, as well as a pair of matrixing transformers to convert the "right" and "left" amplifier outputs to the L + R for the frontally positioned speaker, and to the L − R for the sideways-mounted units, but this has been done effectively by Jensen, and the result is a speaker "system" for stereo which is all in one cabinet—the goal of speaker manufacturers for years.

A complete discussion of the M-S microphone technique appeared in the April, 1959, issue of AUDIO, and the cardioid and figure-8 patterns of Fig. 2 are reproduced from that article. Also appearing in that issue was a schematic of a matrixing transformer, shown in Fig. 3. When we first saw and heard the "Stereo-1," we immediately recalled the microphone technique. It works with microphones, and it works in reverse with loudspeakers.

The "Stereo-1" therefore offers a space-saving advantage to the person who lives in a small apartment, or who has a system in a den, dormitory room, mobile home, or even a boat since only one cabinet is necessary. The effectiveness of this new component will be reported upon in a near-future issue. *Æ*

AUDIO MUSIC REVIEW

Classical Record Reviews

Edward Tatnall Canby

Collections

Handel Overtures and Sinfonias. English Chamber Orchestra, Bonynge.
London CS 6586 stereo. ($5.98)

Seven Handel opera overtures, plus assorted other orchestral music, all in the grandest festive late-Baroque style, make up this showy disc, as knowledgeably and musically played as any I've heard out of England. Most of the overtures begin in the pompous dotted-rhythm "French" style, but there is enough variety, via overtures that start with fast movements, added dance pieces, and several brilliant sinfonias, to avoid monotony.

As Baroque followers know, there were unwritten ornamentations and alterations in Baroque style that, until recently, were lost in performance practice—we performed on the mistaken theory that the notes should be played as written. Scholarly harpsichordists and solo recorder players were the first to re-establish the liberated, half-improvised ways of playing that existed in Baroque times. Instrumental groups, having to play together, have taken longer to come around and only very recently have orchestral musicians come to understand that in all truth they must play what they do *not* see on the printed Baroque page (unless somebody writes it in for them).

A major interest in this disc, then, is the all-out fashion in which a profusion of ornamentation is added to Handel's scoring—trills, appogiaturas and other alterations throughout the music, notably in repeated passages. The "French" opening movements, too, are brilliantly played with the correct double-dotted (short, quick) fast notes. I'd say this orchestra and conductor go further in these respects than anything I have previously heard. They do it surprisingly easily, with a very natural flow.

The music is taken from numerous operas—Berenice, Teseo, Rinaldo, and so on, and oratorios—Solomon. A number of items are familiar from Sir Thomas Beecham's once popular Handel arrangements. If you knew them then, you'll hardly recognize them in this, their more elaborately decorated original form.

Performances: A— *Sound:* B+

John Philip Sousa Conducts his Own Marches.
Everest 3260 sim. stereo. ($4.98)

The real Sousa, in the (recorded) flesh, just as many older people can remember him via the many tours and countless public performances of the famed Sousa's Band back in the days around World War I, is here resurrected in very tolerable acoustic-type fi, minus the surface noise of the original commercial discs on which these recordings were presumably first heard. I don't know where Everest could have unearthed these — evidently from original masters — but wherever they come from they are welcome. The further we get away from Sousa, the less we take him for granted—he is much too good. Distance in time brings his famous and numerous marches ever closer in quality to the similar waltzes of the Strauss dynasty and the hilarious music of Offenbach.

Everest cannily does not say whether this *is* Sousa's own band, or maybe the Marine Corps band (which he had previously led for a dozen years) or some other—it doesn't much matter to us, just so long as Sousa is on the podiim and the music is by Sousa. Not all of it is; but out of the ten numbers seven are the real thing. Just as well to have somebody else's music, for comparison.

Listening to this historic playing—would it be (as per the recorded sound) —in the early twenties?—we note mainly that Sousa's tempi are just a bit on the leisurely side as compared to the average of today. Perhaps it's just the style of playing, not the actual speed. In any case, since legs are longer now, tempi by rights ought to be slower, not faster, so the marching men can keep time. But who *marches* to Sousa? Most of us just listen. That, of course, makes him technically classical.

Performances: A *Sound:* C

(More reviews on page 92)

Schumann-Heink (Arias from assorted operas), recorded 1906-1913.
RCA Victrola VIC 1409 mono. ($2.50)

Madame Ernestine Schumann-Heink (Great Voices of the Century).
Everest/Scala (Period) SC 874 mono. ($2.98)

In my earliest childhood I remember hearing on the radio each Christmas eve a famous old lady opera singer would come out of retirement to render one meltingly eternal song in her own native German—Heilige Nacht. Silent Night. Memory tells me that at her somewhat advanced age she had a chest tone of positively basso proportions, into which she would suddenly descend from a little-girl soprano high range to bellow out the bottom notes of the tune. It quite frightened me—I didn't know ladies could turn into basses. That was Ernestine Schumann-Heink, a much beloved German singer in the golden age of Italian opera.

Here she is, in earlier prime, on two records, almost simultaneous, with no less than four items in common out of the dozen on each. (Very strange, these seeming coincidences.) Everest's disc tends towards specialty songs, oratorio, songs in English by such sentimental favorites as Nevin and Carrie Jacobs Bond, not to mention Silent Night. The RCA collection is all opera. An unusual item on Everest is the Schumann song Monadnacht, quite beautifully sung. On RCA there is a splendid Mozart aria, from La Clemenza di Tito, two

Meyerbeers, two Wagners and two Saint-Saëns. Obviously you should acquire both if you are interested. Yes, the chest tone *is* audible now and then, but it is well styled in the manner of the day—she was decidedly a big singer with a voice to match her matronly figure.

Everest's LP is taken from shellac pressings, the noise doctored but still variably loud, the singing occasionally slightly scratchy, if strong. RCA's would seem to be from extant masters (or some degree of sub-master), perhaps as used for stamping U. S. releases on the old Victor label. The noise is less, the voice smoother, the level lower. Both are entirely listenable.

It should be added that Everest gives no supplemental information, whereas RCA gives quite a lot. Everest does identify Caruso, who sings with Schumann-Heink in one number (Ai nostri monti) but doesn't even notice the anonymous baritone who sings with her in Das Rheingold (Weiche, Wotan)—RCA tells us who he is: Herbert Witherspoon of the Met. RCA also gives all recording dates, mostly 1906 through 1909.

Artur Rubinstein The Guarneri Quartet Brahms: The Three Piano Quartets, Op. 25, 26, 60; Schumann: Piano Quintet, Op. 44.
RCA LSC 6188 (3 discs) stereo. ($17.95)

Beethoven: The Complete String Quartets and the Grosse Fugue. The Fine Arts String Quartet.
Everest 3255 (9 discs) stereo. ($44.82)

Here on a dozen LP stereo discs is enough first class music to keep you busy for months on end—and in both cases the albums are well worth whatever vast sum you will have to pay for them.

