

SPECIAL  
HI-FI SHOW ISSUE

the authoritative magazine about high fidelity

# AUDIO

ENGINEERING  
LIBRARY

OCTOBER

1968 60¢

Build a Background-Music Decoder  
Sound & Decor Ideas • How to Choose Magnetic Tape

Including Stereo Equipment & Record/Tape Reviews



# Scott's new LR-88 receiver takes the



## out of kit building

Building a kit used to be something you couldn't do with ladies and children present, but Scott's new LR-88 AM/FM stereo receiver kit has changed all that. First, there's the instruction manual. In clear and simple language, it leads you, step-by-step, through every stage of the assembly process. And each stage is illustrated . . . full-size, full-color. Next, there's Scott's ingenious new Kit-Pak®. The parts for each assembly stage are in individual compartments, keyed to the instructions. All wires are color-coded, and pre-cut and pre-stripped to the proper sizes. Difficult or critical sections are pre-wired, pre-aligned, pre-tested, and factory-mounted on printed circuit boards. Is soldering your bugaboo? Scott has provided push-on solderless connectors for the hard-to-get-at spots.

About thirty painless hours after you've started, you've completed one great receiver. The LR-88 is the 100-Watt kit brother to Scott's finest factory-wired beauties. It includes the famous Scott silverplated Field Effect Transistor front end, Integrated Circuit IF strip, all-silicon output circuitry . . . in fact, all the goodies that would cost you over a hundred dollars more if Scott did all the assembling. Performance? Just check the specs below . . . and you'll be amazed at how great a receiver sounds after you've built it yourself. Treat yourself to a weekend of fun and years of enjoyment . . . see the Scott LR-88 at your dealer's today.

**LR-88 Control Features:** Dual Bass and Treble; Loudness; Balance; Volume compensation; Tape monitor; Mono/stereo control; Noise filter; Interstation muting; Dual speaker switches; Stereo microphone inputs; Front panel headphone output; Input selector; Signal strength meter; Zero-center meter; Stereo threshold control; Remote speaker mono/stereo control; Tuning control; Stereo indicator light.

**LR-88 Specifications:** Music Power rating (IHF), 100 Watts @ 4 Ohms; Usable sensitivity, 2.0  $\mu$ V; Harmonic distortion, 0.6%; Frequency response, 15-25,000 Hz  $\pm$  1.5 dB; Cross modulation rejection, 80 dB; Selectivity, 45 dB; Capture ratio, 2.5 dB; Signal/noise ratio, 65 dB; Price, \$334.95.

### You'll swear by it



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# AUDIO

October 1968 Vol. 52, No. 10

Successor to **RADIO**, Est. 1917

Number 61 in a series of discussions  
by Electro-Voice engineers

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## STAND UP FOR PROGRESS

THOMAS LININGER  
Microphone  
Project Engineer

For years, microphone stands have received little attention from designers. Once basic functions were satisfied (i.e., floor or desk mounting, switching, etc.) only minor variations were seen, based more on aesthetic considerations than on functional superiority.

Recently Electro-Voice took a close look at the design of their desk stands for broadcast and professional sound applications. The need was underscored by the major change in microphone size and shape in the past decade. With lighter, smaller microphones came a need for matching microphone stands.

Our goal, however, was not to simply make a "pretty" stand, but to provide a design that eliminated several problems noted by studios using current stand designs. The stand had to be low and inconspicuous. It had to be simple, rugged, and easy to use. Assembly had to be quick, and ideally it should provide a degree of noise isolation in addition to simply supporting the microphone.

All of these goals were met in the new Model 421/422 desk stands. Designed to accommodate microphones held in either the Model 300 (1") or Model 310/311 (3/4") microphone clamps, the stands are less than 1" high and are available in two sizes: 3 1/2" x 3 3/4" or 4 1/4" x 4 1/2". The entire stand is composed of just three parts: a heavy metal casting, a rubber base, and a neoprene mounting insert.

The mounting insert is similar to a large grommet, and is easily pressed into the base casting. A microphone is attached by simply inserting the microphone clamp firmly into the neoprene insert where it is held by pressure of the neoprene. The design eliminates any threading or metal uprights.

By eliminating the upright, minimum height is achieved, varied by sliding the microphone in its clamp, or by tilting the microphone to the appropriate angle. In addition, the grommet provides part of the isolation from shock noise achieved by the stand.

Additional damping of noise is achieved by use of a relatively soft rubber pad that covers the entire bottom of the stand, rather than small, hard rubber feet. Use of a large pad also offers maximum resistance to sliding, even on very smooth surfaces. The low height and resistance to sliding creates a stable platform with minimum weight and complexity.

While a stand is perhaps incidental to the success of a microphone, attention to details such as this can contribute to the overall worth of a product. That's why Electro-Voice engineers continue to work closely with studio engineers to help solve their sound problems.

For reprints of other discussions in this series,  
or technical data on any E-V product, write:  
ELECTRO-VOICE, INC., Dept. 1083A  
602 Cecil St., Buchanan, Michigan 49107



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# Coming in November

## Special Professional Audio Issue

★ Historical survey—how it began, where it is now — in celebration of the 20th anniversary of the Audio Engineering Society ★ Experts predict what the future of professional audio will be like ★ What the pro's use (professional products directory) ★ The Art of the Small Recording Studio ★ Inside a Major Recording Studio ★ Altec's Acousta-Voicing System for Matching Sound Systems to Acoustical Environments . . . and more.

### PLUS:

**EQUIPMENT REVIEWS**, including: Viking Model 433 Stereo Tape Deck, Pioneer Model SX-1500T AM/FM Stereo Receiver, and Erath Models LWE-I and LWE-VI Speaker Systems.

### ALSO:

Record and Tape Reviews, ABZs of FM, Audioclinic, Tape Guide, and other regular departments.

**ABOUT THE COVER:** Out of the "musical horn of plenty" bubbles photos of reader installations described in this issue (page 42), as well as Young Edison and his Tin-Foil Phonograph. From this crude talking machine sprang truly sophisticated equipment, culminating in the stereo products to be shown at the New York High Fidelity Music Show (see page 27). Edison cylinder recordings reached their performance zenith with the Amberola cylinders, of which Edward Tatnall Canby writes about in this issue's "Edison Cylinder Recordings on LP."

## Audioclinic

JOSEPH GIOVANELLI

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

### Noisy FM Reception

*Q. My reception of the Metropolitan Opera broadcasts from Pittsburgh are afflicted with a low "frying" noise.*

*I live in a difficult reception area. I am using two Super M/Q's antennae stacked at  $\frac{3}{4}$  wavelength. I also tried stacking them at  $\frac{1}{2}$  and at a full wavelength.*

*On many occasions, the reception from station WTAE, Pittsburgh, is pure and perfect. It's never good on a Saturday afternoon during the operate broadcast. I have tried 72-ohm cable with baluns, but with this cable I have no reception at all from the Pittsburgh station.*

*The installation is too clumsy and heavy for a conventional rotator arrangement. I am only interested in one station anyhow. Would orientation from the same station vary from day to day?*

*Using one antenna gives ideal patterns on the tuner's oscilloscope, but this is never true with two, stacked antennae. Should I discard one antenna and be satisfied with only one and a rotator system? It's feasible that I could use a rotator with the two antennae stacked at one-half wavelength rather than  $\frac{3}{4}$ .*

*I am using low-loss perforated, 300-ohm lead-in especially designed for FM installations. Should I use shielded, 300-ohm cable? I understand that the losses with this kind of cable are very high.*

1. What wavelength stacking is ideal?
2. Does orientation of the antenna vary from day to day for ideal reception?
3. Is a rotator mandatory?
4. Why do I not get a good, horizontal trace with a stacked installation?
5. What cable should I use?

6. Why do I not get the "frying" noise all the time?
7. Could the "frying" noise be caused by a high-voltage power line, 6 KV, approximately 95 feet distant from the antenna?
8. Should I use only one antenna?
9. Should I use a booster?

—Name Withheld

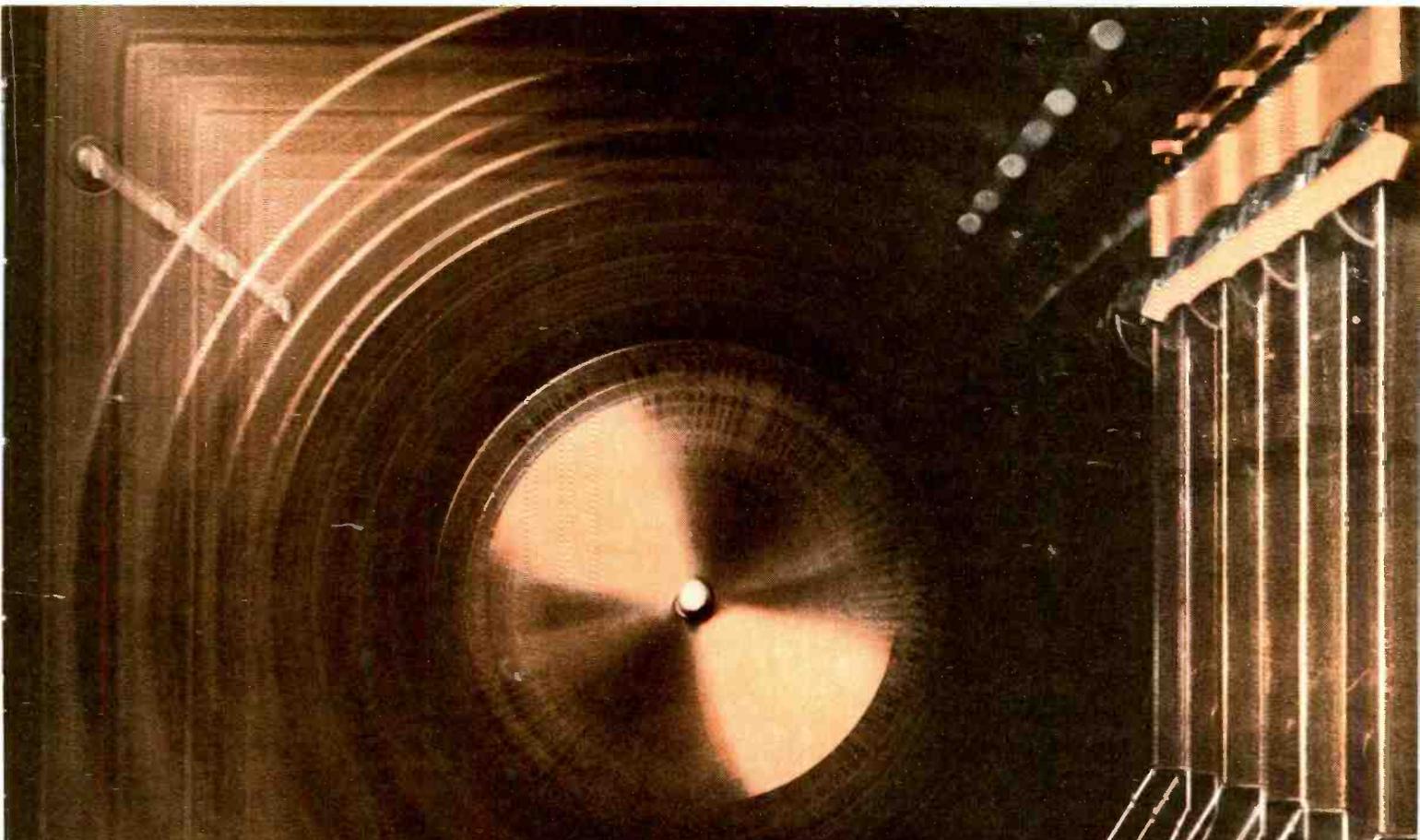
A. Your tuner, while excellent, is not intended to be the most sensitive one available. It is designed to perform well in more average circumstances. It might well be, therefore, that an antenna-mounted booster will help you obtain better reception from the Pittsburgh station. Further, you may have something amiss with your stacking arrangements. You might have one of the antennas upside down. This would result in a cancellation of signal rather than the desired reinforcement. Write to the manufacturer of the array for complete stacking instructions. He may have some special stacking hardware that will enable you to obtain the best performance from the antennas.

When antennas are stacked too close together, they tend to interfere with one another's pickup pattern. I have found that stacking distances of greater than two wavelengths are best.

Unless you can definitely show that the majority of the "frying" is picked up by way of the lead-in, you are well advised to use only open-wire lead-in. This is especially helpful where there is a long run between the antenna and the receiver. If open-wire line is impractical, then use the highest grade of twin lead available. From what I read in your letter, you are already doing that. Either of these types of lead-in cables have less losses than the shielded lead-in. However, the losses produced in the shielded lead-in are not as severe as they once were. There is far less loss with this kind of cable than with coaxial cable and matching transformers.

The antenna-mounted booster will eliminate much of the problem of noise being picked up by the lead-in. Make sure, however, that the booster has a better signal-to-noise ratio than the front-end circuitry of your tuner.

I have never heard of an instance where the orientation of an antenna had to vary from day to day in order to obtain proper reception of a given station on the FM band. I understand that it can happen when receiving distant, shortwave signals. However, generally speaking, such reception phenomena are limited to lower radio frequencies than those used to transmit FM broadcasts. The only time I have observed stations being received from a direction



**If your record player  
today still has  
a heavy turntable,  
it must have yesterday's motor**



Why did Garrard switch from heavy turntables (which Garrard pioneered on automatics) to the scientifically correct low mass turntable featured on the SL 95? Simply because the synchronous Garrard Synchro-Lab™ Motor has eliminated the need for heavy turntables, which were developed to compensate (by imparting flywheel action) for the speed fluctuations inherent in induction motors. The light aluminum turntable on the SL 95 precision matched to the kinetic energy of the Synchro-Lab Motor, effectively relieves weight on the center bearing and reduces wear and rumble in this most critical area. And its full 11½" diameter gives your records proper edge support.

The Synchro-Lab Motor has also made variable speed controls as obsolete as they are burdensome to use. The synchronous section of the motor eliminates the fluctua-



tions in record rotation which cause music to drift on and off key. It guarantees completely constant, unvarying speed regardless of voltage, warm up, record load and other variables. By locking in to the fixed, rigidly controlled 60 cycle current (rather than varying voltage), the synchronous motor insures unwavering musical pitch. And this brilliant new Garrard motor also incorporates an induction section that provides instant starting, high driving torque and notable freedom from rumble.

Garrard innovations such as the Synchro-Lab Motor and new turntable are characteristic of the achievements that make the SL 95, at \$129.50 the most advanced record playing unit available today.

For a Comparator Guide, describing all Garrard models, write Garrard, Dept. R2-8A, Westbury, N.Y. 11590.

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other than the normal one is when the station is reflected from "northern lights" displays or bounced from passing meteors. You can, therefore, ignore this possibility.

A rotator is not mandatory when the desired station or stations are to be received from a single direction. The problem here is to be certain that your antenna is aimed properly. When a rotator is used, the antenna can be adjusted at the receiver location. When no rotator is used, antenna orientation must be adjusted manually at the antenna site. Of course, proper orientation can be accomplished by two persons using walkie-talkies—one located at the receiver and the other located at the antenna installation.

Never rely upon geographical maps to judge the proper antenna orientation. Errors in compass readings—caused by local magnetic conditions—will cause false results in antenna aiming. Further, sometimes signals do not arrive from the expected direction because of reflections. They are sometimes received best from another direction. The best way to know you have proper orientation is to observe the tuner's performance when it is tuned to the desired signal. Sometimes care must be taken to eliminate false signal-

peak readings which are the results of propagation conditions rather than proper or improper antenna heading. It is very likely under these circumstances that you might head the antenna away from the proper orientation and notice an increase in signal strength. That increase might be caused by propagation conditions. Had the antenna been oriented properly, the station might have been even more strongly received.

I would say that another important parameter involved with good FM reception of a distant station is the height of the receiving antenna. The higher this antenna becomes, the greater your "horizon" and the stronger will be the received signal.

I would have to hear the "frying" sound of which you speak in order to make a determination of its nature. Even then I would not want to take bets as to whether I was right or not. It is probably caused by some industrial equipment or perhaps by some hospital facility. It may be that evening reception is improved because the interfering device is not operating during the evening hours. Further, each FM tuner does possess some internal noise. When the desired signal falls in strength below a critical level, this in-

ternal receiver noise becomes evident. This may play a part in your reception problems. The received signal strength from a distant station may not be constant. The amount of moisture in the air, the presence or absence of temperature inversions or the presence of meteor showers, all have a part to play in the reception of a weak FM station. The temperature inversion situation can take place more often in the evening. This can result in stronger received signals.

Usually, power line problems do not have serious effects upon FM reception. They should not be ruled out entirely, however. If you have a reasonably sensitive FM portable radio, set it to some point on the dial where no signal is heard. Just listen to the hiss. When the frying is heard in your main system, take the portable to the vicinity of the power line. Note whether or not the disturbance is heard in this receiver and note whether its intensity increases when you approach the high-voltage line. This is one primitive check which you can make. Assuming that you have reason to think the trouble is transmitted from the power line, you should notify your public utility of this so the proper steps can be taken to eliminate the interference.

## Speaker Muting Problem

*Q. I recently built a Heathkit stereo headphone control unit. The schematic for one channel is shown in Fig. 1.*

*The control unit is located about 30 feet from the amplifier and speakers. When set up as designed, the unit worked very well. I then decided to add an "L pad" control (see Fig. 1) for remote control of speaker volume. When I switch from speaker to headset, I still get sound through the speakers, although it is at a much lower volume than during normal operation.*

*I would like to know why this happens. What can I do to remedy it?—Leo Frandzel, Skokie, Ill.*

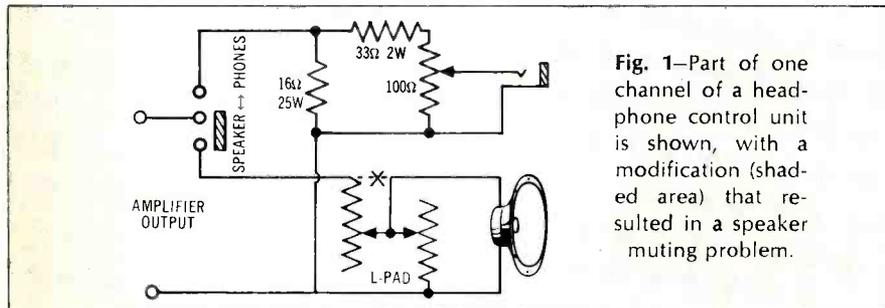
**Note**—A short time after this letter arrived a second letter came, stating: *Since writing you, I have given my*

*problem quite a bit of thought, in addition to some checking. I feel that I did not give you complete information. I checked the L pads. They do short completely in the counterclockwise position. Although the control unit is about 30 feet from the amplifier and speakers, the length of eight-conductor cable used (because of the necessary routing of the cable) is approximately 80 feet. I have calculated the resistance of 80 feet of No. 22-gauge wire as equal to 1.3 ohms. This would indicate that a voltage difference exists between the ground connections of the L pad and the amplifier. Rotating the L pad clockwise (with switch at "headset") decreases the volume slightly. Connecting an 18-gauge conductor directly between the above two points, in addition to the existing connection, also reduces vol-*

*ume a little. As a temporary measure I have installed a double-pole, single-throw switch between the ground side of the L pad and the ground lead. As a result I can remove the L pad from the circuit. This, of course, cuts off the speaker sound completely.*

**A.** There is little that can be added to this, inasmuch as you have guessed the correct solution to this interesting problem. If you intend to use the L pad to reduce the volume of your speakers to zero, I suggest that you relocate this L pad at the amplifier. I believe this is the only way you will ever obtain a good, direct ground.

You indicated in your letter that you are using No. 22 conductors in your cable. Furthermore, this cable is used over a rather long distance. In addition to the troubles you have already experienced, I am sure that the cable also is creating a power loss, which is not particularly important when using headphones, but which is of significance when listening to your loudspeakers. The power loss is only part of the story, however. The resistance in the wire is high enough to prevent good damping between the speaker and the amplifier. If this damping isn't at least reasonably good, the sound quality of your speakers might be degraded. Æ



**Fig. 1**—Part of one channel of a headphone control unit is shown, with a modification (shaded area) that resulted in a speaker muting problem.

# This is more amplifier than you may think you need.

## But after you see the price, why settle for less.



The EICO "Cortina 3150" all-silicon solid-state 150 watt stereo amplifier is truly a lot of amplifier. It combines wide-range preamplifiers, controls, and power amplifiers, all on one uniquely compact chassis. It delivers clean power to two sets of speaker systems, stereo headphones (for which there is a jack on the front panel) and a tape recorder. The Cortina "3150" gives you complete control facilities.

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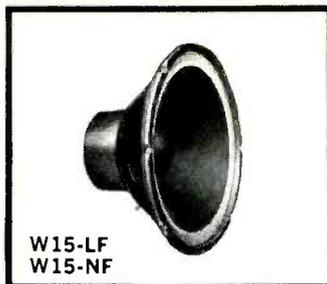
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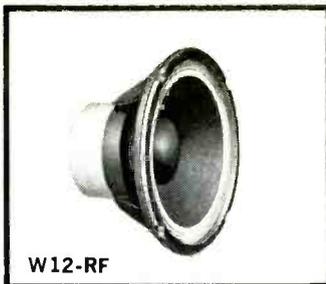
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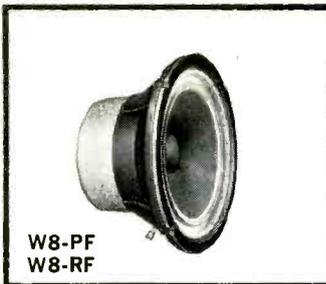
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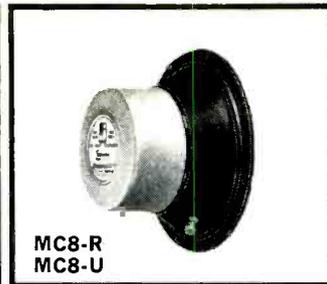
**W15-LF  
W15-NF**



**W12-RF**



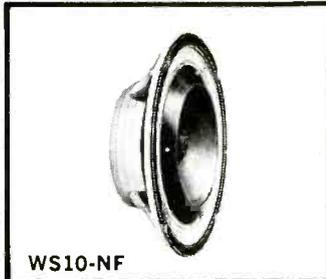
**W8-PF  
W8-RF**



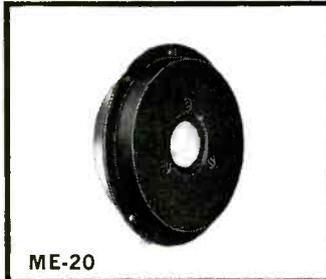
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MC8-U**



**W12-LF  
W12-NF**



**WS10-NF**



**ME-20**

**MC8-R.** Direct radiator 8-in. m-f unit. Closed back permits installation in woofer enclosure. Impedance, 8 ohms. Lowest recommended l-f crossover point, 600 cps. Frequency range, 600-4,000 cps. Power rating to network, 40 watts. Shpg. wt., 4 lbs. . . . \$23.25

**MC8-U.** Direct radiator 8-in. m-f unit. Closed back permits installation in woofer enclosure. Impedance, 8 ohms. Lowest recommended l-f crossover, 600 cps. Frequency range, 600-4,000 cps. Power rating to network, 30 watts. Shipping weight, 3 lbs. . . \$19.25

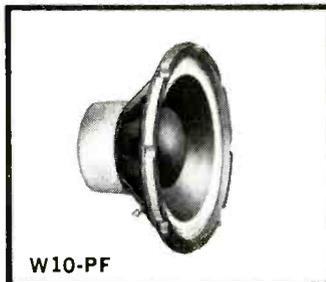
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**W12-NF, 12-in. WOOFER.** FLEXAIR suspension. Power rating, 35 watts. Impedance, 8 ohms. Magnet, 1¾ lb. SYNTAX-6. Highest recommended crossover point, 2,000 cps. Free-air resonance, 20 cps. Shipping weight, 9¼ lbs. . . . \$58.50

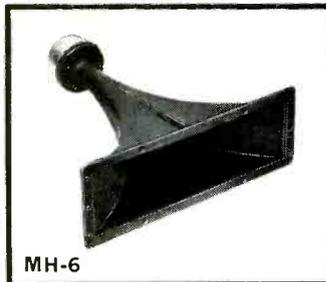


**W10-PF**

**W12-RF, 12-in. WOOFER.** FLEXAIR suspension. Power rating, 30 watts. Impedance, 8 ohms. Magnet, 6.8 oz. DP-Alnico-5. Highest recommended crossover point, 2,000 cps. Free-air resonance, 25 cps. Shipping weight, 6 lbs. . . . \$42.00

**WS10-NF, 10-in. WOOFER.** FLEXAIR suspension. Only 3¾-in. deep. Designed especially for shallow enclosures. Power rating, 30 watts. Impedance, 8 ohms. Magnet, 1¾ lbs. SYNTAX-6. Highest recommended crossover point, 2,000 cps. Free-air resonance, 25 cps. Shipping weight, 9½ lbs. . . . \$53.50

**W10-PF, 10-in. WOOFER.** FLEXAIR suspension. Power rating, 30 watts. Impedance, 8 ohms. Magnet, 14 oz. DP-Alnico-5. Highest recommended crossover point, 2,000 cps. Free-air resonance, 25 cps. Shipping weight, 7¼ lbs. . . . \$43.50



**MH-6**

**W8-PF, 8-in. WOOFER.** FLEXAIR suspension. Power rating, 30 watts. Impedance, 8 ohms. Magnet, 14 oz. SYNTAX-6. Highest recommended crossover point, 2,000 cps. Free-air resonance, 35 cps. Shipping weight, 5¼ lbs. . . . \$42.85

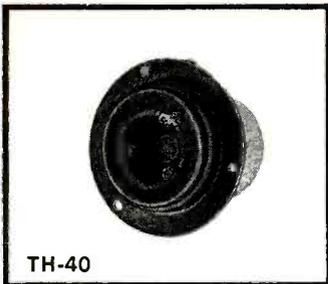
**W8-RF, 8-in. WOOFER.** FLEXAIR suspension. Power rating, 25 watts. Impedance, 8 ohms. Magnet, 6.8 oz. DP-Alnico-5. Highest recommended crossover point, 2,000 cps. Free-air resonance, 35 cps. Shipping weight, 3¾ lbs. . . . \$35.50

**MID-FREQUENCY  
SPEAKER UNITS**

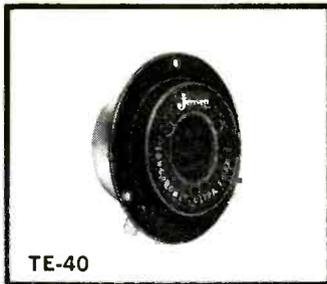
**ME-20.** SUPER SONO-DOME® m-f unit. Closed back permits installation in woofer enclosure. Exceptionally broad sound dispersion. Impedance, 8 ohms. Lowest recommended l-f crossover, 2,000 cps. Frequency range, 2,000-15,000 cps. Power rating, 35 watts to network. Shpg. wt., 5¼ lbs. . . . \$36.90

**MH-6.** Heavy duty horn-loaded m-f compression driver unit. Impedance, 8 ohms. Lowest recommended l-f crossover point, 600 cps. Frequency range, 600-15,000 cps. Power rating to network, 30 watts. Shipping weight, 2¼ lbs. . . . \$24.50

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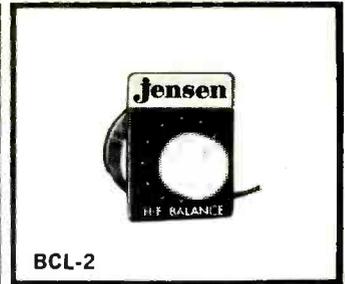
TH-40



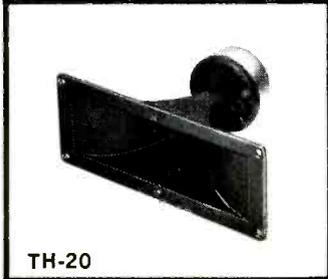
TE-40



A40/8  
A20/8



BCL-2



TH-20



TW30-V



A6410/8



BCP-1

### HIGH-FREQUENCY SPEAKER UNITS

**TH-40 SUPER TWEETER.** Heavy duty horn-loaded compression driver unit. Frequency range, 4,000-18,000 cps. Use above 4,000 cps. in 3-way or 4-way systems. Lowest recommended crossover point, 4,000 cps. Power rating, 45 watts to network. Impedance, 8 ohms. Shpg. wt., 3 lbs. ....\$41.85

**TH-20 HORN TWEETER.** Horn-loaded compression driver unit for 2-way and 3-way systems. Frequency range, 2,000-20,000 cps. Power rating to network, 30 watts. Impedance, 8 ohms. Shipping weight, 1 lb. ....\$19.95



TP30-V

**TE-40. SUPER SONO-DOME ULTRA-TWEETER.** For good dispersion. Frequency range, 4,000-25,000 cps. Use above 4,000 cps. in 3-way or 4-way systems. Power rating to network, 35 watts. Impedance, 8 ohms. Shipping weight, 1½ lbs. ....\$29.95

**TW30-V TWEETER.** Direct radiator with 3-in. diaphragm. Closed back permits mounting in I-f enclosure. Frequency range, 2,000-16,000 cps. Power rating to network, 25 watts. Impedance, 8 ohms. Shipping weight, 1¼ lbs. ....\$13.85

**TP35-V TWEETER.** Direct radiator with 3½-in. diaphragm. Closed back permits mounting in I-f enclosure. Frequency range, 2,000-16,000 cps. Power rating to network, 25 watts. Impedance, 8 ohms. Shipping weight, ¾ lb. ....\$6.50

**TP30-V TWEETER.** Low cost direct radiator unit with 3-in. diaphragm. Closed back permits mounting in I-f enclosure. Frequency range, 2,000-16,000 cps. Power rating to network, 25 watts. Impedance, 8 ohms. Shipping weight, ½ lb. ....\$5.50

### FREQUENCY DIVIDING NETWORKS

**A6/8, 2-WAY CROSSOVER NETWORK.** Provides crossover at 600 cps. for 2-way, 3-way or 4-way loudspeaker systems. Impedance, 8 ohms. Power rating, 100 watts. Shipping weight, 6 lbs. ....\$39.75

**A20/8, 2-WAY CROSSOVER NETWORK.** Provides crossover at 2,000 cps. for multi-way systems. Impedance, 8 ohms. Power rating, 100 watts. Shipping weight, 2½ lbs. ....\$29.95

**A40/8, 2-WAY CROSSOVER NETWORK.** Provides crossover at 4,000 cps. for 3-way or 4-way systems. Impedance, 8 ohms. Power rating, 100 watts. Shipping weight, 2½ lbs. ....\$26.50

**A6410/8, 3-WAY OR 4-WAY CROSSOVER NETWORK.** A deluxe multiple-frequency crossover network for 3-way or 4-way systems. Crossover frequencies; 600, 4,000 and, optionally, 10,000 cps. Impedance, 8 ohms. Power rating, 100 watts. Shipping weight, 7 lbs. ....\$44.50

### BALANCE CONTROLS

**BCL-2 CONTROL.** Wire-wound 2-deck L-pad with knob and escutcheon. For m-f or h-f balance adjustment in multi-way systems. Escutcheon plate reversible for m-f or h-f designation. Impedance, 8 ohms. Power rating to network, 45 watts. Shipping weight, ½ lb. ....\$8.95

**BCP-1 CONTROL.** Low cost wire-wound potentiometer with knob and escutcheon. For m-f or h-f balance adjustment in multi-way systems. Escutcheon plate reversible for m-f or h-f designation. Power rating to network, 30 watts. Impedance, 8 ohms. Shipping weight, ½ lb. ....\$5.75

### AUTOTRANSFORMER

**Z-3422 AUTOTRANSFORMER.** For matching any 2 of 16/8/4 ohm impedances. Power rating, 45 watts. ....\$10.50

Jensen has a complete new line of hi-fi loudspeaker system components. It's the largest selection available . . . anywhere. 26 different models in all. So what!

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# What's New In Audio

## Play and Stow

Ampex Corporation's new portable stereo tape recorder systems, open-reel Models 761 and 1461, feature cube-shaped speakers that nest in the recorder cabinet for either carrying or playing purposes (speakers must be removed from the compartment and placed apart for full stereo separation, of course).

The three-speed Model 761 has three magnetic tape heads, tape monitoring, sound-on-sound (new sound can be added to existing material on a single track), sound-with-sound (recording on one track while playing the other). Sound being recorded on one track may also be recorded on a second track with a slight delay. The three-speed Model 1461 has the same features, except that it uses four tape heads, and includes automatic reversing and tape threading. In addition, an automatic replay feature permits a tape to be programmed to repeat itself indefinitely. Both recorders feature stereo headphone outputs, automatic shut-off, in-



dividual volume controls, separate bass and treble controls, and illuminated VU meter.

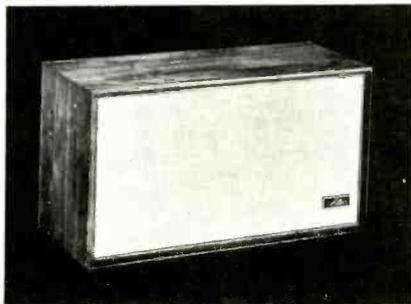
The new Model 415 cube-shaped speakers (sold separately for \$39.95 a pair) weigh about three pounds, are finished in oiled walnut, with a light beige grille cloth. Speakers come with a 10-ft. cord and molded phone plug.

Frequency response of both recorders are: 50 to 15 kHz  $\pm 4$  dB at  $7\frac{1}{2}$  ips, 50 to 7500 Hz  $\pm 4$  dB at  $3\frac{3}{4}$  ips, 50 to 3500 Hz  $\pm 6$  dB at  $1\frac{7}{8}$  ips. Signal-to-noise at  $7\frac{1}{2}$  ips is 46 dB, while wow-and-flutter is 0.15%. Rewind time for 1200 ft. of tape is 150 seconds. Power output is 8 watts rms/channel. Overall dimensions of the recorders are  $23\frac{1}{2}$ " x 14" x  $8\frac{1}{2}$ ", with a weight of 42 lbs. The Model 761 is priced at \$329, complete with speakers and two omni-directional microphones; Model 1461 is priced at \$429.00.

Check No. 4 on Reader Service Card

## New Altec Bookshelfer

Altec Lansing has announced a new bookshelf-size two-way speaker system, The CORONA Model 893A, priced under \$90.00. The  $12\frac{1}{4}$ " x  $9\frac{1}{2}$ " x 22" system, finished in hand-rubbed walnut with a contemporary snap-on grille, incorporates a high-compliance 10-in.



loudspeaker in an infinite baffle and a new three-in. direct-radiating high-frequency speaker. Frequency range is 50 to 18 kHz. The dividing network uses a cross-over frequency of 2500 Hz. System impedance is 8 ohms.

Check No. 8 on Reader Service Card

## Straight-Line-Tracking Tone Arm

A straight-line-tracking tone arm, Model SL-8, has been introduced by RABCO, a Silver Spring, Maryland company. As older hi-fiers will recall, there were a few such tone arms marketed a number of years ago, though none enjoyed great success as a separate component. (Marantz' SLT-12U, at \$295.00, is a combination manual turntable / straight-line-tracking tone arm / wood base unit.) The straight-line-tracking tone arm emulates a cutter-head's movement across a master recording. That is, it moves in a straight line while cutting grooves. Thus, the SL-8 tone arm plays a record as it was originally recorded.

The SL-8 tone arm uses a servo system that includes a single-transistor amplifier and a Swiss servo motor. Power is supplied by a standard "C"



battery, with battery life said to be roughly equivalent to its shelf life. The  $3\frac{3}{4}$ -in. high (adjustable), 14-in.-long arm is said to be able to track with a force as low as  $\frac{1}{4}$  gram. It accepts cartridges with standard  $\frac{1}{2}$ -in. mounting holes. Standard two-channel stereo jacks are provided on the frame. \$149.50.

Check No. 10 on Reader Service Card

## This and That

Norelco has introduced a head-cleaning cassette that will retail for under \$2.50. A porous polyester fiber is said to permit excellent absorption of tape oxide, dirt and grease without eroding the recording or playback tape heads. It's used in the same manner as ordinary cassettes—simply snap it into the machine and let it do its work.

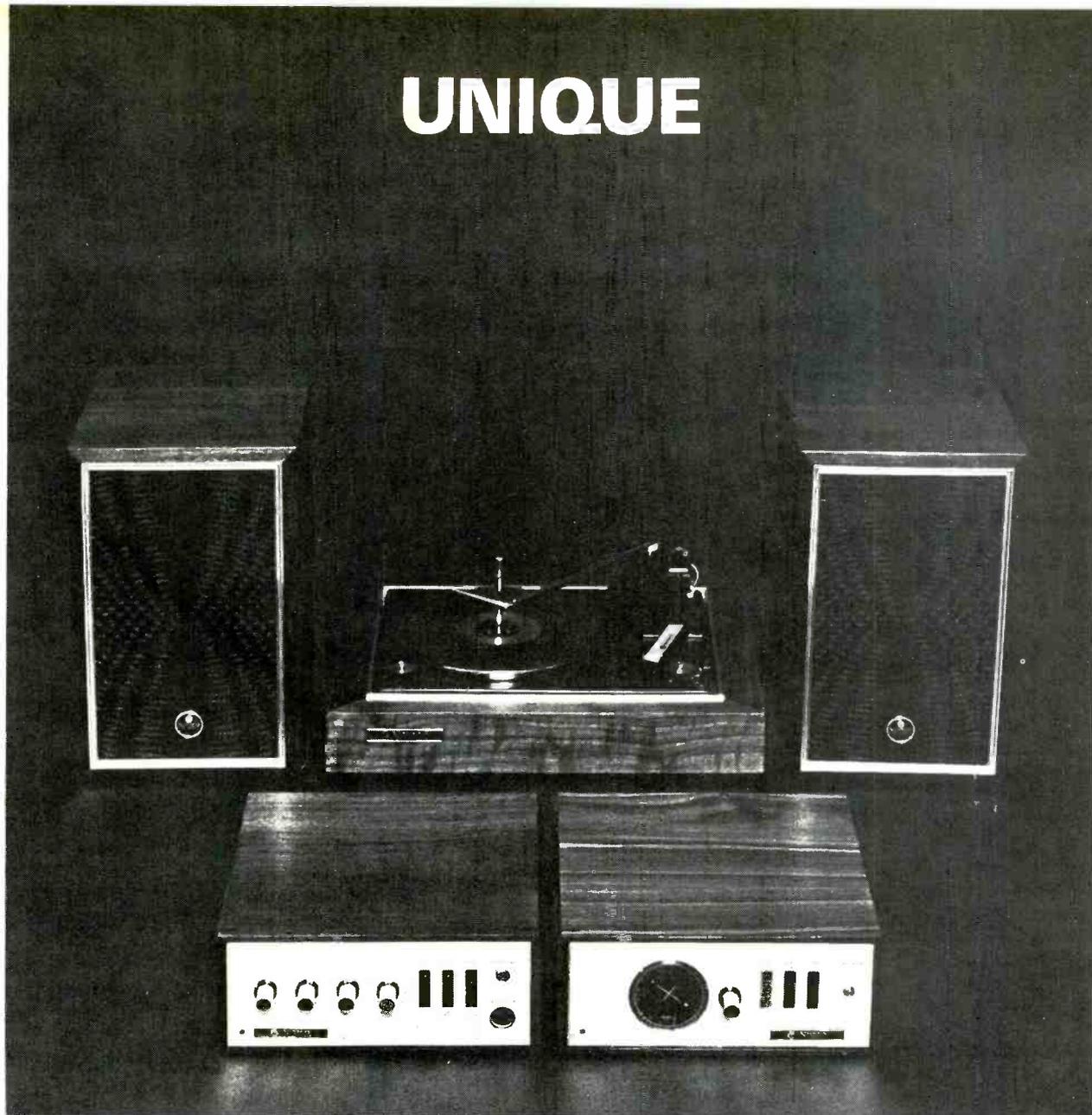
The Hammond Corp. is reported to be planning to enter the hi-fi market with two reverberation models that can be attached to stereo sets.

## Giant Amplifier

Estey Musical Instrument Corporation's Magnatone Division recently introduced a 1000-watt amplifier (EIA rating, no doubt, but impressive nonetheless) that is packaged with two 15-in. woofers, two 15-in. mid-range speakers, two 15-in. passive radiators, four 10-in. high-frequency speakers, and eight high-frequency horns. It stands almost eight feet high and weighs more than 500 lbs.



# UNIQUE



## FOUR COMPONENT MICRO COMPACT SOLID STATE 44 WATT AMPLIFIER, AM/FM FM STEREO TUNER, MICRO 4 SPEED AUTOMATIC STEREO TURNTABLE AND TWO MATCHING SPEAKERS.

Models 5004-5005 clearly reflect another unique characteristic of our approach to the development of home entertainment equipment. Truly an outstanding achievement of miniaturization, each unit weighs just 7 pounds and measures only 9 inches in width, 3 $\frac{3}{4}$  inches in height and 8 $\frac{3}{4}$  inches in depth. Primarily designed to fit on a bookshelf, these units are also ideal for areas where space is a significant problem. Tonal reproduction is dramatically enhanced by the matching speakers (model 5300) which of course are also designed to fit bookshelves or other space-restricted areas. The automatic micro turntable completes this miniaturized stereo package and adds immeasurably to the versatility of the system. Models 5004-5005 and its matching micro components are further examples of the unique home entertainment units we are now introducing in the United States. As Japan's oldest and largest stereo equipment manufacturer we currently produce well over forty percent of all records manufactured in the Orient, as well as design and manufacture every component part of each unit we produce. This latter manufacturing capability enables us to achieve engineering perfection without equal or compromise.

**MODEL 5004 SPECIFICATIONS:** Micro compact solid state amplifier • 44 watts total power • THD at rated power less than 1% • 18 transistors, 4 diodes • tape input jack for recording and playback • tape monitor switch for monitoring sound being taped • stereo headphone jack • size— 9" W. x 3 $\frac{3}{4}$ " H. x 8 $\frac{3}{4}$ " D. • cabinet finished in hand rubbed oiled walnut.

**MODEL 5005 SPECIFICATIONS:** Solid state micro compact AM/FM/FM stereo tuner • automatic frequency control • stereo indicator light • 18 transistors, 4 diodes • size— 9" W. x 3 $\frac{3}{4}$ " H. x 8 $\frac{3}{4}$ " D. • cabinet finished in hand rubbed oiled walnut.

**MODEL 5300 SPECIFICATIONS:** Matching compact speakers • contains 4" woofer with roll-free edge cone, low distortion cone tweeter • completely air sealed cabinet • impedance 8 ohm • response, 45-20,000 Hz • dimensions 11 $\frac{3}{4}$ " H. x 7 $\frac{1}{2}$ " W. x 8 $\frac{3}{4}$ " D. • cabinets finished in hand rubbed oiled walnut.

**MODEL 5204 SPECIFICATIONS:** Micro compact 4 speed automatic stereo turntable • two pole synchronous motor • rubber matted 7 $\frac{1}{2}$ " turntable accommodates records up to 12 inches in diameter • up to 6 records can be stacked and played automatically • ceramic cartridge with diamond needle • dimensions 6 $\frac{1}{2}$ " H. x 14 $\frac{1}{2}$ " W. x 11 $\frac{1}{4}$ " D. • Cabinet finished in hand rubbed oiled walnut.