The older he grows, the more mellow is Arthur Rubinstein's astonishingly virile playing. In the three Brahms works for piano, and three strings, plus the familiar Schumann Quintet, adding the second violin, Rubinstein plays with the young members of the Guarneri, whose total age, the four of them added together, is hardly more than his own. It is an excellent combination. For without Rubinstein these young players would be all efficiency and technique but minus the depth which long experience can provide; on the other hand, Rubinstein—unlike a good many other superstars of his generation—plays a marvelous ensemble performance, blending perfectly, ever attentive to the proper over-all balance of the group, taking a musical back seat whenever the sound requires it as though he were not in fact one of the ranking virtuosi of the immediate and glorious past. Astonishing. But more astonishing is the subtle influence of the old master on his young colleagues, in virtually every phrase and every moment of emphasis. He is the leader, and his way of shaping a melody, unobtrusively, nevertheless has that incredible finesse that comes from long experience in the grand traditions of the past. The others gratefully pick it up from him. RCA's musical balance in the recording is, too, perfect in its way, giving just the right importance to each instrument and to the ensemble sound.

The various Beethoven Quartets in recordings by the Fine Arts Quartet seem to have been around, in my mem-

ory, ever since the pre-disc stereo days, when this group pioneered with some of the very first quartet recordings to appear on (two-track) stereo tape. This vast collection must by inference have spread over a fair span of time in the making—but no matter. The sound is plenty adequate, new or old, and one is aware of only unobstrustive sonic differences from one group of quartets to another.

I can imagine no better way to introduce one's self to the fathomless wealth of this music than this particular album. The Fine Arts is not the most "acclaimed" of quartets, but in its own way it is one of the great ensembles, impeccably versed in the traditions of quartet playing and of Beethoven performance, its ensemble as precise and accurate in detail as any group that ever wielded bows, its musicianship ideal in terms of pitch, rhythm, harmonies. The Fine Arts, it is true, cannot quite equal a few others, notably the famed Budapest, in sheer musical projection and intensity. The Fine Arts voltage is moderate throughout, only once in awhile taking off into the kilovolt passion. Their approach is suave, rather than intense. They do not extract as much from Beethoven, nor as fiercely, as the Budapest Quartet.

On the other hand, where the Budapest, especially in later years, took advantage of the quartet player's traditional right to sacrifice accuracy to impassioned expression, the Fine Arts it totally impeccable; virtually every chord, every note, is in its exact place. For those who are not yet quartet experts, that is a boon! Too often (as with much singing, too) string quartet music is no more than a lot of passionate noise to the learning ear. You can't tell where the notes are, you miss the sense of the harmonies, you lose the rhythms. For the experienced listener, the Budapest versions make ultimate sense. For the aspiring newcomer, I'd suggest the Fine Arts any day.

When you have come to know some or all of this music to your own satisfaction, *then* go out and buy up some Budapest versions, or others played by the more passionate groups.

Performances: A— *Sound:* B— to B

Four Favorite Trios/Istomin-Stern-Rose. (Beethoven "Archduke," Brahms: Trio No. 1 Op. 8; Mendelssohn: Trio No. 1; Schubert: Trio No. 1 in B Flat).
Columbia D3S 799 (3 discs). ($17.94)

Here is another album of piano trios, excellent but very different in playing style and sound.

Instead of a serene old master and his talented cohorts a third his age, here we have three solidly middle age pros, each important in his own right, each with an equal voice in the proceedings. If in the preceding RCA album Rubinstein gets a trace more microphone limelight than his companions—no harm done at all—in this recording the violin and cello are as close and loud as the piano, and the three instruments tend almost to compete for sonic attention, one good way to create a high musical intensity. This is more of a standard high-level pro performance than Rubinstein's with the young Guarneri players, more impassioned and dramatic, less precise in ensemble, with less blend and more of those expressive inaccuracies that seem almost to be a part of Romantic styling. It will please the chamber music specialists immensely, and rightly; but it may be more difficult for relative beginners than the Rubinstein Guarneri.

Of the four works, it struck me that the Schubert was a "natural" for these players and the Beethoven almost as much so. All four are done with fine musicianship and immense energy. The recorded sound, louder and a bit coarser than RCA's, is somewhat wiry in tone and the instruments are close up in a fairly large liveness.

Performances: B+ *Sound:* B—

Classical Record Reviews (continued)

Haydn: Baryton Trios (Nos. 44, 70, 60, 45).
Johnannes Koch; Ulrich Koch, vla., Reinhold Johannes Buhl, cello.
RCA Victrola VICS 1425 ($2.50)

For years I've wondered about the Haydn Baryton Trios. Everybody with an interest in music history has heard about them—but who has ever heard the *music*? Here, at last, is a micro-sample of the 125 works, 96 of them still extant and playable assuming you have a baryton and a performer who knows how. Maybe four examples are enough, for the moment, though I wouldn't mind hearing another four, and maybe even a dozen or two, given time.

Baryton? Not a baritone, but a weird stringed instrument, one of those freaks that developed in the 17th and 18th centuries along with the great mechanical revolution that brought to civilization both "practical" and musical machinery of a complex order. Like a viola da gamba, this monster has six strings for playing via a bow, with frets like a guitar to fix the pitches; but in addition there are ten or fifteen metal strings running under the finger board (somewhat as in the viola d'amore) which are sympathetic—they resonate without being touched—and also pluckable via one thumb. You can bow and pluck at the same time, if you know how. The instrument is so zany and difficult, though, that it's a wonder it persisted at all.

Why Haydn? Politics, as we would say. His patron, or boss, Prince Nicholas Esterházy, was nuts about the instrument. It was his special hobby, and he demanded a steady fare of new music for his own performing. Haydn, ever accomodating and fruitful, obliged.

The music isn't very prepossessing, nor exactly overwhelming, but just as the Prince enjoyed playing it, so skillfully is it put together, so we can enjoy listening to the work of a master composer, trifling but utterly elegant.

Suffice to say that these performers have the music decidedly in hand and the baryton itself sounds suavely professional in its effect, in truth like a viola da gamba (slightly cold-in-the-head in tone) with added *pizzicato*. Not a sensational record; just an interesting one.

Jacqueline du Pré—Haydn: Cello Concerto in D. Monn: Cello Concerto in G Minor.
London Symphony, Sir John Barbirolli.
Angel S-36580 stereo ($5.98)

This one can be summed up quickly enough. Miss Du Pré, one of the most charmingly gifted young cellists around, is here teamed up for a Baroque and a "classic" 18th century concerto with an old-fashioned big symphony orchestra and its decidedly older-minded conductor. The result for any ear accustomed to (a) good Baroque (the Monn) and (b) good Haydn, is pure anathema. Great big, fat, sluggish Baroque sound, a far-too-large aggregation playing in the style of thirty years ago. And, similarly, an old-fashioned Haydn with the same too-big orchestra and sluggishly thickened sound. Was Miss Du Pré pushed into all this by circumstances—? Most performers her age have very different ideas. Or doesn't she know the difference?