**JVC**  
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# Audio Techniques

JOSEPH GIOVANELLI

The following material has been submitted by YOU, the reader of AUDIO MAGAZINE, so that your experiences and ideas related to sound can be shared by others. This is really interesting material, and we all thank you for it. Keep 'em coming!

## Restoring Loudspeaker Dust Covers

During house cleaning, a broom handle was recently allowed to fall against one of my speaker systems, hitting the little dome in the center of the mid-range speaker and crushing it in on one side.

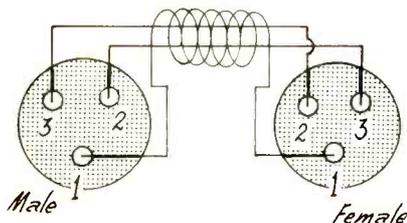
I described the problem to a friend who suggested, "Why don't you try a vacuum," I did. The vacuum is of the tank type. Hence, it has a convenient hose. I applied the metal end of the hose to the dome. After a second of suspense, there was a "plop" sound. The dome was re-shaped.

I intend to put a coating of thinned-down glue over the area, because there is a weak spot now.—C. Kerkham, Manitoba, Canada

## Out-of-Phase Microphones

I have been working sound systems since 1926. During this time I have run into cases of out-of-phase conditions when using two microphones on the same rostrum. Generally there is no time to make the needed correction in the mike cable connections. To overcome this problem I made up a short length of mike cable with a female and a male conductor. (Fig. 1). Instead of

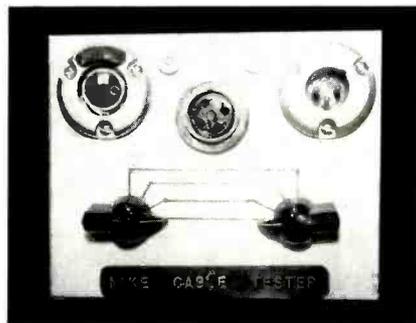
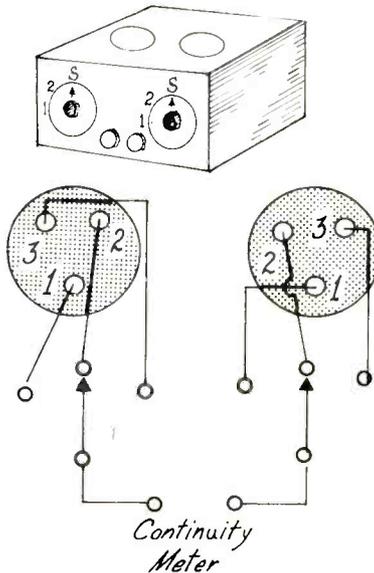
Fig. 1—Device to speedily correct for out-of-phase microphone hookups.



wiring these two connectors straight through as they should normally be wired, I cross-wired them. Now when I find an out-of-phase condition, I have only to insert this special adapter in one line or the other and I am okay.—Edward Scribner, Schoharie, N. Y.

## Checking Mike Cables

I made up a small switch box with two connectors, one a male and the other a female, to fit the mike cables I use (Fig. 2). With two rotary switches and a meter set to read continuity, I am able to determine if the cables are properly phased in their wiring, or be-



Figs. 2 and 3—Microphone cable checker design is shown above, with a photo of the completed instrument below it.

tween the wires and the shield. The meter can be set for very low resistance measurements or for very high resistance measurements, as the use dictates.

Figure 3 is a photo of the completed instrument. At the top of the cabinet, which measures 3" by 4" by 5" (Bud aluminum), you will note the two pin jacks to be connected to an ohmmeter. The black lines indicate where a circuit should be found. If found in any

other combination, something is wrong. On position four (top) there is no circuit, but I included it for (perhaps) something in the future. The four-pin jack in the center is the combination hi-lo impedance plug for Electro-voice and some other mikes.

This four-pin socket is used in conjunction with the male jack, in my case. It may be the female jack with someone else's ideas. This is so easily adjusted for one's own system of cord arrangements, of course.

This tester has saved me many hours of checking, holding the test prods on the terminals, slipping and getting false readings, and then, in the end, forgetting where the trouble lay. Here it is so simple!—Edward Scribner, Schoharie, N. Y.

## Ignition & Generator Noise Suppression

Because for over six years I have owned a Saab auto in which I installed an AM/FM German radio, I have gained practical experience in suppressing ignition and generator noise.

In addition to suppressors on the ignition system, coil output, plugs, generator, distributor, and voltage regulator, grounding is the most overlooked step. To regress, placing resistance wire between the coil and distributor, and the distributor and plugs is the easiest and cheapest method of suppressing interference. (This resistance wire cannot be used with transistor ignition systems.—Ed.)

Connecting heavy, Belden flat braid between the generator and the frame will help suppress r.f., both in and out. Do not neglect the grounding of the springs between the axle of the non-powered wheels and their grease caps. The use of conducting straps connected to the car's frame, and allowed to drag on the ground, sometimes helps.

As a trial-and-error step, re-position the coil. Usually, the shorter the coil's output cable is, the better the suppression.—Earle Stevens, Paterson, N. J.

Got any hints or aids to enhance equipment performance? Simplify operation? Construction shortcuts? Audio invites readers to send them in to Mr. Joseph Giovanelli at AUDIO, 134 North Thirteenth St., Philadelphia, Pa. 19107. Please enclose a stamped, self-addressed envelope.

# Does WHARFEDALE still use sand in its speaker systems?

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## MORE COSTLY TO BUILD... AND WORTH IT!



1. Cabinet back cover being assembled. Heavy plywood walls are further strengthened by thick wood braces, forming a strong, rigid panel with cavities.



2. Panels are stacked on specially designed vibrating machine. Note small, round openings on top edges, for fine-grain, cleansed white sand.



3. Sand is poured on, filtering slowly through small openings into panel cavities. Vibration machine eliminates air pockets, insures maximum compression.



4. Feed holes are sealed with wood plugs. Panel becomes totally inert to the back waves of sound which will be projected against it in the speaker enclosure.

**HEARING... AND SEEING... IS BELIEVING.** Once you hear the sound of Wharfedale *Achromatic* Speaker Systems, you will understand why Wharfedale has earned the loyalty of the most knowledgeable listeners in music and audiophile circles. *Achromatic* sound is rich, full, realistic sound reproduction, uncolored by extraneous modulations. The speakers and cabinet perform together as a single unit in correct acoustical balance to provide a truly faithful duplication of the original performance. It's the result of unique and exclusive construction features and techniques developed by Wharfedale.

What's more, you'll be delighted by Wharfedale cabinets: decor-conscious proportions; fine furniture finish; tasteful grille fabrics, removable at will; design that is a refreshing departure from conventional "boxy" shapes.



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# BEHIND THE SCENES

BERT WHYTE



## An Audio Engineer Reports on the State of Russian Recording

*Last June, Dr. Ray Dolby visited the Moscow studios of Melodiya Records. Here are his impressions, as told to Bert Whyte:*

About a half mile leisurely stroll from the Kremlin and Red Square is an imposing Pre-Revolutionary red-brick edifice set back from the main street about a hundred feet. In the days of the Czars it was an English Protestant Church. Now it is the Moscow headquarters and studios of Melodiya Records, the official Russian state agency for recording.

On June 5th of this year Dr. Ray Dolby was a guest of Melodiya, visiting this unusual recording studio. I asked him what had occasioned his trip to Moscow. "Some time ago," he replied, "I received a letter from Archinov, the chief engineer of Melodiya, requesting information on time constants in my audio noise reduction system. He told me that he had first encountered the system at an English Decca recording session in Vienna. I was at the AES Convention in Los Angeles when my office informed me that Melodiya had purchased several of my A301 units. As I was returning to England via Hong Kong and Singapore, I decided to stop off in Moscow since I was curious about their facilities and how they were going to handle my A301."

I asked Dr. Dolby if he had much trouble with visas and arranging the visit. He laughed and said, "Not as much as you might think. The only problem is that there isn't much choice in Moscow among hotels. I was ensconced in the Metropole, a somewhat down-at-the-heels place, for three days, while awaiting the completion of arrangements for my visit to Melodiya.

The food was terrible! I was also much surprised to find that caviar is almost as expensive in Russia as it is in the States!"

Formalities completed, Dr. Dolby said he received a gracious welcome at the Melodiya studios. Chief engineer Archinov escorted him on a tour of the facilities. "The first thing I noted," said Dr. Dolby, "was the size of their main studio. It is actually the main body of the church where the pews used to be. At the end where the choir chancels and altar were, they built a large glass-windowed control booth. Thirty-foot stained glass windows have been removed and replaced with double-plate glass which has a large air space between the panes for insulation. The walls are completely covered with acoustic tile and there is a wood floor."

I asked if he had heard any recording sessions while he was at the studio. "As a matter of fact," he said, "I interrupted a pop session when I arrived. A 7- or 8-piece combo was arrayed in very much the same fashion as in the States, with Neumann mikes in a typical multi-mike set-up. They made extensive use of reflective and absorptive panels . . . what we call "goboes" in American studio slang."

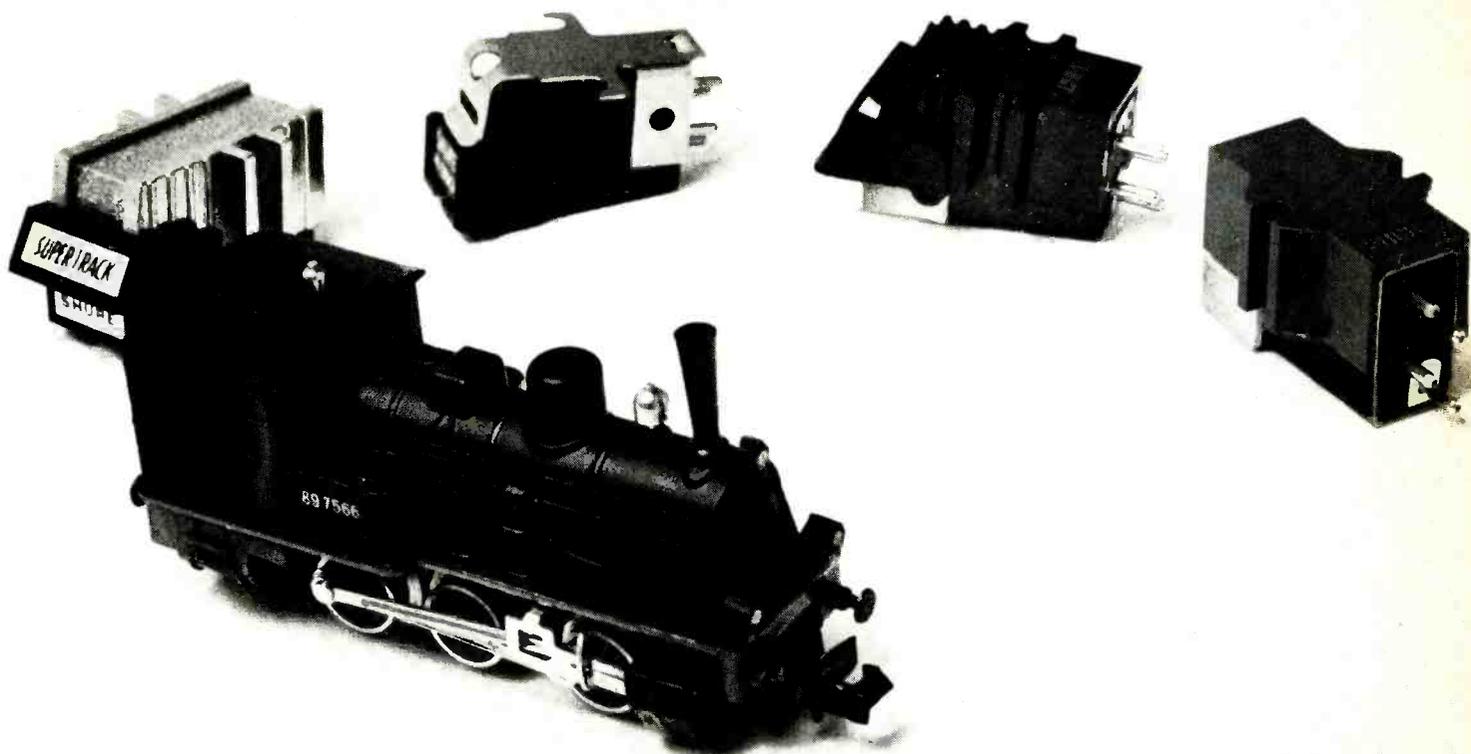
I asked if he had a chance to hear the mix in the control booth. He replied affirmatively, noting that the sound was well balanced and quite clean. In answer to my question on what kind of recording equipment Melodiya uses, Dr. Dolby characterized it as variable. "They use a number of tape recorders, but seem to favor the Danish Lyrec machine and the Studer C-37." (To my knowledge I don't know of any Lyrec recorders in this country, but the Studer is fairly well known, being an import of Gotham Audio in New York. The "baby brother" of the Studer, the ReVox, is also distributed in the U.S.) Dr. Dolby continued: ". . . they also

use Hungarian tape recorders which seem to be a copy of the Studer. The tape format was 3 channel on half-inch tape. Melodiya uses the typical American 3-channel spread in its stereo recording configuration, rather than the M/S or other European types. The monitoring is done on 3 loudspeakers, which look and sound like typical studio Altecs, but are, in truth, Russian built. In fact, the speakers are just about the only Russian equipment in evidence."

"The mixing console is a solid-state unit made by the WSW Company of Vienna. It appears to have at least 18 inputs and a full complement of echo send and return pots. EMT echo units are used, just the same as in America. The Russians prefer to use peak-level recording meters rather than the conventional VU meters. The Russian recording standard is different than either our NAB or European DIN. I should add here that, in general, their transistor technology seems to be lagging behind America. There was one other piece of Russian equipment that was under construction, a tape machine that, again, copied the Studer. Tubes rather than transistors were being used. As I mentioned, Neumann was the predominant mike, with a few AKG, but no Russian designs in evidence. Melodiya uses Agfa type 525 and 555 recording tape. Their mastering speed is 15 ips."

What kind of disc equipment does Melodiya use? Dr. Dolby saw Neumann lathes and Lyrec lathes, the latter seeming to be favored. Ortofon cutting heads are employed. Ortofon vacuum tube amplifiers drive the cutting head and Ortofon amplifiers are also used for various playback purposes. "You may be interested to know," said Dr. Dolby, "that while I was at Melodiya I saw a woman operating a Lyrec cutting lathe . . . a sight not too uncommon in Russia, but certainly rare in our country. In the disc-cutting room I found they were using American Transco lacquers, which rather surprised me." I asked Dr. Dolby if he had seen any typical American recording equipment such as Ampex tape machines, Scully lathes, etc. "No . . . none at all," he replied, "but it is not because they don't want American equipment. They just can't buy it under present restrictions. I don't know where they obtained the Transco lacquers, and they didn't say."

Dr. Dolby then described the other features of the Melodiya operation. "They have about 6 to 8 editing and listening rooms and a room with a few tape machines for small-scale dupli-



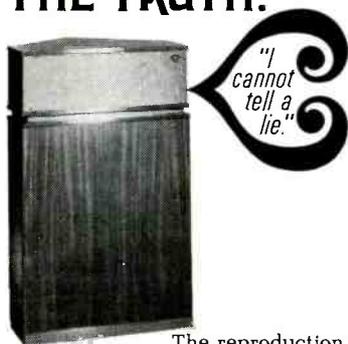
## TRACKABILITY is much more than a train of thought

Trackability makes a *hearable* difference. It's a measure of performance that most cartridges will not attain. *Only* a high trackability cartridge will track all the grooves on today's recordings at record saving less-than-one-gram force. The **Shure V-15 Type II Super-Track** is one such cartridge — the very best. The world over, every independent expert who has tested it agrees to that. Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill. 60204.

Only Shure offers a complete spectrum of cartridges to match your equipment, your ear, and your exchequer. The incomparable V-15 Type II Super-Track at \$67.50; the New M90 series of Easy-Mount Hi-Track cartridges at \$39.95 to \$49.95; the M75 Hi-Track series at \$24.50 to \$39.95; and the Stereo Dynetic series; Model M55E at \$35.50; M44\* series from \$17.95 to \$34.50; M31-32\* series at \$29.95 and \$29.50; and the M3D\*—the all-time best-seller—at only \$15.75. (\*not illustrated) Send for specifications and the complete Raison d'Étre for each.

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cation. The playback equipment is mainly Ortofon for turntables and cartridges, tubed amplifiers and the Russian copy of Altec speakers. One thing I noted was that, in spite of generally new appearing equipment, maintenance was something lacking. For example, with one of the turntables operating, a bad hum was heard. This disturbed me, but didn't seem to bother anyone else. Then, too, there was a general makeshift air to the installations due to exposed cables and so on. The rooms seemed dingy in comparison to the shiny equipment it contained. Perhaps this 'temporary' feeling and look is due to frequent changes of equipment."

Melodiya also maintains complete recording set-ups with mixing consoles, Studer tape machines, and other equipment at the Bolshoi ballet and Tchaikovsky Hall.

What was Dr. Dolby's overall impression of the quality of the Melodiya recording? "Good," he replied, "quite good and getting better. The Russians have competent engineers who make frequent trips to the West and are interested in any new equipment or technique which will enhance the quality of their product. There was no question of ideologies while I was at Melodiya . . . merely polite and courteous interchange of information from scientist to scientist. One big advantage the Russians have is a plenitude of acoustically superb halls which greatly aid their classical recordings."

With the Russians being a very musically oriented people, did Dr. Dolby see any evidence of the beginnings of a high-fidelity market? "Not really," he replied. "The Melodiya output is mainly monophonic and their small stereo output is augmented by imports from their satellite countries such as the Deutsche Shallplatten VEB and Supraphon record labels. There was no sign of FM stereo multiplex, nor does Melodiya issue any pre-recorded tapes. However, it was hinted that when the time comes, the cassette format will probably be favored."

I mentioned to Dr. Dolby that I had heard that records were very expensive in Russia. "On the contrary," he said, "I visited a small record shop, about 20 by 20 feet, on a street which specializes in musical items, and bought a Melodiya stereo LP for the equivalent of a dollar. You should have seen this shop. It was fairly dark and had a sort of fusty Victorian atmosphere. The stock was limited, but the young lady in charged picked up a small catalog and read to me what titles were available! They have what are called 'people's records,' little seven-in. mono

discs that are stamped out of the same type of thin, flexible vinyl much used by record clubs in the U.S. as a sampler. These cost about 10 cents each and the sound on them is surprisingly good. The Russians also have 'music magazines' in which as many as 8 to 10 of these thin plastic discs are included as part of the price of the magazine. Their content is very varied, but often contains music from current movies and plays."

Before Dr. Dolby left Moscow, he was also a guest of the VNIIRT, the Soviet agency for radio and television broadcasting. Accompanied by senior engineer Vasilevsky, he was inspecting the various studios and control rooms when they came upon a Russian prototype video tape recorder under construction. Dr. Dolby was astonished when he recognized circuitry belonging to Ampex video tape recorders, having been mainly responsible for the electronic aspects of the Ampex unit. The Russian engineer blandly explained that they would have preferred to buy the recorders from the West, but since this was not possible, they were forced to copy them! The Russians have several hundred VTRs in operation. Their newest VTR is transistorized and set for color. The Russians use the French SECAM system for color TV, which operates at 625 lines per inch and 50 fields per second. There isn't much color TV activity at present, but they expect a rapid expansion. The VNIIRT has purchased a Dolby A301 unit for evaluation because they have a big tape exchange program among the 800 stations throughout the Soviet Union, and a great deal of tape copying goes on. With the adoption of the Dolby system, they could eliminate the increase of noise on the tape caused by successive generations of tape copies.

In addition to five Dolby A301 units ordered by Melodiya, several of the satellite-country record labels are equipped with one or more A301s, including Balkentone in Bulgaria, Deutsche Shallplatten BEB in East Germany and Supraphon in Czechoslovakia; Polskinagrani in Poland requesting units for evaluation. Presumably they can interchange master tapes with Melodiya in the Dolby "compressed" mode; this will afford a new source of high-quality recordings. Lastly, since Melodiya sends its tapes to Angel in New York, who produce the disc recordings and pre-recorded tapes of Melodiya material for sale in the U.S., it is presumed they will send Dolby copies. Thus we can look forward to many interesting Russian recordings. Æ

# If you enjoy listening to records, you should know why the 15° vertical tracking angle is important to you.

Simply stated, audio engineers and experts agree that for minimum distortion your turntable tonearm should always track at a 15° vertical stylus tracking angle.

Just like the recording cutter that cut the records.

Just like the fine quality manual transcription turntables.

Just like your records were intended to be played.

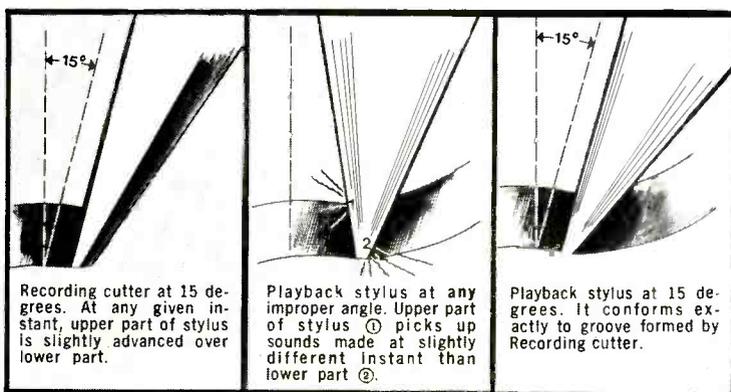
The reason for this is quite simple if you visualize the recording cutting stylus making the record groove, cutting the undulations that will be converted into sound, with the recording cutter set at the 15° vertical angle — the recording industry's now accepted standard. Obviously, the upper part of any single undulation is slightly advanced over the lower part; an imaginary axis through any single vibration would be tilted 15 degrees from the vertical.

Therefore, if a playback stylus moves through the groove at any angle other than 15 degrees, the upper part of the stylus shank will come into contact with a different undulation than the lower part of the shank, producing distortion.

Until now, only with manual transcription turntables, was it possible to obtain 15° vertical tracking — one reason manuals were preferred by high fidelity

experts. Automatic turntables, with a varying number of records on the platter, had to make a compromise in the stylus tracking angle. Either the tonearm tracked the first record perfectly, or the last record, or it was fixed for some "average" record in between.

Now, the new ELPA PE-2020 permits 15° vertical tracking on all records. It has an exclusive, patented



control in the cartridge mount. You can convert the changer into a manual, single-play turntable (with automatic arm return and shut-off), or set it for automatic multiple play . . . and always be assured that you are tracking at the correct angle for minimum distortion.

If the automatic turntable you are consider-

ing doesn't have this feature, it cannot possibly track records perfectly. And this is **only one** exclusive feature of the new ELPA PE-2020. Be sure to see all the exclusive and refined features of this advanced turntable. They make the ELPA PE-2020 the world's finest and most precise automatic turntable in the world.

Give yourself a break. Buy the precision turntable the experts are turning to.

For literature, and name of nearest dealer, write:  
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New Hyde Park, N. Y. 11040



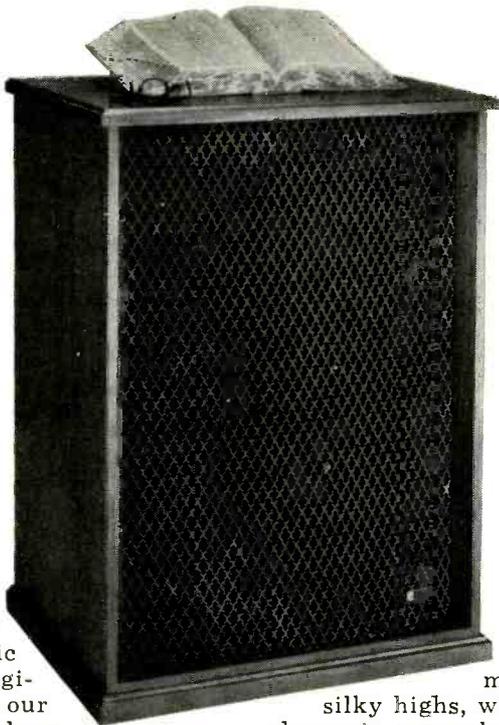
If you own or intend to use  
a cartridge\* with a 15° vertical  
tracking angle, then the  
**ELPA PE-2020**  
is the only automatic  
turntable designed for you!



\* Ortofon, Stanton, Shure, Pickering and other fine 15° Cartridges

\* Ortofon, Stanton, Shure, Pickering and other fine 15° Cartridges

# Our speaker is now a household word.



Around recording and motion picture studios, our name is almost a generic term. Audio engineers swear by our equipment and rely on it for realistic sound reproduction and playback.

But we're just as much at home around people who want studio quality sound in their living rooms.

One reason is our full-sized A7-500W-II Magnificent speaker system you see above.

Its hand-crafted, oiled walnut cabinet and wood fretwork grille handsomely houses our famous A7-500 "The Voice of the Theatre"<sup>®</sup>: a hefty 15" LF speaker with cast aluminum frame and 10-lb. magnetic structure in a front-loaded exponential horn; a HF driver that works from the lower mid-ranges to beyond audibility without distortion or the need for another crossover; a 25" cast aluminum horn that smoothly distributes frequencies above 500 Hz over a wide, room-filling angle at all frequencies; a precision, two-section 500 Hz crossover network that permits this combination of components to perform at peak efficiency.

Another reason is that we don't let a Magnificent out of our sight until all these components are mounted, tested and tuned to perfection.

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Though they're just half the size of the Magnificent, there's no sibling rivalry here.

Full-sized systems in themselves, their 800 Hz "The Voice of the Theatre" components make beautiful sounds from behind contemporary or Spanish styled grilles and oak or walnut cabinetry.

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## Letters

### Absolute Pitch

• Your August item on absolute pitch interests me. Especially the second word in the item: "(alleged)."

If you have never met anyone who had perfect pitch, you may well think it is unlikely or impossible. I grew up with a man who had perfect absolute pitch, and has it to this day. Perfect *absolute* pitch, unlike relative pitch, is the ability to recognize a note immediately and infallibly, with no reference note, no rehearsal, no practice.

It was always amazing to tap on a teacup without warning and say "What note, Larry?" And have him answer "B flat above high C, but it's a trifle sharp." We'd go to the piano and find that he was exactly right. I have seen him tune my violin without any reference tone, and find it in exact tune with a piano. He is a pianist, though not by profession, and grew up in a musical home. However, he claims to have had this ability all his life, and to have run into a number of others who shared it.

The tests you cite seem to be inconclusive, but your parenthesized word "alleged" is certainly out of place.

LEN RUTSTEIN  
New York, N. Y.

*The item was based on conclusions of researchers at Toronto University, who were unable to prove or disprove that there is such a thing as absolute pitch.—Ed.*

### Prerecorded Tape

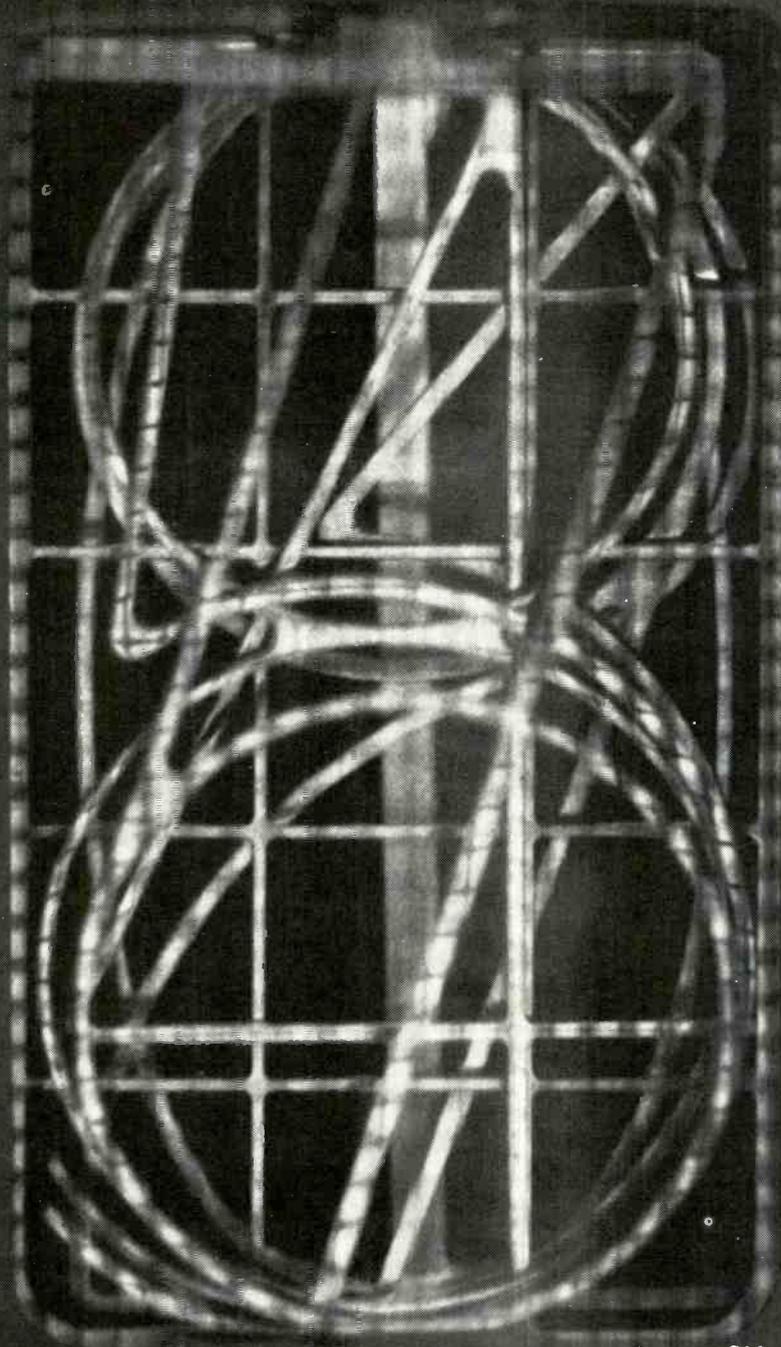
• Your column on prerecorded tapes in the June issue of AUDIO concerned the issue of an RCA Victor, No. TR35018 tape of Miss Leontyne Price doing 18 excerpts from various operas. You stated in your column that you own the equivalent stereo disc.

Speaking for readers of AUDIO who do not own tape machines, I would say that you have dealt us a low blow by not including the disc album number in your remarks.

VOSPHER L. CLARKE  
Newark, N. J.

*RCA Victor disc album numbers are: LM/LSC-2898 and LM/LSC-2968. Any record dealer worth his salt should be able to locate the LP album number quickly, of course. The Schwann Long Playing Record Catalog is most useful for this purpose.—Ed.*

# You'll never dial a wrong number again



Look very closely at the new CM channel selector. You'll see something you never saw before. CM has done away with the traditional tuning dial. Closed the little green eye forever.

Look closely inside the new CM channel selector. You'll see things you never believed possible. New concepts in circuitry to bring you practically distortionless FM reception without drift. Exactly on station every time. You can't dial a wrong number.

Unbelievable? Just relax and . . .  
*listen — for a change.*



**LABORATORIES**  
Norwalk, Connecticut

# Tape Guide

HERMAN BURSTEIN

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

## 'Scope as Record-Level Indicator

If ever there was a difficult course to steer it is between excessive tape distortion and inadequate signal-to-noise ratio. In other words, we are once again talking about the problem of setting a tape machine's record level control *just right*. We have had previous suggestions from readers concerning the use of an oscilloscope as a record level indicator. The 'scope is superior to a VU meter because the 'scope has virtually instantaneous response to audio signals and can therefore show true signal level reaching the tape, thus providing adequate warning of distortion. And the 'scope can match the VU meter in showing relative recording level; that is, one can calibrate the 'scope to show gradations in dB.

By far the most comprehensive communication I have yet had on such use of a 'scope comes from Craig L. Stark of Painesville, Ohio. He writes:

"With care and experience it is certainly possible to do a decent job [of setting record level] using standard VU meters, though of course precious few recorders outside the 'genuine' professional class utilize them . . . But at best the use of such meters requires experienced judgment which takes into account the type of music being recorded. Female chorus frequently under-indicates because the high treble content, subjected to record pre-emphasis, drives the tape into the distortion region long before 'normal' music . . . The reverse is often true with organ music — an important fact because given the tremendous dynamic range involved, every decibel into the red you can go [when setting record level on the basis of a VU meter] means less audible electronic muddying of the soft sections. The cheap

milliammeters called 'VU meters' used in most recorders are even more problematic in their indications.

"I do not know whether it was from you or from the redoubtable Crowhurst that I first got the notion of using a calibrated oscilloscope as a record level indicator. It combines the advantage of the tuning eye's instantaneous response with an ability to judge actual dB units, at least within the tolerance necessary, and gives in addition much important information which can be obtained in no other way. Best of all, the cheapest of 'scopes . . . will do the job.

"I calibrate my 'scope by feeding a 400-Hz signal at 0 VU into the 'scope, left channel into the vertical input and right channel into the horizontal input, and adjust the 'scope gain for the 45° 'mono' line 4 cm. in length. With a white grease pencil I have marked a square on the graticule at the 8-cm. point, which is of course exactly +6 VU. (My VU meters were originally calibrated so the +8 VU produces 3% THD at 400 Hz. This gives a nice 2-dB cushion.) This means that as long as I keep the peaks within the white square, distortion will be acceptably low.

"The 'scrambled egg' pattern produced is exceedingly informative. Any overload, besides exceeding the size of the calibrated square, shows up as a flattening of the deflection due to clipping. Channel balance is easily evaluated this way, and the 'rounder' the scrambled egg, the better the separation. Mis-phasing a microphone makes the monophonic components in the pattern slant the wrong way. And of course one gets peak level indications this way. The only point to check is the calibration of the scope amplifiers, since any considerable line voltage change would directly affect their deflection. I have found, however, that this effect is by and large negligible. Almost any 'scope, including surplus types, has adequate sensitivity, since the level involved is approximately 1 volt, and frequency response in the audio range is adequate with any 'scope I have run into. No sweep, of course, is needed. A thickening of the trace indicates bias leakage."

So much for use of a 'scope as a record level indicator. Mr. Craig moves on to another subject that has perplexed many a tape enthusiast, whether pressure pads are necessarily deleterious. The general belief has been that it is better to avoid them when feasible, and professional machines in the main have done so. But let's see what Mr. Craig has to say on this score:

"My tape equipment is certainly above average for the audiophile, and utilizes the 'wrap' around the heads to eliminate pressure pads. On quarter-track recording, however, despite every possible adjustment to ensure intimate contact between head and tape, there is always some trouble with the upper edge, or left channel. This is most noticeable at the very high frequencies, where frequency response tests are often obscured . . . The addition of a small pressure pad, particularly on the record head (for some reason) clears this up wonderfully, and gives about 2 to 2.5 dB greater response. This means that playback equalization (or record, depending on which is off) can drop back a couple of dB at 15 kHz, more than compensating for any additional scrape noise induced by the pressure pad, and resulting in a better signal-to-noise ratio.

"To this advantage may be added some reduction in flutter (and a considerable reduction of high-frequency dropouts). The pad tends to damp deck vibrations originating in the capstan drive system or drive motor (or revolving flutter-filter) which modulate the signal. In addition, it is well known that flutter and wow frequently originate in the varying tension put on the tape during its passage from the supply to the take-up reel. Unfortunately as the diameter of the supply reel decreases, its tension for holdback increases, and vice-versa for the take-up reel. Ideally there should be no such change in tension, particularly on holdback, where the capstan puck roller can't help. Some holdback is of course necessary, but the higher the proportion of it which is constant, the better. Pads against the tape heads increase the drag there, allowing tension to be lowered at the supply reel, resulting in less overall change during the course of the reel.

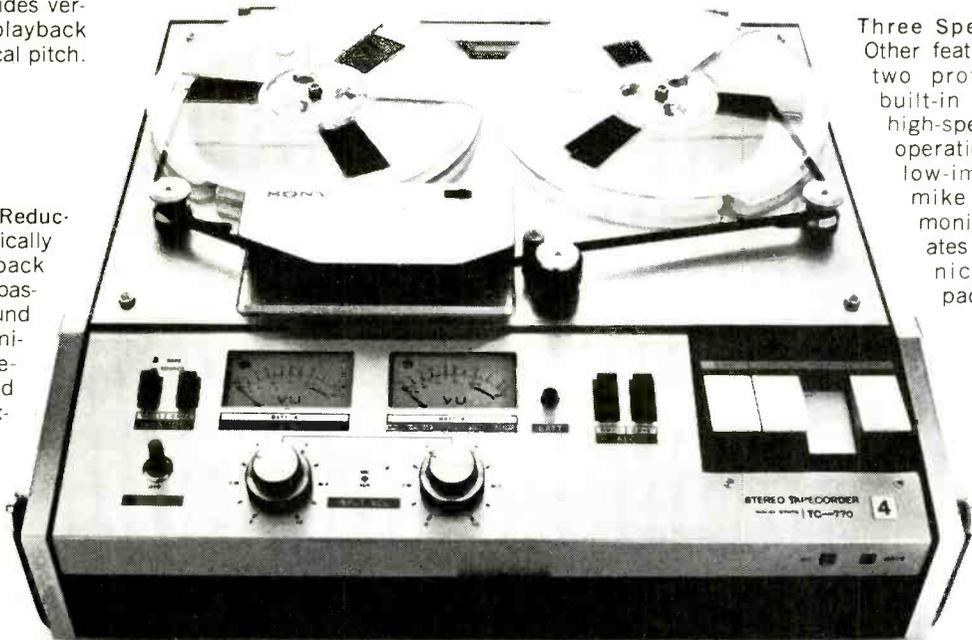
"Fabricating pressure pads for machines which do not normally incorporate them presents some possible mechanical difficulties, of course, but these can be overcome, given sufficient ingenuity. I have found that the contact leaves of a number of different surplus relays are ideal for mounting the felt pads: careful selection permits just enough spring in the pad mounting. It is interesting to note in this connection that the Crown SX-800 series uses such a pad on the record head, and one of Magnecord's people suggested I install one on my Magnecord. The need for a pad is easily determined by simultaneously recording and playing a 15-kHz tone and putting your finger on the

# The best your money can buy. Period!

**Better-than-Studio Specs.** Frequency response: 20 Hz to 22 KHz  $\pm$  2 db 40 Hz to 18 KHz @ 7½ ips. S-N ratio: (Model 770-2) better than 64 db with new Sony Noise Reduction (SNR); (Model 770-4) better than 62 db with SNR. Wow and flutter: less than 0.09% @ 7½, less than 0.12% @ 3¾, less than 0.2% @ 1⅞.

**ServoControl Motor with Vari-Speed Tuning.** Automatically maintains exact speed during mechanical load changes and voltage variations. Built-in VariSpeed tuning provides vernier adjustment of playback speeds to match musical pitch.

**Exclusive Sony Noise Reduction System.** Automatically reduces gain of playback amplifier during quiet passages, when background noise is most predominant. Noise level becomes inaudible and dynamic range is expanded 100%.



**Three Speeds.** 7½, 3¾, 1⅞ ips. Other features include four heads, two professional VU meters, built-in line-and-mike mixing, high-speed cueing, pushbutton operation, scrape flutter filter, low-impedance cannon plug mike inputs, tape / source monitoring and more. Operates on built-in rechargeable nickel-cadmium battery pack or AC.

**Built-in Limiter.** Because some live music has too wide a dynamic range for any tape recorder, Sony builds in a unique automatic limiter to eliminate top-end (loudest) overload distortion.

Sony Model 770. Priced at \$750 for either 2-track or 4-track model. For your free copy of our latest tape recorder catalog, please write to Mr. Phillips, Sony/Superscope, Inc., 8142 Vineland Ave., Sun Valley, Calif. 91352.

**SONY SUPERSCOPE** The Future is Stereo

You never heard it so good.

moving tape while watching the output meter. If output increases, then the pad is justified."

## Other Correspondence

Quite a number of months ago a reader complained of "sputtery" sounds when recording on his tape machine. This reader had made a loop of tape, and the problem re-occurred at the same place in the tape loop; also, the problem was worse at 3.75 ips than at 7.5 ips. Another reader, Charles P. Repka of East Paterson, N. J., suggests that this column may have been wrong in guessing that intermittent signal was being recorded on the tape. Mr. Repka writes: "I believe his problem is intermittent background noise being recorded with the signal. If this is so, then the problem is caused by the tape being used. I suspect that a 'budget brand' of tape is being used. The 'sputtery' sounds are caused by uneven oxide coating on the tape. As the various thicknesses of oxide pass the record head, they interact with the bias signal, and a resultant d.c. signal is recorded on the tape. When passing the playback head, the resultant signal makes a sputtery or popping noise."

In the December 1967 "Tape Guide" there was discussion of a drop-out problem ("Color Me Lemon"). Reader Allen Watson III of San Leandro, California, writes on this score: "I have encountered drop-outs that seem to me to fit the problem described (worse at 3.75 ips than at 7.5 ips; and worse at the ends of the reel), and have found that the trouble was substantially cured by using higher-quality tape, notably the new low-noise types. I first encountered the problem on recordings made either at very low speed (1.875 ips) on 1½-mil high-priced acetate tape, or at higher speeds on low-priced tape. I have concluded that one should expect to get what he pays for."

Reader Andrew A. Griffin of Springfield, Missouri, an audio engineer, has the following suggestions for recording guitars:

"1. Use a high recording speed. I use 30 ips.

"2. Substitute an oscilloscope for the VU meter. This is done by setting up a constant tone that reads 100% on the VU meter, noting the dial settings that produce this reading, connecting the 'scope to the meter terminals, and setting the scope to a sweep rate of 60 Hz or lower; on a 5-inch 'scope the tone that causes the meter to read 100% should produce a trace from ½ inch above the bottom of the screen to about one inch from the top of the screen;

label a line at this height 'S'; then label a line about two inches from the top of the screen '100%.' The trace should be about ½ inch wide. In use the 'scope should show the bulk of the signal reading to the 100% line, with stray transients reaching the S line, and a few transients (fewer than one per second is a good rule) rising above the S line.

"I have grown to like this type of indicator and have built four of them. However, to avoid confusing operators accustomed to meters, I have run the oscilloscope trace horizontally rather than vertically . . . I think that some right-thinking manufacturer could be talked into producing such a device.

"3. The tape one uses can be important. The newer high-output oxides provide the best results.

"The best place to take off the signal in a guitar amplifier is just before the power amplifier stage."

## Reading Material

Reader Lawton H. Wannamaker of Huntsville, Alabama, adds to this column's previous suggestions concerning tape recorder literature: "Haynes, N. M., *Elements of Magnetic Tape Recording* (Prentice-Hall, 1957). Although rather dated in a few respects, I consider it excellent and most complete, including theory, mechanics, and circuits . . . Athey, S. W., *Magnetic Tape Recording*, available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, catalog number NASA SP-5038, \$1.25 postpaid. Published in 1966 . . . Although devoted to instrumentation recording, there is a wealth of information which applies to the audio field, such as chapters on tape-moving systems, disturbances to tape motion, tape recorder mechanical components, etc. For persons interested in motors as employed in the tape field . . . I suggest *A Practical Guide to Motor Conversion*, a mimeographed work of about 40 pages, covering theoretical and practical aspects of induction motors and three types of synchronous motors, including hysteresis, with particular emphasis on tape recording and conversion of common induction motors to different synchronous types, use of motors for dynamic braking, etc. Published by Max H. Pepke Laboratories, 309 W. 19th St., New York, N.Y.