Of course those who simply enjoy symphony-orchestra music, the people who go to symphony cencerts right along, or who buy mainly "symphony" records, will find this a lovely disc. Nothing wrong with it except the style of presentation. The musicality is OK enough.

John Browning Plays Ravel (Sonatine; Le Tombeau de Couperin; Gaspard de la Nuit).
RCA LSC 3028 stereo ($5.98)

Ravel—for some, including this reviewer—was one of the greatest piano composers who ever lived. Technically he was perhaps not as forward-looking (after the fact) as Debussy, who anticipated much in later piano technique; but in his own way Ravel wrote piano music so extraordinary that no composer could ever have followed him. No other piano music sounds even remotely like Ravel. An the astonishing thing is that much of it is also, in alternative versions, music of extraordinary power in orchestral dress, as, for example, the Tombeau de Couperin on this record, which is more familiar in its lovely orchestral version yet is the purest piano music as well.

One approaches a disc like this, by a young pianist, with plenty of doubts. Ravel is a very special idiom. Will he understand it? No problem—John Browning does, and to perfection. I have heard more thundering Ravel, more high-tension; and there are playings more impressionistic. No matter. Browning is utterly master of the Ravel idiom here, as though he had played nothing else for years. Every one of those delectably complex higher-overtone harmonies, the ninths, eleventhS, thirteenths, is as clear as a bell, the bitter-sweet "antique" flavor is nicely projected. The early Sonatine is a bit on the gentle side; the familiar Tombeau de Couperin (with the fugue

movement, omitted from the orchestral version) is absolutely lovely, Gaspard de la Nuit, fiendishly difficult, is a marvel of fluent precision.

Performances: A— *Sound:* B+

Mozart: Four Piano Concertos (K. 467 in C, K. 488 in A, K. 466 in D mi., K. 537 in D). Ingrid Haebler; London Symphony, Rowicki and Galliera.
Philips PHS 2 906 (2 discs) stereo. ($8.96)

Ingrid Haebler, born in Vienna, plays a lovely Mozart, well phrased and fine toned, a bit on the buxom side and not at all recherché. Though she is a Mozart specialist, she does not belong to any sort of Mozart cult, or so she says plainly in her music. So much the better! It is straightforward, and never holier-than-thou.

The London Symphony is one of those modern virtuoso recording outfits that—through long experience—can read almost anything at sight and record it very shortly thereafter. The Mozart in these concerti is impeccable in detail, full of outward expression in all the right places, but nevertheless a bit on the matter-of-fact side, not really well shaped. It did not seem to matter whether the conductor was Rowicki or Galliera, the effect was the same. The orchestra has a rather large sound, as Mozart orchestras go, which will please many and perhaps displease a few. I would prefer a smaller, clearer ambience—though, to be sure, these are late Mozart and thus have a right to sound big.

Performances: B+ *Sound:* B

Erik Satie Piano Music. Frank Glazer.
Vox SVBX 5422 (3 discs) stereo. ($9.95)

Frank Glazer, of the Eastman School, is a fine pianist and musician. This is a splendid big effort, adding more first-line material to the sudden revival of the French gadfly composer who kept the French musical world on its toes for thirty years or so after the 1890s. And yet—somehow, Glazer is not the man for this music, in spite of his informed, carefully styled performances.

Matter of opinion, of course—but it seems to me that old Satie, like young Poulenc after him and many another of the snazzy generation, needs a certain glassy, pseudo-deadpan style of hard playing, a kind of exaggeration in reverse, to bring out the wickedness and satire as well as the simplicity in this music. Glazer plays it quite otherwise, with considerable seriousness, quite a lot of pedal and a good deal of rubato. He is Romantic-Impressionist in his approach, where neo-classic might do better.

To be sure, most of Satie's well known works date from the Impressionist era, the first years of the century. Some of Satie's music sounds like Debussy—even to an extent anticipates the late Debussy style. But many of the little ironic trifles with the zany names are satirical in a way that becomes merely tiresome when the music is given too much expression. Before splurging on this bargain set, listen to a few of the excellent Satie recordings by pianist Aldo Ciccolini on three (more expensive) Angel discs. For my ear, he has the style and content down to perfection.

Performances: B— *Sound:* B

Chopin: Piano Concerto No. 2; Rondo in C for Two Pianos. Samson François; Monte Carlo Opera Orch., Frémaux. Pierre Barbizat, 2nd piano.
Seraphim S-60109 stereo. ($2.49)

Though the last movement is a bit

messy in detail in the orchestra (it often is), this is one of the most pleasingly musical and fresh performances of the familiar Chopin Concerto out of dozens of versions made available over the years. François is a towering pianist, not only in his lean, strongly masculine technique but in the tempered plasticity which it supports—never a harsh note, never a poor phrasing or over-played climax. Indeed, where his Debussy (on a recent Capitol semi-pops release) was astonishingly big and loud, this Chopin is in the true, and often neglected, Chopin tradition, strong but on the whole gentle, sweet, somehow languid even in its most flowery bursts of piano brilliance. First class Chopin player, this Samson François.

Equally attractive is the fresh, sincere sound of the orchestra in the long opening passage of the concerto before the piano makes its dramatic entrance-music that is too often churned out in a most perfunctory fashion by orchestras with much better reputations than this minor-league outfit.

The Rondo for two pianos is a very early work, gorgeously laid down for two enormous instruments, nicely spaced in stereo, a splendid sound but of no great musical profundity. Two or three nicely sugared tunes and a great deal of elaborately decorative passage-work, set—for Chopin—to rather conventional harmonies. Derivative. After all, he must have been about 17, no more.

Performances: A— *Sound:* A—

The Rococo Cello. Janos Starker, Castle Hill Festival Orchestra, Pilzer.
Everest 3257 sim. stereo. ($4.98)

Sometimes these tricky titles, designed to catch the eye for sales, go too far altogether. This one caught me, as did the color photo of a fantastically carved and curliqued Rococo-period cello—also the name Janos Starker, he being one of the sterling cellists of our day.

All we have here is that too-familiar old Boccherini Cello Concerto, the one that *every* cellist plays. And a somewhat doubtful cello arrangement of a Mozart Horn Concerto that would surely be more appealing in its original form. Even Janos Startker isn't going to make this combination amount to very much. And the recording is an old one, treated to updating via simulated stereo. Vintage Starker, if you will, but otherwise hardly exciting.

Popular Classics in Brief

Peter Nero: Fantasy and Improvisations. Gershwin: Concerto in F. With P. Nero, piano, Gene Cherico, bass, Joe Cusatis, drums. Boston Pops, Fiedler.
RCA LSC 3025 stereo. ($5.98)

'Yall know the Gershwin Concerto in F, late, hectic Gershwin-turning-classical, more nervous, less spontaneous than the earlier Gershwin. 'Yall probably know Nero, too. This big, bloaty opus of his is (for my ear) merely the latest in those pseudo-semi-Rachmaninoff monster concertos that combine the worst excesses of late Romanticism with the least inspiring elements of routine super-virtuoso jazz and show music. Full of sound and fury, signifying not very much. Take this from a confirmed classicist—me—who enormously prefers the Beatles, Simon & Garfunkle, the Supremes and *early* Gershwin to this sort of big fatso sound. Even Fiedler can't warm it up very far.

Bizet: Carmen and Arlésienne Suites. Sinfonia of London, Mathieson.
Crossroads 22 16 0222 stereo. ($2.98)

The familiar suites are played by a big-sounding orchestra in a large and somewhat cumbersome space—a bit of that *ker-plunck* sort of reverb gets mildly in the way of a chord or two, here and there.

Three Centuries of Military Marches. Deutschmeister Band, Hermann.
Everest 3245 stereo. ($4.98)

Forget the three centuries—it all sounds like band music, with only minor variations for the casual ear. What does come through is (a) the typically solid, slightly tubby sound of a European band, as compared to the snazzier, snappier U. S. approach and (b) a huge arena of some sort, the band quite some distance off in it like at a circus in Madison Square Garden (old model). You can almost hear the cheers of some vast and festive audience.

Great American Ballets, Vol. 1: Bernstein: Fancy Free, Facsimile. Great American Ballets, Vol. 2: Copland: Rodeo, Appa-

lachian Spring. Concert Arts Orch., Robert Irving.

Capitol SP-8701, 8702 stereo. ($4.98)

Once ultra-modern, these familiar American works are now pretty close to pop for the popular ear—they roll off the platter and into the brain with the greatest of ease. Spicy rhythms, colorful dissonances, racy picturesqueness, not a bit of which will offend anybody's sense of what's right, these days. The Concert Arts Orchestra is one of those hard working semi-popular aggregations, if I remember rightly, but Robert Irving is a first-rate ballet conductor who knows exactly what to ask from these versatile musicians—in case they don't happen to know by themselves.

Chopin Hit Parade. Adam Harasiewicz, Piano.

Philips SPS 2 908 stereo (two discs). ($9.96)

Phew! Awful lotta Chopin—four whole sides, all hits? Well, take *that* idea or leave it, but be reassured to to the listening. This Polish pianist has a lovely lilt and plasticity, his Chopin moves right along, gracefully and expressively. I wouldn't be afraid of six sides, even. The Philips piano sound is nicely broad, a European-type piano, the upperworks occasionally a bit percussive. Not unpleasantly so.

Alicia de Larrocha Homage to Granados. Conchita Badia, soprano.

Everest 3237 stereo. ($4.98)

Careful now Everest—this looks like another gracious piano disc, fit for comfortable listening what with Alicia de Larrocha's name in very large type and the singer's in *very* small, 'bout one tenth as high. Not fair. What you hear is primarily the soprano, accompanied by piano, in no less than seventeen songs; being Spanish, this means they include a great deal of loud and/or throaty voice production of the concert sort. She's OK, though occasionally a bit flat in pitch—but this isn't in the least a "pop" record, even if it looks like one.

No texts, no translations, in case you really want to know what the songs are all about. That's unhelpful too, from the viewpoint of the serious listener. Good record, poor packaging.

Morton Gould: Venice; Vivaldi Gallery. Seattle Symphony, Milton Katims.

RCA LSC 3079 stereo. ($5.98)

When the talented Morton Gould turns to heavyweight Composition—Heaven forbid. If Nero-Boston Pops is on the pretentious side, imagine *this:* impressions of Venice for *double* orchestra *and* brass choirs, no less. And on the reverse, an echo of Vivaldi themes that drowns that spartan Venetian in a hundred thousand tons of orchestral treacle. (Molasses, if you will.) Glurp.

It's some people's idea of pops music, probably including Gould himself, so go right ahead and sample.

A Pops Serenade. Boston Pops, Arthur Fiedler.

RCA LSC 3023 stereo. ($5.98)

As 'most everyone knows, the Boston Pops is a transformed Boston Symphony, an institution (and a warm-weather concert series) unique in the U. S., often imitated but never with fidelity. What distinguishes the "Pops" —and has for most of any middle aged listener's life—is a certain touch of elegance and grace that makes even the sleaziest entertainment stuff sound better than it is—or, shall we say, sound at its best. Also, the "Pops" combines first-rate music and lesser stuff with consummate ease; and the "Pops" never, *never* sounds heavy, pompous, or just coarse and loud.

This disc abounds in orchestral corn of the ickiest sort, the kind now called "favorites" by the press; but Schubert is included, not to mention Wagner, Mendelssohn, and Boccherini. Big, fat sound, somewhat impeded by the too-vast reverb effect. *Æ*

Carl Schuricht conducts Johann Strauss. Vienna State Opera Orch.
Vanguard Everyman SRV 256 SD stereo. ($2.50)

Every Viennese orchestra plays Strauss waltzes and polkas; if one of theme were ever to botch the job, there would be revolution. The great Carl Schuricht merely lets this famous outfit have its head, and all goes according to tradition. The expected big, full, rich sound, four or five of the famous waltzes and a brace of lesser known items.

Tchaikowsky: The Nutcracker Suite & Sleeping Beauty. Royal Philharmonic Orch., Sir Adrian Boult.
Capitol SP 8690 stereo. ($4.98)

The familiar Miniature Overture and its little trail of miniature dances sound a bit overwhelmed in the great wash of sound on this disc—the big reverb seems to be the style for pops classics these days. The rest of the Tchaikowsky, being bigger, sounds better, though ideally there should be much less blur, since the music, after all, was written for ballet, which takes place in relatively dry acoustics. If you like your Tchaikowsky big and wallowing, this is for you.

Rimsky-Korsakoff: Symphony No. 2 ("Antar"). Miaskovsky: Symphony No. 21. Chicago Symphony, Morton Gould.
RCA LSC 3022 stereo. ($5.98)

When Morton Gould puts his mind to it, he is a first rate conductor of late-Romantic-style music. This is a dilly (and the sound is far sharper, less muddied up by reverb, than most recordings of an avowed pops intent). Rimsky's early symphony, from 1869, makes for colorful listening in an easy-going way. Miaskovsky's twenty first, right out of the same mold though first performed in 1940(!) shows how, if you really want to, you may write super-Romantic music long after the fact, with only a touch here and there of dilute Hindemith or watery William Schuman to tell you that this music is out of the 1930s, not the 1890s or before. This disc rates as a good big-orchestra pops classic, much less pretentous sounding than some that really *try* to be pops.