## Deck Vs. Integrated Machine

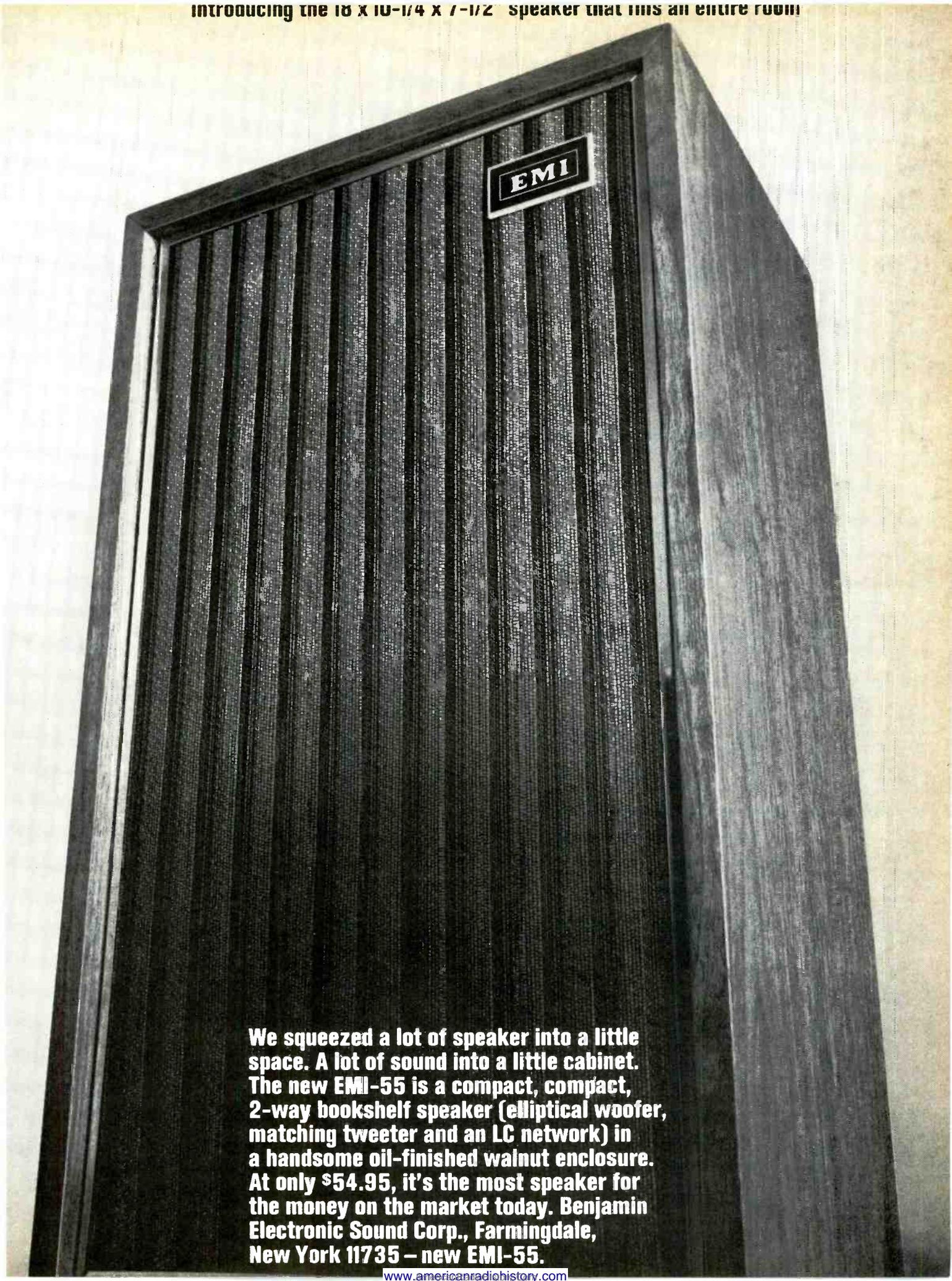
*Q. I am planning to purchase a high-quality stereo tape recorder or deck, but I am stymied by all the various*

*makes and models. My first decision has to be whether to buy a deck or an integrated recorder. Do the advantages of a self-contained machine outweigh those of a deck? Just exactly what are the advantages of a deck? Does it offer better fidelity in playback and better overall specs? What specifications are most important to look for? Why? What is the significance of several motors and heads? Is the number an indication of quality? Is a hysteresis motor critical? Is it possible to use a recorder as a deck, i.e. use an external amplifier and speaker?—Al Stober, APO San Francisco, Calif.*

A. Until just a few years ago, tape recorders with truly high-fidelity specifications in terms of frequency response, noise, distortion, and motion came only as decks. They did not incorporate power amplifiers and speakers. Today, however, it is possible to buy integrated tape machines (including power amplifiers and speakers) that provide high-fidelity performance. Still, the *very* finest units as a rule are decks rather than integrated. Such units (quality decks) are intended to feed into quality amplifiers and speakers—of substantially better grade than the power amplifiers and speakers in a self-contained machine. Inherently, though, the deck has no advantage except that it is usually lighter in weight because of the exclusion of power amplifiers and speakers. The integrated machine has the advantage of portability: You can play back either in conjunction with your high fidelity system or without it.

The most important specifications in shopping for a tape machine concern noise, distortion, frequency response, and motion—not necessarily in that order. The number of motors usually has no significance as to quality of performance. However, two or three motors, compared with one, tend to make for a mechanically simpler machine and therefore a sturdier and more reliable one. A hysteresis motor tends to make for more accurate speed, and for more consistent speed throughout the reel. Separate record and playback heads tend to improve quality of performance because each head can be designed specifically for its own function; and a separate playback head permits monitoring the tape at the same time it is being recorded, so that you can be sure you are getting a satisfactory signal on the tape. I think you will find almost every self-contained machine permits you to take the playback signal prior to the power amplifier and speaker and feed it to external equipment.

Introducing the 18 x 10-1/4 x 7-1/2" speaker that fills an entire room!



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**We squeezed a lot of speaker into a little space. A lot of sound into a little cabinet. The new EMI-55 is a compact, compact, 2-way bookshelf speaker (elliptical woofer, matching tweeter and an LC network) in a handsome oil-finished walnut enclosure. At only \$54.95, it's the most speaker for the money on the market today. Benjamin Electronic Sound Corp., Farmingdale, New York 11735 — new EMI-55.**

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# EDITOR'S REVIEW

## Hard on the Ears

Routine screening of University of Tennessee freshmen last fall revealed a high proportion of students with measurable hearing loss. Some students' hearing had already deteriorated to the level of an average 65-year-old, according to Dr. David Lipscomb, director of the university's audio clinical services.

It is suspected that the cause is listening to music at loud levels for sustained periods of time. In an experiment, music at a discotheque was recorded and played back to a guinea pig at 120 decibels, which is about the noise level of a jet engine. After 88½ hours of exposure to the music, spread over a period of three months to match the average discotheque-goer's listening habits, it was found that many of the cells in the animal's cochlea (the seat of the hearing organ) had shriveled up like peas. The animal's other ear, which had been plugged, was normal.

According to the report, sound in discotheques has measured as high as 138 decibels, or just below the threshold of pain. Based on the above, perhaps discotheques will one day be required to post signs forewarning customers about "... a causal relationship," etc., etc.

### Ernest B. Schwarzenback, 1898-1968

We were saddened to learn that Ernest Schwarzenback, 70, President of Sony Corporation of America, drowned while swimming in rough ocean at Surf City, N. J., September 2.

He was born in Ruschlinkon, Switzerland, May 24, 1898, and came to the U. S. in 1922, earning a Master's Degree in international finance at New York University. As a specialist in this field, Mr. Schwarzenback pioneered financing of Japanese issues in this country after World War II. Named President of the Sony Corporation of America in early 1966, succeeding Mr. Akio Morita, who was elected Chairman of the Board, he quickly made many friends in the industry due to his warm, friendly manner. Not one to be content sitting on the dais at a press meeting, the tall, energetic man, who looked younger than his years, mixed with members of the press with great zest. They, in turn, enjoyed his genuineness. Aside from his professional activities, he loved to travel, climb mountains, and swim. From 1949 to 1962 he was Deputy Mayor and then Mayor of the Village of Great Neck Estates, Long Island, New York, where he resided.

Survivors include his widow, a son, a daughter, and two grandchildren.

## Stereoplay

Spare-time playwright Robert Herron (managing editor of Visual-Sonic Medicine Magazine, a sister publication of *Audio Magazine*) has devised a new play form that he calls "stereoplay."

In his play, "Arrangement for Children," which premiered late summer at the Fourth Annual National Playwright's Conference in Connecticut, he uses a double stage technique to create separate "channels." Conversations were simultaneous and on completely different subjects. "... They mesh beautifully," says one reviewer.

## IHF Doings

The Institute of High Fidelity handles a variety of projects. For example, one can purchase a copy of *Your Career in High Fidelity* (\$4.00) by contacting the IHF (see address below). The book, written by Bernard Newman, is designed to introduce young people to career prospects in the high fidelity industry.

One of the Institute's latest accomplishments is a free sales training program for dealer (affiliate) members of the IHF. A 12" LP disc, recorded on both sides, accompanies the course. The recording illustrates a variety of salesman-customer situations, giving practical illustrations on how to improve communications between salesmen and their customers.

Information on how to become an affiliate member of the IHF was mailed to component dealers around the country. If a dealer has not received this membership package, which also outlines a group insurance program, he may receive it by writing to the Institute of High Fidelity, Inc., 516 Fifth Ave., New York, N. Y. 10036.

## Audio Shows

You don't have to be a member of the Audio Engineering Society to attend a special seminar, "From Studio to Microphone to Listener," to be given at the AES's 35th Convention, at 7:30 P.M., October 22, in the Oriental Room of the Park-Sheraton Hotel in New York City. Nor is a registration fee required for this practical, "how-to" discussion on various aspects of audio reproduction. Pre-recorded tapes will be played to demonstrate techniques described by panelists, and the audience will be invited to ask questions. If you're interested in audio reproduction, don't miss this one!

The public's timetable of the upcoming High Fidelity Music Show in San Francisco, Calif., is published in this issue on page 95.

The popular Washington High Fidelity Music Show will take place over the weekend of February 14, 15, and 16 at the Sheraton Park Hotel, Washington, D. C. More than 20,000 audio fans were reported to have attended the last stereo exposition held in Washington in 1967, according to Teresa S. Rogers, show director.

A.P.S.

# Invitation to euphoria.

Among all those who listen to music from records, there is a select few who do it very, very seriously. They originally spent countless hours comparing one component against another. Then they tried their speakers here and there at home until they worked to perfection with the room.

And when people like this listen, they do nothing but listen. Just as though they had paid good money for dinner out, orchestra seats and a baby sitter.

They know what that record should sound like. From deep soul-satisfying bass to those delicate, sweet highs.

They're never satisfied until they find themselves in that blissful state that tells them there's just nowhere else to go.

Euphoria.

If you don't know it, just leave everything as it is. Except your cartridge and favorite record. Take both to an audio dealer who has a particularly good listening room.

Listen first with your present cartridge. Then with the golden XV-15/750E. That's all.

You won't mind spending the sixty dollars. It's the least expensive passage to euphoria you'll ever find.

Pickering & Co.,  
Plainview, L.I., N.Y.

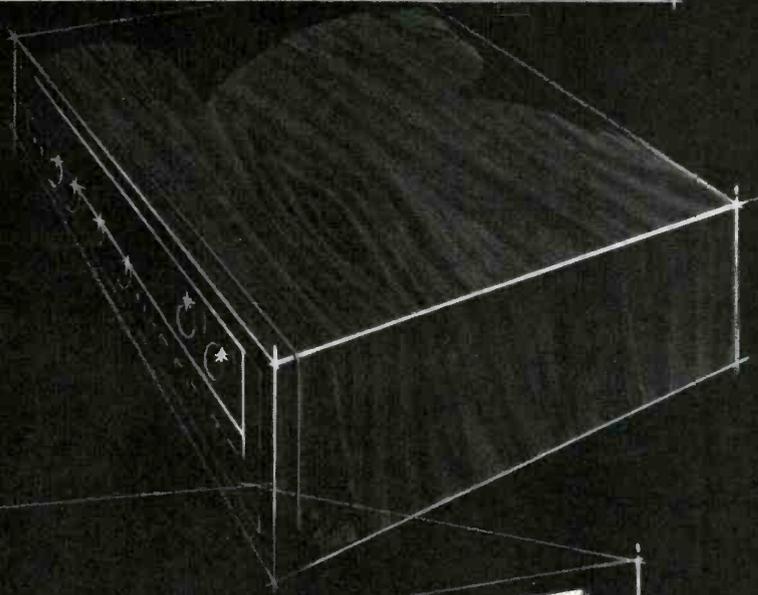
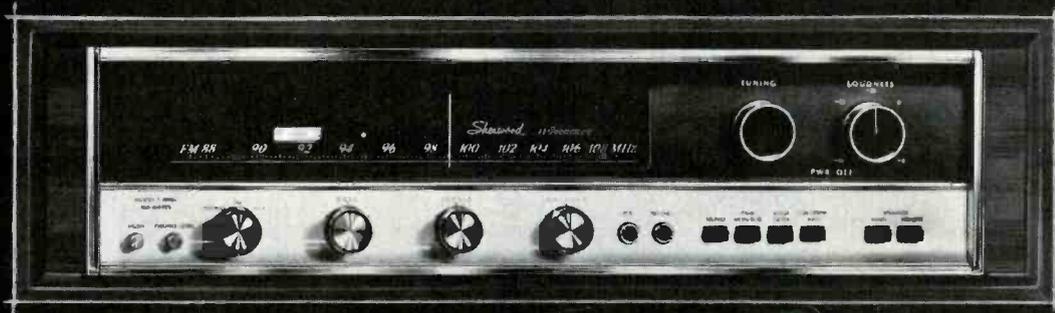


The new Pickering XV-15/750E

THE XV-15/750E, WITH A DYNAMIC COUPLING FACTOR OF 750, DELIVERS 100% MUSIC POWER THROUGHOUT THE ENTIRE AUDIBLE RANGE AT 1/2 TO 1 GRAM TRACKING FORCE. IT IS THE NEWEST AND FINEST OF PICKERING'S XV-15 SERIES. EACH XV-15 MODEL IS DCF-RATED FOR A SPECIFIC CALIBER OF TONEARM, FROM A DCF OF 200 TO 750, AND ALL DELIVER 100% MUSIC POWER. PRICED FROM \$29.95. DYNAMIC COUPLING FACTOR AND DCF ARE SERVICE MARKS OF PICKERING & CO.

**First of a  
new breed  
—from  
Sherwood**

This is what high performance is all about. A bold and beautiful new FM Stereo Receiver bred to leave the others behind. 160 crisp, clean watts—power in reserve. Up-front, ultra-now circuitry featuring Field-Effect Transistors and microcircuitry. Front-panel, push-button command of main, remote, or mono extension speakers and loudness contour. Sherwood high-fidelity—where the action is—long on reliability with a three-year warranty.



Model S-8800a \$399.50

*Sherwood*

Sherwood Electronic Laboratories, Inc. 4300 North California Avenue, Chicago, Illinois 60618 Write Dept. A-10

# Small Music Rooms

M. RETTINGER

The author examines how a room's dimensions can affect music reproduction

WHAT IS THE best ratio of height, width, and length of a small room intended for the playing of music as well as for the reproduction of music from tape, radio, and records? The question puzzled many early researchers in architectural acoustics, particularly during the '30s and '40s, before the problem was investigated with the aid of wave acoustics in place of geometric acoustics. Should this ratio be 1:2:3, in similarity to the harmonic, integrally multiple, relationship of the fundamental and overtones of so many musical instruments? Should it conform to the famous Greek "golden rule" of dimensions involving the square root of five? Or should it agree with some other significant mathematical formula?

Below are six of the formerly most prominent dimensional ratios together with their identifying description:

RATIO	DESCRIPTION
1:2:3	Harmonic
1.6:3:4	V. O. Knudsen
3:5:8	European
1:1.6:2.5	J. E. Volkmann
2:3:5	P. E. Sabine
$(\sqrt{5} - 1):2:(\sqrt{5} + 1)$ = 1.236:2:3.236	Golden Rule

Normalizing these ratio to six arbitrary volume units, we obtain:

RATIO	NORMALIZED RATIO
1:2:3	1:2:3
1.6:3:4	1.08:2.03:2.71
3:5:8	1.1:1.84:2.95
1:1.6:2.5	1.14:1.82:2.85
2:3:5	1.17:1.75:2.92
1.236:2:3.236	1.12:1.82:2.94

It is seen that these ratios, calculated for equal volume, are not so widely different as they might appear at first glance. For this reason also, rooms built according to one or another of these ratios are generally not significantly different in their hearing conditions to permit saying that one is much better than another.

As more researchers became active in this field and the problem was investigated by a more advanced physical and mathematical methodology, it was learned that there was really no optimal ratio of room dimensions, only a range of acceptable ratios; and that a low-frequency limit of acceptability was more a matter of room volume than dimensional ratio.

Figure 1 shows the ratio ranges graphically.

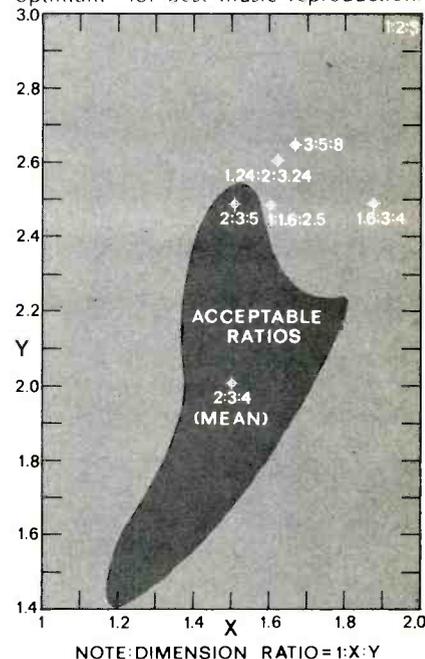
To permit the previously noted ratios to be readily compared with the acceptable ratio range on Fig. 1, they have been rewritten for equal ceiling height of unity:

RATIO	RATIO FOR EQUAL CEILING HEIGHT
1:2:3	1:2:3
1:6:3:4	1:1.88:2.5
3:5:8	1:1.67:2.67
1:1.6:2.5	1:1.6:2.5
2:3:5	1:1.5:2.5
1.236:2:3.236	1:1.62:2.62

The only one of the above ratios which actually falls within Bolt's area of acceptable ratios is 2:3:5, although Volkmann's ratio 1:1.6:2.5 comes close to it, as does the Golden Rule ratio. The harmonic ratio 1:2:3 is particularly distant from the acceptable area region, since it makes for a coincident reinforcement of the normal modes in such a room, which leads to emphasis of a series of notes. However, if one as much as enters an empty rectangular enclosure, or places a chair in it, one changes the ratio of room dimensions from an acoustic point of view. This is even truer the more furniture is installed in a room, or the more people are congregating therein. Hence, it becomes impractical to design a room to have an optimal ratio

(Continued on page 87)

Fig. 1—Ratio ranges of height, width, and length of a room popularly thought to be "optimum" for best music reproduction.





# THE 1968 New York High Fidelity Music Show

**A Statement by  
John Koss,  
President,  
Institute of  
High Fidelity**

**T**HE Institute of High Fidelity as an association represents a young, rapidly maturing industry. As an organization, it represents the efforts of thousands of people dedicated to bringing the finest possible sound-reproducing components into the home.

The component high fidelity industry has just passed its second decade of continuous growth. While the first cylinder recordings of the late 1800's planted the seed for our industry, it is still impossible to pinpoint our future.

In 1953 Lowell Thomas presented his first CINERAMA spectacular in New York City. Audiences were astonished at the sound reproduction of people screaming while plummeting down a rollercoaster track . . . it was so realistic that it seemed as though the sounds were emanating from the audience's area, from any location.

Audio electronics engineers took this hint from Mr. Thomas and, shortly after, introduced stereophonic sound reproduction on recorded tape and on disc. This, too, was a magnificent accomplishment for our industry, and held the spotlight until only a few years ago, when transistors and other solid-state designs were unveiled.

What lies ahead? . . . electrostatic wall panels transforming an entire wall into a living stereophonic speaker system . . . micro-circuits which could transform a component amplifier, tuner, or receiver into an even higher-quality instrument the size of a cigarette box . . . the range of possibilities is limitless and offers a fascinating challenge to the imagination.

During the early growth years of our industry, the Institute of High Fidelity was born to serve as a catalyst between the highly technical engineer and the consumer, who thought that a component high fidelity system in his living room would have to resemble the cockpit of a B-52.

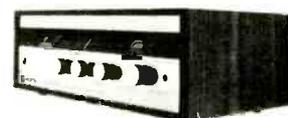
For the component manufacturer, the Institute was to serve as a melting pot for ideas, as well as an agency to create standards for new equipment, conceive methods of measurement for components, and to establish guideposts for consumer selection. To these ends, the IHF has undertaken many programs for the benefit of the consumer and the industry. Today's components are housed in attractive enclosures of walnut, teak, and mahogany, for example. The Institute has developed decorating hints in the form of room settings to assist the homemaker in placing component equipment attractively in her home, and to help the hobbyist with built-in ideas for home entertainment systems. The IHF has also devised important equipment standards which include meaningful tests for published equipment specifications. This work, which is only one continuous function of the Institute, is done to assist the consumer in making comparisons and decisions.

Other programs undertaken annually by the Institute of High Fidelity include regional shows for the consumer, such as the New York Component High Fidelity Show at the Statler Hilton Hotel. There will also be a San Francisco Show at the Civic Auditorium, which will run from October 31 through November 3. Each show will be highlighted by a series of seminars moderated by audio experts and pioneers from some of the nation's top component manufacturers. Seminars at each show are designed for both the audiophile and the novice, and will provide a complete education on all forms of sound reproduction.

As in the past, our continuing efforts will aim to perpetuate the standards of excellence that have established the component high fidelity industry's image of quality. It is these standards of quality, service, and pride that set our industry apart and make it unique in the world, where the light of craftsmanship grows ever dimmer.



AR Model A Amplifier



Acoustech VIII Tuner



Altec 711B Receiver



Bogen DB250 Receiver



C-M 911 200W Amplifier



Crown DC300 Amplifier



Dynaco PAT-4 Preamplifier



EICO 3150 Amplifier



Electro-Voice EV-1181 Receiver



Fisher 250-T Receiver

# The Sound of '69

**AUDIO's preview guide to stereo hi-fi component equipment and systems to be featured at the New York High Fidelity Music Show**

Well over fifty manufacturers of stereo hi-fi components will display their equipment at the New York High Fidelity Music Show, September 19 through 22. This includes ten exhibitors who were not present at last year's show, some of whom are newcomers to the U.S. hi-fi scene. Absent, however, are nine exhibitors who participated in last year's show, leaving an actual gain of one exhibitor (see list of exhibitors at conclusion of article).

Shown here are the hi-fi components and systems expected to be the "hot" ones for the '68-'69 season, based on manufacturers' reports.

## Receivers, et al

As regular readers of AUDIO already know, receivers—combination tuners (FM stereo or FM stereo/AM), control preamplifiers, and power amplifiers—have usurped the major role once played by separate components. This does not mean that separate tuners, preamplifiers, and basic power amplifiers are passe. It simply indicates that more and more people are buying all-in-one units to either save space, to make it easier to integrate the electronics into a room's decor, or simply to avoid interconnecting different components (as easy as it is to do).

Based on AUDIO's Annual Product Directory listings (see August 1968 issue), however, the number of receiver models available this year compared to 1967 actually dipped about 5 per cent, while the number of separate components models showed a distinct rise (as high as 10 per cent). In this basic mix, we also note that some companies have mated amplifiers with speaker systems. And, of course, compact music systems, where *all* components, including a record changer and two speaker systems, continue to command a growing share of the market.

Solid-state devices are firmly entrenched in present-day circuitry, naturally, though vacuum-tube diehards can still purchase a few good performers that are not transistorized. Field-effect transistors in tuner front ends are rather commonplace this year, as are integrated circuits. Both devices can improve per-

formance, given proper circuit design.

Unlike the auto industry, hi-fi component manufacturers do not always discard the previous year's models in order to present "brand new" ones. Thus, many models introduced last year will continue to carry the company's banner into 1969. For example, *AR* will exhibit its clean-lined 60 watts rms/channel integrated amplifier (\$225); *Altec* will display the \$399.50 Model 711B FM stereo receiver (50 watts IHF/channel, 1.9  $\mu$ V FM sensitivity); *C-M Labs.* will show the 100 watts rms/channel Model 911 power amplifier (\$477); *Dynaco* has the PAT-4 solid-state preamplifier (wired, \$129.95, kit \$79.95); *Koss-Acoustech* its VIII FM stereo tuner (\$349 wired, \$249 kit); *Marantz* will titillate attendees again with its \$695 Model Eighteen FM-stereo receiver's built-in 'scope; and so on.

Some of the above-named manufacturers will introduce *other* hi-fi products for the first time, however. Rumors indicate that *C-M* will debut a tuner with a built-in 'scope, as well as an electronic crossover; *AR* is expected to introduce a new speaker system; *Koss-Acoustech* an AM/FM stereo receiver kit with digital read-out for broadcast station and go/no-go tuning (used instead of a meter); and *Marantz* will unveil speaker systems for the first time.

New receivers will be plentiful. *Bogen* will show off its 75-watt, 1.5- $\mu$ V FM sensitivity, AM/FM stereo receiver (\$279.95), which has an FET front end and ICs. *Electro-Voice* will display two new low-silhouette receivers, Models E-V 1181 (FM stereo) and E-V 1182 (AM/FM stereo). Identical except for the additional AM broadcast band on the E-V 1182, they feature 20-watts IHF/channel power output, 2.5  $\mu$ V FM sensitivity, and FETs and ICs. The FM receiver is priced at \$176; \$23 more for the AM/FM stereo model. *Fisher* plans to introduce its Model 250-T AM/FM stereo receiver (\$299.95) to the public, among many other components, compact music systems, and consoles. The 250-T offers 100 watts of music power (IHF), with an IHF FM sensitivity of 2  $\mu$ V. It features



Grommes 503 Receiver

JBL SA660 Amplifier



Kenwood KT-7000 Tuner

Marantz Eighteen Receiver



Nivico 5003 Receiver

Pioneer SX-1500T Receiver



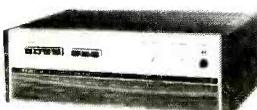
Sansui MD 5000 Receiver

Scott 341 Receiver



Sherwood S-8800a Receiver

Sony 6060F Receiver



TEAC AS-200 Amplifier



A-R Model XA



BSR McDonald 600



Miracord 620



Bogen B62



Dual 1212



Elpa PE-2020



Koss Rek-O-Kut B-12GH



Garrard SL-95



Marantz SLT-12U



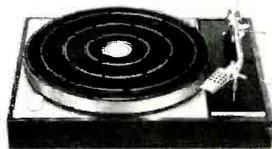
Pioneer PL-25



Sony TTS-3000



TEAC TS-80



Thorens TD150AB



Elac STS-244



Ortofon SL-15T



Pickering XV-15



Shure M9



Stanton 681EE

Tune-O-Matic® circuits, permitting pushbutton selection of any of five FM stations, as well as conventional station selection with a tuning knob. Circuit design includes an FET FM front end and integrated circuits. Among a raft of other components expected to be shown is Fisher's Model TX-1000 120-watt music power control amplifier (\$329.95) and its Model TFM-1000, 1.8- $\mu$ V sensitivity FM stereo tuner (\$429.95). Harman-Kardon will feature its 70-watt/channel "Noc-turne 520" FM stereo receiver, at \$315.00. JBL will be showing its \$435.00 SA650 60-watt rms/channel control amplifier. Among its unusual features are a three-position phono switch for best signal-to-noise ratio selection, and an Aural Null stereo balancing circuit. Kenwood intends to introduce matching pairs of components: Model KT-7000 AM/FM stereo tuner, with a 3-FET front end, ICs and crystal filters, providing 1.5  $\mu$ V sensitivity, and the KA-6000 stereo control amplifier with 170-watts music power, blue light indicators for mode identification, and step-type tone controls. \$249.95 each, including walnut cabinet. Pioneer will feature its SX-1500T, 170-watts music power, AM/FM stereo receiver. Features include one FET in the front end, four ICs, and a walnut cover. Priced at \$360. The company will also unveil a 210-watt power amplifier, Model SM-100, which has a damping-factor control from 1.5 to 100. Priced at \$375. Among H. H. Scott's very broad line of components, music systems, and consoles, the Model 341 FM stereo receiver, at \$249.95, is expected to have wide appeal. The receiver features 50-watts music power, 2.5- $\mu$ V FM sensitivity (IHF) and an FET front end. Highlight of Sansui's exhibit will be its Model 5000, a 160-watt music power, 1.8- $\mu$ V FM sensitivity, AM/FM stereo receiver. Priced at \$449.95, it has an FET front end and four IC devices. The model's dial face has a "black-out" design, with only the broadcast

dial, signal and tuning meters lighting up in this mode, and only identification lamps lighting in color when other functions are selected. Sherwood will introduce a 160-watt, 1.8- $\mu$ V sensitivity, FM stereo receiver, Model S-8800a. It features six push-button controls on a new front panel. \$399.50, less case. Sony Corp. of America's leading star will doubtlessly be its first receiver, the Model STR-6060FW, 110 watt (music power), FM stereo/AM component. Featuring three FETs in its front end, piezo-electric filters in the i.f. strip, and an IHF FM sensitivity of 1.8  $\mu$ V, the receiver is priced at \$399.50. A flipdown front panel section hides most of the controls. Sony's separate tuner, integrated amplifiers, three-channel electronic crossover, preamplifier, and other products will be on display, too, of course.

Two newcomers to the N. Y. Hi-Fi Show are JVC America (Nivico) and Grommes. The Nivico Model 5003, a 140-watt (total) AM/FM stereo receiver priced at \$339.95, features a "Sound Effect Amplifier" that consists of five slider controls to shape the frequency response. Grommes, an old component stalwart who has been absent in the audio salon marketplace for many years, returns at the show with a line that includes AM-FM stereo receiver model 503, a 35-watt IHF/channel component.

Two prominent tape recorder manufacturers will exhibit amplifiers, too: Crown International, a 150-watt rms/channel basic power amplifier, the Model DC300 at \$575; TEAC, a \$299.50 40-watt IHF/channel integrated amplifier.

Do-it-yourselfers will not fare too poorly at the show, either. In addition to Dynaco and Koss-Acoustech, EICO and H. H. Scott offer hi-fi kits. EICO will introduce two new additions to its "Cortina" line: Model 3150, a 150-watt stereo integrated amplifier kit at \$149.95 (\$225 fully wired); model 3770 AM/FM stereo, 70-watt receiver kit at \$189.95

(\$279.95 fully wired). *H. H. Scott* will reveal its new LR-88, a 100-watt AM/FM stereo receiver kit at \$334.95. The LR-88 incorporates an FET front end and an integrated-circuit i.f. section.

And there's even a bevy of electronic crossover units now available, including Sony, Sansui, and Kenwood, with C-M Labs. expected to join them shortly. So there's a wider choice among "electronic" components than ever before, it seems.

## Record-Playing Components

The automatic turntable (changer) vs. manual turntable battle that once raged here has lost its intensity. Automatics have won hands down if you count the number of sales; manuals are still bought by audio perfectionists; some people own both types. There is no dearth of either type. For example, there are six companies at the N. Y. Hi-Fi Show that offer automatic turntables, most of whom have a variety of different models. And there are nine manufacturers who will display manual turntables.

British Industries' line of Garrard automatic turntables is topped by the \$129.50 SL95 member of the company's Synchro-Lab Series. Introduced last year, it uses a combination synchronous-induction motor, said to provide fast start and high driving torque, while locking into the 60-Hz current for constant speed. It features manual cueing, built-in stylus gauge, anti-skating control, and snap-in cartridge clip. New for '69 is a three-way dust cover that can be raised at an angle and "locked," slid off the base from the front of the player, or lifted up and removed completely. The styrene cover, designed to fit two new Garrard bases, are priced at \$5.95 for model D-2 (for SL95 and SL75 turntable models) and \$4.95 for Model D-1 (for other Garrard models).

*BSR McDonald's* show highlight will be its Model 600/XM44E combination automatic turntable/Shure cart-

ridge / "power" base / cover, priced at \$131.00 for the pre-assembled package. The turntable has a cueing control and an anti-skating control. Benjamin's *Miracord* automatic turntable line includes the new Model 620 turntable, priced at \$89.50, the lowest in the company's line. The 620 contains a four-pole induction motor (its Model 50H, at \$149.50, employs a Papst hysteresis-synchronous motor), and features a cueing control and an anti-skating control. United Audio's new *Dual* 1212, at \$74.50, will be introduced to the public for the first time at the show. The new model features a variable pitch control that allows its three speeds (33 $\frac{1}{3}$ , 45 and 78 rpm) to be varied over a six per cent range, as well as a silicon-damped cueing control and an anti-skating control. *Elpa Marketing's* Perpetuum-Ebner Model PE-2020 will be one of the exhibitor's main attractions. The \$129.95 automatic turntable incorporates a 15-deg. vertical tracking angle adjustment, as well as cueing and anti-skating controls. *Seeburg* will be displaying its LP storage/playing system (plays both sides of 50 LP records automatically), with prices starting at \$695 for component units.

Most of the manual turntables to be presented to the public at the N. Y. Hi-Fi Show were in evidence at last year's show. Many have integrated tone arms, though there are some that allow for mounting of a tone arm of your choice. *AR's* two-speed turntable / tone arm / base / cover Model XA, at \$78.00, features a 24-pole, tiny synchronous motor. *Bogen's* four-pole-motor B62 (\$37.95) also has an integral arm, and features variable speeds from 29 to 86 rpm. *Empire's* line of hysteresis-motor turntables includes manuals (\$114.00 and up) with integrated arms as well as without tone arms. The company has a separate tone arm available for \$75.00. *Koss-Rek-O-Kut* will show its B-12GH three-speed turntable with tonearm (\$159.95). *Marantz's* SLT-12U straight-



Crown SX-722 or SX-724



Panasonic RS-1000S



Sony TC-666D



Tandberg 64X



Viking 433



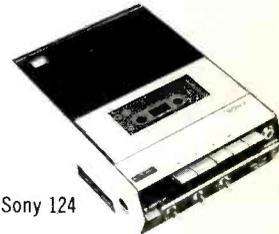
AR-3a



Harman-Kardon CAD-4



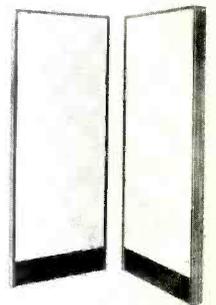
ReVox 77A



Sony 124



TEAC A-4010S



Acoustech X Electrostatic

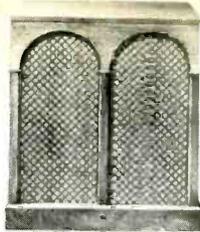


Altec 895 "La Paz"

Bose 901



Bozak B310/B410 in Moorish Enclosure



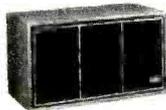
Elite "Maxim"



EMI Model 55



Electro-Voice EV-Four-A



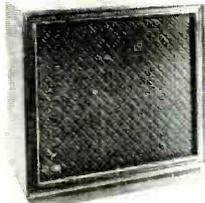
JBL L75 "Minuet"



Empire Grenadier 7000



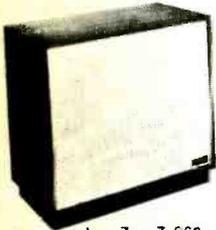
Fisher XP-15B Consolette



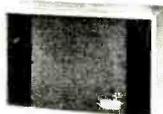
JVC Nivico 5303



JansZen Z-960



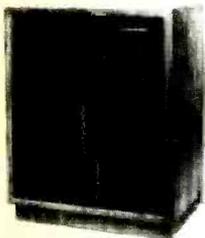
Jensen TF-15



Rectilinear VI



Marantz Imperial I



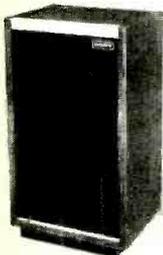
Pioneer CS-5



Scott S-14



Sony SS-3100



Wharfedale W60D



Tannoy "GRF Windsor"



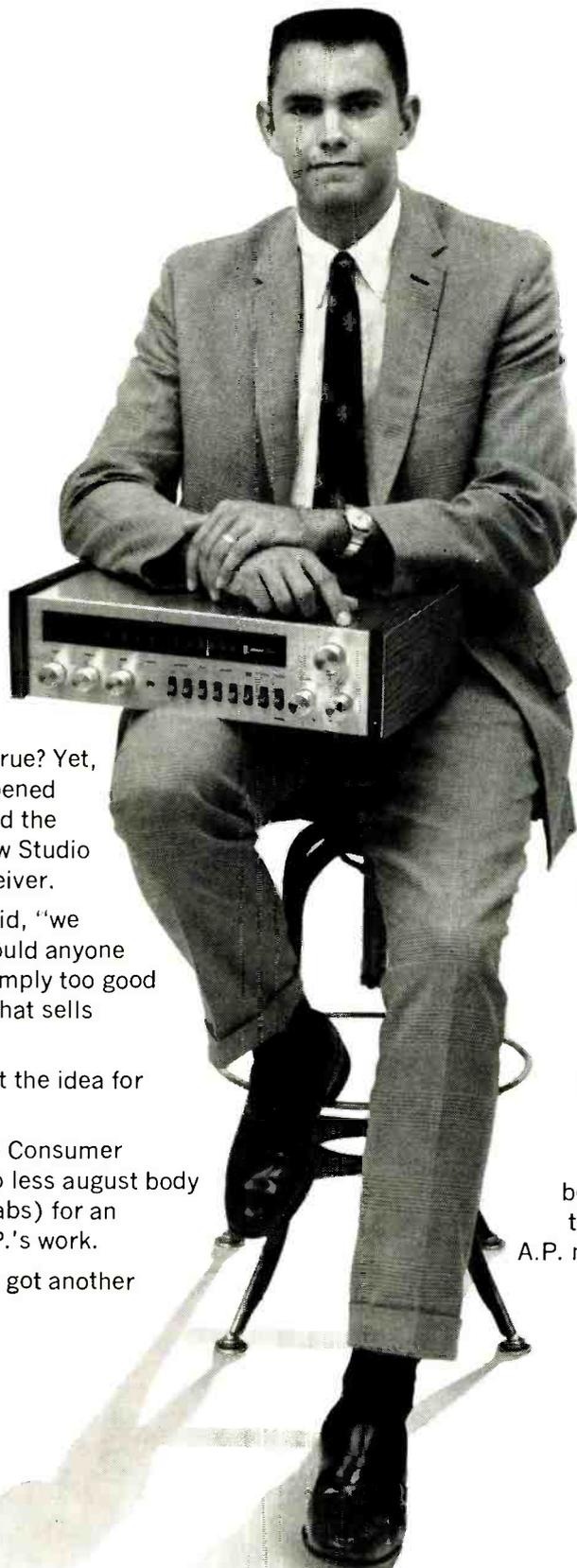
line tracking. hysteresis-motor turntable features zero tracking error since it travels in a straight line across the disc. (\$295.00.) *Pioneer's* manual turntable. Model PL-41F, at \$199.95, has an integrated tone arm and a hysteresis motor. *Sony Corp. of America's* Model TTS-3000 manual turntable boasts a servo-controlled motor to achieve precise motor speed. Additionally, the turntable incorporates a  $\pm 5\%$  variable speed adjustment plus a built-in strobe. The two-speed turntable is said to attain operating speed in less than one second (about one-half a revolution), which enhances cueing efforts. (\$149.50.) A 12-in. tonearm with a silicon-damped, built-in cueing device, and an anti-skating compensator, is available, too (\$85.00.) TEAC, better known for its line of tape recorders, enters a manual turntable with a tone arm and a moving-coil cartridge this year. The two-speed (said to be electronically controlled) unit is priced at \$239.50. *Thorens* (Elpa Marketing Industries) will spotlight its TD150AB manual turntable/integrated tonearm unit (\$99.75), as well as its other *Thorens* turntables. The belt-driven TD150-AB has a double motor on a single shaft, and features a unified turntable / tonearm suspension system. *Thorens* and *Ortofon* tonearms will also be displayed.

Though some "solid-state" cartridges and other piezo-type cartridges create a stir from time to time, none has quite made it big in the component hi-fi field. At the N. Y. Hi-Fi Show, for example, it's a magnetic cartridge world, the only exception being *Kenwood's* photo-electric cartridge at \$120.00.

A number of new cartridges will be introduced at the show, while some made their initial appearance earlier. Benjamin Sound will reveal their new *Elac* line of cartridges. The top-of-the-line Model STS-444E, at \$69.50, is equipped with an elliptical stylus. Stereo separation is 26 dB at 1000 Hz, 17 dB at

10 kHz; and it tracks at  $\frac{3}{4}$  gram to 1.5 grams. The same model is available with a 0.5 mil stylus. Other models in the line include 0.7-mil styli. *Empire* will be playing its Model 999VE cartridge, also equipped with an elliptical stylus. Stereo separation is said to be 30 dB at 1000 Hz and better than 20 dB at 10 kHz. Tracking force is  $\frac{1}{2}$  to  $1\frac{1}{2}$  grams. *Elpa's* *Ortofon* stereo cartridge, Model SL-15T, a moving-coil design (the cartridges previously mentioned are moving-magnet designs), claims 20 dB to 30 dB separation. It uses an external stereo in-line transformer. *IMF Products* will demonstrate its new imported cartridge, the Super 800E. The \$60.00 cartridge tracks at 0.8 grams and its frequency response is said to be within 1 to 2 dB up to 19 kHz. Also to be shown is the Audio & Design tone arm, which, at \$120.00, employs mercury contacts. *Pickering's* new XV-15 Series of magnetic cartridges is topped by its new XV-15/750E model, designed for use with top-quality turntables, automatic or manual. Equipped with an elliptical stylus, the model tracks at  $\frac{1}{2}$  to 1 gram. A DUSTAMATIC™ brush, set off-center, automatically cleans record grooves while playing a record. Priced at \$60.00. There are five other XV-15 models in the series, each with progressively higher tracking force requirements and lower prices (down to \$29.95). The "750" number in *Pickering's* new model number relates to the company's "Dynamic Coupling Factor" index of stylus performance as related to playback equipment; the higher the number, the lighter the tracking-force. *Shure's* "hottest" cartridge is expected to be its new Model M91E (\$49.95), said to be second for tracking ability only to its V-15 Type II cartridge in the company's line. The elliptical-stylus-equipped magnetic cartridge features  $\frac{3}{4}$  to  $1\frac{1}{2}$ -gram tracking, channel separation over 25 dB at 1000 Hz. *Shure's* other models, including the \$67.50 V-15 Type II and the \$39.50 M75E, will

**Our A. P. Van Meter designed the PRO-120 so well,  
he had to go through  
the indignity of being double checked.**



Who ever heard of double checking the head project engineer, just because his design seemed too good to be true? Yet, that's exactly what happened when A.P. first submitted the specifications on his new Studio Pro-120 FM Stereo Receiver.

"A.P.," management said, "we believe you, but why should anyone else? These specs are simply too good to be true in a receiver that sells for \$379.50!"