Borodin: Symphony No. 2; "In the Steppes of Central Asia." Philhormonia Hungarica, Maga.
Turnabout TV 34273 stereo. ($2.50)

—And more of the same, even better (especially if you are overstuffed with too much pops sonic glop). This one has everything, and Dolby too. The sound itself is close, sharp, and clear though not close enough to spoil the over-all impact. Maybe the refugee Philharmonia Hungarica (players escaped from Hungary in 1956) isn't as slick-smooth as the Boston Pops but it knows the Central European tradition of music and plays its Borodin—music from almost next door—with a loving familiarity, both the larger Symphony and the short "Steppes," which as R. D. Darrell notes is practically the original example of Impressionistic tone painting, before Debussy ever got there. Good. And while you're at it, please note the price on this one.

Music of Glinka. U.S.S.R. Symphony, Svetlanov.
Melodiya Angel SR 40081 stereo. ($5.98)

Add this to the Russian complement; it's good, even at first-line prices. This orchestra plays with immense freshness and verve, for an impact that gets through even in the fairly fat sonic surround. Glinka, of course, is as tuneful and colorful as Borodin or Rimsky-K. though chronologically he came first of them all.

The Russians' current sound still is a trace tubby in the bass (could be the acoustics) and very slightly shrill in the highs. Not enough to notice if you enjoy the music.

Leonard Bernstein The Great Tchaikowsky Symphonies (Nos. 4, 5, 6). New York Philharmonic.
Columbia D3S 781 (3 discs). ($17.92)

Pops? Well, plenty of people think so. In a few brief words, Lenny's interpretations bring out the maximum schmalz in a sometimes sentimental but always wholly honest fashion—he believes in what he does. No mere playing for effect. Columbia's version of the big sound tends to emphasize close-ups, but always within the vast over-all primary effect. You won't lose a bit of detail here.

Leonard Bernstein Pierre Boulez Luciano Berio "The Female Prisoner" (selections from the motion picture score). N. Y. Philharmonic, London Symphony, Cathy Berberian, Electronic Sounds.
Columbia OS 3320 stereo. ($5.98)

If you've seen the film, this sort of montage of recordings is just fine, including as it does a resume of the story line so you'll maybe remember what happens as the music unfolds. But for the rest of us, there's merely a cross section of mildly related works—Webern, Mahler, and a piece for magnetic tape by Berio made out of, in part, a doctored soprano voice.

If you saw these works listed straight out on the record cover you'd think, ugh—modern classical! But with that naked doll in chains, and the film title, of course you'll call it pops. Sort of, anyhow. *You* try it!! A rose is a rose . . .

Light Listening

Sherwood L. Weingarten

(Continued from page 38)

record stuck in a groove (but that doesn't mean groovy).

"Two Minutes of Silence" is just that (ah, blessed relief), and "Radio Play" consists of tapping, tapping, tapping, with muffled conversation in the background, and then a scratchy sound.

All "compositions" are listed as written by the Lennon-Ono team.

Oh, well, maybe a Zapple a day will keep the psychiatrists away.

Electronics are merged with rock, pop, and classical strains on 16 tracks of DARK SHADOWS (Philips, PHS-600-314), a disc sure to sell well because of the 20 million viewers of the ABC-TV soap opera that's a horror in more ways than one.

The original music, showcasing the orchestra of its composer, Robert Cobert, is dramatic and suspenseful. Unfortunately, it also is inadequate—*unless* you're a buff of the serial.

A few of the tunes are well put together ("Josette's Theme," a simple, poignant, child-like melody with music box quality; "No. 1 at the Blue Whale" and "Back at the Blue Whale," both rockers), and several more might be good as straight instrumentals but are marred here by superimposed narration of Jonathan Frid (who portrays Barnabas) and David Selby (who plays Quentin). Frid's voice appears on five cuts, Selby's only on "Quentin's Theme," which is a chartbuster as a single.

* * *

More Spins & Needles

Listening to so much recorded garbage makes the mediocre seem extraordinary. Case in point: NARROWING THE GENERATION GAP (Metromedia, MD1006), a Lester Lanin attempt to bring hit rock tunes to a broad audience.

Lanin's orchestra, noted for playing at society bashes where everyone's too stoned to listen to the music, tones down the chartbusters just enough to

allow the post-30 listeners to gain an insight to where it's at. The disc, with 11 tunes, passes muster by the skin of its drums; in imagination, it rates as high as a mutilated IBM card. Because the beats are nonetheless too hip for the Geritol Gang, the vinyl most likely will become one for listeners and not dancers (the young 'uns, despite the title and the liner notes, will avoid it like the draft).

The first side includes a Beatles' success, "Ob La Di, Ob La Da," which is bouncy in an old-fashioned way; "Little Green Apples," the lone imaginative piece, a Latin arrangement supplanting the original country flavor, and "Goodbye Columbus," a mellowed rocker. On the flip side are "Dizzy," a zippy number with the beat held by a sturdy tambourine; "Aquarius," which retains its stardust, and "Love Theme from Romeo and Juliet," with guitars and flute carrying the burden of musical translation.

* * *

She had veered from the thing she did best, but now she's back. DAVID'S ALBUM (Vanguard, VSD 79308) is Joan Baez' best LP in her last four, probably because she sticks to folk-country music and shies from the contemporary artsong bag she toyed with for too long.

Her angelic voice was never better, much more mature than when she popped out of nowhere years ago to become the hit of a Newport Folk Festival that acted as her springboard to stardom. Her dovish opinions that many find objectionable are limited to liner notes, and thus do not interfere with the quality or impact of the songs.

Backing the thrush are 14 musicians led by Grady Martin, who quadruples on electric and acoustic guitars, mandolin, and dobro. Helping create the down-home flavor of the disc are the usual complement of instruments, plus steel guitar, fiddle, viola, and electric bass.

The album, dedicated to the singer's draft-dodging husband, David Harris, starts with "If I Knew," a lovely melody that encases lyrics that border on poetry. "Rock Salt and Nails" is presented in the classic country style, and "Glad Bluebird of Happiness" is the one appeasement to contemporary music, a gyrating melody that is not unlike compositions by Bob Dylan.

"Poor Wayfaring Stranger," a traditional tune, utilizes a rhythm section that offers soft jazzy lines and vocal assistance on choruses by Mimi Farina Melvin. Also traditional are "Will the Circle Be Unbroken," with backing by The Jordanaires, and "Just a Closer Walk With Thee," both of which feature gospel-rock motifs.

"My Home's Across the Blue Ridge Mountains" is a bluegrass blueplate special, and "Green, Green Grass of Home" is a bow to the Tom Jones chartbuster. The best selection, though, is the twangy "The Tramp on the Street," which features an added last verse written by Miss Baez.

On the album jacket the singer writes that her husband "had sent his draft cards back to the government . . . with a note explaining the he intended to live his own life, in a way which could affirm the lives of others, not destroy them, and that meant total non-cooperation with the military."

"We figure," she adds, "that if the day is ever to dawn when we practice peace on earth, it will happen only because we have given up war and exploitation. That will only be when men and women refuse to exploit and kill each other. And this is the wrong decade to wait for someone else to begin the change." Æ

Jazz & Blues

BERTRAM STANLEIGH

Jazz & Mississippi Delta Blues

In 1967 and 1968 George Mitchell, author of *Blow My Blues Away*, made several trips to the Mississippi Delta with his wife. Their purpose was to locate and record previously unrecorded blues singers and to disprove the contention that all of the good blues singers of the twenties and thirties had been recorded. Certainly a great many of the Delta singers who have been recorded for the first time during the fifties and sixties can better be described as *somewhat evocative of a style and period* than as *good singers*. And it is Mitchell's emphasis on finding genuinely good singers for his study that distinguishes this set from any number of earlier collections.

While Mitchell has been largely successful in confining his attentions to hitherto unrecorded artists, he has not been so arbitrary in his selection of performers that he has ruled out the participation of Joe Callicott, who cut a single record in 1930, and Dewey Corley, who used to blow jug for the oft recorded Memphis Jug Band. Nor has he ruled out a guitar accompaniment by the recently popular Fred McDowell on Johnny Woods' taping of *Three o'Clock in the Morning*. What he has been diligent about is finding singers who deserved recording and who still preserve the special country blues character of this poverty-ridden area and its misery-laden, bitter, tormented, despairing music. It has frequently been suggested that the Mississippi Delta is the region where the blues originated, and the collection of singers represented on these first two volumes has the intensity and emotional authenticity that one expects from good field recordings of the genuine article.

While all of the fourteen singers heard here have not been regular performers in recent years, most of them are presently practicing their art, and those who have adopted other ways to scratch out a livelihood from this dying section, still have a sure touch in their fingers and a quality of authority in their voices. These are real performers with real messages, and in more cases than not, the songs they sing are versions they have acquired from regional sources, rather than from the many phonograph records that have been made of this music.

In a collection of this type, there is a temptation to present each artist in depth with a variety of performances, and there is an equally compelling desire to offer as many different musicians as possible. The present set attempts to do a bit of each, offering six songs each by R. L. Burnside and Joe Callicott and only a single offering in most of the other cases. To this listener, at least, neither approach provides the in-depth encounter with each of these musicians that one might wish. Do-Boy Diamond's offerings of *Long Haired Doney* and *Going Away Blues*, Napoleon Strickland's *Oh Baby* and Houston Stackhouse's *Canned Heat* leave me with the hope that Mitchell's archives contain many more performances by these singers, and the highly dramatic narration of *The Death of Sonny Boy Williamson* by James "Peck" Curtis whets my appetite for this singer in more typical material. Even the half-dozen numbers by Callicott seem far too few to represent this deep, dark-voiced singer with ringing top tones and a strongly rhythmic strumming guitar style.

As high-quality recording equipment gets more portable and scholars become more knowledgeable in their use of this equipment, field recordings get better and better. The present set offers good stereo, in-focus miking, and commendable solutions to what must have been a number of difficult acoustical problems. There is no indication that subsequent volumes are likely to appear in this series, but the present platters are so good that one hopes they will receive their justly deserved public sup-

port and that additional sets will be forthcoming in response to overwhelming popular demand.

Mississippi Delta Blues, Vol. 1: **Napoleon Strickland, Do-Boy Diamond, Johnny Woods, Walter Miller, Tom Turner, Furry Lewis, Robert Diggs, Dewey Corley, Houston Stackhouse, James "Peck" Curtis,** and others. Vol. 2: **R. L. Burnside, Joe Callicott,** and **Rosa Lee Hill**

Arhoolie Stereo 1041 and 1042

Performance: A *Sound:* A

Barney Bigard–Albert Nicholas

RCA Victor Mono LPV-566

Two of the top clarinetists to emerge from New Orleans in the twenties are brought together on opposite sides of a Vintage Series reissue that is rich in musical rewards and nostalgia. Bigard's eight numbers were recorded in 1940 and 1941 with members of the Ellington orchestra and Ellington himself at the piano. In spite of the strong personality of the Duke, and the fact that the repertoire consists of numbers associated with his band, Bigard's style and character are the dominant influence in such numbers as Ellington's *Charlie the Chulo, A Lull at Dawn,* and *"C" Blues,* Billy Strayhorn's *Noir Bleu,* Bigard's *June* and *Ready Eddy,* Bigard and Strayhorn's *Lament for Javanette,* and Mercer Ellington's *Brown Suede.*

Less sophisticated, but wonderfully bright, alive, and secure are the six sides that Albert Nicholas cut in 1935 with Adrian Rollini, Joe Turner, and a few others, and *Tap Room Special* and *Ev'rything is Okey Dokey* by a sextet that included Ward Pinkett's trumpet. The difference between the two styles is too great to draw any parallels about the two artists. But these are prime examples of the work of giants who have bridged the entire span of jazz development, and, as one has learned to anticipate, the RCA transfers from the original 78s have been handled superbly.

Performances: A *Sound:* A—

Grady Tate: Feeling Life

Skye Stereo SK-1007D

The impact that drummer Grady Tate created with his first release as a singer is maintained on this new waxing. Drama, musicality, and the perfect timing that one can expect from a jazz drummer are coupled with impeccable diction and an intensity of feeling that make Tate one of the very finest of present-day vocal stylists. The moody, contemplative ballad seems to be his specialty, and on this new set, he offers *Hooray, My Ship, The End of a Love Affair, You're Gone, I Fall in Love Too Easily, Meditation, Nature*

Recorded Tape Reviews

BERT WHYTE

CLASSICS

Sibelius—Symphony No. 4 / Tapiola. Lorin Maazel conducting the Vienna Philharmonic Orchestra
Ampex/London M67215
8-track cartridge, ($6.95)

A classical cartridge for a change and an exceptionally good one. Maazel has been recording all of the Sibelius symphonies for London and with considerable success. This 4th symphony must be judged the best available at present. Maazel emphasizes the dramatic aspects of the music, and makes it quite exciting, although his fast pace is almost too much in certain sections. He gets superb playing from the orchestra, especially the first strings and the contrabassi. I recorded the late Tauno Hannikainen conducting Tapiola, so my judgment of Maazel's reading of Tapiola as equally good implies an especial compliment. London has given Maazel superb sound, with a very spacious acoustic perspective, yet with plenty of presence and orchestral definition. The basses are especially sonorous. Dynamic range quite wide, in fact too much so in the case of playing this in the car where the high ambient noises swamp some of the softer sections. This too was a Dolby production, but alas, at present the benefits of this cannot be fully realized and the hiss level, while good for a cartridge, is still too high.