And that's when they got the idea for the double check.

They called Nation-Wide Consumer Testing (a division of no less august body than the U.S. Testing Labs) for an impartial analysis of A.P.'s work.

Then somebody in sales got another

bright idea, "Why not ask them to certify that the Pro-120 will meet or exceed its published specifications?"

The men from U.S. Testing agreed, but on one condition. They wouldn't test a Pro-120 at their lab. (After all, anyone who cares can "tune-up" a unit just as you would a car.) Instead, they would come to University in Oklahoma City and pull units at random right off the production lines.

And that's how the University Studio Pro-120 came to be the world's first and only certified receiver. Just because it seemed too good to be true.

What about A.P.?

Well, getting his baby certified made believers out of lots of people. Including the boss. So, instead of a double check, A.P. now has the dignity of a doubled check.

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FM Stereo Music System



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Harman-Kardon SC2350 AM/FM-Stereo System  
with omni-directional Speakers



"Scottie" AM/FM Stereo Music System



Clark 300 Stereo Headset



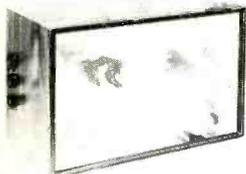
Superox "ST-PRO" Headphones



Koss Electrostatic Headphones



Telex "Encore" Sterophone



EICO "Cortina 3440" Color Organ



EDITape Tape Editing & Splicing System

Toujay "Sound-X-Pander" Cabinet



also be performing. The *Shure/SME* separate tone arm, at \$106.50, which includes viscous damping, cueing, and anti-skate adjustment provisions, will doubtlessly be shown, too. The *Stanton* "Calibration Standard Series," headed by the Model 681EE with elliptical stylus (\$60.00) will be actively displayed. Each cartridge in the series incorporates a record-cleaning brush which is hinged on an off-center pivot. The 681EE has a tracking force recommendation of  $\frac{3}{4}$  to  $1\frac{1}{2}$  grams, and features a nominal channel separation of 35 dB. A line of moderately priced (\$25 to \$35) cartridges, *Stanton's* "Broadcast Standard Series," will also be exhibited. These do not include a record-cleaning brush.

In all, there will be some 35 phono cartridges featured at the show.

## Tape Recorders

Though there will be a few eight-track tape machines here and there at the show, the main tape recorder attractions will be open-reel tape recorders and cassette tape recorders; more of the former than the latter.

*Crown* is stressing the SX-700 series of solid-state recorders which accept  $10\frac{1}{2}$ -in. reels on a 3-head modular-type transport with magnetic differential braking, hysteresis-sync drive motor, and separate spooling motors. These models feature 5-inch lighted VU meters, and are professional in every respect. Priced from \$895, these recorders are available in several configurations for every application.

*Harman-Kardon* will show its new CAD-4—a stereo cassette recorder with many of the features usually found on reel-to-reel machines. The claimed frequency range of  $\pm 2$  dB from 50 to 12,000 Hz is at least half an octave better at both ends than the ordinary cassette recorder. According to specs, distortion is low, and wow and flutter is comparable to that of conventional machines. Plays and records both mono and stereo. Price, \$179.50.

*KLH* is expected to introduce its first tape deck, an open-reel unit with an audio-noise-reduction system. Price, about \$600.00.

The new Royal Deluxe Model 10,000 by *Uher* is featured by Martel Electronics. This is the first vertical recorder from *Uher*, and it includes a wide range of high-quality specifications and operational advantages, such as four speeds, built-in Dia-Pilot for sound/slide synchronization, interchangeable two- and four-track head assemblies, and an independent 10-W/channel hi-fi amplifier. Also shown will be the *Uher* 4400—a stereo model of the famous 4000L and its predecessor, the 4000 Report-S. This portable machine fills a definite need in the stereo field.

*Panasonic* will exhibit a long line of recorders—20 in all, of which seven are being shown for the first time. These models include both a.c. and battery-operated machines, some combined with an AM/FM-stereo radio receiver. The RS-280S, for example, is a four-track stereo cassette recorder combined with the receiver, and sells for \$269.95. Several models feature continuous automatic reverse. Model RS-1000S is one of these, in a 3-motor, four-head configuration adaptable to push-button remote control. This model is priced at \$699.95.

Sony's wide range of tape recorders will be displayed by *Superscope*, and will include the new TC-666D Auto-Reverse Deck which incorporates a noise-reduction system. This model is priced at less than \$575.00. The noise-reduction system is said to reduce noise in playback by 6 dB without affecting frequency response. Also new this year is the Model 124CS, a cassette recorder system which includes two matching speaker systems. The unit has a claimed frequency response of 50 to 10,000 Hz, and is priced at less than \$199.50.

*Revox* is showing their new model 77A which combines most of the features of the older 736 in a newly designed

(Continued on page 90)



**Willi Studer thought you'd like  
a professional standard, low noise  
low distortion 30-20 kHz at 3 $\frac{3}{4}$  i.p.s. and  
a dynamic range of over 60 db  
plus beautiful styling and  
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# How to Build an SCA "Background Music" Adapter

LEONARD FELDMAN

A DETAILED DESCRIPTION of how SCA background music broadcasts are hidden on public FM broadcasts was published last month in *AUDIO Magazine*. The article concluded with a brief study of a new method of demodulation (gate FM detector) suggested by noted inventor, Mr. Murray G. Crosby. Here are plans for building a complete SCA adapter (using the gate FM detector) so that, with an FM set, you can decode otherwise silent SCA broadcasts and, as a result, listen to background music at will.

The SCA or background music adapter developed here was built on a circuit board measuring only 5 $\frac{3}{8}$  in. by 2 in. A full-size *exact* layout of the printed-circuit board is shown in *Fig. 1*. It can be used to prepare a circuit board of your own, if you are so inclined. If you'd like to build your own "background music adapter" but would rather not get involved with the layout, drilling, and

etching of your own board, a limited number of pre-drilled, etched boards, ready for parts insertion are available at a cost of \$10.00 each from SCA Services, P.O. Box 209, Great Neck, N. Y. 11023. All other parts are readily available from local or mail-order electronic parts dealers.

A complete schematic is shown in *Fig. 2*, together with a full parts list. *Figure 3* is a complete pictorial diagram of how the parts are installed in the circuit board. This pictorial is presented *looking from the COPPER SIDE OF THE BOARD*—or, as if you were looking through a transparent board from the copper side and could see all the components mounted from above.

## Construction Hints

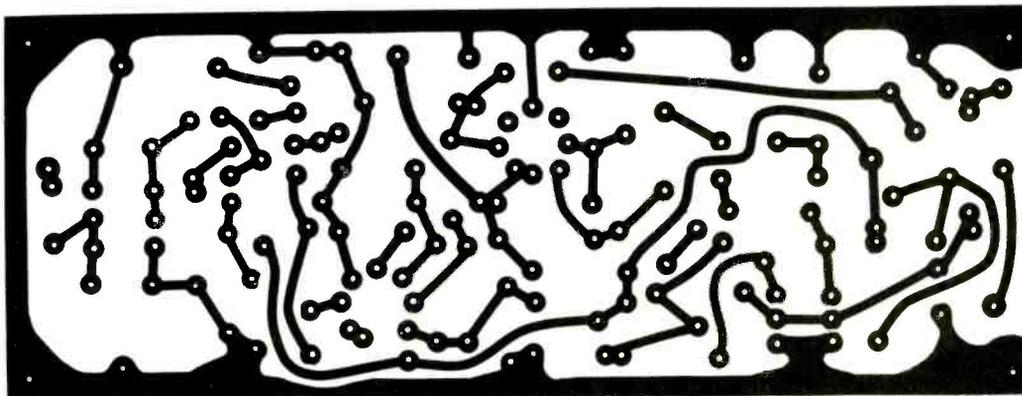
If you are preparing your own circuit board, drill all holes with an .040 in. (#60) drill first. Then, enlarge the holes which are intended

for the coil terminals of  $L_1$ ,  $L_2$ , and  $L_3$  with a #55 drill. Also enlarge the holes intended to accept the shielded-can tab of these coils to about  $\frac{1}{16}$  in. in diameter. The four corner holes may be enlarged to suit the mounting method you plan to employ, as they are strictly for that purpose. We drilled ours out to .156 in. (#23 drill) to clear a 6-32 machine screw and mounted the finished board on a metal chassis together with a simple 12-volt power supply, a schematic of which is shown in *Fig. 5*. Most readers will have 12 volts available from some existing piece of equipment, however; the entire circuit draws only about 10-15 milliamperes.

In inserting the parts, pay particular attention to the basing of the FETs as well as  $Q_3$ ,  $Q_4$ , and  $Q_5$ . Their basing diagrams, again viewed from *underneath* the transistor or FET, are given in *Fig. 6*, together with the basing arrangement of the

## PARTS LIST

Symbol	Description	Symbol	Description
C-1, C-5, C-18	Capacitor, Ceramic Disc; .001 $\mu$ F, 10% 200V	R1, R18, R26	Resistor, 100K, $\frac{1}{2}$ W, 10%
C-2, C-4	Capacitor, Ceramic Disc; .002 $\mu$ F, 10% 200V	R2, R3, R6,	
C-3	Capacitor, Ceramic Disc; 470 pF, 10%, 200V	R9, R11, R14	Resistor, 4.7K, $\frac{1}{2}$ W 10%
C-6, C-9	Capacitor, Ceramic Disc; .02 $\mu$ F, 10%, 50V	R4	Potentiometer, (Printed Circuit "Trim" Type); 100K, 20% (see text)
C-7	Capacitor, Ceramic Disc; 47 pF, 10%, 200V	R5	Resistor, 2.2K, $\frac{1}{2}$ W, 10%
C-8, C-10, C-11, C-12, C-13, C-14, C-15, C-16, C-17, C-19, C-20, C-22, C-24	Capacitor, Mylar, 0.1 $\mu$ F, 20%, 50V (miniature)	R7, R13	Resistor, 100 ohm, $\frac{1}{2}$ W, 10%
C-21	Capacitor, Ceramic Disc; .005 $\mu$ F, 20%, 200V	R8, R16	Resistor, 1K, $\frac{1}{2}$ W, 10%
C-23	Capacitor, Ceramic Disc; .0068 $\mu$ F, 10%, 50V	R10, R12, R15,	
D-1	Diode, 1N60 or Equal.	R19, R22	Resistor, 10K, $\frac{1}{2}$ W, 10%
L1, L2	Inductance, $\approx$ 2.8 MH; J. W. Miller #9059 (See Text)	R17	Resistor, 150 ohm, $\frac{1}{2}$ W, 10%
L3	Inductance, $\approx$ 6.0 MH; J. W. Miller #9060 (See Text)	R20	Resistor, 470 ohm, $\frac{1}{2}$ W, 10%
Q1, Q2	Transistor, FET (N-Planar); Motorola MPF-102 or Equal	R21	Resistor, 3.3K, $\frac{1}{2}$ W, 10%
Q3, Q4, Q5	Transistor, Type 2N3414 or Equal	R23	Resistor, 47K, 10%, $\frac{1}{2}$ W (see text)
IC-1, IC-2	Integrated Circuit, RCA #CA-3028A (or CA-3028B)	R24	Resistor, 220K, $\frac{1}{2}$ W, 10%
		R25	Resistor, 22K, $\frac{1}{2}$ W, 10%



*Fig. 1*—Exact layout of copper side of required circuit for building the background-music adapter described. See text for hole sizes.

## SCA DECODER MODULE

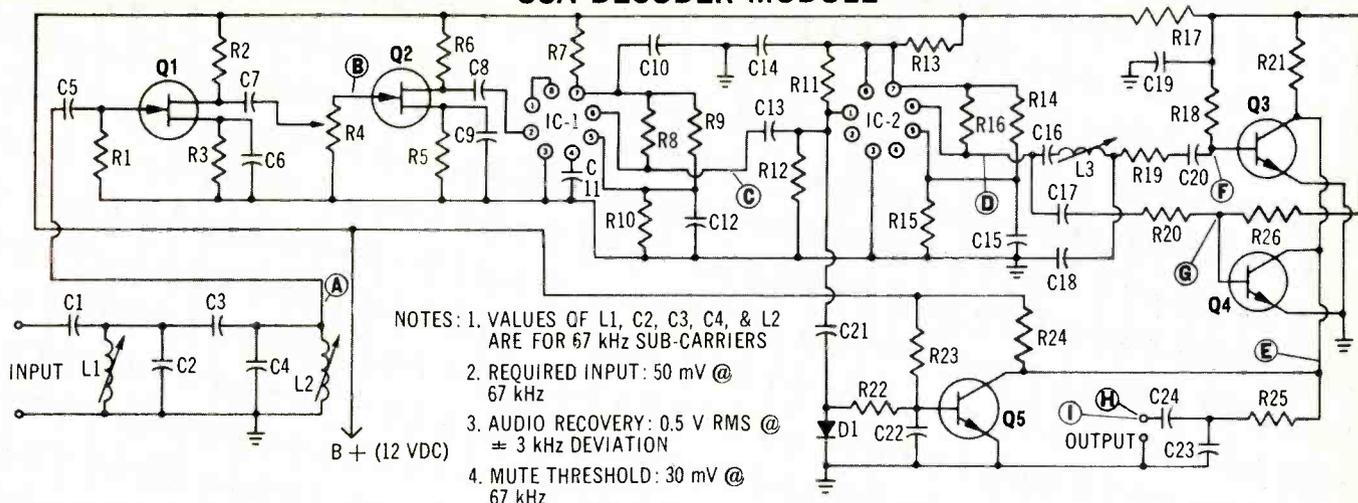


Fig. 2—Schematic and parts list for SCA decoder module. Circled letters refer to waveform patterns (see next page).

RCA CA-3028A Integrated Circuit. Use a very small-tipped soldering iron, especially in soldering the FETs, transistors and ICs. Complete soldering each lead as quickly as possible to avoid damage to the components or the copper pattern on the circuit board. Do not push the ICs all the way down to the board. The eight leads should be inserted in appropriate holes with most of the lead length remaining above the board, so don't cut the leads down in length.

Obtain the smallest Mylar® capacitors you can get for the 0.1- $\mu$ F units required. There are 13 needed, and they must be small to fit on the board. If you cannot obtain miniature Mylars, purchase 100-volt paper units, but they will have to be mounted on the board in a "standing up" position because of their greater size.

Connection points are shown in Fig. 3 and consist of supply voltage

(+ and -12V, d.c.), and input, output, and common grounds for each. Specific "ground points" for supply, input, and output are not called out on the circuit board for good reason: the entire border of copper is "ground" and the shields of input and output cable as well as the negative of the supply may be returned to this copper border wherever it is most convenient. Do not, however, depend on hardware mounting to establish a good ground between the circuit board and the metal chassis (if you use one).

### Connection to FM Sets

Nearly all FM tuners or FM receivers utilize either a ratio detector or a discriminator as a detection scheme. Some sets, built in the late 1950s and early 1960s are equipped with a "multiplex jack" (originally intended to accept an adapter for stereo). If you own such a set, you're

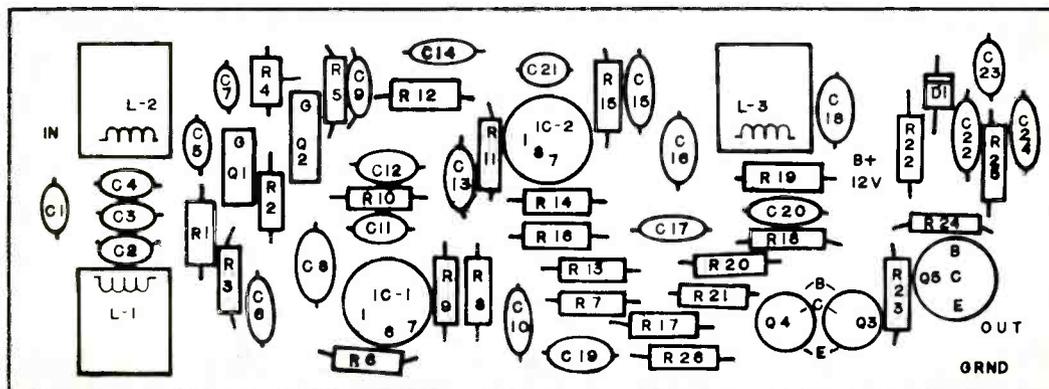
practically in business. All you need do is connect, by means of a short pin-to-pin cable, from this "multiplex" jack on your tuner or receiver to the input of the SCA Decoder and from the output of the decoder (again, using a shielded cable) to an unused input of your amplifier.

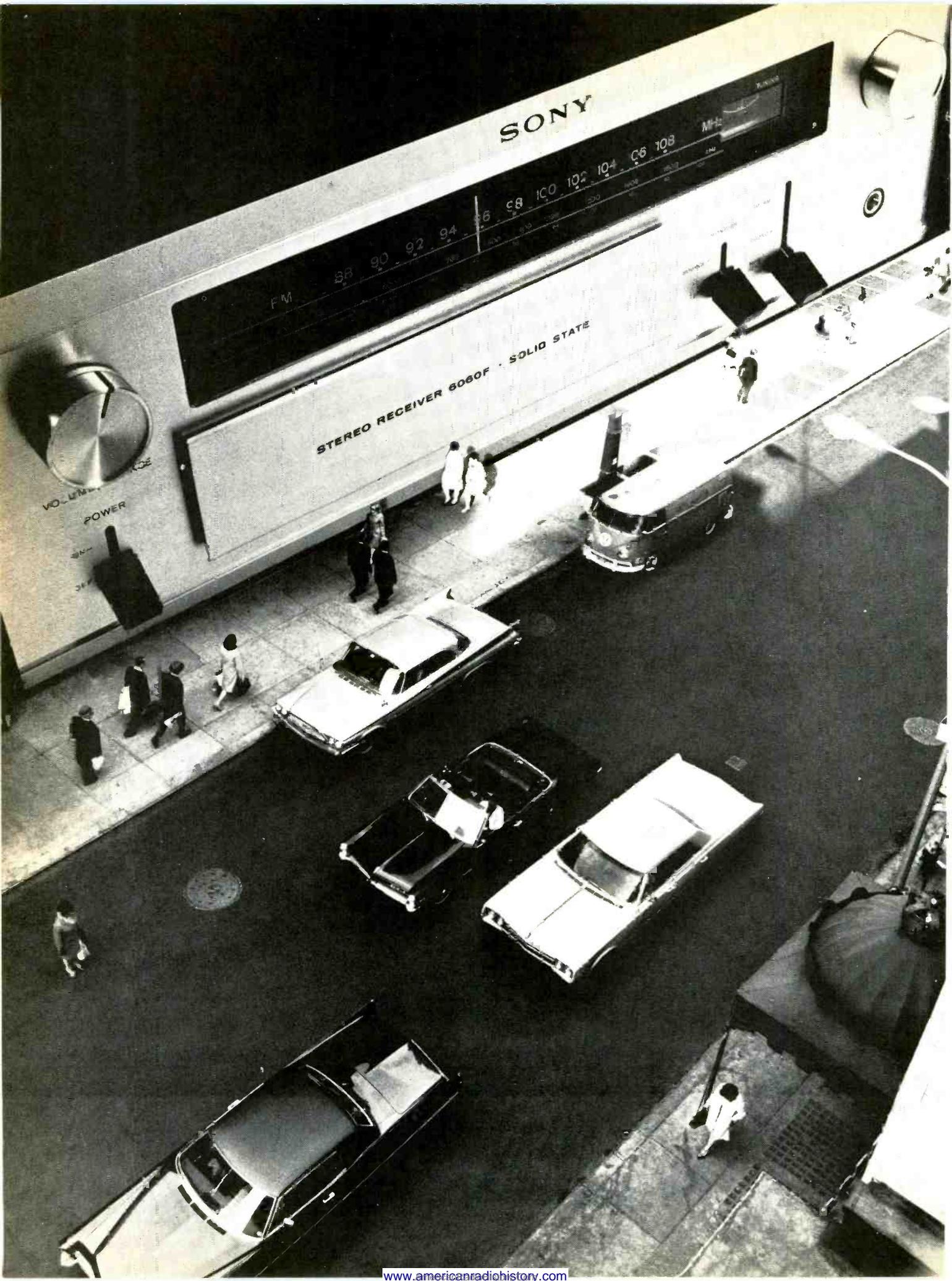
Those of you who have sets not equipped with a discrete multiplex jack need only refer to Fig. 7 (A or B) to determine where to get at the composite detector output signal suitable for application to the SCA decoder. Use a short length of shielded cable, the shield of which can serve to make a common ground between your tuner or receiver and the SCA Decoder.

### Alignment

Start with the tuning core of  $L_1$ , protruding from the coil about  $\frac{1}{16}$  inch, and the cores of  $L_2$  and  $L_3$ , out about  $\frac{1}{8}$  inch. If you have made no

Fig. 3 — Pictorial diagram showing parts installed on the PC board.





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Here's what Sony built: *Amplifier*—110 watts IHF power into 8 ohms. Distortion less than 0.2% at rated output. *The tuner*—sensitivity 1.8uV; selectivity, 80 dB; capture ratio, 1.5 dB; spurious signal rejection, 90 dB. *Abundant control facilities*: auto-

matic stereo reception; zero-center tuning meter; front panel headphone jack; switches for tape monitoring, muting, speaker selection, tape or Aux. input, loudness—the works.

At \$399.50 (suggested list) the 6060 outshines receivers costing up to \$500. Get a Sony disposition. Just direct your feet to one of the Sony hi-fi dealers listed below. Sony Corporation of America, 47-47 Van Dam Street, Long Island City, N.Y. 11101

**ALABAMA** BIRMINGHAM: Likis Stereo Center, 2018 11th Ave. So.

**ARIZONA** PHOENIX: Bruce's World of Sound Inc., 2711 E. Indian School Rd.

**CALIFORNIA** ANAHEIM: Henry Radio, 931 N. Euclid Stereo Mart, 979 S. Anaheim Blvd. AZUSA: Rancho Sound, 18532 E. Alosta Ave. CANOGA PARK: Wallichs Music City, 6600 Topanga Cyn. LAKEWOOD: Wallichs Music City, 5255 Lakewood Blvd. LONG BEACH: Humphrey's Music Co., 135 E. Third St. Wallichs Music City, 1501 N. Vine St. Winstead Cameras, 5015 E. Second LOS ANGELES: Bel-Air Camera & Hi Fi, 927 Westwood Blvd. Crenshaw Hi Fi, 4051 Marlton Ave. Henry Radio, 11240 W. Olympic Blvd. Henry's Camera, 516 W. 8th St. Jonas Miller Stores, 3025 Crenshaw Magnelic Recorders, 7120 Melrose Ave. Schireson Bros. 344 So. Broadway Winstead Cameras, 724 So. Broadway PALM SPRINGS: Palm Springs Music, 360 W. Palm Canyon Dr. Pat Barbara Music, 121 So. Palm Canyon Dr. PALO ALTO: Yamaha Peninsula, 3731 El Camino Real PASADENA: High Fidelity House, 563 S. Fair Oaks Ave. Stereo Mart, 3205 Foothill Blvd. REDONDO BEACH: Bay Elect., 2315 Artesia Blvd. SAN DIEGO: Milo Double "E", 3686 El Cajon Blvd. SAN FRANCISCO: Skinner Hirsch & Kaye, 229 Kearney St. Tokyo Electronics, 1766 Buchanan St. SANTA ANA: Hi Fi Assoc., 2220 No. Main SANTA MONICA: Bob Pilot's Stereo Ctr., 2201 Santa Monica Blvd. SUN VALLEY: Electronics Division, 7562 San Fernando Rd. TARZANA: Stereo Mart, 18410 Ventura Blvd. TORRANCE: Griffey's Elect., 3840 Sepulveda Blvd. Wallichs Music City, 17540 Hawthorne WEST COVINA: Wallichs Music City, 2917 E. Garvey Ave. WHITTIER: Oxbow Elect., 15914 E. Whittier Blvd.

**COLORADO** BOULDER: Lloyds Hi Fi, 1134 13th St. DENVER: Empire Audio Exchange, 1100 Broadway Lloyds Hi Fi, 1599 S. Colorado Blvd.

**CONNECTICUT** NEW HAVEN: David Bean Smith, 262 Elm St. NORWALK: Arrow Elect., 18 Isaac St. WESTPORT: Klein's, 44-50 Main St.

**WASHINGTON, D.C.**: Glen Music & Audio, 1204 "G" St., N.W.

**DELAWARE** WILMINGTON: High Fidelity House, 3910 Concord Pike

**FLORIDA** MERRITT ISLAND: Stereo Assoc. (Helene's Int), 545 N. Courtenay Pike MIAMI: Electronic Wholesalers, 9390 N.W. 27th Ave. Hi Fi Associates, 3188 Biscayne Blvd. ORLANDO: Electronic Wholesalers, 345 Graham Ave. TAMPA: Viviano Hi Fi Center, 1538 So. Dale Mabry Hwy. TITUSVILLE: Stereo Assoc. (Helene's

Int), 4549 S. Hopkins Ave.

**ILLINOIS** CHICAGO: Allied Radio, 111 N. Campbell Ave. Musiccraft, 2035 W. 95th St. Musiccraft, 48 E. Oak St. Schwartz Bros., 8533 S. Cottage Grove. HINSDALE: Hinsdale Camera, 49 Washington.

**LOUISIANA** BATON ROUGE: Kadair's Inc., 226 W. State MARYLAND BETHESDA: Audio Center, 4962 Fairmont Ave.

**MASSACHUSETTS** CAMBRIDGE: Audio Lab, 16 Eliot St. Minute Man Radio, 30 Boylston St., Harvard Sq. SPRINGFIELD: Consumer Audionics of Springfield, 461 Summer Ave.

**MICHIGAN** DEARBORN: Alamas Hi Fi Stereo, 15031 Michigan Ave., DETROIT: Pecar Electronics, 11201 Morang Dr. Stereolead, 17131 W. McNicols, 20746 Mack Ave.

**MINNESOTA** MINNEAPOLIS: Audio King, 7010 France Ave., So.

**MISSOURI** KANSAS CITY: David Beatty Hi Fi, 1616 W. 43 St. ST. LOUIS: Hi-Fi West Inc., 8217 Delmar Blvd. **NEW JERSEY** CHERRY HILL: High Fidelity House, 244 W. Marleton Pike NEW BRUNSWICK: Hi Fi Haven, 28 Easton Ave. NORTHFIELD: Rainbow Electronics, 318 Tilton Rd. PARAMUS: Sam Goody, Garden St. Shopping Plaza. Music Age Inc., 171 Rte. 4. SPRINGFIELD: Federated Purchaser, 155 Rt. 22. TRENTON: House of Hi-Fi, 1819 No. Olden Ave. Ext. TOTOWA: Arrow Electronics, 255 Rt. 46. WAYNE: Stereo Sound, 1459 Route 23.

**NEW MEXICO** ALBUQUERQUE: H. Cook, 308 Central Ave., S.W.

**NEW YORK** NEW YORK CITY: Arrow Elect., 97 Chamber Audio East, Inc., 319 E. 79 St. Audio Exchange, 1305 Second Ave., 415 Lex. Ave., 110 W. 32nd St. Electronic Workshop Sales, 26 W. 8th St. Grand Central Radio, 124 E. 44 St. Harmony House, 197 E. 76 St. Harvey Radio, 2 W. 45 St. Interiors & Sound, 1307 Second Ave. Leonard Radio, Inc., 18 Warren St., 1163 Ave. of the Americas Liberty Music Shop, 450 Madison Ave. Lyric Hi-Fi Center, 1221 Lexington Ave. Marconi Brothers, 864 Lexington Ave. Sam Goody East, 666 3rd Ave. Sam Goody West, 250 W. 49 St. G. Schirmer Inc., 4 E. 49 St. Sonocraft Corp. (Asco Sound), 115 W. 45 St. Victor International, 13 W. 46 St. Wexler & Sporty Inc., 125-127 Lafayette St. BRONX: Arista Camera Specialists, 2194 White Plains Rd. BROOKLYN: Audio Exchange, 1065 Flatbush Ave. Kitcraft (Dyna Tech Labs), 738 Washington Ave. FARMINGDALE: Arrow Elect., 900 Broad Hollow Rd. HUNTINGTON: Sam Goody, Walt Whitman Shopping Ctr. JAMAICA: Audio Exchange, 153-21 Hillside Ave.

**MINEOLA**: Arrow Elect., 525 Jerich Tpke. NANUET: Electronics 59, 346 W. Rt. 59. ROSLYN: Audio Exchange 1040 Northern Blvd. SYRACUSE: Q-Tronics, 3461 Erie Blvd. E. VALLEY STREAM: Sam Goody, Green Acres Shopping Ctr. WAPPINGER FALLS: Arnee Audio Designs, Nine Mall Rt. 9. WHITE PLAINS: Audio Exchange, 239 Mamaroneck Ave. WOODBURY: Harvey Radio, 60 Crossways Pk. W.

**OHIO** AKRON: Electronic Eng. Co., Audio Hall, 362 W. Bowers St. CINCINNATI: Hi Fi Audio Co., E. McMillian at Woodburn CLEVELAND: Winteradio, 4432 Mayfield Rd. COLUMBUS: Anderson Hi Fi, 2244 Neil Ave. Custom Stereo Electronics, 1391 So. Hamilton DAYTON: Hauer Music Co., 4421 Salem Ave. KETTERING: Hauer Music Co., 3140 Far Hills Ave. PARMA: Winteradio, 5373 Ridge Rd. SPRINGFIELD: Bradley Kincaid Music, 130 So. Fountain TOLEDO: World of Sound, 3139 W. Central Ave. YOUNGSTOWN: Audio Arts, 4224 Market St.

**OKLAHOMA** OKLAHOMA CITY: Sonax Co., 1200 E. Britton Rd. TULSA: Sound Unlimited, 3745 So. Peoria **PENNSYLVANIA** ARDMORE: Soundex, 45 W. Lancaster Ave. FAIRLESS HILLS: C. A. Rogers Audio Lab, 312 Oxford Valley Rd. PHILADELPHIA: Danby Radio Corp., 19 So. 21 St. Sam Goody, 1125 Chestnut St. PITTSBURGH: House of Audio, Terrace Level, 218 Allegheny Ctr. Radio Parts Co., 6401 Penn. Ave.; 929 Liberty Ave. Solar Elect., 2354 No. Mall POTTS-TOWN: Amity Supply Co., 216 River Rd., So. WAYNE: High Fidelity House, 167 W. Lancaster Ave. YORK: Sol Kessler, 126 So. George St.

**RHODE ISLAND** WOONSOCKET: Sound Products, 230 West School St.

**TENNESSEE** MEMPHIS: Opus Two, 404 So. Perkins St. **TEXAS** AUSTIN: Home Entertainment Ctr. 4803 Burnet Rd. DALLAS: Gramophone Shop, 2800 Routh DENTON: Music City EL PASO: Ayoub & Wardy, 218 S. Stanton HOUSTON: Audio Center, 1424 Westheimer Home Entertainment, 5310 Kirby Dr., Nassau Bay Shopping Ctr. Mall, 18091 Upper Bay Rd. LAREDO: Cowi's Music Center, 1212 Hidalgo St. SAN ANTONIO: Vandergriff, 6740 San Pedro Vision Elect., 1116 E. Houston St.

**UTAH** SALT LAKE CITY: House of Music, 156 So. Main St.; 4835 Highland Dr.

**VERMONT** BURLINGTON: Concert Electronic, 1161 Williston Road. **WASHINGTON** SEATTLE: Standard Records & Hi Fi, 1028 N.E. 65 St.

**WISCONSIN** MADISON: Specialized Sound, 621 Gammon Rd.; 411 State St. MILWAUKEE: Wack Sales Co., 5722 W. North Ave.



Fig. 4—Waveform patterns observed at scope points of schematic in Fig. 2, with pertinent notes.

(A) (Filter response if sweep frequency is applied. In final setting of L1 and L2, a plot of response may be made from about 40 kHz to 75 kHz should sweep facilities not be available.)

(B) (.035 volt rms observed for .050 volt input at 67 kHz.)

(C) (Approximately 2.5 volts rms.)

(D) (Approximately 1.5 volts rms.)

(H) (Output with no audio modulation shows residual 67-kHz integrated pulses, approximately .05 volt peak-to-peak.)

(I) (Recovered audio shows traces of residual 67 kHz pulse.)

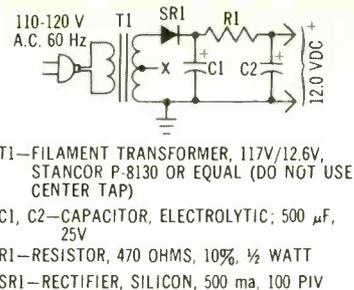
errors in parts assembly, you should encounter one or two “background music” programs as you tune across the FM dial. Bear in mind that a good, outdoor antenna is an absolute *must*—much more so even than for good FM stereo reception. Inherently, the signal-to-noise ratio of SCA is at least 20 dB (often more) poorer than regular FM. Therefore you need all the signal you can get. Final alignment can best be done by listening to a background music station (once found) and adjusting the core of  $L_3$  for loudest and cleanest sound.  $L_1$  and  $L_2$  can then be trimmed for least audible cross-talk (main channel leaking into the sub-channel program). The waveform photos, corresponding to lettered points on the schematic, will prove helpful in the event of real trouble. A photo of the completed printed-circuit-board assembly is shown in Fig. 8.

### Enjoying “Commercial-Free” Music

There are just a few more things you should know about SCA programming. The programs are arranged with frequent pauses between musical selections. During these pauses, the 67-kHz subcarrier actually disappears, “triggered on” again by first musical note of the next selection. About a millisecond of sound is lost before the circuit reacts. During the silent period, a muting circuit is required to avoid hearing an enormous amount of static and noise. In this SCA decoder, this muting circuit consists of  $C_{21}$ ,  $D_1$  and transistor  $Q_5$ , along with its associated resistors  $R_{22}$ ,  $R_{23}$ , and  $R_{21}$ , and capacitor  $C_{22}$ .

In the absence of a sub-carrier,  $Q_5$  is biased heavily into conduction by the positive voltage applied to it. This conduction gives  $Q_5$  the appearance of a virtual “short circuit” across the output of the gating pair of transistors. When a 67-kHz signal is applied to the decoder, part of the amplified signal is applied, through  $C_{21}$ , to rectifier  $D_1$ , and an opposing *negative* voltage is developed at the junction of  $R_{22}$  and  $R_{23}$ . This overcomes the fixed positive voltage and

(Continued on page 40)



T1—FILAMENT TRANSFORMER, 117V/12.6V, STANCOR P-8130 OR EQUAL (DO NOT USE CENTER TAP)  
C1, C2—CAPACITOR, ELECTROLYTIC; 500  $\mu$ F, 25V  
R1—RESISTOR, 470 OHMS, 10%, 1/2 WATT  
SRI—RECTIFIER, SILICON, 500 ma, 100 PIV

Fig. 5—Suggested power supply for use with SCA decoder described here if no other source of +12 volts d.c. is available.

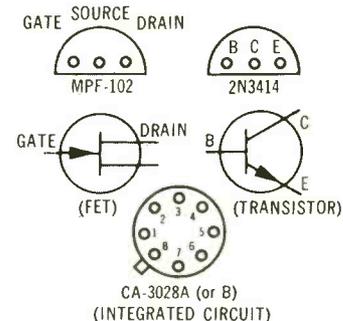


Fig. 6—Basing arrangements of FETs, transistors, and ICs used in constructing the SCA decoder. All views are shown looking at the leads from the bottom of the device.

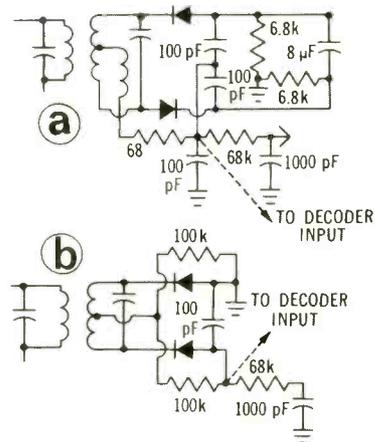
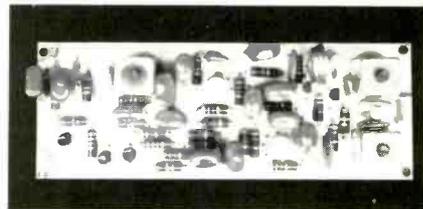


Fig. 7—Typical ratio-detector (A) and discriminator (B) circuits with indication of proper take-off points for feeding the SCA decoder. This point is identical to the take-off point used for connection of stereo FM decoder circuitry.

Fig. 8—Completed SCA decoder, less power supply, viewed from the top of the printed-circuit board.



# Everybody bulls, bluffs and brags about their tape recorders.

## This new Ampex will clear the air.

It seems like all tape equipment manufacturers chatter about all sorts of features.

One talks automatic threading. Others boast automatic reverse. Still more hit you with 4 heads, sound-with-sound, dual capstan drive, automatic tape lifters, 3-speed operation and on and on.

It makes the mind boggle.

Because the fact is that no one has all these features on *one* stereo machine. Except us. Ampex.

Our new model 1461 has automatic threading. And automatic reverse. And 4 deep-gap heads. And sound-with-sound. And dual capstan drive. And tape monitoring. And automatic tape lifters. And 3-speed operation. And two omni-directional dynamic microphones.



And lots more. Like full-dimensional stereo cube speakers that nest inside the unit for portable use and separate up to 20 feet. A 1-year overall warranty and 3-year head warranty. Automatic shut-off. Even stereo headphone output.

Just one great feature after another.

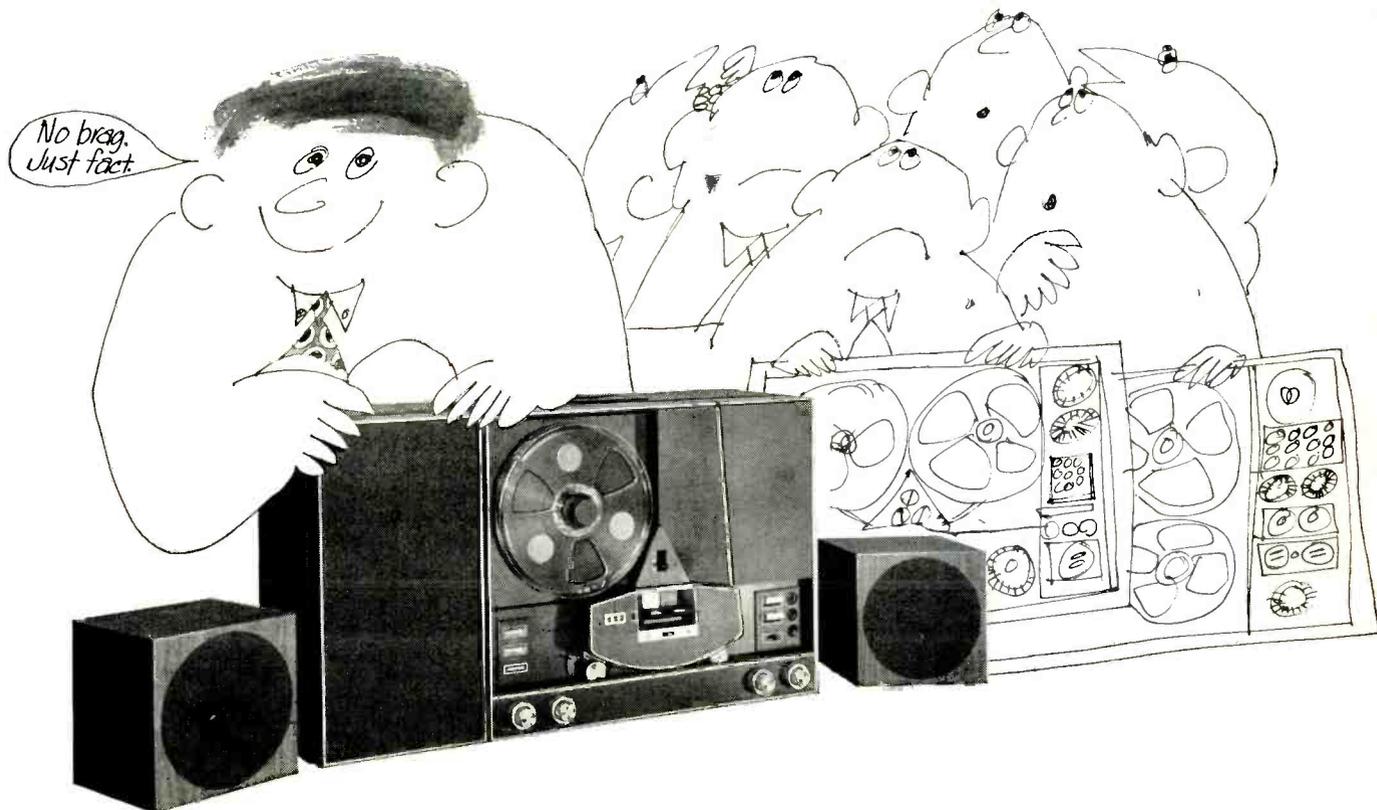
Sure, you can find some of these features on other machines. But not all on *one* machine. Except ours. So see an Ampex Sound Idea Dealer today. He has the outfit that has it all.

No brag. Just fact.

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Sound  
Idea  
People.

**AMPEX**

AMPEX CORPORATION  
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## SCA ADAPTER

(Continued from page 38)

cuts off  $Q_s$ , thus creating an "open circuit" across the output of the gate.

In the case of a weak signal, however (or, if you are tuned off-station altogether), the noise at the output of the detector (of your FM set) contains enough signal at around 67 kHz to pass through the input filter, be amplified and heard as an annoying static in the output. FM quieting of 50 dB or better will cause adequate muting between selections, however, and this should not be difficult to obtain with a good antenna and a reasonably sensitive tuner or receiver.

The potentiometer  $R_1$  is a miniature printed circuit "pot" made by Mallory (their "Minitrol" type) and is used to compensate for high-output tuners. With the pot fully clockwise, the decoder will work with input signals as low as 30 to 50 millivolts of subcarrier. If more output is available, lower the setting of the potentiometer to improve cross-talk rejection. If you can't obtain a mini-

ature pot to fit the layout of the board, a full-size potentiometer may be used, mounted as close to the circuit as possible, with leads from the three terminals of the pot to the appropriate circuit-board holes. Alternatively, if you are certain that your FM detector output does not provide more than 0.2 volts of SCA signal (figure  $\frac{1}{10}$ th of maximum audio output of regular FM), simply insert a 100 K-ohm resistor, making certain to connect from former "arm" terminal of  $R_1$  to the former "high side" terminal.

Some stations not yet engaged in stereo broadcasting use an SCA subcarrier having a frequency of 41 kHz. While they constitute a minority, the decoder as shown will *not* receive and demodulate such a subcarrier. If you know for sure that you have such a subcarrier associated with a station in your area and can receive none other, the filter elements should be changed. Referring to the schematic in Fig. 2, capacitors  $C_2$  and  $C_4$  should be changed to .005  $\mu$ F,  $C_3$  to 1200 pF, and  $C_{18}$  to 2200 pF.  $L_1$ ,  $L_2$  and  $L_3$  remain unchanged

(though they may require re-tuning). Cross-talk rejection will not be as good as in the case of a 67-kHz sub, where we measured over 45 dB of main-channel rejection.