Dvorak—The Slavonic Dances (Complete) George Szell conducting the Cleveland Orchestra
Columbia MQ1007 **open reel, 7½ ips** ($9.95)

There have been other complete recordings of the Slavonic Dances, several of them excellent performances, but none has approached the level of inspiration achieved by this George Szell performance. The word "definitive" is used with altogether too much abandon in music critiques, but here I think it is justified. Tempi, phrasing, inner balances, passion or restraint, blazing color or subtle nuance, Szell is the master at the conductorial helm. It might be thought that 16 dances are a bit much to consume at one sitting, but such is the splendor of Szell's reading that you find yourself wanting more. This feeling is heightened by the magnificent playing of the Clevelanders, which in this music under Szell's baton is an exercise in sheer orchestral virtuosity. With such fine musical values, good recorded sound would be icing on the cake, but alas, there are a few problems in this respect.

The orchestra is recorded quite close-up, with barely enough reverb to lend some spaciousness to the sound. The overall sound is very bright, and in fact, for many ears will seem overbright. I would say that your reaction to the sound will depend on the kind of speaker system you own and the acoustics of your room. Those who have speakers with a "peaky" top end and restricted bass will find the recording "thin," with a shrillness to the strings. Manipulation of the tone controls will help some, but since I feel the midrange of the recording is somewhat elevated, what is really needed is the type of equalizer that can cope with individual portions of the spectrum, such as the Pultec unit. In my own case I cut a little of the extreme top end, came down a few dB at about 2 kHz and achieved a respectable balance and enjoyable sound. Apart from the "brightness," the sound was generally good, with adequate and tasteful separation and a good center fill, fairly wide dynamics. A plus virtue was the low hiss level, and very little print-through or crosstalk. In summation . . . the performance is so outstanding, that it is worth your while to spend some time adjusting and "diddling" with controls and/or acoustics to achieve a reasonable sonic balance.

Gershwin—An American in Paris/Porgy and Bess (Symphonic picture.) Eugene Ormandy conducting the Philadelphia Orchestra
Columbia MQ1129 **open reel, 7½ ips** ($9.95)

In spite of zillions of recordings, these Gershwin staples continue to appear in new versions. This recording has the great Philadelphia Orchestra coping with Gershwin's jazzy scores, and for these solid musicians, this poses no problems. Maestro Ormandy however, doesn't seem to have much empathy with this music and his performance is on the pedestrian side . . . rather slow-paced and deliberate. Oh,

it is no more "four square" or "stodgy" than many others, but one rather expected a more idiomatic performance from Mr. Ormandy. The sound may make the difference for some buyers. This recording has a big, bright, close-up sound with adequately spacious acoustics. There is good balance between orchestral choirs, modest directional qualities and good center fill. The dynamic range was moderately wide, generally good presence. The Philadelphia strings are as smooth and lush as ever, but percussion in the "American in Paris," could have been more sharply defined and cleaner. The tympani in particular were somewhat over-resonant. In "Porgy," the percussion was cleaner, with more weight and better articulation. As with most Columbia tapes these days, it is pleasant to report that hiss was at a very low level, print-through and crosstalk infrequently encountered.

Russian Fireworks—Stanley Black conducting the Royal Philharmonic Orch.
Ampex/London LPL75021
open reel, 7½ ips ($7.95)

As you might expect from the title, this is a collection of pot-boilers, served up in the usual frantic Phase Four fashion. Thus conductor Stanley Black with more fire than finesse leads his men through the ubiquitous "Night On Bald Mountain," "In The Steppes Of Central Asia," "The Flight Of The Bumble Bee," "Marche Slav," and Borodin's lovely "Nocturne," and concludes with the rousing "Comedians Galop" of Kabalevsky. Performance values are strictly subservient to the creation of spectacular sonics. In this they have succeeded admirably. Fortes and climaxes are grossly exaggerated, great masses of sound are elicited from the brass and percussion. If you don't take it seriously it can be good fun. In spite of the tongue-in-cheek approach the sound is top notch . . . very clean, big and bright, recorded close-up with lots of reverb. Hiss was moderately low, there was some print-through, but no audible crosstalk.

Mozart—Piano Concerto No. 20 in D Minor—Piano Concerto No. 6 in B Flat Major. Vladimir Ashkenazy, piano; Hans Schmidt-Isserstedt conducting the London Symphony Orchestra
Ampex/London L80214
open reel, 7½ ips ($9.95)

In this superb recording pianist Ashkenazy once again demonstrates his affinity for the music of Mozart. Whether it is the stately measures of the early B Flat Major concerto, or the drama and excitement of the D Minor concerto, Ashkenazy is completely masterful. His playing is full of sinew and muscle, tremendously powerful and evocative . . . yet he plays too with great elan and exquisite refinement. His reading of the D Minor concerto is a remarkable feat combining tonal production of great beauty with phrasing of meticulous execution and an overall elegance which makes this the recording of choice. He is aided by the sympathetic accompaniment of Schmidt-Isserstedt, who also elicits virtuoso playing from the London Symphony. London has provided Mr. Ashkenazy with a fine-sounding recording. The piano is recorded moderately closeup, in nice balance with the orchestra, one never covering the other. All is placed in a fairly broad acoustic perspective that allows spaciousness with plenty of detail from piano and orchestra. Piano transients are clean and crystalline clear, with nary a trace of overhang or "buzz." Directional qualities are just right with the piano neatly occupying the center. Dynamic range was quite wide. A Dolby original recording plus Ampex "EX-Plus" processing probably accounts for the low his level. There was however, some noticeable print-through, no audible crosstalk.

Big Band Fare

The Brass Menagerie—Enoch Light and his Orchestra.
Project Three/Ampex X5036
open reel, 3¾ ips ($5.95)

Run, do not walk to your nearest tape dealer and buy this recording. This is one of the best "big band" recordings in years! The repertoire is nothing too unusual,consisting of items such as "California Dreamin'," "Both Sides Now," "My Favorite Things," "The Fool On The Hill," "Wichita Lineman," and so on. What makes it worthwhile are the extremely clever and sophisticated arrangements and the outstandingly good sound. Which brings up a point . . . Ampex has issued this at 3¾ ips and while the sonics are astonishingly good for this speed, it certainly is deserving of being afforded the benefits of the 7½-ips speeds. It so happens I attended this recording session in New York. Engineer Phil Ramone recorded this on an 8-track/one-inch tape machine. However he did not use the isolation techniques so common with multi-track recording, having all the musicians in one large studio. The various choirs were disposed at strategic spots in the studio . . . for example, he had five trumpets in a circle around an omnidirectional Neumann mike, four french horns off to one side

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QUOTES: STEREO COMPONENTS Foreign & Domestic, Box 18026, Seattle, Washington 98118.

TAPE RECORDING MAGAZINE – Enthusiasts monthly magazine for amateurs and professionals. Send $3.75 for 1 year subscription to 14-18 Holborn, London, E. C. 1. England.

SOLID-STATE audio plug-in octal (1" dia. x 2" H) modules. Mic preamps, disc & tape preamp-equalizers, tape bias osc. & record amp., power amps & power supplies. Send for free catalog and audio applications. Opamp Labs, 172 S. Alta Vista Blvd., Los Angeles, Calif. 90036.

FOR SALE: Marantz 15, $265.00 and Marantz 7T, $260.00 with oil cab. Paul Mascetta, 2837 Decatur Ave., Box 10458, N. Y.

RECORDS, TAPES, MOVIES, BOOKS. Unlimited selection, big discounts. Send 50c for record or tape catalog, 25c for others. Specify catalog desired. Murphy's, P.O. Box 358A, LaPlace, Louisiana 70068.

KENWOOD amplifiers and speakers–discount prices–free catalog and quotations. Playboy Shop, Box 221, Agana, Guam.

HARD-TO-GET folk, jazz and blues lps. Send wants. Monon Record Service, Box 18221 BK, San Francisco, Calif. 94118.

HIGH PERFORMANCE, miniature wireless microphones direct from manufacturer. Free literature. Dealers welcome. Audiotronix, Ad 2, 156 Fifth Ave., New York, N. Y. 10010.

STEREO COMPONENTS from Japan–tape recorders, speakers, amplifiers, turntables, and accessories. Free catalog and quotations. Playboy Shop, Box 221, Agana, Guam.

REVOX G36 $350.00. As new, (25 hours) warranty. After 7:00 pm 609-854-3448 Barclay, Apt. 406B Parkview, Collingswood, N. J.

CATALOGS Broadcasts, Soundtracks, Personalities of Thirties, Forties. Box 225, New York, N. Y. 10028.

ELECTROSTATIC STEREO HEADPHONES. Koss ESP-6, $55 ($95 list). Box AO9-2.

ASSEMBLED KITS at unwired prices. One Scott LT-112-B-1 Stereo FM Tuner, $165; Scott LR-88 100-W AM/Stereo FM Receiver, $295; Dynaco PAT-4 Stereo Preamplifier, $90. All perfect. Box AO9-1.

UHER 4000L Tape recorder, all accessories, used only 30 hours, $250. C. L. Robertson, Smith College, Northampton, Mass. 01060.

FOR SALE

HARPSICHORD: Same as owned by Philadelphia Orchestra and RCA Victor. In kit form for home workshop assembly, $150. Clavichord kit, $100. Free brochure. Write: Zuckermann Harpsichords, Dept. R., 115 Christopher St., New York, N. Y. 10014.

NEW low prices on all stereo components and tape recorders. Write for our quote. Stereo Corp. of America, 2122 Utica Avenue, Brooklyn, New York 11234.

MARANTZ Model 9, 70-watt, rack mount. Like new, pair $500. Citation A Preamp. $125. J. M. Edelman, M.D., 4550 North Blvd., Baton Rouge, La. 70806. Phone: 504-927-3553.

TAPE RECORDER SALE. Brand new nationally-advertised brands, $10 above cost. Amazing discounts on stereo components. Arkay Electronics, 1028-H Commonwealth Avenue, Boston, Mass. 02215.

GARRARD record changers, hi-fi components, cartridges, needles, Scott, Fisher, Dual, AR. Write for Unbelievable Prices. Gregg Electronics, Post Office Box 184, Glen Head, New York 11545.

24-TRACK?–Modular tape recording amplifier with bias and erase buffer. Dop Audio, 601 S. Vermont, Los Angeles, Calif. 90005 (213) DU 8-7104.

SYLVANIA TV'S, stereos, components–model number. Furniture, 933 W. 7th Street, St. Paul, Minn. 55102.

KLIPSCH–Bass horns with high-frequency drivers, $200 each unfinished. ALSO: 4 corner horns with JBL drivers unfinished. 202-546-7405 or write Doug Van Horne, 919 Constitution Avenue, N.E., Wash., D. C. 20002.

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WOULD LIKE TO WORK as a record distributor assistant. Call (215) KI 6-0220.

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CASH FOR YOUR unwanted LP's and prerecorded tapes. Record House, Hillburn, New York 10931.

PAIR Altec M20's, etc. Fred Hermes, 616 6th St., Racine, Wis. 53403.

WANTED: Stereo Disc Cutter. 3C Westrex or better. Peter J. Helffrich, RD No. 2, Allentown, Pa. 18103.

WANTED, 3-channel prerecorded tapes compatible with Nortronics .5701 head. Send information. Norman Fleming, 145 Hillside Ave., Villanova, Pa. 19085.

DYNA 120, FM-3, PAT-4; AR-3a, AR-3; Garrard SL-75, SL-95. J. Russell, Box 86, Lenoir, N. C. 28645.

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You can tell it's the Münchner Nationaltheater when you listen with a Stanton.

The reconstructed Nationaltheater in Munich, originally built 1811-18, scene of the world premieres of "Tristan" and "Meistersinger."

PHOTOGRAPH BY FRANZ EDSON

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

It's the sound of the hall.

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

It's easy to blame the recording, but often it's the cartridge.

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

When a cartridge reproduces these undulations with the utmost precision, you can hear the specific acoustics of the Nationaltheater in Munich, or of any other hall. If it doesn't, you can't.

The Stanton does.

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

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

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

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It's easy to spot the new Musicaster IA. Look! Listen!

All that's left of the great old Musicaster* is the size and the mounting hardware. Everything else is changed — and it's all for the best.

Start with the silicone-treated weatherproof speaker. Changed from an 8″ to a 12″ Radax.* With smoother response, better bass, yet the same high efficiency and 30 watt power handling. Protected by a ¼″ Acoustifoam* weather barrier sandwiched behind the grille.

The enclosure is new, too. By using a one-piece glass-filled polyester housing, we saved two pounds overall, without reducing strength or utility. The peripheral ducted port combines with a fiberglass-filled interior to smooth and extend bass response.

And don't overlook the importance of good looks. The clean, contemporary lines of the new Musicaster will get you quick architectural approval where other uglier speakers would be banned out of sight.

The net effect is a great music speaker that also does full justice to voice. The ideal combination for so many of your multi-purpose sound installations. And the mounting bracket still doubles as a handle for portable use.

Finally, you can choose from two models, the basic Musicaster IA at $69.90 net, or the Musicaster IIA with horn-loaded T35B tweeter for extended highs and outstanding uniform polar response at only $88.50 net. Both cost a little less than the old Musicaster; but they give you much more to sell. Prove it to yourself today.

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