Finally, a word of warning. There are laws protecting the background music companies from "piracy." You could be in serious trouble if you plan to build and use an adapter for commercial purposes, and it is hardly the intent of this author or publication to encourage unfair use of private subscriber music in public places where others have to pay for the same music service. There is, however, no law which can prevent you from experimentally building this decoder for use in your own home and for your own private enjoyment of this talk-free programming. While the fidelity is not high by our standards (frequencies above 5 kHz are not normally used because of complex relationships that would exist in the form of interfering sidebands, and so on), the music is pleasant and really suited to non-attentive listening for hours on end.

Æ

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(That's what's so good about it.)

Marantz isn't the name that most people think of first when they think of components. It's understandable. The price of Marantz equipment is simply beyond them.

On the other hand, price is the very reason a Marantz component can be as good as it is. (Nobody can give you something for nothing.)

Quite frankly, our philosophy is to let our engineers design a piece of equipment as best as they know how. Not as cheaply. (There are enough other manufacturers doing that already.)

We believe that the four superb stereo components illustrated here are the finest

performing stereo components available anywhere in the world. The Marantz SLT-12U Straight-Line Tracking Turntable (\$295). The Marantz 7T Solid-State Stereo Preamplifier Console (\$325). The Marantz 15 Solid-State Stereo Power Amplifier (\$395). And the Marantz 10B Stereo FM Tuner (\$750).

As soon as you examine these components, we know you will appreciate what goes into making a Marantz a Marantz. That's why your local franchised Marantz dealer will be pleased to furnish you with complete details together with a demonstration. Then let your ears make up your mind.

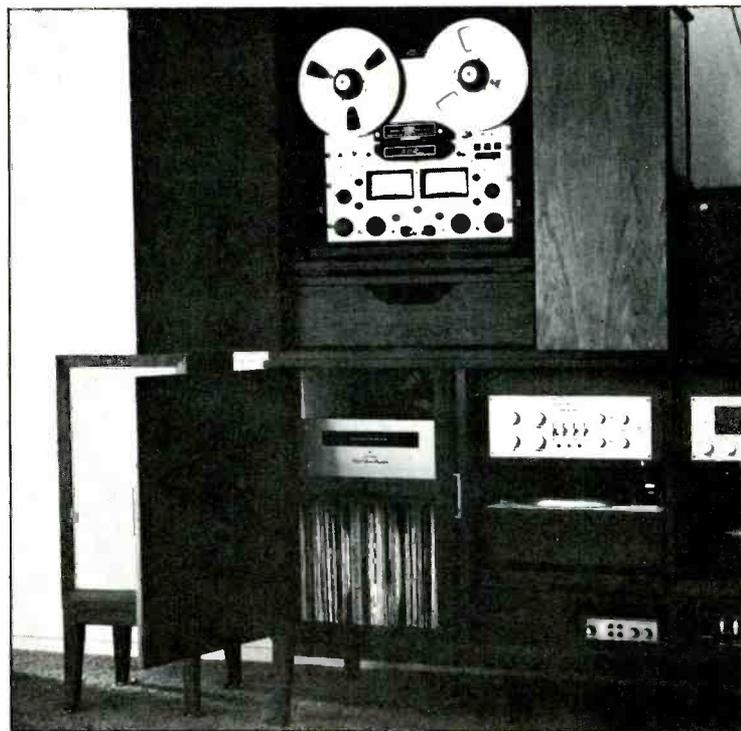


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# Sound & Decor Styles

## Bedroom Stereo Niche

Ronald Finger, Jamaica, N. Y.—This reader advises that space limitations in his apartment leave no room for a furniture-enclosed stereo system. And his landlord does not permit him to have an in-the-wall installation (no surprise). Solution: Shelves, loaded with hi-fi gear, LP records and magnetic tape reels, all in a corner of a bedroom. In addition to two speaker systems at this location, he has two speaker systems in the living room. Equipment includes: Dyna SCA-35 integrated amplifier, Dyna FM-4 tuner, Viking 88 tape deck, Thorens TD124 manual turntable with Ortofon RMG-212 tone arm, two AR-4 speaker systems, two custom-made speaker systems, Koss PRO-4 headphones.



## An Open and Shut [Cabinet] Case

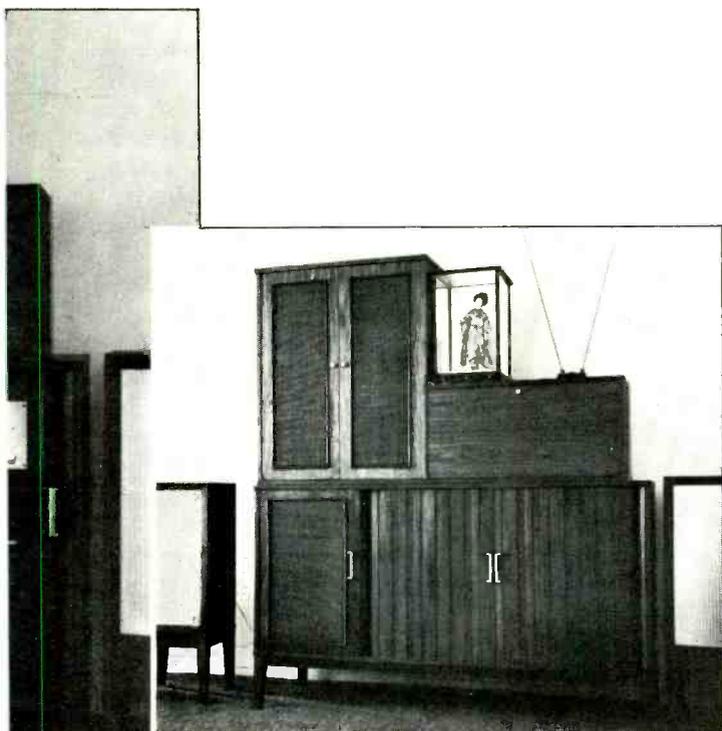
Harry Nuss, Brooklyn, N. Y.—Here is a cabinet installation that uses a Furn-A-Kit cabinet modified to the owner's requirements. Behind the cane door at left is a Marantz Model 15 solid-state amplifier which rests on a roll-out shelf for easy access to connections. Behind the amplifier is a Rotron fan, a holdover from the tubed amplifier that was previously owned. In the center is a Marantz Model 7T solid-state stereo preamplifier. Next to this, at right, is a Marantz Model 10B stereo tuner. The panel mounting board for the tuner was extended forward  $\frac{3}{4}$ " to accommodate the depth of its chassis. Below the preamp is one of two record players. This one, a Fairchild 412-1 manual turntable, includes a Grado tone arm with a Shure M55E phono cartridge and a Grado "Dustat." To the right is the second turntable, a

AUDIO INVITES YOU TO SEND IN PHOTOS AND DETAILS ON YOUR HI-FI SYSTEM. PAYMENT WILL BE MADE FOR ALL PUBLISHED MATERIAL.



### A Clean, Modern Installation

Donald Clyne, Brooklyn, N. Y.—Shown here is a stereo hi-fi installation in a reader's new home. The tonearm here is the Ortofon Transcriptor Fluid Arm from England, working with a Sony manual turntable. A Marantz FM stereo tuner and a Marantz stereo preamplifier are rack-mounted, with a JBL power amplifier hidden in the cabinet. LP records are kept in the cabinets.



Dual 1019 automatic that incorporates a Pickering V15/AME cartridge. (Both cartridges are equipped with elliptical styli.) Below the phono sections are a Fairchild "Compander," built from a kit, and a Lafayette stereo balance meter.

Recording equipment is located in a hutch that rests on top of the floor cabinet. Here you can see a 4-track Crown SS824. A roll-out turntable is used so that the recorder can be pulled out and turned around, even with its 10½" reels attached. Underneath the recorder is a storage drawer for accessories, which include David Clark Model 100 stereo headphones, two Shure 545 Unidyne microphones, Crown low-impedance mike transformers, tape-head demagnetizer and splicer, audio cables, and so on. All audio connectors and speaker wires are color-coded for easy identification.

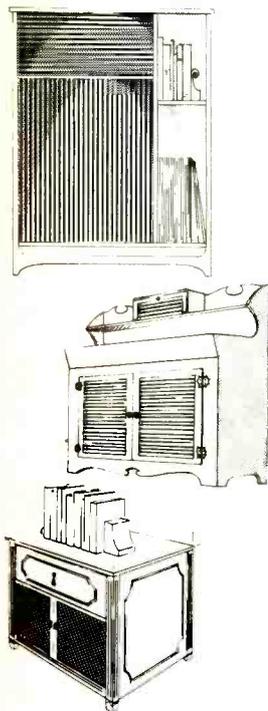


### Free-Standing Wall Unit

Thomas R. Marshall, Fort Wayne, Ind.—Behind sliding doors of a free-standing wall cabinet are a Scott 344B stereo receiver, Garrard Lab 80 automatic turntable, and a Roberts 1740X tape recorder. Large bookshelf speaker systems, JBL Lancer 77s, are situated at eye level at each end of the cabinet.

# Sound & Decor Styles eye- fidelity

JERRY JOSEPH, F.I.P.D.



An audio enthusiast generally gets a great deal of enjoyment visiting his favorite sound salon. It's a place where he can browse leisurely and carefully study each and every piece of stereo hi-fi equipment on display.

Often a knowledgeable buyer, he is aware of the large variety of components available to complete a fine sound system, components composed of various shapes and sizes. There is the sleek and delicate tone arm, obviously designed for gentle intentions toward its record companions. There are the sturdy yet handsomely built receivers, amplifiers and tuners, dressed up in stylish metallic faces. Even some of the hard-working members of the audio family, the turntable and tape decks, are being designed at present without that "Put me in the closet" look. There is, unfortunately, one very important unit that we cannot al-

ways include as part of our favorable observations on component style trends—the loudspeaker system.

When it comes to speakers, the audio enthusiast usually makes his choice after listening very carefully to the various makes, carefully reading equipment evaluation reports, and so on. The lack of unanimity among buyers for any one type verifies our individual taste for sound. It is unfortunate, however, that we are not accorded the same privilege when it comes to choosing for "looks." Except for a few isolated makes, most people end up with a box. It may be a large box or a small box, a square or a long box, but a box nevertheless. A friend of ours who recently surprised his wife with a stereo hi-fi rig was greeted with, "Where will I place the boxes?" Now as the owner of a lovely traditional home, the question seemed appropriate. Wouldn't you agree?

Let's see what we can do with the box. Actually, experience has shown us that there are three interesting ways in which we can treat the box, aside from just plain ignoring it. First we can hide it; second, we can camouflage it; finally, we can emphasize it!

Let's try hiding the box. The un-decorative method is simply to find a space behind a large piece of furniture, such as a sofa, or behind some drapes. But out-of-sight is often out-of-sound (good sound reproduction, that is). The ideal method of hiding the box is to incorporate it into a smartly styled cabinet. Fine audio furniture is now available in all period styles, in many sizes, and in an infinite variety of finishes. Antique reproductions are also available for the connoisseur, where cost is of secondary importance to taste.

For the hi-fi buff who wishes to have a fully isolated speaker system (where the speaker system is not in physical contact with the equipment portion of the cabinet), there are a number of designs being presently manufactured which consist of the equipment cabinet and two matching speaker cabinets. These fit adjacent to one another to form good-looking consoles. Another design to effect speaker isolation is where the speaker box sits on the floor (on

carpeting or a pad) inside the cabinet. Still another new and interesting method of housing bookshelf speakers is a cabinet design where the end portions of the cabinet are mounted on swivel bearings. This type of design not only affords the isolation desired, but has the additional advantage of being able to rotate the speakers 180 deg., for any desired sound dispersion.

Secondly, we come to camouflaging the box, a challenge to many an interior designer. This challenge can easily be solved, with gratifying results, with a little imagination. Both contemporary and traditional home interiors allow for interesting settings.

The question now is, when is a box not a box? When it is a lamp table, a pedestal, or an attractive corner planter. To successfully conceal the box without impairing its main function, additional custom woodworking must be considered.

Lamp tables in Contemporary, Classic, and even Early American periods are suitable designs to work with. Some examples are shown in the accompanying sketches.

As a modern pedestal for unique and abstract pieces of sculpture, the bookshelf speaker lends itself easily to this form by the simple addition of a recessed base in black, approximately two in. in height. Topping it off with a thick slab of marble (not less than 5/8-in. thick) will enhance the pedestal feeling while adding height and style.

Finally, *emphasizing* the good old box is another decorative road we can follow. This can be accomplished by using the box as a focal point in wall design. These wall-hung variations are only limited by the taste and budget of the home owner. Another method of emphasizing bookshelf speakers is the cabinet design that is constructed with open-end platforms—the speaker boxes simply sit on these platforms. Still another new and interesting design is the vertical unit that houses components above an open platform on which the speaker sits.

So as you can see, a little effort and imagination can go a long way to help you match speaker systems to a room's decorating scheme. Æ

# a few new reasons you should see the Pioneer line now!

In every area of high fidelity, new components by Pioneer are making listening more enjoyable... a richer experience. Although these components represent the newest and most advanced technology in audio electronics, each is backed by the 30 years' experience of the world's largest manufacturer devoted solely to high fidelity and audio components. Here is a sampling of some of the things to come in the next few months.

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#### **CS-52T-Compact 2-way Speaker System**

Brilliant sound reproduction from a

very small enclosure (13 $\frac{3}{8}$ "H x 8 $\frac{1}{2}$ "W x 8 $\frac{3}{8}$ "D). Driven by a 6 $\frac{1}{2}$ -inch woofer with extra large and heavy magnet, and 2 $\frac{1}{2}$ -inch cone-type tweeter. Excellent transient response and sparkling highs with very wide dispersion.

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Pioneer has led the way in advanced concepts of bi-amplification and electronic crossovers — the Pioneer Integrated Systems. Hailed as the ultimate approach to perfect sound reproduction, Pioneer introduces for 1969 (available now!) this basic music programmer — an AM-FM stereo tuner, a transcription turntable, and preamplifier, in one integrated module to couple with bi-amplified speaker systems such as the IS-80. Beautifully designed in walnut, charcoal, and white gold, with smoked acrylic cover.

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The turntable perfectionists have been waiting for — the precision of

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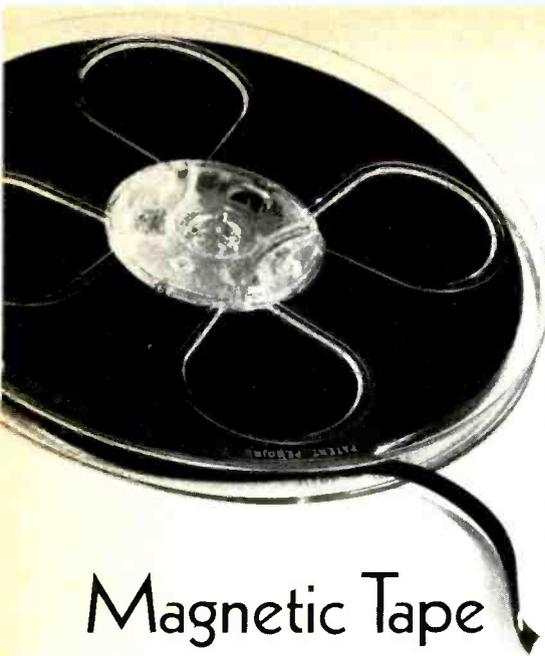
#### **CS-5-Intermediate-sized, Budget priced Speaker System**

An intermediate-sized speaker system at the lowest possible price, from the world's largest manufacturer of loudspeakers. The CS-5 is a convenient bookshelf-size system, using the most advanced transducers for full range reproduction, to fit anyone's budget. Measurements: 21 $\frac{1}{4}$ "H x 11 $\frac{7}{16}$ "W x 8 $\frac{13}{16}$ "D.

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# Magnetic Tape

AL FANNING

## How to choose the right type from among all-purpose, low-noise, low-print-through, high-output tapes

MAGNETIC AUDIO TAPE is one of the most ingenious and resourceful partners a hobbyist could have, if he understands how to choose and use it. This thin ribbon of plastic—shiny on one side and dull on the other—is an endlessly versatile tool. But there is much to bewilder a tape recordist—imperfect tape, different thicknesses, many trade names, and so on.

Good-quality tape can't be made without unremitting care in manufacture and fanatically intense inspection of the finished tape, because the process requires extreme precision in a number of important respects. Obviously, the maker must have skill and, literally, devotion to quality if he is to put out tape that is uniformly good. So your chances of getting good tape are a lot better if you buy "brand" tape from the top names in the field. The "white box" tape sold at bargain prices carries no such initial presumption of quality. One box of it may be pretty good, and the next wildly off the beam. Some white-box tape is instrument tape that has been *rejected* by manufacturers (You wouldn't want a dropout when a computer is calculating *your* income tax would you?).

What do you watch out for? Whatever the origin of tape, it may have any of the faults discussed in the following. Some of the most important arise from the fact that the strength of the signal varies with the thickness of the coating of magnetic particles that forms the active side of the tape. To understand this and some of the other faults, let's review quickly how tape is made.

The process is a continuous one in which the plastic backing, at this point two to three feet wide, moves slowly through a machine that flows the liquid coating onto it. Next the broad band of plastic goes through an oven that hardens the coating. Then it goes to a slitting machine which cuts it, in one operation, into 40 or 50 ribbons which are (for open-reel sound tape) one-quarter inch wide.

The preparation of the coating to go onto magnetic tape is an extremely demanding process. The coating consists of billions of particles of iron-oxide powder, the "magnetic" part of magnetic tape, mixed into liquid glue, the "binder," which holds them onto the plastic backing. The oxide particles are needle shaped and each one is only a few millionths of an inch long. When the binder hardens, the particles are, ideally, laid out along the tape in a perfectly even "carpet" that has the same magnetic properties at every point on the tape.

The coating must be flowed onto the backing with a thickness uniform within a few millionths of an inch. And the backing must have a mirror-smooth surface on that side.

### How deficiencies originate

What happens if the coating *does* change in thickness a tiny bit, getting a little thinner, say, at some point? The signal level will suddenly drop a few decibels, a very disconcerting fault found in poor tape. Elimination of such changes depends, in the final event, on 100% inspection. A lot of tape doesn't get it, as already suggested. The reason for this sensitivity to coating thickness is simple: the thicker the coating, the more iron there is on the tape and the stronger the magnetism produced at any point by a given

signal in the recording head.

Now let's suppose that the iron is not evenly dispersed in the coating, or that the iron particles themselves are not uniform in size. Then the tape will have a high noise level: it will be very hissy, and this is probably the most common fault of poor tapes. We can see that the particles together produce a kind of "grain" in the magnetic coating. The finer and more even this grain, the lower the noise.

If the tape backing is microscopically rough, the coating will have tiny variations in thickness that are heard as noise. So use of a low-grade backing pushes up the noise level.

The binder itself has to be just right, very tough and smooth when it hardens but *not* brittle or stiff, because the tape must be flexible enough to conform to the heads in recording and playback. If the binder lacks the necessary toughness or is brittle, the coating may tend to flake off after a time, or the oxide may rub off in large amounts in the form of a gummy dust. A flaky or powdery tape should be removed from the machine the instant it shows its character. You can detect extremely good binder quality by running a finger nail over the coating side of the tape. But this may not show up a more moderate coating weakness that would be unacceptable on your machine. Deposits around the heads or guides are often the first signs that a tape is shedding its coating.

If the binder is very rough or sticky, you have some other troubles: you may get extreme head wear, or a squeaky tape, or high flutter, (from uneven motion), or poor high-frequency response, or a lot of noise. This shows how important the adhesive chemist is in tape manufacturing. He has to come up with a glue that has just the right properties when hard. Top-quality tape today has nearly always been given another operation to reduce binder roughness: the coating side is lightly polished to make it very smooth, so it passes over the heads with a minimum of friction. At slightly higher cost, you can get tape that is "lubricated" with a silicone to make it slide even better. Some manufacturers put a lubricant in the coating as a routine matter. Low fric-

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## A-4010S STEREO TAPE DECK

with three precision motors: dual-speed hysteresis synchronous for capstan drive—plus two eddy-current outer rotor motors for reel drive. This TEAC exclusive means less wow and flutter, more studio-quality sound. Other outstanding features:

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- 4 solid-state amplifiers
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## AS-200 INTEGRATED AMPLIFIER —

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## MAGNETIC TAPE (cont.)

tion at the heads is of great importance because, among other things, it reduces "modulation noise," the mushy garbling sound that seems to be in back of the music in wide-range reproduction. Modulation noise is really a very fast flutter that results from the tape's sticking a little on the head, then jumping forward, then sticking, etc. The less it sticks, the lower this noise. And that adds up to a lot of trouble from a rough or sticky binder.

Now let's suppose that the mixing process has not been complete, so that there are little clumps or nodules of the powder on the surface of the tape. When one of these passes over the head, it tends to push the tape away from the head. We lose high frequencies, or maybe the whole signal, for a fraction of time. We have, in other words, a "drop-out," a kind of hole in the sound. If the loss is very short, a few milliseconds only, it may not be noticeable in sound recording (in digital instrumentation recording any drop-out is serious because the loss of just one of the microscopic dots of magnetism will change the story on the tape). A longer drop-out of course, is very disturbing.

A more subtle fault found in much poor tape, and one depending on a combination of factors in manufacture, causes high-frequency deficiencies. The oxide characteristics, the shape and size of the particles, and a number of other things affect the high-frequency response of tape. Since getting super highs in tape recording is a challenge, you are badly licked if the tape itself falls off considerably in this part of the spectrum. It is worthwhile making a trial recording on any tape you are not sure of if you are going to use it for a job in which the ultimate in fidelity is important.

As a final entry in this litany of tape sins, consider what happens if the slitting machine does not cut the tape ribbons absolutely straight, as is sometimes the case. The edge of the tape may be "curly," which tends to produce uneven motion with attendant flutter, wow, increased modulation noise. The tape may skew back and forth over the heads, causing gross variations in signal; or it may repeatedly rub against the

flange of the supply or take-up reel, again a cause of flutter or wow.

### Types of magnetic tape

So much for the sins of tape. Let's talk about which *good* tape the savvy recordist chooses for any given recording job. First there is the division into the two types of backing material, acetate, polyester, and polyvinyl chloride.

Acetate is a little cheaper and is satisfactory for all ordinary recording jobs, including those in which you are aiming at top fidelity. Its inferiority to polyester shows up mostly when it comes to life in storage. Extreme changes in humidity and temperature may degrade the acetate backing somewhat, making it brittle or causing the coating to peel. Polyester is more resistant to such changes.

The polyester is also considerably stronger than acetate at a given thickness. Thus the 1-mil polyester is, roughly, about as strong as 1½-mil acetate, and this makes 1-mil polyester very attractive for all-around amateur recording. On the other hand, a lot of professional recording is done on acetate, partly because of one fault of polyester: its tendency to stretch before breaking. If a tape breaks without stretching, it can usually be put together with little or no loss of the recording, but a stretched section of tape is ruined.

For a little more money still, though, you can get "tensitized polyester," which has both high strength and a reduced tendency to stretch (it's pre-stretched). To sum up, if your machine runs at fairly low tension or is so arranged that it very seldom breaks tape, the straight polyester is a good all-around tape for recordings you want to keep indefinitely. If you have occasional tape breakage or stretching, use tensitized tape for irreplaceable recordings.

The third type of tape base is polyvinyl chloride—PVC—which is available from a few manufacturers. This material is claimed to exhibit a strength similar to polyester, and is extremely supple, thus providing excellent head contact. It is usually pre-stressed, and is not affected by humidity.

Concerning the three backing

thicknesses, 1½, 1, and ½-mil: the thinnest, the ½-mil, should be used only if you can't do without its increased playing time on a particular job. It has a greater tendency to break or stretch than thicker tape. It also exhibits increased "print-through," which is the transfer of the signal from one layer of tape to another in storage. The unhappy outcome is stronger pre- and post-echoes.

There are tapes with specialized characteristics, including "high output," "low print-through," and "low noise." But select them with care because you may lose a desirable characteristic to gain another one. For example, the high-output tape may be handy if you are recording from some source that puts out a very low signal, forcing you to run the gain on the tape recorder very high, a possible cause of increased noise. But note that higher-output tape tends to have high print-through. So if print-through has been troubling you, high-output tape is likely to make it worse.

You can reduce print-through by recording at a lower level, by using a thicker tape, or by using a low-print tape at some loss in sensitivity to signal. The low-print tape may be indicated if you must record fairly high and if you have plenty of low-noise signal so that the sensitivity of the tape is of secondary importance. Low-noise tape is especially useful with slow-speed recorders, where signal-to-noise ratio and high-frequency response is poorer than at higher tape speeds. This tape reduces background noise and lifts the high end. But a problem arises here: recorder bias requirements are different from bias current needs of other tape oxides. Thus a recorder bias adjustment may be needed to match low-noise tape. This will allow a recordist to take full advantage of the tape's attributes. This is not an acute problem, though, because there is generally sufficient bias margin to produce desirable results with magnetic tape having special characteristics. Performance will be further enhanced, however, when bias current is right on the button for the type of tape used. This squeezes out that last drop of higher fidelity.

(Continued on page 117)

# press comment *on the*

# AR-3a

## THE AMERICAN **record guide**

(Larry Zide)

"In choral works and other music of relatively 'heavy' content, the AR-3a simply eliminates any mid-range lack of clarity . . . I find myself repeating what I said in 1959 [about the AR-3]. The AR-3a . . . easily succeeds its prototype as a speaker that I consider 'as close to musical realism in the home . . . as the present state of the art permits.' In a word, it's superb."

## **HIGH FIDELITY** (Norman Eisenberg)

"Our reaction on first hearing the AR-3a was [an] . . . enthusiastic one which has not diminished after weeks of listening . . . in normal use, predominantly fundamental bass is evident to about 30 Hz . . . Tones in the 13 to 14 kHz region can be heard clearly at least 60 degrees off axis . . . at [high] levels, the speakers sounded magnificent . . . On any material we fed to them, our pair of AR-3a's responded neutrally, lending no coloration of their own to the sound."

## **HiFi/Stereo Review** (Hirsch-Houck Laboratories)

" . . . the best speaker frequency response curve we have ever measured using our present test set-up . . . virtually perfect dispersion at all frequencies — perhaps the most non-directional forward-facing speaker we have ever tested . . . AR speakers set new standards for low-distortion, low-frequency reproduction, and in our view have never been surpassed in this respect."

## **Chicago's AMERICAN** (Roger Dettmer)

"I have not encountered truer 'fidelity' . . . in three decades of home listening."

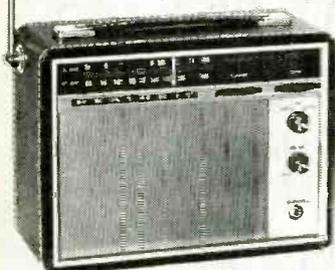
The AR-3a is priced from \$225 to \$250, depending on cabinet finish. Literature is available for the asking.

**ACOUSTIC RESEARCH, INC., 24 Thorndike Street, Cambridge, Mass. 02141**

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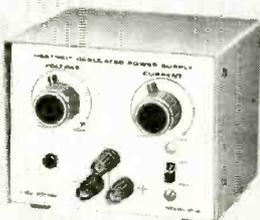


**NEW** kit AD-27  
\$169<sup>95</sup>



**NEW** kit GR-17  
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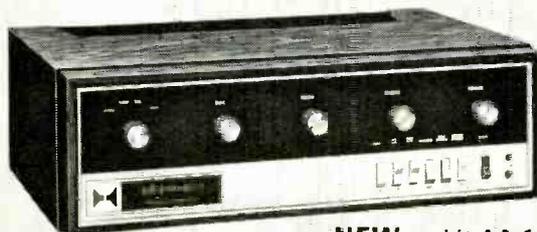
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## Heathkit FM Stereo COMPONENT-COMPACT

This new Heathkit AD-27 stereo compact has features not found in other units costing twice as much for one very simple reason. It wasn't engineered to meet the usual level of compact performance. Instead, Heath took one of its standard stereo/hi-fi receivers, the AR-14, and re-arranged it physically to fit a compact configuration. The result is performance that is truly high fidelity without compromise. It features 31 transistor, 10 diode circuitry with 15 watts per channel dynamic music power (enough to let you choose most any speaker systems you prefer), full-range tone controls, less than 1% distortion, and 12 to 60,000 Hz response. The pre-assembled FM stereo tuner section with 4-stage IF offers 5  $\mu$ V sensitivity, excellent selectivity, AFC, and the smoothest inertia tuning. The BSR McDonald "500" turntable offers features usually found only in more expensive units . . . like low mass tubular aluminum tone arm, anti-skate control, cueing and pause control, plus a Shure magnetic cartridge with diamond stylus. It's all housed in a smart oiled walnut cabinet with sliding tambour door that disappears inside the cabinet. For value and performance choose the AD-27, the new leader in stereo compacts. Shpg. wt. 41 lbs.

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Here's performance others can't match. The new Heathkit GR-17 portable has 12 transistor, 7 diode circuit with the same front end as Heathkit hi-fi tuners; 3-stage IF; big 4" x 6" speaker; tone control; AFC on FM and amplified AGC on AM; built-in AM rod antenna plus telescoping 34" FM antenna; 350 milliwatt output; and 200-300 hour battery life. Shpg. wt. 5 lbs.

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## HEATHKIT AJ-15 Deluxe Stereo Tuner

For the man who already owns a fine stereo amplifier, and in response to many requests, Heath now offers the superb FM stereo tuner section of the renowned AR-15 receiver as a separate unit. The new AJ-15 FM Stereo Tuner has the exclusive design FET FM tuner for remarkable sensitivity, the exclusive Crystal Filters in the IF strip for perfect response curve and no alignment; Integrated Circuits in the IF for high gain, best limiting; elaborate Noise-Operated Squelch; Stereo-Threshold Switch; Stereo-Only Switch; Adjustable Multiplex Phase, two Tuning Meters; two variable output Stereo Phone jacks; one pair variable outputs plus two fixed outputs for amps, recorders, etc.; front panel mounted controls; "Black Magic" panel lighting; 120/240 VAC operation. 18 lbs. \*Walnut cabinet AE-18, \$19.95.

## HEATHKIT AA-15 Deluxe Stereo Amplifier

For the man who already owns a fine stereo tuner, Heath now offers the famous amplifier section of the AR-15 receiver as a separate unit. The new AA-15 Stereo Amplifier has the same superb features: 150 watts Music Power; Ultra-Low Harmonic & IM Distortion (less than 0.5% at full output); Ultra-Wide Frequency Response ( $\pm 1$  dB, 8 to 40,000 Hz at 1 watt); Ultra-Wide Dynamic Range Preamp (98 dB); Tone-Flat Switch; Front Panel Input Level Controls; Transformerless Amplifier; Capacitor Coupled Outputs; Massive Power Supply; All-Silicon Transistor Circuit; Positive Circuit Protection; "Black Magic" Panel Lighting; new second system Remote Speaker Switch; 120/240 VAC. 26 lbs. \*Walnut cabinet AE-18, \$19.95.

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CL-335

# Electronic Organs

NORMAN H. CROWHURST



The author discusses how variances in electronics produces different sounds

**I**N BUYING ANYTHING that costs as much as an electronic organ, the first question in the buyer's mind is, "How much can I get for my money?" As you read that, you'll say, "How much what?" Even this isn't a simple question to answer. For non-professionals — and few of us are professional organists — the problem can get quite confusing.

What complicates it is that the way the many features provided on home organs are designed to appeal to laymen — non-professionals. Many people who bought an organ that impressed them tremendously when it was demonstrated in the showroom, were dissatisfied when they got it home and started to play seriously.

This happens because any organ, built for today's market, can be demonstrated so that it sounds like a lot of organ for the money. You don't really find out how much or how little you've bought until you have time to get familiar with it.

## How Much Organ?

To make the how-much-organ question easier to understand, let's divide it into two parts. A little oversimplified, perhaps, the part questions might be phrased this way: "How many different things can the organ do?" and "How many different things can it do at once?" I say "over-simplified," because there's more to that second part than the simple wording reveals.

When the demonstrator flips tabs

and makes the organ produce different tonal effects, from full-bodied to reedy, resembling brass or strings, then puts in or removes vibrato possibly at different rates; then perhaps adds percussion, sustain, and any special features the organ may have; you can be very impressed. Perhaps he plays some excerpts of popular music, with a little classical or religious thrown in, to show off these features. You're convinced it's a lot of organ for the money.

Then you get it home and start playing yourself. It's true that after a while, you repeat all the different effects he showed you. But somehow it doesn't sound like "as much organ" as it seemed in the showroom when he did it. Whatever you do, it lacks the full richness of a big organ. However many notes you play together, or tabs you flip (unless you play a discord, which you'll notice quickly), it doesn't sound like much. It sounds like a little organ.

In a sense, you get this impression because although it makes many different sounds, the organ doesn't make them all *at once*. Say you flip tabs labeled 'flute' and 'violin,' one after the other: you get different tones. You can imagine them as somewhat like flute and violin, respectively. Now you flip the two together, expecting to hear these impersonations of flute and violin, as if they both played together.

But it doesn't sound like that. Instead, you get another tone that sort of "splits the difference" be-

tween sounds you identified as being like flute and violin. While flipping combinations of tabs does add more variety to the sound the organ can make, it doesn't make it sound like "more organ."

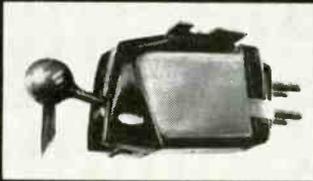
After you tried out the various combinations, you probably got to thinking it sounds pretty "same-ish." When you've played flute and violin separately, splitting the difference between them isn't really new. If you could play them both at once, you'd feel more satisfied.

## How Much Electronics?

This comes back, from the electronic viewpoint, to the way tones are built up. Suppose your organ uses a master-oscillator bank, with dividers to get all the other notes on the organ, and formant filters to select the frequency bands in the composite music you play, rather like elaborate tone controls or equalizers in a hi-fi system. You will definitely get this effect. Whatever you do with the tabs, pressing one key plays only one note, or produces only one tone.

If you press one key and flip the flute tab, and then the violin tab, you get two different sounds. But now you flip both tabs, and you don't hear both sounds at once. You may have combined the harmonics of both sounds, but it's still only one sound. The early way to change this is to have the one key play two notes, or sounds, when the two tabs are flipped.

If the organ has two complete sets



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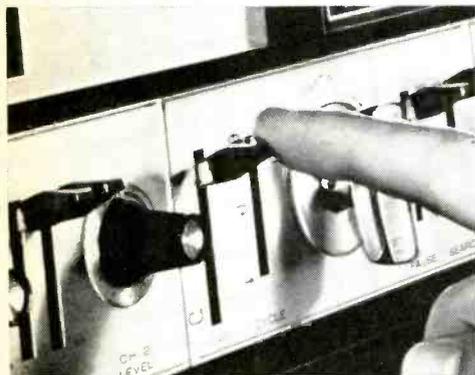
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Until now, it was pretty easy, because none of the choices really did much more than move tape from one reel to another.

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Because our new Autoload® Model 2293 does a lot more than move tape from one reel to another.

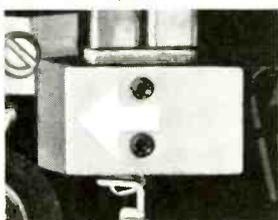
It loads itself, because it has Autoload, Bell & Howell's ingenious fully-automatic threading system.



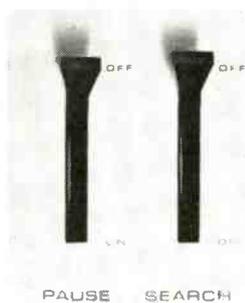
You never touch the tape because a gentle cushion of air transports it through the tape path directly onto the take-up reel. The entire process takes about three seconds, and it functions perfectly whether the deck is mounted horizontally or vertically.

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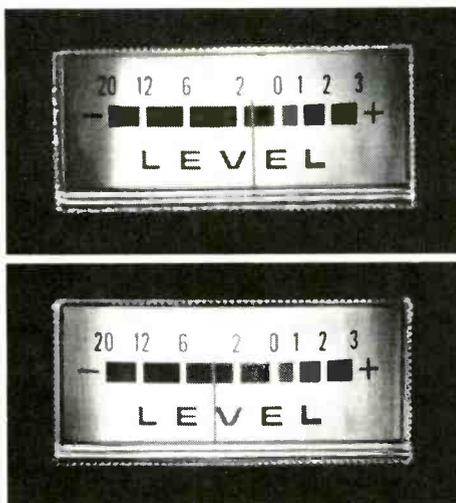
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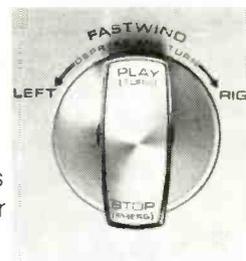
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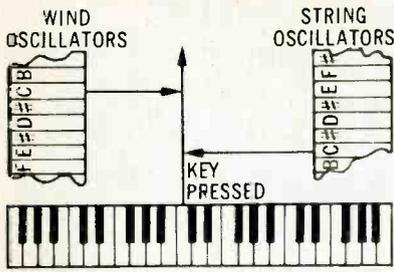


Fig. 2-1. One way to get two genuine voices: two complete sets of oscillators.

Fig. 2-2. The difference between the master oscillator and separate oscillator systems, as revealed by playing two notes an octave apart.

Fig. 2-3. Emphasizing separate voices by applying vibrato to only one of them in the master oscillator system (with two sets).

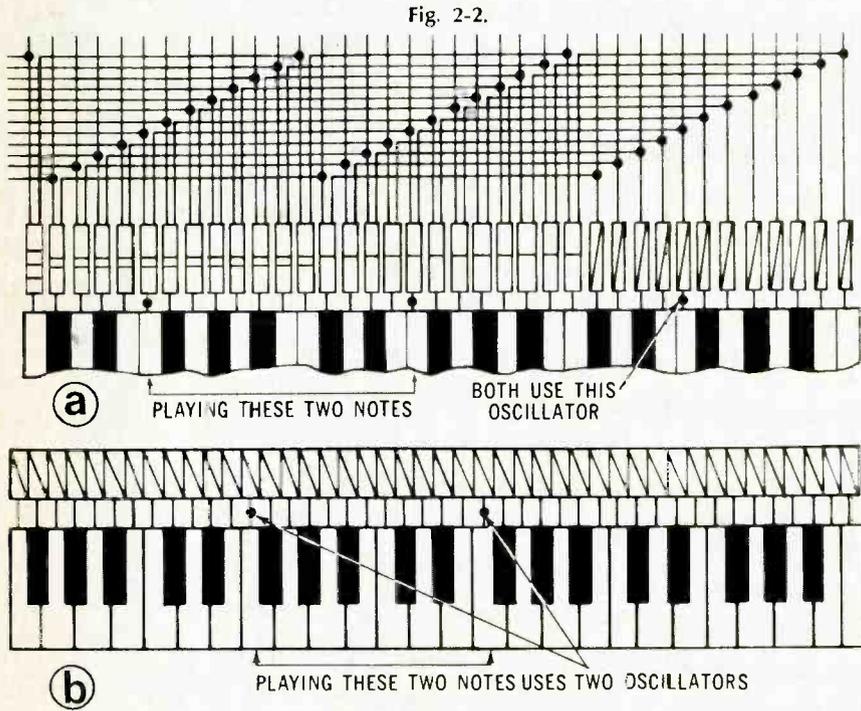
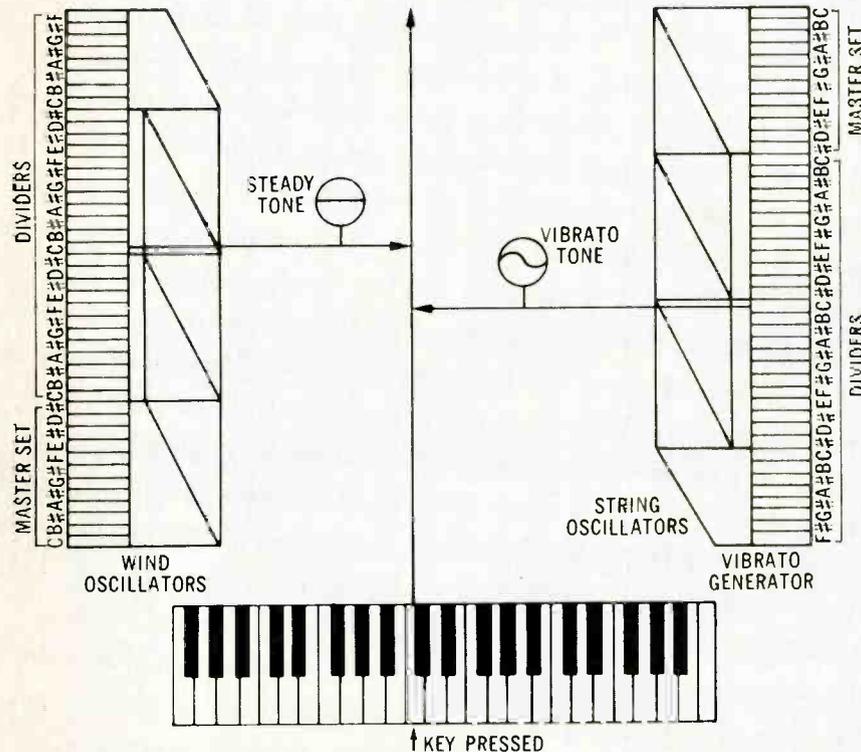


Fig. 2-3.



of oscillators, two notes or sounds can be heard for each key pressed. Each sound has its fundamental and harmonics, independently generated. They are closely in tune, *but they are not the same.* (Fig. 2-1). This is an important difference.

If the organ uses two or more sets of master oscillators, each with a set of dividers to provide all the notes, playing one note while two tabs are flipped separately and then together will "double up" on the sound if the two tabs flipped together use different oscillator sets. But the organ using one or more master-oscillator sets will show another difference from the organ using complete sets of separate oscillators.

You'll find this difference if you spread your hand to play an octave. On the master-oscillator organ, playing two notes an octave apart sounds as if you're only playing one note. It provides no more change in sound than changing tabs might provide when only one note is played.

But on the organ with separate oscillators, playing the octave notes sounds like two notes sounding "in unison." I quote those words, because the reason the difference can be heard is that the unison is not quite perfect (Fig. 2-2).

The usual way of applying vibrato to a master oscillator type of organ aggravates the apparent difference. The vibrato warbles the tone of the master oscillators, and all the other notes warble with the masters, which makes the organ sound as if it had only 12 notes.

If an organ has two or more sets of master oscillators, each with dividers, vibrato can be applied to one, while the other is left steady. Or the two can have different vibrato rates and/or depths. This emphasizes the fact that the organ has two separate voices. (Fig. 2-3). With conventional vibrato for master-oscillator systems, this is the only way to do it.

But there is another way. Vibrato can be applied afterwards to a set of fixed tones, but it's a little more complicated to do. It works by shifting phase back and forth, rather than changing frequency, which isn't possible in this situation. With this method two different sets of tabs can use the same generators, with their

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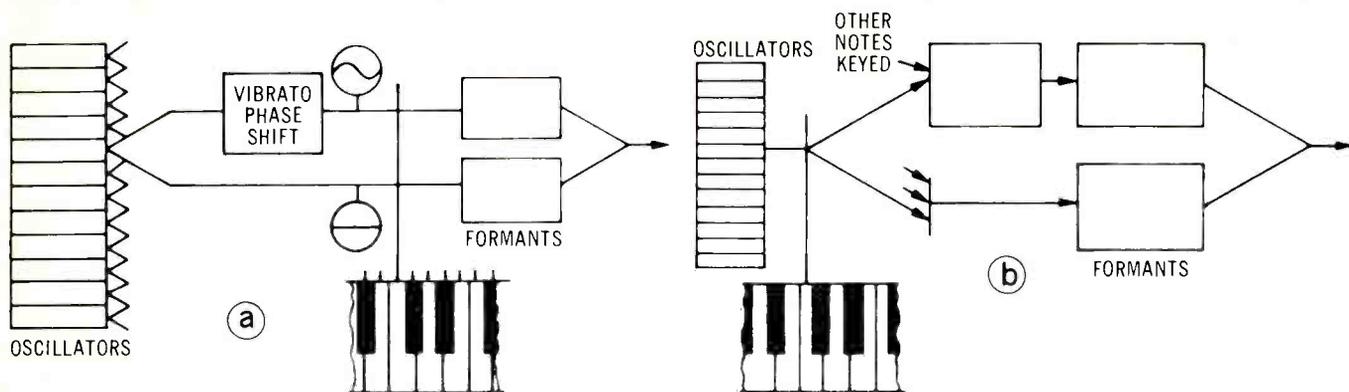


Fig. 2-4. An alternative method, using only one set of master oscillators. The vibrato can be added either before (a) or after (b) keying.

dividers, but some with and some without vibrato, or perhaps with some using different vibrato rates or intensities.

Combining notes that have these differences will sound as much like two separate notes as where separate master oscillators are used (Fig. 2-4). Wurlitzer pioneered this approach.

Some have argued about the validity of synthesis, as used in the Hammond, compared with systems that work on the waveform of the generator in one way or another. But this argument is far from resolved.

The argument some academic theorists advance is that 3rd, 5th, and 6th harmonics, as added in by the synthesis method, aren't "true." Instead of being precisely three times fundamental, which happens with waveform shaping, the "3rd" added by synthesis multiplies the fundamental by  $2\frac{1}{2} = 2.99661099$ . The "5th" added by synthesis multiplies the fundamental by 5.03968450. The "6th" by 5.99322198.

If the fundamental is 260 Hz, which was a concert pitch used before A was standardized at 440 Hz,

the true 3rd, 5th, and 6th will have frequencies of 780, 1330, and 1560 Hz respectively. These are nice even figures for comparison. The synthesis harmonics are tabulated in table 2-1, along with the errors in a 3rd column.

Are these differences audible as beats? They're no more audible than the beat on a well-tuned piano when

today. Major musical intervals were explained as being due to simple ratio-type relationships between the notes of a chord. As some misunderstanding still persists on this subject, we'll treat it a little more thoroughly here. Table 2-2 shows the so-called true diatonic scale frequencies, based on a C of 260 Hz.

Also tabulated are the major

TABLE 2-1

Element	True Value	Synthesized Value	Difference
Fundamental	260 Hz.	260 Hz.	0
3rd Harmonic	780 Hz.	779.1188574 Hz.	- 0.8811426 Hz.
5th Harmonic	1300 Hz.	1310.31797 Hz.	+ 10.31797 Hz.
6th Harmonic	1560 Hz.	1558.2377148 Hz.	- 1.7622852 Hz.

three notes in a major chord are played together, because it's virtually the same thing. Some assert that they "grate" because the harmonics aren't true, and are therefore discordant. Is this true? This assertion derives from an obsolete musical theory.

The theory explained why playing in different keys sounds "flat" or "sharp" in terms of the "diatonic scale," which is purely theoretical

chords and their ratios related to the chord's key. By the figure '1', which is the key, the musical nature of the chord is indicated: open (O), flat (b), or sharp (#). By each ratio is an indication as to whether it coincides with the true diatonic (O), or is higher (+) or lower (-).

Even on this theoretical basis, it is difficult to justify the explanation why chords sound 'flat' or 'sharp'. But this isn't all. Modern instru-

TABLE 2-2.

Note	Hz	Ratio	C	C#	D	D#	E	F	F#	G	G#	A	A#	B
C	260	1	1(O)					.75(0)			.632(+)			
C#	276.25	17/16		1(b)					.75(0)			.647(+)		
D	292.5	9/8			1(#)					.75(0)			.644(+)	
D#	308.75	19/16				1(b)					.75(0)			.635(+)
E	325	5/4	1.25(O)				1(#)					.75(O)		
F	346.67	4/3		1.255(+)				1(O)					.762(+)	
F#	368.33	17/12			1.26(+)				1(b)					.756(+)
G	390	3/2	1.5(O)			1.263(+)				1(O)				
G#	411.67	19/12		1.49(-)			1.277(+)				1(b)			
A	433.33	5/3			1.48(-)			1.25(O)				1(#)		
A#	455	7/4				1.474(-)			1.235(-)				1(b)	
B	487.5	15/8					1.5(O)			1.25(O)				1(#)
C	520	2/1	2(O)					1.5(O)			1.264(+)			

## **A history of dedication to achieving the ultimate in sound reproduction**

The BSR quest for perfection in high fidelity sound reproduction began in England in 1933 when Dr. D. M. McDonald, an early electronics innovator, established BSR Ltd.

During the ensuing years, BSR earned an international reputation for outstanding advanced engineering and precision craftsmanship in the manufacture of automatic turntables.

Today, still headquartered in Great Britain, BSR is the world's largest manufacturer of automatic turntables and related equipment... a fitting tribute to the superb quality and performance of BSR's electro-mechanical sound reproduction equipment.

Until recently, BSR automatic changers were available only as the turntable units in portables and hi-fi console systems fabricated by the major companies in the home entertainment field and sold under their own brand names.

Having recognized that fine high fidelity sound reproduction has ceased to be the expensive privilege of a few, BSR decided to produce a limited group of automatic turntables specifically designed for high fidelity component systems, and to make them available under the proud BSR McDonald name.

This decision was reached only after BSR was convinced that it had created an extraordinary new group of automatic turntables with exclusive features heretofore reserved for only the most expensive turntables.

These magnificent new BSR McDonald models represent a third of a century of electronic innovation, technical know-how and incomparable British craftsmanship. Each incorporates features that assure maximum fidelity, ease of operation, and performance reliability.

Closely examine these features and we feel quite certain you will agree, BSR McDonald automatic turntables represent a most remarkable value.

## **TOTAL TURNTABLES A BSR McDonald first**

Making a decision on which turntable you should own doesn't end there. You must also decide on the purchase of a cartridge, a base for the turntable and most often a dust cover as well.

To simplify this complicated selection problem for you, and to save you money at the same time, BSR invented the "Total Turntable." Here in one complete unit, in one package, all factory pre-assembled and tested is the turntable, a top-rated cartridge, an attractive base and a dust cover... ready to plug into your hi-fi system and play beautifully. Each of these individual items are made precisely for each other to insure maximum fidelity of sound reproduction and handsome appearance. Every BSR McDonald turntable is available as a "Total Turntable." Ask your dealer for the surprisingly modest prices.

## Important features of BSR Mc

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



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

Micrometer Stylus Pressure Adjustment permits  $\frac{1}{3}$  gram settings all the way from 0 to 6 grams. This important part of the tone arm assures perfect stylus pressure in accordance with cartridge specifications.



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

## These other quality all three BSR McDona

- Light tracking design permits minimal tracking and tripping operation.
- Tone arm supported on virtually frictionless preloaded horizontal ball bearing pivots. The 600 and 500A also have ball bearing vertical pivots.
- Jam-proof arm design safeguards arm mechanism from damage or need for readjustments, even if tone arm is held during cycling operation.
- Interchangeable center spindles for manual or automatic play.



**The world's largest maker  
of automatic turntables  
presents the  
world's finest collection...  
BSR McDonald**



**PRECISION CRAFTED IN GREAT BRITAIN**

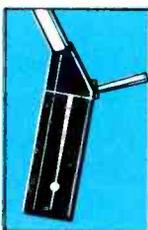
## Donald Automatic Turntables

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



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

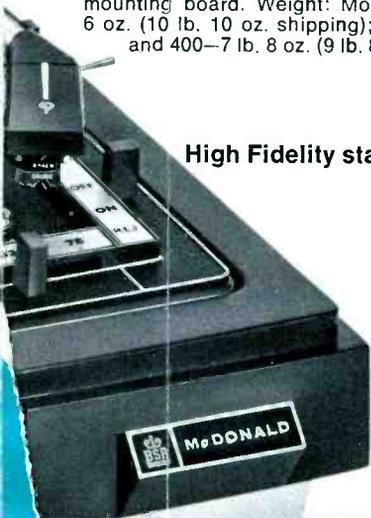
All BSR McDonald automatic turntables have a Clip-In Cartridge Head. This lightweight tone arm head, with finger lift and clip-in cartridge holder, provides universal mounting and quick change facility. It can accommodate practically every contemporary cartridge currently on the market.



## features are basic to Donald Automatic Turntables

- Easy operating controls for manual or automatic selection of 7", 10", or 12" records at 16, 33, 45 or 78 RPM.
- Complete flexibility of operation in automatic, semi-automatic, and manual play, along with continuous repeat-play features by virtue of positive record size selection.
- Dynamically balanced, resiliently mounted, hum-shielded 4-pole induction motor has high torque, constant speed design assuring minimum rumble and wow. An induction motor is used because of its inherently lower rumble characteristics as compared to synchronous or other motor types.
- Pop Filter eliminates annoying "pop" which can occur in any turntable due to A.C. switch arcing when unit shuts off.
- Includes 6-foot UL approved power cord with ground lead and 4-foot twin shielded color coded audio cable. Wired for 120 volts, 60 cycle operation (easily convertible to 50 cycle operation). Operates on 105-130 volts, 60 cycle A.C. Overall dimensions: 13 1/8" x 11 1/4", 4" above, 2 1/2" below top surface of mounting board. Weight: Model 600—9 lb. 6 oz. (10 lb. 10 oz. shipping); Models 500A and 400—7 lb. 8 oz. (9 lb. 8 oz. shipping).

High Fidelity starts here



The most brilliant of the trio of BSR automatic turntables! Indulge in an expression of the precision craftsmanship and undisputed engineering know-how that have made BSR the world leader. The BSR McDonald 600 encompasses every fine automatic turntable feature.



### BSR McDONALD 600 TOTAL TURNTABLE (600/XM-44E)

Includes factory pre-assembled and tested:

- BSR McDonald 600 automatic turntable ..... \$74.50
  - Shure M-44E Cartridge ..... \$34.50
  - BSR PB-1 Decor-matic power base ..... \$15.00
  - BSR DC-3 Deluxe Dust Cover ..... \$7.00
- (See your dealer for special package price) Value \$131.00

The PB-1 Decor-matic power base can be set to have the turntable automatically shut-off the receiver when the last record is played or allow operation of the receiver without the use of the turntable.

The matchless performance and appearance of the Model 500A bear the stamp of BSR engineering excellence. Along with the inherent family features, the softly styled satin black and brushed aluminum 500A boasts several exclusive features that contribute to making this model a favorite with discriminating equipment purchasers.



### BSR McDONALD 500A TOTAL TURNTABLE (500A/XM44E)

Includes factory pre-assembled and tested:

- BSR McDonald 500A Automatic turntable ..... \$59.50
- Shure M-44-7 Cartridge ..... \$19.50
- BSR PB-2 Standard Base ..... \$5.00
- BSR DC-2 Standard Dust Cover ..... \$5.00

(See your dealer for special package price) Value \$89.00

This beautiful turntable dispels the theory that a fine high fidelity automatic turntable must be costly. The Model 400 is the least expensive of the trio, yet it incorporates the same high standards and many of the fine features of the other models in the BSR McDonald line.



### BSR McDONALD 400 TOTAL TURNTABLE (400/XM7N21D)

Includes factory pre-assembled and tested:

- BSR McDonald 400 Automatic turntable ..... \$49.50
- Shure M7N21D Cartridge ..... \$17.00
- BSR PB-2 Standard Base ..... \$5.00
- BSR DC-2 Standard Dust Cover ..... \$5.00

(See your dealer for special package price) Value \$77.45

Outer dimension of all the Total Turntable models—including dust cover and base; 15 1/4"W x 13-3/16"D x 7 1/4"H.

## BSR McDONALD 600

...t, non-magnetic, specially balanced and ma-  
...ntable offers optimum flywheel action along  
...imum record support.

...usly adjustable, dynamic Anti-Skate Control  
...continuously corrected degree of compensation  
...ved at all groove diameters to neutralize inward  
...force and eliminate distortion caused by un-  
...de wall pressure on stylus.

...eter Stylus Pressure Adjustment permits 1/3 gram  
...s for 0 to 6 grams.

...ific spring suspension system in conjunction with  
...mass tone arm design minimizes susceptibility to  
...al shock common to other turntables with ordinary  
...er-balanced tone arms.

...mass tubular aluminum tone arm is perfectly counter-  
...nced both horizontally and vertically.

...iliently mounted, coarse and fine Vernier Adjustable  
...counterweight.

...ereo Muting Switch for complete silence during change  
...le.

...e Model 600 turntable is handsomely styled in satin  
...ack and brushed aluminum, with the turntable mat  
...ecoratively fitted with a large diameter brushed aluminum  
...im ring.



**Suggested Retail Price \$74.50**  
(less base and cartridge)

## BSR McDONALD 500A

- Resiliently mounted, coarse and fine Vernier Adjustable Counterweight.

- Low mass tubular aluminum tone arm is perfectly counter-balanced both horizontally and vertically.

- Scientific spring suspension system in conjunction with low mass tone arm design minimizes susceptibility to external shock common to other turntables with counter-balanced tone arms.

...Full size, deep-drawn turntable platter for ideal record  
...support. Turntable mat is fitted with wide brushed alumi-  
...im ring.

...meter Stylus Pressure Adjustment permits 1/3 gram  
...s for 0 to 6 grams.

...usly adjustable, dynamic Anti-Skate Control  
...continuously corrected degree of compensation  
...ired at all groove diameters to neutralize inward  
...force and eliminate distortion caused by unequal  
...t pressure on stylus.



**Suggested Retail Price \$59.50**  
(less base and cartridge)

## BSR McDONALD 400

...mass tubular aluminum counter-weighted tone arm.

...p, deep-drawn turntable platter for ideal record

...fic spring suspension system in conjunction with  
...mass tone arm overcomes susceptibility to external  
...common to other turntables.

...re Adjustment easily accessible for setting  
...ing force as required by cartridge manufac-

...e dynamic Anti-Skate Control applies continu-  
...ected degree of compensation as required at  
...e diameters to neutralize inward skating force  
...inate distortion caused by unequal side wall  
...on stylus.

...0 is styled in the same attractive satin black and  
...aluminum as the other members of the BSR  
...ad trio of automatic turntables.



**Suggested Retail Price \$49.50**  
(less base and cartridge)

# BSR would not make this extraordinary replacement guarantee if these were just ordinary turntables.

An automatic turntable is a complex precision engineered mechanism consisting of hundreds of parts, some of which you can see—many you can't. All parts must be machined to operate perfectly together or the fidelity of sound reproduction and trouble-free operation are in jeopardy.

BSR is obsessed with quality control—so much so, that practically every part is manufactured by us in our own factories... even the tiniest screw.

Each unit is scrupulously tested at dozens of intervals along the various stages of sub assembly and upon final assembly before shipment from Great Britain.

Upon arrival in the U.S., each turntable is unpacked, adjusted and re-tested under actual playing conditions... and then re-packaged for shipment. These photographs



show some of the quality control operations at the BSR plant in Blauvelt, N.Y.

No other automatic turntables are subjected to this degree of quality control—and that is why BSR has the lowest rate of warranty claims and returns in the industry. That is also why every BSR McDonald turntable is backed by this unique guarantee.

• If for any reason... up to 7 days from the date of purchase... your BSR McDonald turntable does not operate to your complete satisfaction—your dealer is authorized by us to replace it immediately with a new unit from his stock with no questions asked.

• In addition, BSR guarantees all parts (except the cartridge) and that includes labor too... for one full year from the date of purchase.

Do you know any better way for us to convince you that BSR quality control is second to none in the industry?



## ACCESSORIES



### BASES

#### PB-1 Decor-matic Power Base

Provides option of having turntable automatically switch off entire system upon completion of last record—or use of receiver only, while turntable is off. Illuminated rocker switch selects function. Molded in ebony with silver accents. Optional walnut grained insert panel included. Accepts drawer slides.

Suggested retail price \$15.00.

#### PB-2 Standard Base

Molded in ebony with silver trim. Accepts drawer slides.

Suggested retail price \$5.00.



### 45 RPM ADAPTORS

#### AS-2 Adaptor Spindle Kit

Adaptor spindle permits manual and automatic operation of large-hole 45 RPM records on all BSR McDonald automatic turntables. Kit includes unique new "spindle park" mounting bracket that solves the problem of storage for extra spindles. Mounting screws included.

Suggested retail price \$2.25.



### DUST COVERS

#### DC-3 Deluxe Dust Cover

High styled smoke tint dust cover with walnut vinyl and silver trim. Matches and enhances the beauty of all BSR McDonald bases. Designed for operation with cover in place.

Suggested retail price \$7.00

#### DC-2 Standard Dust Cover

Well designed smoke tint cover fits and complements all BSR McDonald bases and automatic turntables. Designed for operation with cover in place.

Suggested retail price \$5.00.



#### CK-50 50 Cycle Conversion Kit

Suggested retail price \$1.00

#### H-1 Clip-in Cartridge Holder

Suggested retail price \$2.00

#### MB-2 Mounting Board

Smoothly sanded, unfinished wood mounting board with cut-out to fit all BSR McDonald turntables. 15 7/8" x 15 7/8" x 1/2".

Suggested retail price \$2.25.



PRECISION CRAFTED IN GREAT BR  
BSR (USA) LTD., BLAUVELT, N.Y.

MD 10150/A Printed in U.S.A.

**TABLE 2-3**

Note	Tempered Scale	Diatonic Ratio	Diatonic Scale	Difference
C	261.62	1	261.62	0
C#	277.18	17/16	277.97	+0.79
D	293.66	9/8	293.83	+0.17
D#	311.12	19/16	311.24	+0.12
E	329.62	5/4	327.02	-2.6
F	349.22	4/3	348.83	-0.39
F#	369.99	17/12	370.63	+0.64
G	391.99	3/2	392.44	+0.45
G#	415.30	19/12	414.24	-1.06
A	440	5/3	436.04	-3.96
A#	466.16	7/4	457.84	-8.32
B	493.88	15/8	490.55	-3.33
C	523.24	2/1	523.24	0

**TABLE 2-4**

Element	Up-to-down Ratio							
	1:1	2:3	1:2	1:3	1:4	1:5	1:6	1:7
Fundamental	1	1	1	1	1	1	1	1
2nd Harmonic	0	.310	.500	.707	.810	.866	.900	.925
3rd Harmonic	.333	.206	0	.333	.540	.667	.745	.803
4th Harmonic	0	.200	.250	0	.250	.433	.560	.652
5th Harmonic	.200	0	.200	.200	0	.200	.360	.482
6th Harmonic	0	.167	0	.236	.167	0	.167	.308
7th Harmonic	.143	.088	.143	.143	.232	.143	0	.143
8th Harmonic	0	.077	.125	0	.202	.216	.125	0
9th Harmonic	.111	.111	0	.111	.111	.222	.200	.111
10th Harmonic	0	0	.100	.141	0	.173	.224	.185
11th Harmonic	.091	.091	.091	.091	.091	.091	.204	.220
12th Harmonic	0	.051	0	0	.135	0	.150	.218

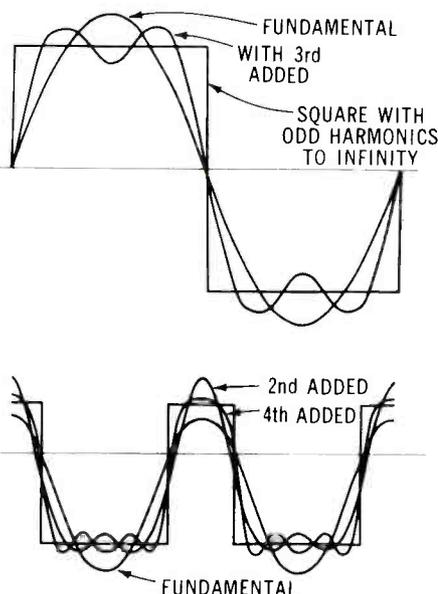
ments are tuned to the 'tempered scale', so the ratios are identical for all chords, although none of them coincides with this theoretical diatonic ratio set.

Table 2-3 shows frequencies, based on A = 440 Hz in the tempered scale, compared with a diatonic scale having the frequency for C, with a notation of the differences.

Coming back to tone synthesis, it would be true to say that the effect of synthesis is slightly *different* from the "true" harmonic, but it would be hard to say that one is more "valid" than the other.

The fact is, the whole origin of

**Fig. 2-5.** Changing the balance of a square wave to rectangular alters the harmonic content. The symmetrical wave at the top contains all odd harmonics, and only odd harmonics. The 2:1 wave below contains 2nd, 4th, 5th, 7th, 8th, 10th, 11th, etc. (See table 2-4 for more details.)

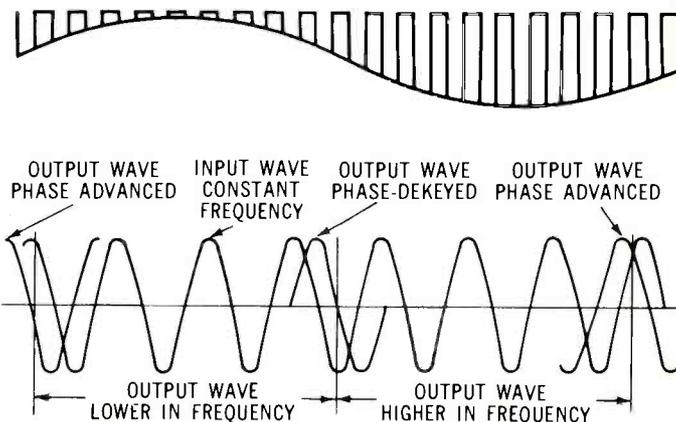


organ sounds began as a way of organizing the playing of sounds previously associated with orchestral instruments. Many of these instruments, for various reasons, produce "harmonics" that are not "true" in the mathematical sense.

Organ music has become accepted in its own right, not as a means of synthesizing an orchestra all played by one person. So we accept the fact that synthesized tones sound different from similar ones produced in other ways. The Hammond organ is just a little different, in its characteristic sound, from other organs. It takes an expert to tell the difference by ear. And even then experts will not agree whether they prefer one or the other.

If you know what you are listening for, you can probably tell that pure harmonics have a "locked tone" effect, like the master oscillator types with a single set of oscillators. This could accurately be described as "clear." Some salesman will then add the expression "bell-like." But this phrase doesn't apply. It's clear, but not bell-like.

**Fig. 2-6.** How a square or rectangular wave can have tremolo applied very simply, without the need for variable gain stages.



**Fig. 2-7.** How phase variation can produce a vibrato effect from a fixed frequency.

Things can sound 'clear' in different ways. The clarity here is the singleness of tone associated with a pure sine wave, or one with only a few harmonics. A bell has a much richer sound, as you'll know if you've ever tried to synthesize a bell tone by adding different frequencies together.

So organs differ in having simpler, clear-type sounds, or in giving a richer tone effect, with more "character."

The Compton organ, which uses a waveform synthesized in the tone wheels, is the opposite of the Hammond in this respect, although they both classify as electromechanical. The waveform from a note on the Compton repeats itself exactly, every cycle. When 3rd, 5th, and 6th harmonics are used in the Hammond synthesis, the waveform does not repeat, because the harmonics are not electrically exact.

Different waveforms are adapted for doing different things with. A square waveform is rich in harmonics. Properly balanced, with equal

(Continued on page 84)

# Equipment Profiles

- Revox Model 77A Stereo Tape Recorder
- Sansui Model 2000 AM/FM Stereo Receiver
- Acoustic Research Model AR-3a Speaker System
- Benjamin Model 1050 Compact Music System

## ReVox Model 77A Stereo Tape Recorder

**MANUFACTURER'S SPECIFICATIONS—**  
 Tape Speeds:  $7\frac{1}{2}$  &  $3\frac{3}{4}$ . Motors: Three, incl. electronically governed capstan motor. Reel size:  $10\frac{1}{2}$  in. max. Tape Heads: Three. Wow & Flutter: .08% max. at  $7\frac{1}{2}$  ips; 0.1% max. at  $3\frac{3}{4}$  ips. Frequency response: 50-15,000 Hz  $\pm 1.5$  dB at  $7\frac{1}{2}$  ips; 30-20,000 Hz, +2, -3 dB at  $7\frac{1}{2}$  ips; 50-10,000 Hz  $\pm 1\frac{1}{2}$  dB at  $3\frac{3}{4}$  ips; 30-16,000 Hz +2, -3 dB at  $3\frac{3}{4}$  ips. Distortion: 2% max. at  $7\frac{1}{2}$  ips, 3% max. at  $3\frac{3}{4}$  ips. Crosstalk: Better than 45 dB (stereo) & 60 dB (mono). Equalization: record, NAB; playback, NAB and IEC (switchable). S/N: 58 dB at  $7\frac{1}{2}$  ips; 56 dB at  $3\frac{3}{4}$  ips. Oscillator frequency: 120 kHz. Inputs: low- and high-Z microphone; radio, aux. Outputs: 2.5 V across 600 ohms; 200-600-ohm phones. Output amplifiers: optional plug-in, 8 W/chan. rms. Remote control: optional; plug-in prov. on chassis. Weight: 34 lbs. Price, \$499.00 without power amplifiers, \$569.00 with amplifiers (both with wood base). Portable version with amplifiers, built-in speakers, leatherette carrying case, \$599.00.

When the predecessor of the current ReVox 77A was reviewed in these pages (Feb. 1966) it was readily apparent that the reviewer could find little fault with the machine. The same could be said of the 77A, which boasts complete transistorization, electronic speed control, remote-control facility, and a quality of construction which puts it in the deluxe class.

Its control layout is similar to the older G-36, in that the knobs perform basically the same functions. Transport operation is controlled by five pushbuttons at the left side of the panel — FAST REWIND, FAST FORWARD, PLAY, STOP, and RECORD. Below these are two controls combined with concentric switches; the left knob controls

playback level, the right one controls balance. See Fig. 2. The left switch, actuated by a clear plastic disc at the base of the knob, has four positions—STEREO, CH I, CH II, and MONO. The right switch is marked NAB, INPUT, and IEC, and controls the source of the signal being monitored—the input signal or the playback from the tape with either NAB or IEC equalization. The latter provides for European recordings made with DIN 45513 or CCIR II equalization. (The difference is shown in Fig. 9.) At the right are the two VU meters, flanked by two red push-push switch buttons which select the channel to be recorded, and below them another pair of concentric controls and switches. See Fig. 3. The knobs control recording level on the two channels, while the switches (six positions) select the source. Two positions are used for introducing echo or for sound-on-sound recording. Between the two groups of controls are three phone jacks—stereo headphones and left- and right-microphone inputs. To the right of the controls are the pilot light and the line

switch/tape tension switch:  $3\frac{3}{4}$  small reel, designated by a small o;  $3\frac{3}{4}$  large reel, designated by a large O; off,  $7\frac{1}{2}$  O, and  $7\frac{1}{2}$  o. Thus, optimum tape tension can be achieved. The power switches are cam-operated micro-switches, while the equalization and speed changes are accomplished by a long slide switch with the contacts located adjacent to the circuits they control.

Above the control panel is the tape-path shield—a plastic strip which covers the path of the tape, and which swings down out of the way for threading. We would have preferred this to be a metal strip to ensure against warping. The reel turntables are in the upper part of the front panel, with spring-loaded sleeves which hold the reels in place on the splined spindles. Between the reels is a 4-dial digital counter which resets by a single push-button. The cover panel is black plastic, and it snaps into fittings on the chassis.

Along the top at the rear are the connectors for inputs and outputs—a 10-terminal DIN socket for the remote

Fig. 1—Revox Model 77A with  $10\frac{1}{2}$ -in. reels, and a second view that exposes its high-quality interior.





# HAAAAH PROOF

**THE SHURE UNIDYNE IV** is the newest and premier member of the famed Unidyne family of true cardioid dynamic microphones which have pickup symmetrical about microphone axis at all frequencies . . . in all planes. The Unidyne IV is so rugged that it can withstand a Karate chop. Reinforced, cushioned cartridge withstands severe impacts and vibrations . . . the diaphragm can take the full force of a leather-lunged Karate yell! Trouble-free Cannon-type connector. Exceptionally easy to service in the field. The strongest, most durable Unidyne yet! Send for all the facts: Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill. 60204.

Available in two models: Model 548 (hand-held), at \$100.00 list; Model 548S (with On-Off switch and swivel connector for stand use), at \$105.00 list.

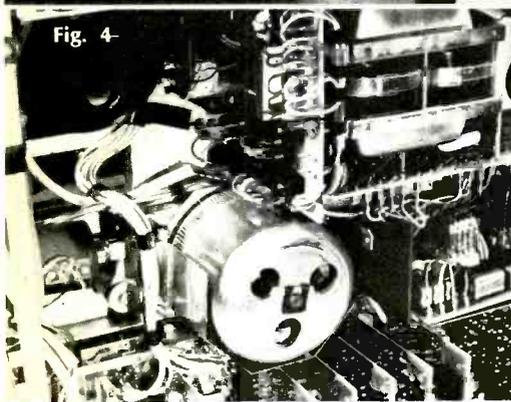
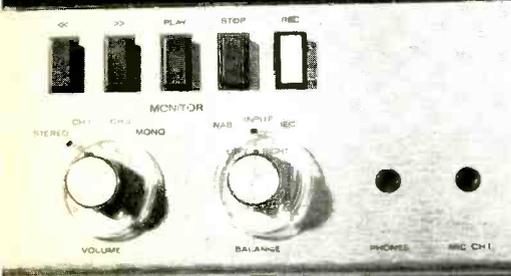
© 1968 SHURE BROTHERS, INC.

Fig. 2—Closeup photo shows pushbutton operating facilities.

Fig. 3—Right side of the Revox's front panel focuses on a one-knob speed control (small zero and large zero markings provide automatic tape tension adjustment for use with small or large reels, respectively) and on-off power switch.

Fig. 4—Rear view exposes electronically-governed capstan motor and printed-circuit boards.

Fig. 5—Solid-state power amplifier plug-in module.



## Equipment Profiles (continued)

control with its dummy plug, the two speaker sockets, also DIN types, two pairs of phono jacks for aux and mic inputs, a 5-terminal DIN socket for connection to radio, another pair of phono jacks for outputs, and the line cord receptacle. The voltage selector switch and the line fuse are accessible through a plastic door on the back of the cabinet.

The 77A comes in a variety of combinations—the recorder chassis in a wood housing; the same with the power amplifiers; the same in a carrying case with or without amplifiers; and in another carrying case with a pair of loudspeakers and the power amplifiers. Each case has a “cheater” plug which completes the a.c. line connections to the recorder when it is installed in the case. To use the instrument out of the case, one must put in a dummy plug, which is actually a European-type line plug.

With the tape-path shield open, one has access to two additional push-push switches—one turns off the power to the reel motors for easy editing, and the other switches off the speakers.

The unit is built on cast end trusses which provide a remarkable solidity to the chassis, the rear view of which is shown in Fig. 4. Along the lower side can be seen the printed circuit boards. The record and play amplifiers are duplicated, one for each channel. These printed circuit boards simply plug into jacks which are mounted on the front section, adjacent to the switches and controls. Adjustable controls, which can be seen along the upper edges of the boards, face downward, and are accessible through holes in the retaining plate. This plate is covered with a paper sheet on which are printed the locations and functions of the various controls. Each location is designated by a circle which actually covers a hole in the plate, thus permitting access to the controls simply by punching out the paper. Above the circuit boards is the relay panel, which performs all of the transport controls.

The two spooling motors are Papst torque models, and they operate on 35 V for 7-in. reels, and on 42 V for 10½-in. reels. The capstan motor is built by the manufacturer of the Revox and the famous Studer line of professional recorders—Willi Studer. The rotating outside of this motor is grooved as shown in Fig. 4, and these grooves are “read” by a pickup head similar to a recording head. Its output is fed to the speed-regulating circuit board which holds the speed constant, regardless of line frequency or—within

limits—voltage. Changing from the European 50-Hz line frequency to the U. S. standard of 60 Hz requires no change whatever in the machine. This panel employs 9 transistors and a diode bridge. Since the change for 7½ ips to 3¾ requires only the application of 22 V to the control circuit, the speed change is entirely electrical.

The power transformer has four primaries which are switched to accommodate the six possible line voltages. It has five secondaries—two furnishing 32 V a.c. separately to the two power amplifiers, if they are used, one furnishing a rectified and filtered 24 V d.c. to the control circuits, one furnishing a rectified and regulated 21 V d.c. to the remaining circuit boards, and one furnishing a number of a.c. voltages to the motors, as required.

Of the seven printed circuit boards, one is the input amplifier which is shared by both channels. This employs six transistors—three for each channel. This is followed by switching and the record amplifier boards, one for each channel. Each of these has five transistors and four adjustable controls—high-end equalization for each speed, low end equalization, and recording level. It also has bias traps and provides drive for the VU meter. The record relay board switches on the oscillator through a transistor and removes a short from the output of the record amplifier. It also provides a dummy load for the erase head that is not in use when recording on only one channel.

The two playback boards, each with five transistors, provide all the necessary playback gain. The oscillator board furnishes the necessary bias and erase voltages at a frequency of around 120 kHz. Two transistors are used in a push-pull circuit and four controls are provided to adjust bias on both channels at each speed.

The power amplifier boards, shown in Fig. 5, are mounted above the capstan motor. Each is separately fused, and provides its own d.c. supply by means of a bridge rectifier. The circuit is a quasi-complementary arrangement, and an output power of 8 W is provided to loads from 4 to 16 ohms. When using the model which has the speakers in the housing, plugging another set into the DIN sockets cuts off the built-in speakers.

### Operation

The tape is threaded over a solid post and under the guide—a stationary ring with a sand-blasted surface to provide some stabilizing drag—past the

erase head, under the lifter and past the record and play heads, then under the capstan and another guide and up to the takeup reel. Just ahead of the erase head, the tape passes between a light and a light-dependent resistor. When the tape is in place, the light is shaded, and operation is normal. When the end of the tape passes through the recorder, light energizes the cell and the machine is stopped. To free the tape reels for easy threading or for editing, depress the "reel motors off" button and then depress either of the fast-wind buttons. These will release the brakes so the tape can be moved freely. The pressure roller can be moved against the capstan by another lever to permit editing with ease. To restore the machine to normal operation, simply press the stop button and press the reel-motors-off button again.

In playback, the STEREO position of the switch is used for stereo material; CH I will play the material on track I into both outputs; CH II will do the same for the other channel; MONO will play both tracks combined into both outputs. Similarly, in recording, if only one of the buttons adjacent to the meters is depressed, both inputs will be recorded on the respective channel, thus making it possible to mix two separate inputs monophonically. If neither button is depressed, the record button is ineffective and tape can not be erased inadvertently.

Echo is obtained by re-injecting the playback signal while recording, and can be done only in the mono mode. Similarly, sound-on-sound recording—also mono only—can be done by recording a signal on one track, rewinding, then re-recording that signal combined with another on the other track. Both of these facilities are provided for simply by correctly positioning the controls. In all, it is a most flexible machine.

## Performance

Let it be said first that this is the "flattest" machine we have ever encountered. Using Scotch Dynarange 202 tape—which the machine's equalization and bias were set up for—the record/play curve was flat to within  $\pm 1$  dB from 20 to 20,000 Hz (which is better than the specs). The difference between channels was never more than 1.3 dB. Response at 22,000 Hz was down only 5 dB. These figures were for  $7\frac{1}{2}$  ips. At  $3\frac{3}{4}$  ips, the same can be said for the range from 20 to 15,000 Hz, with the maximum deviation at 17,000 Hz being only 5 dB. Flutter

measured .03% in the band from 0.5 to 6 Hz, .06% in the band from 6 to 250 Hz, and .07% in the overall band from 0.5 to 250 Hz at  $7\frac{1}{2}$  ips. Overall flutter at  $3\frac{3}{4}$  ips measured at 0.1%.

Frequency-response curves are shown in Fig. 6. The dotted line on the  $7\frac{1}{2}$  curve shows the effect of the IEC equalization. Both channels were so close that the width of the line would include both.

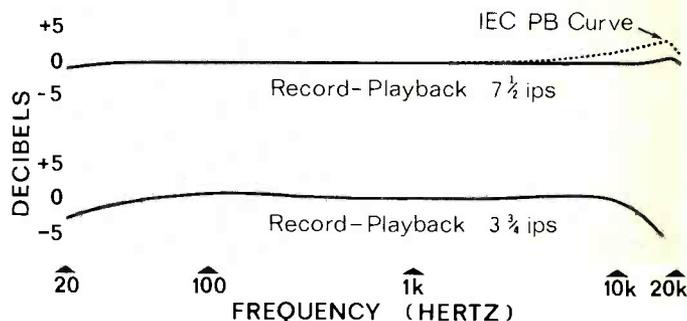
At  $7\frac{1}{2}$  ips, hum and noise measured 62 dB below the 3% distortion point, which was 9 dB above the indicated 0 level. (Using professional standards, this is 53 dB below the 1% point, also excellent.) For this measurement, the standard "A" weighting network was used. At  $3\frac{3}{4}$  ips, hum and noise mea-

—pull out the line cord and the machine stops with no spillage of tape.

A few additional figures: Fast forward and rewind times for 1200 feet of tape measured at 62 sec. each way. The required input signals for 0-level recording were as follows: AUX, 15 mV; MIC HI, 1.2 mV; MIC LO, 0.15 mV; RADIO, 1.2 mV. Output signal measured at the external jacks was 2.5 V into 600 ohms with a 0 level on the tape.

In use, the machine was a dream to handle. The push buttons, which control operation of the transport, actuate relays and are thus not burdened with any mechanical function. In the record mode, the VU meters are illuminated—both for stereo and only one if only one channel is being recorded. Repro-

Fig. 6—Revox Model 77A's frequency response at both its speeds.



sured 58 dB down. Distortion (THD) at 1000 Hz, measured at 0 recording level, was 1.3 and 1.9% respectively at  $7\frac{1}{2}$  and  $3\frac{3}{4}$  ips. At the same level, distortion at 100 Hz was 1.5 and 1.9%, and at 10,000, it measured 2.7% at  $7\frac{1}{2}$  and 3.4 at  $3\frac{3}{4}$ .

At the output of the power amplifiers, distortion measured 0.42% at 1000 Hz, 0.2 at 100, and 1.2 at 10,000, all at 8 W output (into 8 ohms), which is the rated output of the amplifiers. Measured through the tape at a recording level of -10 dB, 1000-Hz distortion measured 2.0%. Channel separation in the stereo mode measured 48 dB, while in the mono mode it measured 58 dB. On the whole, a rather impressive set of performance measurements.

The electronic speed control held the speed exactly "on the nose" at all input voltages from 135 down to 92, where a buzz appeared in the output of our sample. Our final observation resulted from the use of a 100-W amplifier feeding a reversed 25-V transformer to produce 115 V at the output, and with a varying low-frequency signal from an audio oscillator from 40 to 70 Hz, we again found no speed variation, although the buzz appeared again at 42 Hz. The recorder was fully "fail safe"

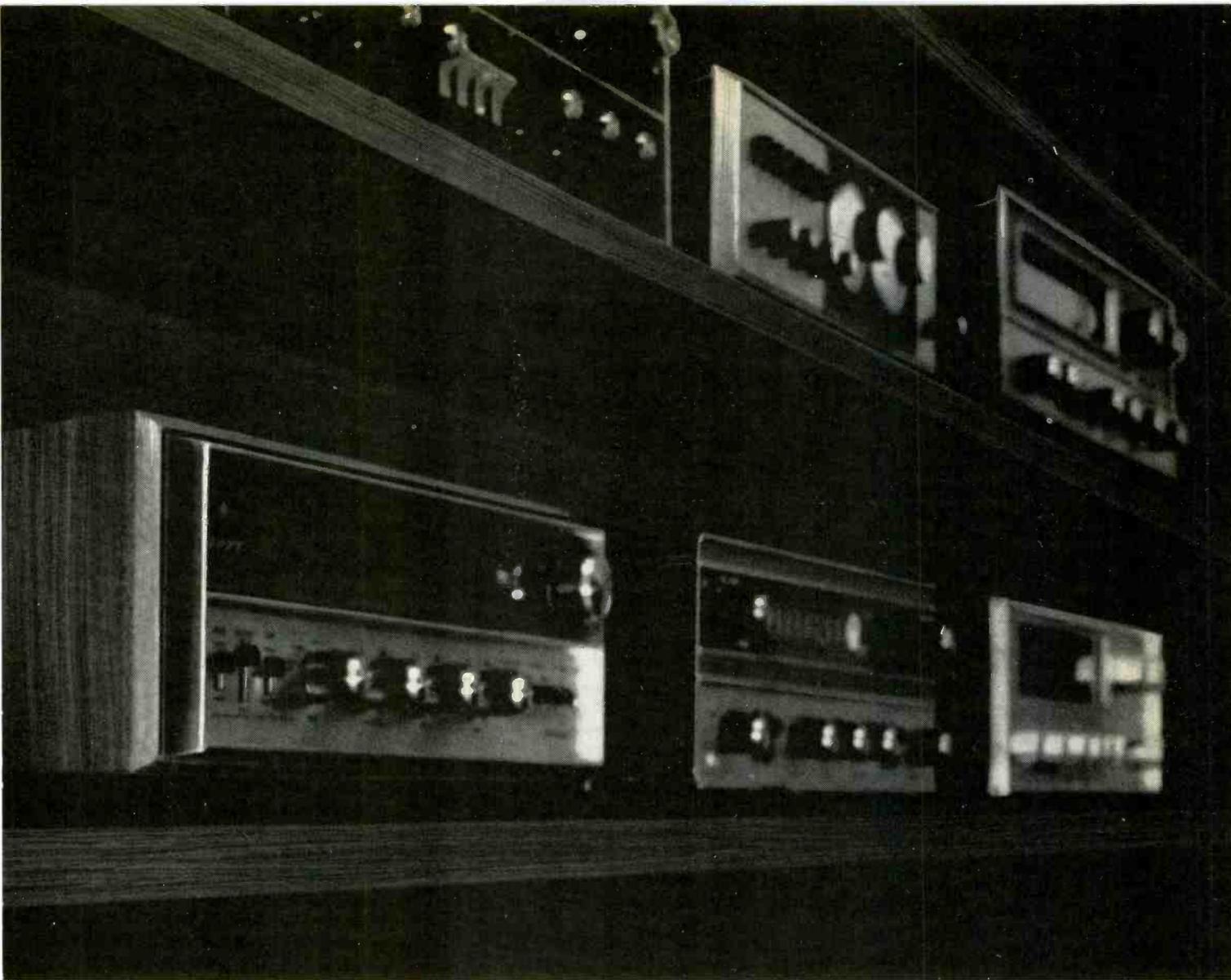
duction at  $7\frac{1}{2}$  ips sounded the same whether monitored from source or tape; at  $3\frac{3}{4}$  ips there was only the slightest difference in the highest frequency range. The pleasure of listening to reproduction with such an extended frequency response and a minimum of flutter is difficult to describe without "gushing," but that is what is necessary to get the idea across that the 77A is a superb machine.

In 1966, our review concluded with this: "Somewhere along the line we trust that you have reached the conclusion that we are enamored of this machine. Because we are." We can think of no better ending, yet we decidedly prefer the new 77A reviewed here because; it's solid state; it's flatter; and it's mechanically and electrically quieter.

The machine has just about everything the serious recordist could wish for in the way of performance and flexibility. And the high-quality workmanship under the top deck gives promise of long life. In fact, excepting the plastic escutcheons, et al., the unit is as "professional" as you can hope for in its price class.



# Take the goosebump test.



**(A not totally scientific but very enlightening comparison of the highly rated Harman-Kardon Nocturne Five Twenty vs whoever.)**

By Goosebump Test we don't mean a head-on comparison of specifications. Most receivers costing what the Five Twenty costs have about the same "specs," give or take a point or two. And we're not talking about a beauty contest either. Of course, we think our "Nocturne Look" is the prettiest thing that's ever happened to receivers. But admittedly we are biased, and styling is most certainly a matter of taste.

So what is the Goosebump Test? Just what it sounds like. Go to your dealer and listen to a competitively priced receiver and then listen to our Nocturne Five Twenty. We think you'll not only hear the difference but actually feel the difference between our

instrument and our competitor's. *Feel* the difference enough to get goosebumps.

Actually there is a very scientific reason why the Nocturne Five Twenty sounds different. It is called wideband response. It's a design technique that allows us to build our amplifiers so they deliver frequency response well beyond 20 and 20,000 Hz. Most receiver manufacturers restrict their amplifiers so that they do not go below 20 Hz or above 20,000 Hz, reasoning that response outside of those parameters is inaudible and therefore meaningless.

We don't agree.

We can graphically prove that this restriction causes critical distortion in the mid-range where most of the music is. (We will be happy to send you a square wave analysis upon request.)

But more important than graphs or charts is what you hear. Our Five Twenty makes an oboe sound like an oboe. Clearly defines the subtle differ-

ence between a cello and a viola. Makes the bite of the bow, the hard metal of the brass an integral part of your listening experience. You hear the music as it is—not as it is interpreted by a severely limited electronic device.

*Hi Fi/Stereo Review* magazine recently called the Five Twenty one of "the cleanest, open sounding receivers" they had ever heard.

We call it "The Goosebumper."

Are you getting your fair share of goosebumps? Take the Goosebump Test. Today. At your Harman-Kardon dealer.

For more information, write Harman-Kardon, Inc., 55 Ames Court, Plainview, N.Y. 11803, Box # A-10



## Sansui Model 2000 AM/FM Stereo Receiver

**MANUFACTURER'S SPECIFICATIONS—**  
**Amplifier Section:** Power Output: Music Power (IHF): 100 watts (at 4 ohms), 85 watts (at 8 ohms). RMS Power: 36 watts/channel (4 ohms, both channels driven). Harmonic Distortion: 08% at rated output. Power Bandwidth (IHF): 20 to 40,000 Hz (8-ohm load). Frequency Response: 15 to 40,000 Hz  $\pm$ 1.5 dB. Damping Factor: Greater than 24 at 8 ohms. Tone Control Action: Bass: +12, -15 dB at 50 Hz; Treble: +12, -12 dB at 10 kHz.  
**Tuner Section:** (FM): Usable Sensitivity (IHF): 1.8  $\mu$ V ( $\pm$ 3 dB). Harmonic Distortion: Under 0.8%. Capture Ratio: 2.5 dB. Signal-to-Noise Ratio: Greater than 65 dB. Selectivity: Greater than 50 dB. Image Rejection: Greater than 80 dB. IF Rejection: Greater than 95 dB. Stereo Separation: 35 dB at 1000 Hz. (AM): Usable Sensitivity: Less than 15  $\mu$ V at 1 MHz.  
**General:** Dimensions: 16 $\frac{3}{4}$  in. W x 5 in. H x 13 $\frac{1}{4}$  in. D. Weight: 26 $\frac{1}{2}$  lbs. Price: \$299.95.

In the very popular just-under-\$300 price range, Sansui has come up with a most attractive all-in-one component receiver. Equipped with just about every feature you could hope for (and some that you might never even have thought of), the Model 2000 offers an elegantly designed exterior as well as a carefully conceived circuit arrangement to please component fanciers with modest pocketbooks.

The handsome gold and matte black panel, pictured in Fig. 1, contains a great many more controls than are immediately obvious because the arrangement has been functionally placed to prevent a "cluttered" look. The lower portion of the panel contains an independent power on/off push button switch at the extreme left of the panel. This is followed by a stereo headphone

jack and a speaker selector switch with positions for either one of two pairs of speaker systems as well as an "off" position which permits use of headphones exclusively. Next is a pair of momentary pushbuttons which actuate low- and high-frequency filters. These are followed by dual-concentric, clutch-type bass and treble controls which permit simultaneous or separate control of bass and treble of both stereo channels. The remainder of the lower section of the panel contains the usual balance control, volume control, and a six-position signal-source selector switch.

With the power turned off, the entire upper half of the dress panel appears matte black. When power is applied, the upper left area becomes illuminated with a legible dial scale (AM and FM), a peak-reading tuning meter, and the single, yellow word, "power." We wondered at the need for this "redundancy until we switched to one of the positions other than radio. To our surprise, the dial scale itself disappeared (including meter illumination) and only the word "power" remained, together with a newly appeared word such as "aux" or "tape" (depending on switch position selected). This provides a dramatic and pleasing visual effect. When you really stop to think of it, why do so many receivers illuminate the tuning dial needlessly when the function switch is in phono, tape, etc.?

The words "FM Stereo" also appear behind the dial glass area whenever a stereo broadcast is encountered, vanishing completely in the presence of a monophonic program. Although we never saw it light up, there is even a "protector" light, activated by an output transistor protection circuit which becomes illuminated if the output devices draw excessive current.

To the right of the dial area is the large tuning knob, whose "flywheel"

action is only moderately effective and a bit too noisy (mechanically) when spun hard. At its right are five in-line rectangular push-buttons. The first of these converts the volume control into a loudness-contour control. The next is a "muting" control for elimination of noise between stations in FM tuning. Next is a tape monitor switch (for interrupting the audio circuit to accommodate multi-headed tape recorders with monitoring provisions). This is followed by a switch which reverses the left and right channels. This control used to be quite popular in the early days of stereo, when "left" and "right" program source standardization was still a thing of the future. Today, cartridge outputs, tape head outputs and the like are all standardized as far as "left" and "right" program information is concerned, so this function is now only a frill.

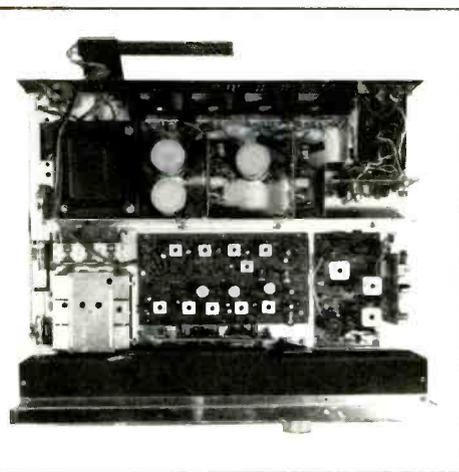
The final pushbutton of this grouping is a "mono-stereo" switch, used to parallel the left and right inputs to the amplifiers. Used in conjunction with the "reverse" switch, it is possible to connect either the left external inputs to both amplifier channels (by depressing *only* the mono switch) or the right external inputs to both amplifier channels (by depressing both the "mono" and the "reverse" switch simultaneously). For monophonic FM listening, a switch position on the main selector identified as FM Mono will defeat the stereo FM circuitry even in the presence of a stereo signal (FM). It is used when stereo FM signal strength is too weak to give noise-free stereo FM reception. With the main selector switch set to FM Auto, circuitry operates in either the FM mono or FM stereo mode, depending upon incoming signal. The FM Stereo light indicates presence of FM stereo even with the mode switch in the FM Mono position. This can be either a good or bad feature,



Fig. 1 — Front view of Sansui Model 2000 AM/FM stereo receiver.

Fig. 2 — Back-panel view of Model 2000.

Fig. 3 — "Inside" view of Sansui receiver with metal enclosure removed.



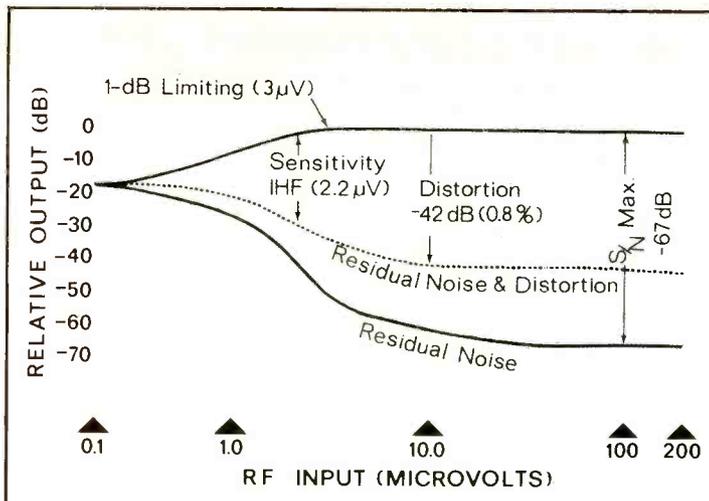


Fig. 4 - Various FM characteristics of Sansui 2000.

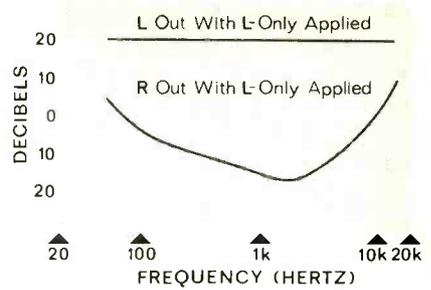


Fig. 5 - FM separation characteristics and 'scope displays of "L" and "R" outputs.

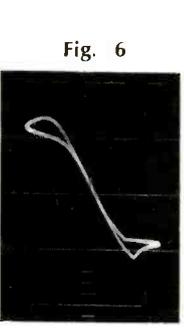
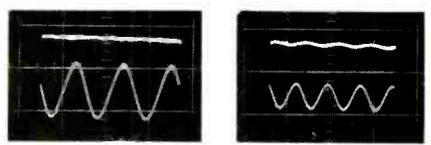


Fig. 6

Fig. 6 - Sweep alignment trace shows linear ratio-detector for over 400 kHz of 1 MHz total sweep.

Fig. 7 - Distortion vs. rms power.

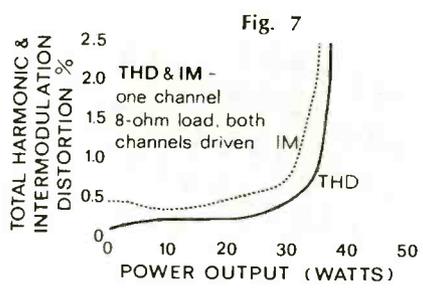


Fig. 7

Fig. 8 - (Far right) Tone control, loudness contour at -30 dB, and filter response.

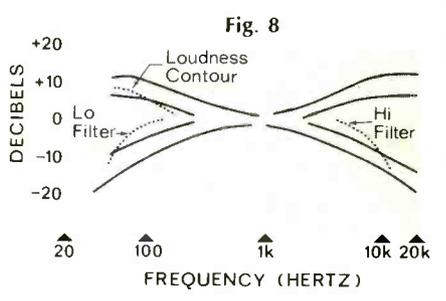


Fig. 8

depending upon your personal listening habits. We would prefer the light to be extinguished when in mono mode.

The rear connection panel of the Model 2000 is shown in Fig. 2. Left and right input jacks are arranged in pairs, along with tape recorder output jacks and a 5-pin DIN socket, the latter intended for inputs and outputs for many tape recorders manufactured in Europe and Asia.

Speaker terminals (for two pairs of stereo speaker systems) are provided on rugged barrier strips to prevent accidental shorting of adjacent speaker leads. Two 2.5 ampere, quick-acting fuses protect the output (speaker) lines, while a 3-ampere line fuse protects the rest of the receiver. Two convenience outlets (one switched, one unswitched) are available for connection of auxiliary powered equipment—phonograph turntable, tape recorder, and the like. Terminals for properly matched connection of 300-ohm or 75-ohm FM transmission lines are grouped with a pair of AM antenna and ground terminals, where an external AM antenna is required. The built in AM ferrite antenna (loopstick), is mounted so that its physical position may be oriented in two planes for best reception.

There remains one little feature

which we saved for last in discussing the rear panel, largely because we take issue with its presence as a "customer" control. This is an externally mounted "separation" control. The control can reduce separation from an excellent 35 dB to as little as 10 dB, but since it is not a setting which can be optimized by ear it would be best to hide it on the interior part of the chassis, away from a user's itchy fingers.

Removal of the metal enclosure of the Model 2000 discloses a well laid-out chassis which includes nine individual printed circuit modules, plus a separate, sealed front end and hand-wired power-supply and power-output sections. A total of 50 transistors (including a new MPF-102 FET device used as an FM r.f. stage), 36 diodes (one of which is a Zener diode), one thermistor and one SCR (Silicon Controlled Rectifier) constitute the "active" devices in this carefully assembled receiver. There is ample evidence of good quality control practice in both the workmanship of assembly and in the individual component selection. The more-than-adequate power supply (including the large power transformer which can be seen in the photo of Fig. 3) runs quite cool, even after eight hours of continuous use at high power levels.

## Performance

Published specifications conformed with measured performance. IHF usable sensitivity was measured as 2.2 microvolts. In the published specifications, however, this spec was given as  $1.8 \mu V \pm 3 \text{ dB}$ , a most unorthodox way of stating IHF least usable sensitivity. Still, if we add 3 dB to  $1.8 \mu V$ , we come up with about  $2.6 \mu V$ , so the receiver's  $2.2 \mu V$  is well within specifications. What we'd like to see is the production set that comes out on the "minus" side of the spec, for that would mean a sensitivity of  $1.3 \mu V$  IHF! Other FM-related data are illustrated in the curves of Fig. 4. Ratio-detector bandwidth is at least 600 kHz, with about 400 kHz of that being very linear, as shown in the S-curve display of Fig. 6, in which end-to-end deviation is approximately 1 MHz. FM stereo separation is plotted in Fig. 5. The photos confirm the fact that separation is excellent at midband frequencies (better than 35 dB at 1 kHz), but falls off fairly rapidly at the low and high ends. Separation at 10 kHz is confirmed visually as the 20-dB separation figure shown in the curve of Fig. 5.

As for amplifier performance, maximum power output measured 35 watts r.m.s. per channel with both channels

## Equipment Profiles (continued)

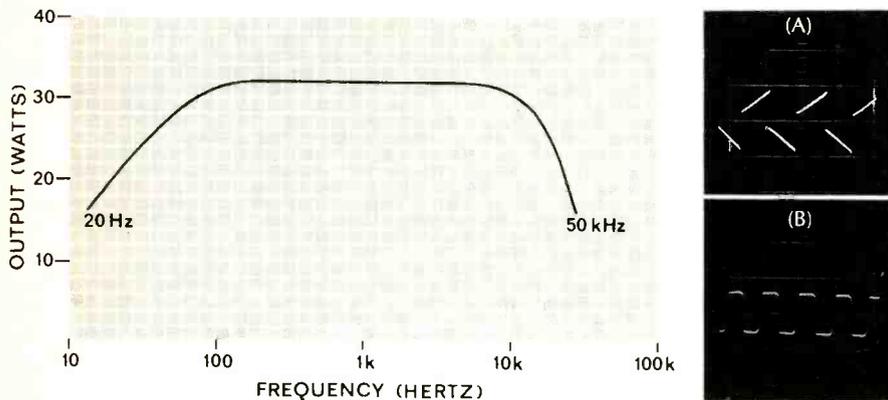


Fig. 9—Power bandwidth of Sansui 2000 with 8-ohm load. Also, square-wave response at (A) 100 Hz and (B) 10 kHz.

driven, as compared to the claimed 32 watts, all at 0.8% THD. Distortion at this and lower power levels, as well as IM distortion, are plotted in Fig. 7. Tone control action is plotted in Fig. 8, and from the plot it is evident that the preferred form of feedback, or variable-crossover tone-control circuit, has been incorporated in this receiver. Loudness compensation has been plotted on this graph as well, for a setting of about  $\frac{1}{3}$  volume clockwise, and is close to the recommended compensation for a  $-30$ -dB contour. While high-frequency filter action is effective in reducing record scratch and other high-frequency noise, the low-filter cuts excessively into desired bass pro-

gram material, attenuating the response by fully 10 dB at 50 Hz. Filter action, both low and high, is also plotted in Fig. 8.

We used the Sansui Model 2000 with a great deal of pleasure for nearly two weeks and learned to appreciate its many features. A minor criticism involves the volume-control curve, particularly on FM. The control could not be advanced above  $\frac{1}{2}$  before the volume became excessive. A moderate reduction in "gain" or a changed volume-control taper would seem to be in order.

Muting worked very well, introducing virtually no added distortion at the threshold point, which was at about 10 microvolts. While tuning meter indica-

tions meant little in relation to signal strength—the meter went to full scale for everything above 50 microvolts—the meter was sensitive enough to serve as an accurate center-of-channel indicator even though it was of the peak-reading type, and is active on AM, as well as on FM.

Audible hum and noise are extremely low in "Phono" and "Tape Head" settings. With a magnetic cartridge connected there is practically no "transistor hiss" in evidence.

Square-wave response at 100 and 10,000 Hz is typical of that found in receivers with this range of power bandwidth, as shown in Fig. 9. Transient response was excellent at all power levels, and a recent live broadcast of Shostakovich's 10th Symphony could do nothing to break up this hardy performer.

As part of the receiver's comprehensive package of instructions and service material, a clever idea in the form of an abbreviated instruction chart is included. The short-form chart, printed on a huge, long-lasting plastic card, serves as a "painless" instruction booklet for those who are just too lazy to read the longer text. Functions of all controls are indicated pictorially.

At under \$300.00, the Sansui Model 2000 surely represents great value. It is rugged, handles well, has most of the features of sets costing \$100 to \$200 more, and has plenty of power for at least two sets of speaker systems.

Check No. 70 on Reader Service Card

## Acoustic Research Model AR-3a Speaker System

**MANUFACTURER'S SPECIFICATIONS—**Impedance: 4 Ohms. Crossover Points: 575 Hz and 5 kHz. Size 14" x 25" x 11 $\frac{3}{8}$ " deep. Weight: 53 lbs. Price: Glossy walnut, oiled walnut, cherry, oiled teak: \$250; Mahogany, birch: \$240; Unfinished pine: \$225. Factory conversion of an AR-3 to an AR-3a: \$90.

In 1954 Acoustic Research, Inc. demonstrated with their Model AR-1 speaker system that clean bass could be reproduced with a bookshelf-sized speaker system, using the acoustic suspension principle. As applied by AR, this principle required that the air inside the enclosure act as the "spring" against which the speaker cone worked, rather than the pleated cloth or paper ring normally seen around the circumference of the cone. In 1959 AR developed hemispherical dome devices for the mid-range and high end

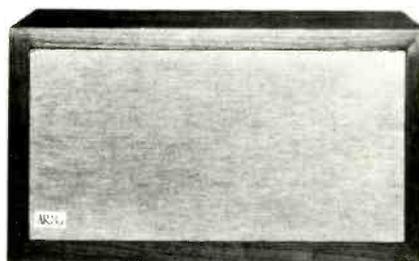


Fig. 1—AR-3a speaker system. Three speakers are revealed when front grille is removed.



which complemented their excellent woofer, and out came the AR-3, a fine and popular speaker system. A point of criticism leveled against the AR-3, however, has been a slight roughness at mid range. It is this portion of the audio spectrum to which AR appears to have focused its attention in developing the AR-3a.

The AR-3a, then, is the most recent of a series of speaker systems derived from the original acoustic suspension design introduced in 1954. Three drivers are used in the AR-3a: A 12-inch bass unit in a 1.7-cubic-foot sealed enclosure that is filled with loosely packed glass wool; a hemispherical mid-frequency radiator, 1 $\frac{1}{2}$ " in diameter; and a  $\frac{3}{4}$ " hemispherical radiator which handles high frequencies. The output levels of the smaller radiators are independently adjustable by controls on the rear panel of the enclosure. The AR-3a's cabinet is identical in size to the AR-3; externally, only

the grille cloth is different. The AR-3a woofer is also identical with that used in the AR-3, except that it is only used up to 575 Hz rather than at the 1000-Hz crossover point of the AR-3. According to AR, a 575-Hz cutoff frequency eliminated roughness at the top end of the woofer, makes the woofer essentially omnidirectional and (because it is done electrically, well below the woofer's natural cutoff frequency) guarantees consistency.

A hemispherical direct-radiator speaker takes over at 575 Hz and a similarly constructed tweeter handles frequencies upwards from 5 kHz. In contrast, the earlier model AR-3 crossover frequencies are 1000 Hz and 7.5 kHz. Voice-coil diameters of the new AR-3a's mid-range and tweeter domes are 1½ and ¾ inches, respectively, compared with the AR-3's diameters of 2 and 1⅜ inches, respectively. The AR-3a's smaller dome diameter makes it possible to obtain superior dispersion and high-frequency power radiation. At the same time, AR has been able to lower the crossover frequencies, obtain still greater power-handling ability, even lower distortion, and greater smoothness by design changes in the dome. The new domes use different diaphragm materials and suspensions, and use copper instead of aluminum wire in the voice coils.

Concerning power-handling ability, always a controversial subject, Acoustic Research is among very few speaker manufacturers who, along with frequency response and related technical data, specify the actual rms power which their speakers will safely handle. According to that data, the AR-3a will tolerate a sustained input of 11 watts rms at any frequency for an indefinite period, 23 watts rms for at least 30 seconds, and overloads of 400 watts for 2 seconds (with a Fusetron type FNM 1¼-ampere fuse in series with the system). When we convert this input power to acoustic power we observe the power that the speaker can produce. Assuming conversion efficiency of just under 1% for the AR-3a, and no saturation or other peak limiting effects in the system, this would be peaks of 3 acoustic watts, 0.2 acoustic watts for 30 seconds, and 0.1 acoustic watts for an indefinite period. So the AR-3a offers one a respectable sound-pressure-level capability which should be sufficient for any home and many professional applications. In fact, during our listening tests of the AR-3a, the louder we played it, the better it sounded. Due to its low conversion efficiency, however, lots of electrical power is required from the power amplifier. This is a

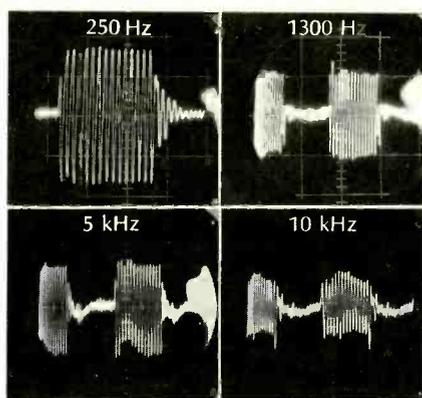


Fig. 2—Response of the AR-3a speaker system to tone bursts at frequencies of 250 Hz, 1300 Hz, 5 kHz, and 10 kHz. Excellent transient response is evident at all frequencies.

price gladly paid in view of the fine results obtained in terms of reproduction quality. To really do justice to this speaker system, and have ample reserve for peaks when listening to it at high levels, we recommend an amplifier that has an available power of 60 clean watts (rms) per channel at 4 ohms (its nominal impedance), about 50 watts at 8 ohms.

### Performance

In measuring the frequency response of the AR-3a, we found it to be exceptionally wide and smooth. Our multiple-microphone measurement technique yielded an impressive 30 to 17,000 Hz  $\pm 6$  dB after optimally setting the tweeter and mid-range level controls and compensating for room resonances. The bass started to roll off at 50 Hz and was down only 7 dB at 30 Hz. The mid-range and treble had no significant peaks or dips, to which the tone bursts of Fig. 2 attest. No significant oscillations were evident throughout the audio range.

The harmonic-distortion performance at bass frequencies was outstandingly low. We measured 5% and 2% at 30 and 50 Hz, respectively, using a 10-watt input level. These are very

low distortion figures for speakers at these frequencies, with such a high input, and relate closely to the manufacturer's data.

During listening tests of the AR-3a's, we couldn't resist comparing the model to the predecessor, the AR-3, which, after all, is a good speaker. The AR-3a sounded distinctly better on most program material. No amount of diddling with the mid-range and tweeter controls in back of the AR-3 could make it sound as good as the AR-3a, which has a measurably wider dispersion and brighter sound. The high-frequency dispersion, in fact, is the widest of any speaker we have tested thus far.

The AR-3a's most important asset, in our opinion, is its smoothness and lack of peaks when listening to it in a typical listening room. This may very well be the result of its wide dispersion. Anyone preferring a still brighter sound is free to turn up the amplifier's tone controls and play with the mid-range and treble controls in back of the speaker. We liked them turned up to somewhere between their average and maximum positions most of the time. But the best setting really depends on the listening room itself and on how clean the high end of the source material really is.

One of the things that we feel needed change in the AR-3 is the potentiometer in the back. The AR-3a still uses it. We believe that a selector switch-type control, though not infinitely resolvable, would have been preferable because of its more reliable design. (*The manufacturer advises that new, heavy-duty, wire-wound pots are used in the AR-3a—Ed.*)

That the AR-3 has flourished as a high-quality system in a competitive speaker market for over eight years means that its basic design and performance have been received well. It isn't easy to improve that kind of good design, but AR has done it, creating a new high standard of performance at what must be considered to be a bargain price.

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**Benjamin Model 1050  
Stereo Compact System  
(w/Optional Model  
CRB-1000 Cassette  
Tape Recorder)**



**MANUFACTURER'S SPECIFICATIONS—**  
AM/FM Stereo Receiver Section: Power Output: 85 watts (IHF, combined channel power) into 8-ohm load. Harmonic Distortion: Less than 1% at rated output. Power Bandwidth: 20-35 kHz. Frequency Response: 15-35 kHz. FM Sensitivity (IHF): Under 3  $\mu$ V. FM Image Rejection: Better than 60 dB. FM Spurious Response Rejection: Better than 85 dB. Multiplex (Stereo FM) Separation: -35 dB. AM Sensitivity: 50  $\mu$ V per meter. Dimensions (Receiver and Turntable): 10 $\frac{1}{4}$  in. H x 18 $\frac{3}{8}$  in. W x 16 $\frac{5}{8}$  in. D. Automatic Turntable: Miracord Model 50. Magnetic Cartridge: Elac 244, 07-mil diamond stylus. Loudspeaker Systems: Two EMI 92 speaker systems. Dimensions: (Each Enclosure): 23 $\frac{1}{8}$  in. H x 11 $\frac{3}{4}$  in. W x 10 $\frac{3}{4}$  in. D. Price: \$549.50 (Plastic Dust Cover, Opt. Extra). With Optional Cassette Tape Recorder, \$689.00.

Proof that so-called "compact systems" can approach the quality level of some separate components is amply demonstrated by the Benjamin Stereo Compact, Model 1050. While this system is, in every sense of the term, a "compact" (receiver/changer in one cabinet, with loudspeaker systems supplied as part of the "system" price), it consists of recognized components (some of which could have been bought separately) which have been pre-selected by the manufacturer.

Thus, in evaluating compact systems of this type, our job is really twofold: first, how do each of the components selected stand up on their own and, second, how are they when matched together. Let's consider the stereo receiver section first.

**Features**

The receiver, mounted below the sleek Miracord 50 automatic turntable, in a sloped-front, tastefully designed walnut enclosure, is an elegant-looking unit. With power to the system turned "off," the upper half of the heavy aluminum-extruded front panel appears black, with only the model number appearing to one side and the tuning knob at the other end. Controls located on the lower half of the dress panel are neatly arranged. Starting at the left is the power switch, a white push-button. The selector switch consists of five in-line rectangular push-buttons for selecting program sources which include "Tape Monitor," "Aux/Tape," "Phonograph," "AM Radio" and "FM Radio." These buttons are interlocked with respect to each other, with the exception of the independent "tape monitor" button.

Further along the panel is a pair of tiny knobs, each associated with a phone jack that is used for either a microphone or a musical instrument pick-up (as from a guitar). The user can actually *mix* his virtuosity with any of the electronic sources selected by means of the selector push-buttons. Alternatively, these jacks may be used with no other source applied by simply popping out *all* selector switch buttons and working only with the mic and instrument inputs.

Bass and treble controls, which follow, are of the ganged type operated by a single control knob each. The balance control knob, in addition to its usual function, is used to select mono or stereo mode by pulling out on the knob for a monophonic program mix. The volume control acts as a loudness-compensated control when it is *pushed in*.

At the lower right of the panel are three more buttons. The first two actuate speaker systems "1" and "2." Because of the nature of these buttons it is therefore possible to choose *both*

local and remote speaker operation at once (by depressing both buttons) or *no* speakers, as when listening to headphones (by releasing *both* buttons). An AFC (Automatic Frequency Control) button is the last of this cluster, and it is white, to distinguish it from the speaker selector switches adjoining it. Normally "off," the AFC action is introduced by depressing this last button *after* desired FM stations have been carefully tuned in. The final item on this portion of the panel is the popular stereo headphone jack.

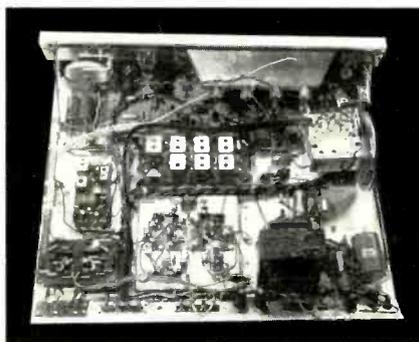
As power is applied to the receiver, the previously black upper area becomes softly illuminated, disclosing a long slide-rule dial of AM and FM frequencies, as well as a 0-100 logging scale. A zero-center meter (for accurate FM tuning) is at the right of the dial scale; the right of the meter is the now-indispensable stereo indicator light.

We were really startled when we started to spin the tuning knob. Flywheel action? Yes, but it's much more than that. By a well-balanced combination of step-down gear ratios and a heavy flywheel plus a low-friction dial drive, this tuning knob has a "feel" unlike any we have ever twisted—and it spells quality of mechanism. The front panel view of the receiver/changer combination is shown in *Fig. 1*.

Because this receiver is already interconnected to the Miracord automatic turntable chosen to go with it, back-panel connection facilities are minimal, including terminal strips for speaker systems "1" and "2" with screw terminals well separated. The antenna strip comes with an "indoor" antenna connected to it. This is really a .01  $\mu$ F capacitor coupled to one side of the power line cord. While it works for "local" FM reception, we removed it for our tests and connected a more conventional dipole FM antenna. Provision is also made on this strip for connection of an outdoor AM antenna. Speaker line fuses, power line fuse, tape out and "aux" jacks as well as an unswitched convenience a.c. power outlet complete the back-panel layout. Strictly speaking, this is not a back panel at all, but midway between a back panel and an "underneath" panel, and we found access to it a bit difficult, especially in making speaker connections.

Circuitry in this receiver is as advanced and sophisticated as that found in many component receivers. The FM front end includes an FET r.f. amplifier, separate local oscillator, and separate mixer. The AM tuner section includes a separate r.f. stage and there-

Fig. 2—Internal construction of Model 1050 receiver section.





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# Equipment Profiles (continued)

fore a three-gang tuning capacitor, indicating that the inclusion of AM here was not just a compromise afterthought. The i.f. circuit module includes a four-transistor (three in use for AM) i.f. and there is a stage of audio amplification after the ratio detector prior to the multiplex decoder module. The MPX module, i.f. strip, and front end all are powered from a Zener-diode-controlled source of 10.5 V. Stereo decoding (for FM) is accomplished in a "switching" circuit which includes more than adequate SCA rejection (measured as greater than 45 dB), four NPN transistors, a bridge demodulator, a pair of 38-kHz rejection filters, plus two extra transistors for triggering the stereo indicator light.

No less than ten parts on the magnetic preamp module were found to have 5% tolerances, so that gain and equalization did not vary by more than 0.5 dB between channels at any frequency from 30 to 15,000 Hz.

Each mic/instrument input has its own preamp stage, separate from the twin phono preamps just described. Tone control action is achieved by means of the popular Baxandall (feedback) circuit. These circuits, along with loudness and balance controls and necessary voltage amplifiers, are contained on another circuit board mounting a total of eight more transistors (four per channel). The audio output module (which really includes drivers as well as outputs) is transformerless and includes five transistors per channel, of which two are the push-pull 2N3055's used as the output pair. Protective speaker-line fuses are used in

each channel. Internal construction of the chassis can be seen in the photo of Fig. 2.

## Performance

As for measured performance of this receiver section, nearly all parameters compare favorably with published specifications. IHF FM sensitivity was, indeed,  $3.0 \mu\text{V}$ , measured at 98 mHz (though it did deteriorate slightly to  $3.5 \mu\text{V}$  at 108 mHz). Figure 3 details IHF sensitivity as well as other important FM parameters. Although no S/N figures are claimed, we measured S/N as 58 dB. Distortion at 100% FM modulation was measured as 1.5%.

Total Harmonic Distortion (THD) was also measured for stereo conditions in FM. In making this measurement it is important to understand the nature of the modulation pattern that will occur under conditions of stereo broadcasting. In no instance does audio deviation exceed 67.5 kHz (as opposed to 75 kHz in mono). This is because 10% of the total deviation is reserved for the 19-kHz pilot carrier which is always present when stereo is transmitted. As a practical matter, however, and with typical programming, "L"-only or "R"-only signals seldom exceed 35 to 40 per cent modulation individually. Measured at the maximum 90 per cent modulation, the 1050 had a THD of 1.5% (identical to its THD in mono). At  $37\frac{1}{2}\%$  modulation, THD measured 1% (actually better than in mono at full modulation).

If mono standards were to be applied (incorrectly) to this measurement, the

unrealistic modulation results in a THD of about 3%. This higher figure arises *not* from any inherent deficiencies in the multiplex decoding circuits, but from the voltage swing limits imposed by the audio stage which follows the stereo decoder circuits. As such, this latter measurement has no relationship to actual performance under broadcast listening conditions.

Stereo FM separation coincided nicely with published specs. as shown in Fig. 5.

Rms power was measured at just over 36 watts per channel into an 8-ohm load. This power output resulted in a distortion of 1%, as shown in the curves of Fig. 4. IM (Intermodulation Distortion) for 36 watts output per channel is 3.5%. The manufacturer's claim of 42.5 watts (IHF) was confirmed by maintaining constant supply voltages.

In evaluating a "compact" system, listening tests are perhaps more important than in reviewing a single piece of equipment. Since the user is denied the "freedom of choice" associated with component purchase, it is extremely important that manufacturers of compacts come up with compatible equipment sections. In view of the rather excellent performance of the receiver discussed so far, the fine-performing Model 50 Miracord is a good match. Almost identical to the Miracord Model PW-50H reviewed here previously (Sept. '67 AUDIO, p. 46), it differs only in choice of motor, featuring a 4-pole induction motor instead of the synchronous motor in the 50-H. During our use, we tracked all manner

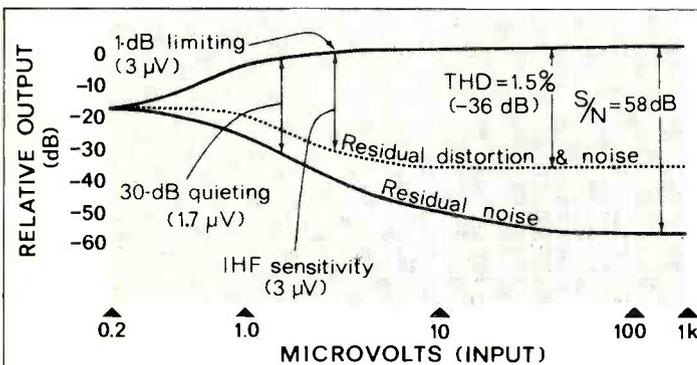


Fig. 5—FM stereo separation measures -35 dB.

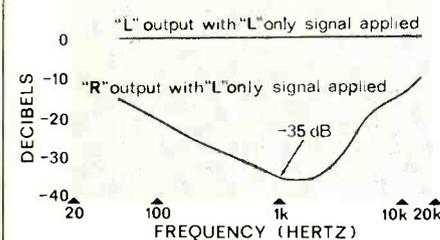


Fig. 6—Power bandwidth at 36 watts rms.

Fig. 3—FM characteristics of Benjamin Model 1050.

Fig. 4—Total harmonic distortion and intermodulation distortion (per channel) vs. watts (rms).

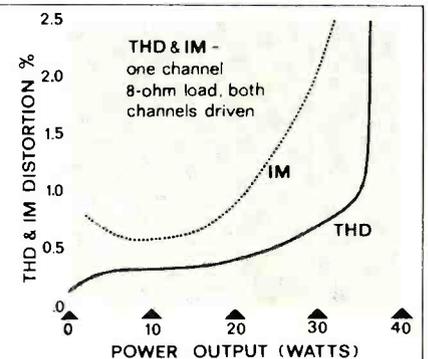
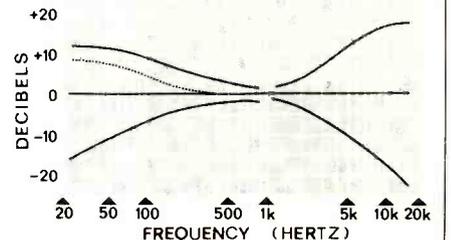


Fig. 7—Dash lines show loudness contour response at  $\frac{1}{2}$  rotation of volume control.



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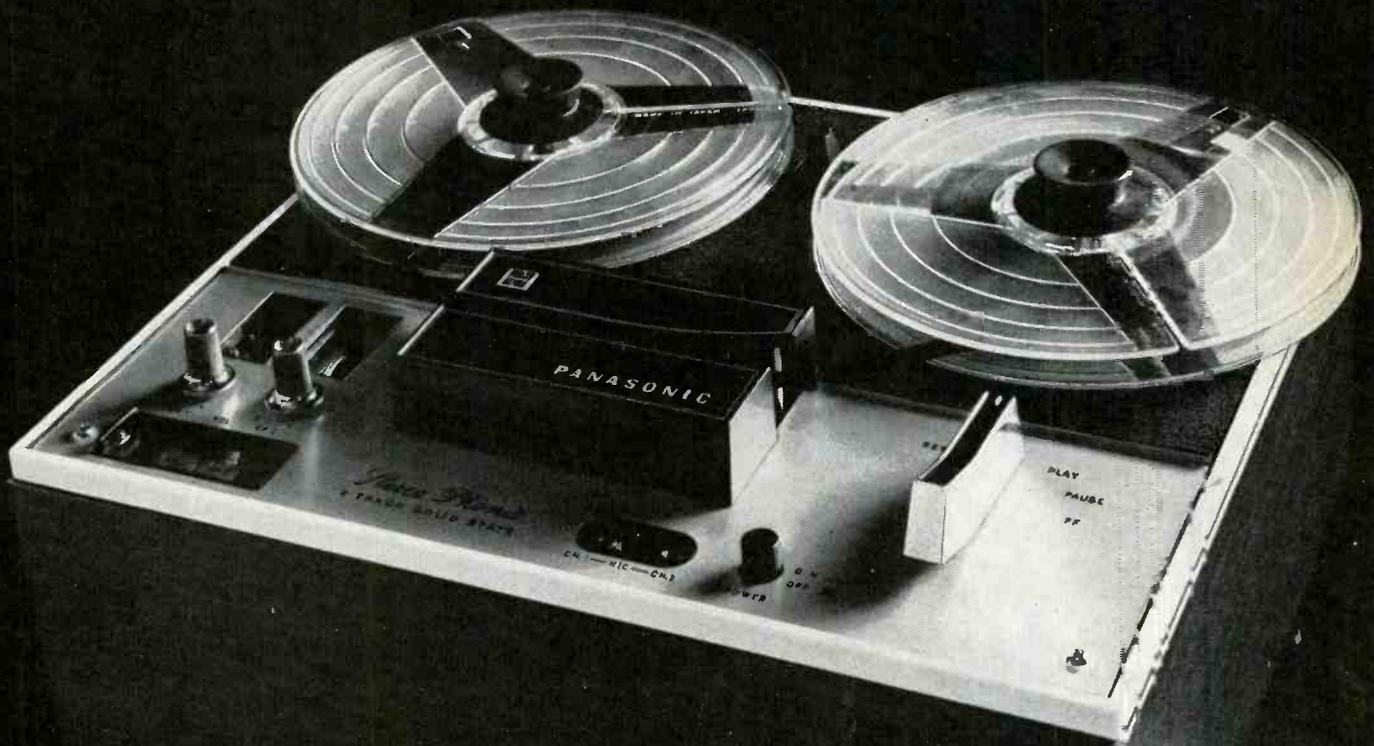
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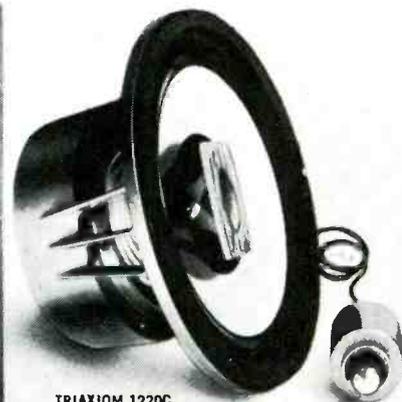
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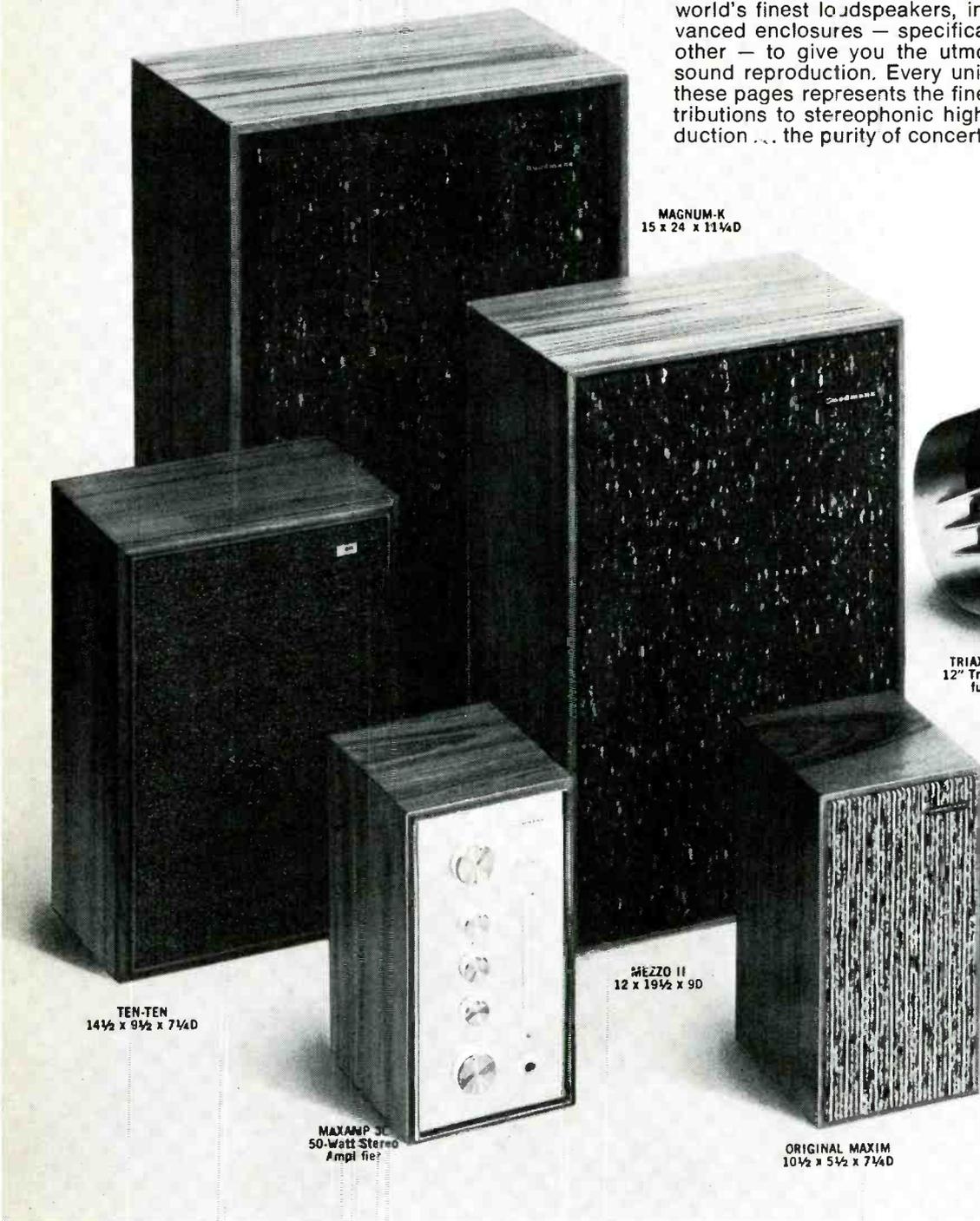
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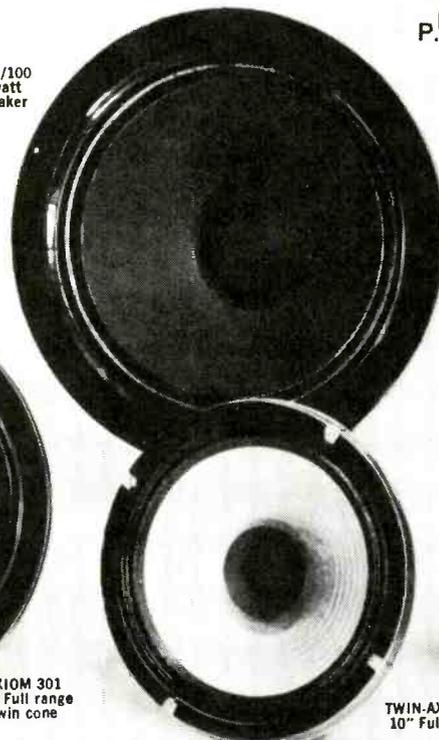


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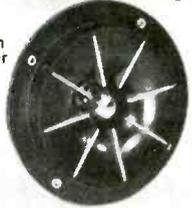
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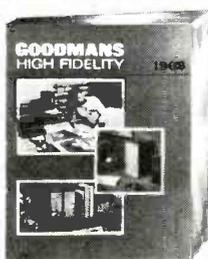
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## Equipment Profiles (continued)

of recorded material at 1.5 grams and could not detect any significant speed error at either 45 or 33 $\frac{1}{3}$  rpm. Its fine features lift the model 50 right out of the "mass product" class. (Those wishing to know more about this elegant automatic turntable should re-read the review referred to above.) The Elac 244 cartridge mated to the changer is a medium-output magnetic type. It appears to be free of any "high-frequency peaks" and is capable of distortion free, adequately separated two-channel reproduction from stereo recordings. Judgment here was purely subjective.

### Speaker Systems

As for the loudspeakers supplied with the Benjamin 1050, they are regular production versions of EMI-92 bookshelf speakers. These speakers normally retail for \$109.95 each, when purchased separately, which should give you an idea of the category to which they belong. They feature a 13 $\frac{1}{2}$  in. x 8 $\frac{1}{8}$  in. elliptical woofer and a 3 $\frac{3}{8}$  in. cone-type tweeter; a 12 dB/octave crossover network (LC type). A 13-position "brilliance" control is included. Far from being a "low-efficiency" type, which one might expect from their size and the type of enclosure (infinite baffle), they turned out to be remarkably efficient. When used with the 1050 receiver section, we were able to produce room-filling (20 ft. x 15 ft.) orchestral sound of great dynamic range with the volume control just past 12 o'clock. Oscilloscope observations during these listening tests revealed power peaks no greater than about 8 to 10 watts per channel. These measurements indicate that a second, remote pair of stereo speaker systems can be installed with this system without taxing its power handling capacity.

Of course, this speaker efficiency is gained at the expense of low-end response. Severe doubling was noted at about 60 Hz and below with anything over a couple of steady-state watts applied. Within its frequency range, however, this EMI system is smooth and natural sounding. Mid-range, often notably deficient in "book-shelf" types of enclosures, is very much in evidence and well balanced. Highs seem well dispersed with no apparent diminution of treble in the extreme corners of our listening area. All in all, that bottom octave (below 60 Hz) seems a small price to pay for the otherwise fine sound attainable with these systems.

### Cassette Tape Option

With the many types of tape record-

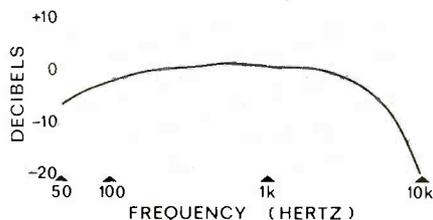


Fig. 8—Cassette tape recorder (optional) fits below receiver/changer unit. A sliding door arrangement permits it to be opened, as shown, or closed flush with the base.

Fig. 9—Frequency response (complete record-play loop) of CRB-1000 cassette recorder when incorporated into the Benjamin 1050.

ing and playing techniques available, Benjamin chose to offer a "cassette" record/play stereo unit as an optional accessory for the 1050 Compact. Identified as the Benjamin Model CRB-1000, it is more than just an "add-on." Rather, it has been cleverly packaged into an attractive ebony "drawer" which neatly fits *under* the Model 1050 receiver/changer section. The combination of the two units is shown in the photo of Fig. 8. Notice that the entire "cassette" system is mounted on slides. It can be pulled forward for operation without upsetting the rest of the center section. Once you make the simple interconnections of audio in, out, and a.c. power, recording and playback becomes fully automatic. Whatever happens to be going on in the receiver—AM or FM broadcasts, record playing, and so on—can be recorded directly, without using a microphone. While there is a "microphone" input jack on the recorder unit itself, users are directed to plug microphones into the special "mic" inputs on the main receiver. Just as well, too, since the "single" "mic" jack is really a three-wire stereo input and requires the same tip-ring-sleeve type of plug common to stereo headphones, but not so common to commercially purchased microphones!

The deck has such additional niceties as a three-digit counter for locating portions of a recording and for timing, a tiny but adequate "level" meter to prevent over-recording, and a separate volume control for setting up record levels. Playback level is fixed and must be adjusted by means of the

main receiver's volume control. The recorder features pushbutton operation. A "cassette" button releases the cassette by popping open a plastic spring-loaded door.

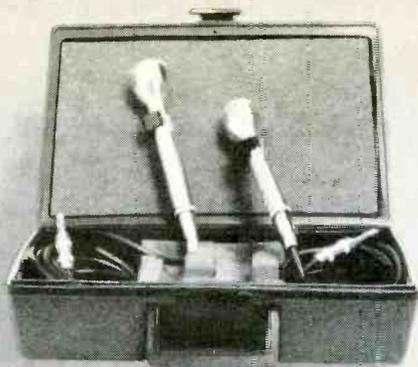
At such a slow playing speed (1 $\frac{7}{8}$  ips), we found the fast forward and fast re-wind almost *too* fast for comfort, making it a bit difficult to locate specific sections of a recording unless you are extremely dexterous and can develop a sort of "wind-stop" motion with your index and middle finger extended in a perpetual V-for-victory rocking motion. For all you may say about the lack of "fidelity" of the cassette system in its present state of perfection (see frequency-response curves of Fig. 9), it is really a joy to use and should appeal to the members of the family who have resisted tape because of the "threading" problem.

An A-B comparison between the "original" and the "playback" via this or any other cassette system (at 1 $\frac{7}{8}$  in. per second) does disclose an obvious loss of extreme highs. Much of its use will be for background music listening or voice recordings. It is perfectly adequate for these applications. For serious music listening, however, it is out-performed by other music-producing formats. Surprisingly, wow and flutter proved to be low as based on listening tests. Repeated listening to piano recordings (transcribed from disc to cassette by us, not professionally pre-recorded stuff) suffered from none of the "wow" effects associated with old imported British films. Considering the fact that this cassette system records and plays stereo, fits neatly in with the rest of the Benjamin 1050, and costs only an additional \$139.50, it is certainly a "fun" addition to this compact system.

In summing up we must emphasize that the 1050 itself requires no condescension from anyone. It is as honest an attempt to assemble a group of quality components into a system to be marketed under one price tag as we have seen. Each element has been wisely chosen, each performs well alone and equally well with its companion elements. We still prefer to choose our own separate components, retaining the flexibility of matching each component to our needs as well as matching them to each other. But if one is not so inclined, as so many are not, the Benjamin 1050 would certainly make a fine choice. You would have to go far to find a better amplifier/control section and record changer in a compact system, for example, while the tuner section and speaker systems complement them well.

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# ABZs of FM

LEONARD FELDMAN

## Limiters in FM Receivers

Strictly speaking, a "limiter" stage in an FM receiver is really another stage in the i.f. amplifier section of the receiver. Its distinction is that — unlike the stages which precede it—its function is not necessarily one of amplification but rather that of removing amplitude modulation by providing a constant amplitude signal for a rather large range of input signal voltages.

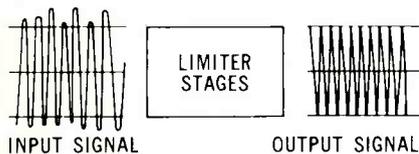


Fig. 1—A limiter is used to remove amplitude variations from the FM i.f. signal.

The signal frequency is, of course, 10.7 MHz, just as in the rest of the FM i.f. system.

If it were possible to design a "perfect" FM detector or demodulator, there would be no need for limiters. As it is, however, all forms of FM detectors (including the popular discriminator and even the ratio-detector types) are, to some degree, sensitive to amplitude as well as to frequency variations in an FM signal. Without the presence of a limiter, the recovered audio output would contain voltages corresponding to both the amplitude and the frequency modulations. A limiter stage (or multiple stages) removes the amplitude modulation component and passes on a pure frequency-modulated signal for final detection. In general, a discriminator (often called a Foster-Seeley detector, after its inventors) will require a full stage of limiting or more, whereas, a ratio detector, because of its own partial limiting characteristic, is sometimes designed into a set with no limiters ahead of it, often with a partial limiter stage and at other times (in better sets) with a full stage of additional limiting.

A simple illustration of the action of a limiter is shown in Fig. 1. A clearer understanding of the functioning of a limiter will be gained by looking at Fig. 2, the transfer characteristic of a typical limiter. When applied to this

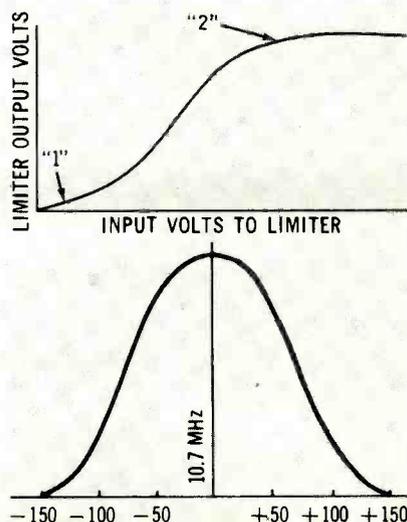
stage, all signals having more than a certain minimum will produce an output voltage which is substantially constant. In the region beginning at point "2" and to the right, the stage is a "limiter" in its action.

A signal which is too weak to drive the limiter beyond point "2" will cause amplitude variations in the output of this stage (and consequently, in the output of the detector, to a lesser degree) which are not part of the original desired audio information. Thus, for a limiter to operate properly, it is necessary that the incoming signal be strong enough to drive the limiter into "full limiting."

You may be wondering how amplitude variations are imparted to an incoming frequency-modulated waveform in the first place. There are two basic causes for this form of distortion. First, there are atmospheric disturbances covering all frequencies used in radio communication. These disturbances may be from natural sources, such as lightning storms, or they may arise from man-made interference such as automobile ignition systems, sparking of electrical motor brushes and the like. These types of noise sources are all external to the receiver itself and, in that respect, are beyond the control of the design engineer. In the receiver proper, unequal response of the various tuned circuits above and below resonance contributes towards amplitude variations. You will recall from the discussion last month that the ideal response curve through an i.f. system would be rectangular in shape. Such response is seldom achieved, however,

Fig. 2—Effective limiting occurs at all input signal levels to the right of point "2."

Fig. 3—Practical intermediate-frequency (i.f.) response results in varying amplitude as signal is modulated above and below the center i.f. frequency.



and the response is usually more like that shown in Fig. 3. A frequency-modulated 10.7-MHz signal fed to an i.f. system having such a response will be amplified *more* at the instant the carrier is passing through the center frequency, and somewhat less when deviation caused by audio information shifts the carrier above or below the center frequency (in this case, 10.7 MHz). For effective limiting, the circuit must function beyond the "knee" of its response curve for *all* frequencies that are likely to be encountered under conditions of normal program modulation. For this reason, the limiter has a great bearing over the design and se-

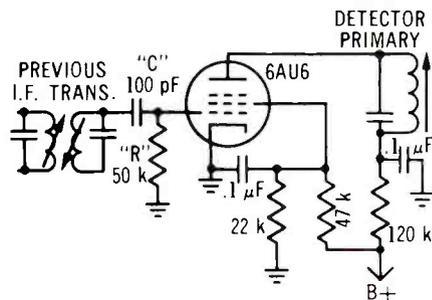


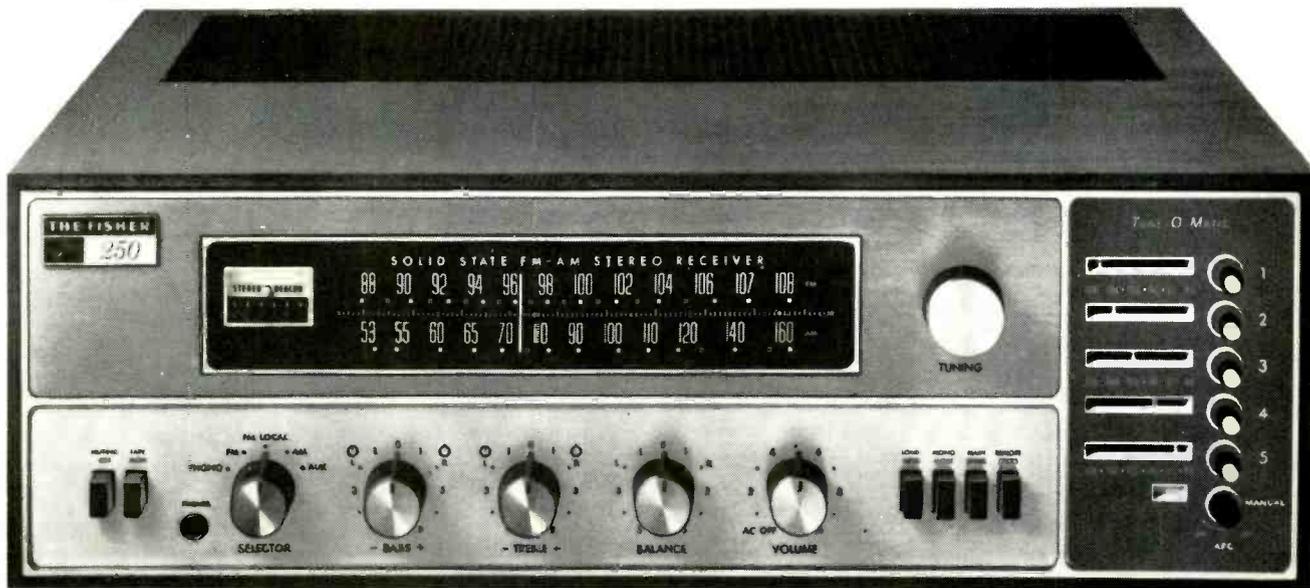
Fig. 4—Typical tube limiter uses grid-leak bias and reduced plate and screen voltages.

lectivity of the preceding i.f. stages, as well as upon their degree of amplification.

## Limiter Circuits

The two most widely used circuit schemes for limiting (in the days of vacuum tube equipment) are combined in the typical limiter shown schematically in Fig. 4. The R-C circuit consisting of a 100-pF capacitor and a 50k-ohm resistor form a grid-bias network which, in the presence of an incoming signal, sets the bias point of the grid at some negative value, determined by the amplitude of the signal. Thus, a given amplitude of output is determined by the bias point. If the incoming signal were to undergo a sudden increase in amplitude, the developed grid-leak bias would increase, lowering the effective gain of the stage or, to put it another way, attempting to keep the amplitude of the output *constant*. Unfortunately, the time constant of this arrangement is such that high-frequency amplitude variations are too fast for the grid leak bias to adjust. As a result, this form of limiting is not very effective in reducing the effects of sharp impulses of noise, such as those arising from automobile ignition noise. The time constant of the bias circuit is determined by the numerical product of the R and C elements in the grid circuit. In this instance,  $t = 100 \times 10^{-12}$  (farad)  $\times$  50,000 (ohms) =  $5 \times 10^{-6}$  second. For most amplitude variations encountered, such a time constant will

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be adequate. In the case of sharp pulses such as ignition noise, even 1- or 2-microsecond time constants may be too slow for the bias to follow, and noise results in the output of the detector which follows.

In addition to grid-circuit limiting, the circuit of Fig. 4 utilizes limiting action brought about by reduced plate and screen voltages. Such reduced voltages alter the normal transfer characteristic in such a way that much less input signal is required to drive the plate current into saturation. With a tube (or a transistor, as we shall soon see) operating in a saturated mode, sharp positive pulses applied to the grid do not alter the amplitude of the output waveform which is, after all, a form of limiting.

A dynamic limiter overcomes the inability of the grid-bias type to follow high-frequency amplitude variations. Utilizing semiconductor diodes (one

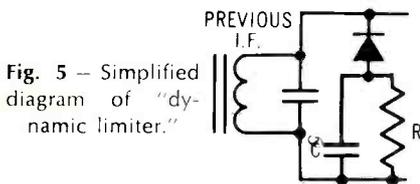


Fig. 5 - Simplified diagram of "dynamic limiter."

or more) that respond instantly to amplitude variations, the dynamic limiter has an RC circuit which holds its characteristic constant with regard to audio variations but permits relatively slower changes to adjust the signal level. A simplified circuit of dynamic limiting is shown in Fig. 5. Many experts maintain that the combination of a dynamic limiter followed by a well designed ratio detector afford the best results obtainable in an FM tuner or receiver. Of course, solid-state limiters, including IC (integrated-circuit) stages have changed some of the design philosophy of limiters, but the end goals remain the same.

An example of a transistorized partial limiting stage is shown in Fig. 6. Unless you had the rest of the i.f. circuitry before you it would be difficult for you to know, for sure, that the stage is operating as a limiter. The key lies in the operating voltages. While the preceding stage had an emitter-to-collector potential of 9.8V, here the voltage is only 4.2. Essentially, we have saturation limiting translated to solid-state circuitry. Since this stage is followed by a conventional ratio detector (which affords some limiting too), the limiting is only partial, the rest of the required action being provided by the action of the ratio detector itself.

The principal advantage of the new IC's designed for FM i.f. use is that they can be used as amplifiers as well as for limiting purposes. Last month

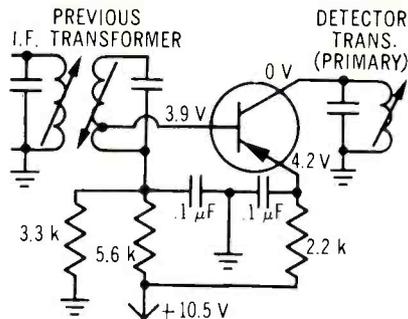


Fig. 6—Partial limiter using a PNP transistor rebiased for this junction.

we showed an RCA CA-3012 used in an i.f. circuit. A second such IC, cascaded after the first one and operating with virtually the same voltages operates as a very stiff and effective limiter above certain required input voltages. This limiting action is illustrated graphically in Fig. 7. Note that with an input voltage of only about 1 millivolt, full audio recovery (which is the same as saying full limiting) takes place. Since the IC can be designed in circuit to provide a voltage gain of about 60 dB, an input of only 1 microvolt applied to the first of two cascaded IC stages could, in theory, result in full limiting! In practice some other losses occur, but it is easy to see that no more than two such high-gain limiting circuits would generally be enough for a complete FM i.f. design right up to the discriminator. Some of the newest IC's even include the few parts necessary for FM detection as well, so that we are beginning to see complete

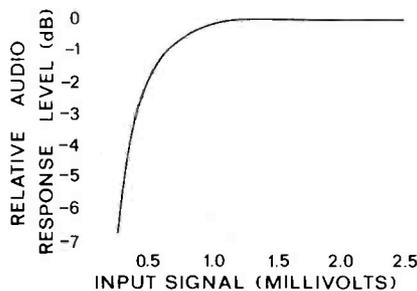


Fig. 7—Limiting characteristic of RCA integrated circuit used at 10.7 MHz for i.f. and limiting purposes.

i.f. systems consisting of nothing more than a couple of IC's, a couple of crystal filters or other frequency-sensitive devices, and a few necessary surrounding capacitors which cannot be included because of their large size.

To the reader who has patiently been following these megahertz signals these past months—take heart! Next month we begin to explore the various methods available for converting that wandering 10.7 MHz into meaningful audio information at last. We'll start with the discriminator. Æ

## ELECTRONIC ORGANS

(Continued from page 63)

"up" and "down" parts, it has only odd harmonics. Unbalanced, it can emphasize other harmonics, some of which may be even (Fig. 2-5). Table 2-4 gives the harmonic content, up to 12th harmonic, of rectangular waves with precise ratios of 'up' to 'down' from 1:1 to 7:1. Note how the harmonic structure varies. Very little change in the proportion of the wave can produce a quite noticeable change in musical timbre.

Using a rectangular wave also has the advantage that it can be varied in intensity simply by varying the chopping point on the waveform (Fig. 2-6). Thus a square or rectangular waveform lends itself to creation of a tremolo effect, which wobbles the amplitude, rather than vibrato, which warbles the frequency.

The sine wave, and a wave close to that form, lends itself to phase variation, which can be converted to vibrato (Fig. 2-7). Then, if desired, more harmonics can be added, by running the wave through limiters that convert it to square, and formant filters that select the frequency content to be emphasized.

Different electronic organ designers adopt varying approaches to design. Some concentrate on making their organ give a "good" sound, without concerning themselves whether it resembles a pipe organ. Others, of which Allen is an exponent, go to considerable lengths to simulate the traditional windblown-sound.

If I say the latter appeal to professionals, I shall be inviting argument. This is a trend. The professional appreciates what he has come to regard as "his instrument." But some lovers of traditional organs who are not organists may appreciate this difference, while some organists may accept the more modern synthetic kinds of sound, not worrying about whether they sound like any "real thing" or not. This is a matter of taste.

In this installment, we have gone through some of the more basic electronic differences. In the next we'll start getting down to details.

(To Be Continued)



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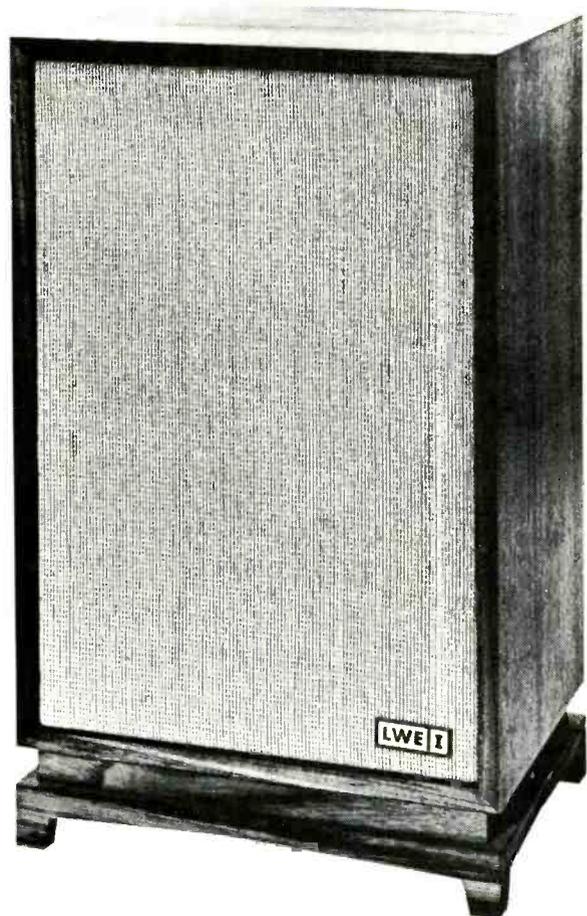
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Altec Lansing	36/37
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Universal Audio-Urei	24
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Waveforms-Urei	25
Wiegand Audio Laboratories	56

### AES CONVENTION PAPERS

#### To be presented at Technical Sessions

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

#### Monday, October 21:

(9:00 a.m.)

#### SOLID-STATE TRANSDUCERS

Chairman: Donald S. McCoy, RCA Laboratories

**A1 Use of solid-state transducers in mechanics and acoustics**

Warren P. Mason, Columbia University

**A2 Interactions of strain with P-N junction devices and their applications in sensors**

J. J. Wortman and L. K. Monteith, Research Triangle Institute

**A3 An evaporated thin-film diode strain sensor**

Robert M. Moore, Charles J. Busanovich, and Frank Koziellec, Jr., RCA Laboratories

**A4 IFGET strain transducers utilizing piezoelectric materials**

James Conragan, Dept. of Elec. Engrg. & Computer Sciences, University of California

**A5 Electret condenser microphones—performance in normal and severe environments**

Preston V. Murphy and Freeman W. Fraim, Thermo Electron Corp.

(1:30 p.m.)

#### SOUND REINFORCEMENT

Chairman: William K. Connor, Tracor, Inc.

**B1 Ford Foundation headquarters auditorium sound reinforcement and translation system**

Irving S. Rosner, Robert J. Nissen, and A. Belmares Sarabia, Rosner Television Systems, Inc.

**B2 Seven-channel stereo sound reinforcement system for opera and stage presentations in Philadelphia Civic Center Convention Hall**

John E. Volkman, RCA Laboratories

**B3 Effects of an audience on equalized sound systems**

G. R. Thurmond, Tracor, Inc.

**B4 An unusual nightclub sound reinforcement system**

Peter W. Tappan, Bolt Beranek & Newman, Inc.

**B5 Broadband equalization of small meeting rooms—Is there a common denominator?**

Daniel Queen, Ampli-vox Department, Perma-Power Div. of Chamberlain Manufacturing Company

**B6 Live announcement record/reproduce facilities for air terminals—A review of two new systems**

Robert C. Coffeen, R. C. Coffeen & Associates

**B7 Remote Control Audio/Visual facility for an advertising agency**

Herbert T. Chaudiere, Robin M. Towne & Associates

(7:30 p.m.)

#### AUDIO ENGINEERING AND THE ENVIRONMENT

Moderator: Leo L. Beranek, Bolt Beranek & Newman

**C1 Noise pollution—its measurement, characteristics, and effects on humans**

George W. Kamperman, Bolt Beranek & Newman

**C2 Legal aspects of noise control**

Frederick P. Houston, Otterburg, Steindler, Houston and Rosen

**C3 Noise from aircraft**

Lewis S. Goodfriend, Goodfriend-Ostergaard Associates

**C4 Noise control in buildings**

Cyril M. Harris, Dept. of Elec. Engrg., Columbia University

(Continued on page 88)

## SMALL MUSIC ROOMS

(Continued from page 25)

of dimensions, although certain dimensional bounds should be observed.

Rather than trying to design a music room for optimal dimensions, short of making it large enough to permit good low-frequency reproduction, attention should be directed towards obtaining a satisfactory reverberation period in the enclosure. Unfortunately, to accommodate a wide variety of programs, the reverberation should be adjustable. Since jazz and rock-and-roll are most always played in "dead" rooms, such as crowded dance halls, this type of music is reproduced to best advantage in rooms with a similarly short reverberation period. A distinction might even be made as to the best reverberation time for Italian and Wagnerian operas: since the music of the latter is generally more stately and slower, its reproduction will be enhanced by a slightly longer reverberation time (about 10%) compared to that found satisfactory for the more lively and quicker Italian

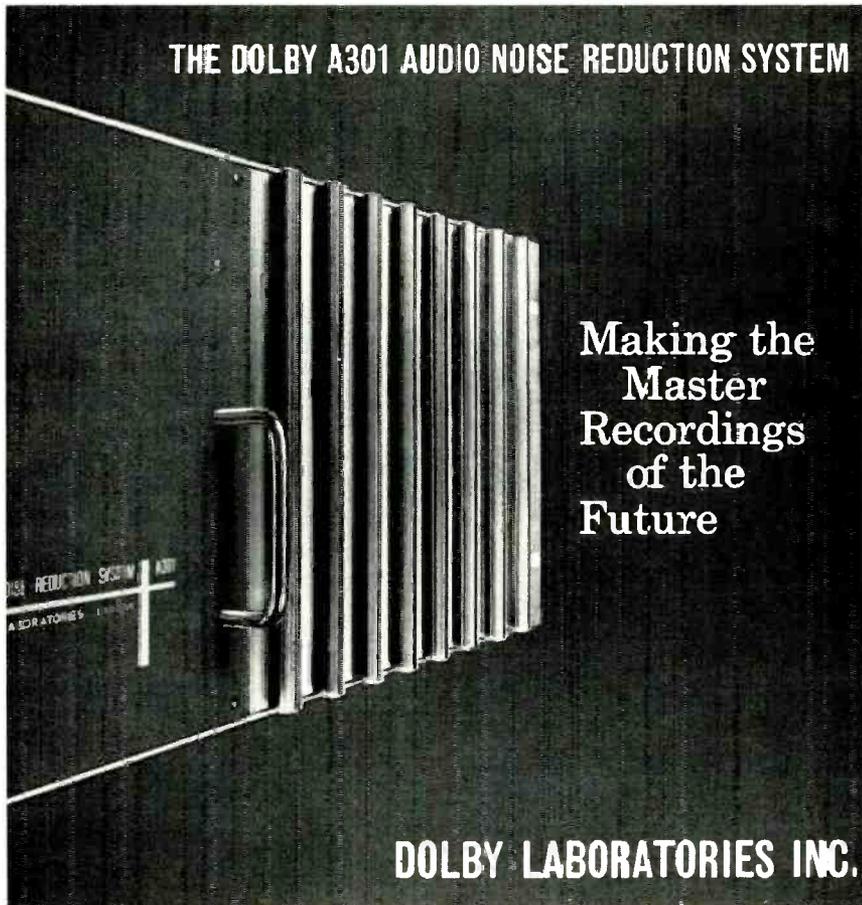
opera. Choral and ecclesiastic music is generally reproduced most pleasingly in "live" surroundings.

For the home, draw curtains are probably the most economic means for providing a change in the reverberation period of a music room. Caution is directed towards placing such materials — excepting perhaps the most sound-transparent silk—in front of loudspeakers, in view of the resulting large phase differences at the high frequencies during reproduction. Also, drapes should be hung at a distance from a hard wall, and furled, for effective and more uniform sound absorption. In the case of recording studios, of course, far more elaborate means are employed to achieve variable acoustics.

For a room with fixed absorption, reverberation may be increased for music reproduction by employing some kind of electronic or electro-mechanical reverberator — Hammond Organ Company coil-springs, Gotham Audio Corp. EMT steel plate, Universal Audio, Inc. electrostatic reverberator, Fisher Radio Corporation "SpaceXpander," tape

delay units, and so on. These devices can add a significant quality to a rendition, often to otherwise inferior recordings, and should be viewed in the same light as other electronic control devices (equalizers, loudness adjusters, noise suppressors, and the like). To that extent one might even speak of "active home acoustics" in place of "passive home acoustics"—in similarity to terms coined by Dr. H. F. Olson for electronically reinforced sound compared to non-reinforced reproduction.

The preferred acoustic material in small rooms is often one of individual preference, although many acoustical engineers, the writer included, prefer some wood paneling. The preference is often ascribed to a more adequate low-frequency absorption, although this could be achieved by vases and other resonators as well. It is this writer's opinion that panels make for surface radiators, enveloping the listeners in the warmth of low frequencies, while effectively reflecting the high notes generally absorbed by curtains and carpets. Æ



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## AES CONVENTION PAPERS (Continued)

**Tuesday, October 22:**

### (9:30 a.m.) DISC RECORDING

**Chairman:** John J. Bubbers, Pickering & Company

**D1 The operation of the recording laboratory in the Library of Congress**

Robert B. Carneal, Recording Laboratory, Library of Congress

**D2 A complete solid-state tape to disc transfer system**

Stephen F. Temmer, Gotham Audio Corporation

**D3 High-density disc recording systems**

Leo M. Levens, American Foundation for the Blind

**D4 Stereo recordings—monaural playback—their compatibility**

I. J. Sobel and Ronald Kneubel, The Astatic Corporation

**D5 Stereo/mono disc compatibility: A survey of the problems**

John M. Eargle, RCA Record Division

**(1:30 p.m.)**

### MAGNETIC RECORDING

**Chairman:** John G. McKnight, Ampex Corporation

**E1 New compact 16-track, 2-inch recorder/reproducer**

C. Dale Manquen, Mincom Division, 3M Company

**E2 On the design of reliable miniature recorders**

Edward J. Foster and Patrick Murphy, CBS Laboratories

**E3 A user-oriented high speed duplicating system**

James B. Wood, General Recorded Tape, Inc.

**E4 Subjective quality of the nth generation tape copy**

Keith O. Johnson, Gauss Electrophysics

**E5 The development of long-wearing magnetic heads**

F. A. Oliver, Arvin Magnetics, Arvin Industries

**E6 Magnetic tape testing and interpretation**

Klaus E. Naumann, BASF-Computron, Inc.

**E7 Magnetic recording tape: The influence of the magnetic coating thickness upon signal parameters**

William A. Manly, Jr., Ampex Corporation

### (7:15 p.m.) AUDIO IN MEDICAL PRACTICE & RESEARCH

**Chairman:** Philip Kantrowitz, Sonotone Corporation

**F1 "Symbiotic" R-wave monitor**

Thomas W. Argy and William Greenbaum, Zenith Radio Corporation

**F2 Phases in the development of an intracranial pressure transducer**

Lauchlan McKay, Long Island City College

**F3 Some promising new techniques in hearing research**

Edmund M. Glaser, Dept. of Physiology, University of Maryland School of Medicine

**F4 Amplifying and processing myo-electric signals for use in man-made machines**

Dudley S. Childress, Northwestern University

**F5 Sonic removal of cataracts**

Charles D. Kelman, M.D., Manhattan Eye, Ear, and Throat

**F6 Cardiac pacing for rate and rhythm control**

Seymour Furman, M.D., Montefiore Hospital and Medical Center, Bronx, New York

**F7 Feasibility of automated analysis of the phonocardiogram**

John E. Jacobs, M.D., Kazuo Horikoshi, M.D., and Mathew A. Petrovick, M.D., Northwestern University, Bio-Medical Engineering Center, Technological Institute, Evanston, Illinois

**F8 Heart sound analysis in the diagnosis of heart disease**

Abner Delman, M.D., Dept. of Phonocardiography, Montefiore Hospital, Bronx, New York

### (7:30 p.m.) FROM STUDIO TO MICROPHONE TO LISTENER

**Chairman:** Irving L. Joel

Capitol Records, New York, New York

**G1 Practical acoustics**

Victor Brociner, Assistant to the President, H. H. Scott, Inc., Maynard, Massachusetts

**G2 Selection and placement of microphones within the environment**

L. R. Burroughs, Vice President, Electro-Voice, Inc., Buchanan, Michigan

**G3 Electronic signal processing**

John M. Eargle, Manager, Recording-Quality Control, RCA Record Division, New York, New York

## SESSION H

**Wednesday, October 23:**

### (9:30 a.m.) AUDIO APPARATUS & COMMUNICATIONS SYSTEMS

**Chairman:** L. Glen Whipple

Federal Communications Commission

**H1 A specialized audio control console**  
James Cunningham and Bruce Sweiden, 8 Track Recording Company, Chicago, Illinois

**H2 The sophisticated speaker?**

David J. Barnett, Elite Electronics, Inc., Plainview, New York

**H3 On the measurement and evaluation of loudspeakers**

Amar G. Bose, Mass. Inst. of Tech.

**H4 The development of the simulated live-vs-recorded test into a design tool**

John R. Kissinger, Jensen Manufacturing Division, The Muter Co.

**H5 The real world of headphone performance**

Abraham B. Cohen, Telephonics, Division of Instrument Systems Corporation

**H6 Distortion-Measurement Interpretation**

R. W. Peters and M. D. Burkhard, Industrial Research Products, Inc.

**H7 Trans-World broadcast and recording center**

Warren L. Braun, Warren L. Braun Consulting Engineers

### (1:30 p.m.) The C. J. LeBel Memorial Symposium

**Commemorative remarks**

C. G. McProud, AUDIO Magazine

**(2:00 p.m.) AUDIO—1988**

**Moderator:** Dr. Frederick V. Hunt, Harvard University

**I1 Electronic music**

Dr. Daniel W. Martin, D. H. Baldwin Co.

**I2 Home Entertainment**

Dr. Harry F. Olson, RCA Laboratories

**I3 Communications**

Dr. J. R. Pierce, Bell Telephone Laboratories

**I4 Sound Reinforcement**

Dr. C. P. Boner, Professor of Physics and Architecture, University of Texas

**(6:00 p.m.) Social Hour**

**(7:00 p.m.) Annual Banquet**

**Thursday, October 24:**

**(9:00 a.m.) AUDIO ABROAD—I**

**Chairman:** J. L. Ooms, Philips' Phonographic Industries

**J1 Extraction of pitch of speech by means of a phase-locked tracking filter**

Giuseppe Righini, Istituto Elettrotecnico Nazionale "Galileo Ferraris," Turin, Italy

**J2 Historical development of magnetic tapes from the point of view of the Preissach diagram**

Jiri Struska, Research Institute of Sound and Picture, Prague

**J3 An electronic piano**

P. R. Dijksterhuis and T. Verhey, N. V. Philips Gloeilampenfabrieken, Eindhoven

(Continued on page 90)



## Now, what's the best way to play your records for under \$80?

For years the AR turntable, at \$78\* has been the only truly fine record playing mechanism you could buy for under \$80.

A well informed audiophile, who wanted to save some money on his complete stereo system, bought the AR turntable. Period.

But now, if you're out to make an informed choice of a low cost turntable, you'll have to take one other product into consideration.

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Just like the AR, the Dual 1212 exceeds every NAB standard for broadcast turntables in rumble, wow, flutter and speed accuracy.

But only the Dual lets you vary any of its speeds by 6%. That'll come in handy if you're pitch-sensitive.

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But so that your cartridge will ride in the center of a stereo groove at low tracking forces, the Dual has built-in anti-skating compensation. (The AR has no equivalent device.)

And to protect your cartridge, the Dual has a cueing control that gently lowers the arm anywhere on your record. It also lets you conveniently interrupt play for a time, and then continue in the same place. (Again, no AR equivalent.)

The Dual is automatic. It can start or stop automatically. With one record or a stack of six. (The tracking

force of the Dual arm won't vary from first record to last.) And even when you place its arm on a record by hand, the Dual will start turning automatically.

The AR is a manual turntable with no automatic features.

Your records will probably sound exactly the same played on whichever of the two turntables you choose.

So go to your dealer and see them both. And then decide which way you want to play records.

With a host of Dual convenience features, for \$74.50.

Or without them, for \$78.

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\*Including base and dust cover. \*\*Base and dust cover are extra.

## AES CONVENTION PAPERS (Continued)

### J4 Sound reinforcement for banqueting halls, ballrooms, and conference rooms

G. E. Horn, P. G. Tandy, and Percy Wilson, Percy Wilson and Partners, Oxford, U. K.

### J5 Thin bilaminar piezodisks used as microphone and telephone membranes

J. Roos and J. Koorneef, Philips Research Laboratories, Eindhoven

### J6 Horn loudspeaker with an electrostatically driven diaphragm

Josef Merhaut, Technical University of Prague

### J7 A high fidelity large-output sound reproducing system

T. Itow, Waseda University, Elec. Comm. Dept., Tokyo

### J8 Simulator-Model computer for electromechanical analogies

Bernhard Weingartner, Akustische u. Kino-Geräte GmbH., Vienna

## (1:30: p.m.) AUDIO ABROAD—II

Chairman: Percy Wilson, Percy Wilson and Partners

### K1 A new method for subjective rating of loudspeakers

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

### K2 Trackability test by complex tones and biasing force effects of phonograph pickups

A. Hayashi, M. Kobayashi, and M. Kuriyagawa, Central Research Laboratory, Tokyo Shibaura Electric Co., Tokyo

### K3 Measuring gramophone pickup performance

John Walton, Rainer-Walton Enterprises, London

### K4 Synchronous TV sound recording

Michel Calmet, Office de Radiodiffusion-Télévision Française, Paris

### K5 A new concept of a capstan drive system for professional and home tape recorders

Arturo E. Stosberg, Pa. Willi Studer, Regensdorf, Switzerland

### K6 An estimation of annoyance caused by dropouts in magnetically recorded music

B. L. Cardozo and G. Domburg, Institute for Perception Research, Eindhoven

### K7 Audio control facilities in modern recording studios

A. Balster, Philips' Phonographic Industries, Baarn, The Netherlands

### K8 Monitoring standardization for multi-track recording systems

Sylvio M. Rabello, Discos CBS S.A., Indústria e Comércio, Rio de Janeiro

### K9 The loudness balance of audio broadcast programs

Ernst Belger, Institut für Rundfunktechnik GmbH, Hamburg

### K10 A new approach to dynamic range compression for audio systems

Barry Blesser and K. O. Bäder, Electro-messtechnik Wilhelm Franz KG, Lahr, Germany

## (7:30 p.m.) DEVELOPMENTS IN ELECTRONIC MUSIC SYSTEMS

Chairman: Earle L. Kent, C. G. Conn, Ltd.

### L1 The application of digital integrated circuits in an electronic rhythm generator

William V. Machanian and Peter E. Maher, The Wurlitzer Company

### L2 The evolution of an electronic snare drum

James S. Southard, C. G. Conn, Ltd.

### L3 Description of a real-time, multiparallel waveform analyzer-synthesizer

David A. Luce, Melville Clark Associates

### L4 Recent trends in electronic music studio design

R. A. Moog, R. A. Moog, Inc.

### L5 An electronic music learning system

Victor J. Blong, C. G. Conn, Ltd.

## THE SOUND OF '69

(Continued from page 32)

solid-state recorder with electronically controlled capstan speed. This model, priced at \$499.00, is profiled in this issue.

The three-speed *Tandberg Model 64X* incorporates a hysteresis-synchronous motor, automatic tape stop, horizontal or vertical mounting capability, and separate record and play amplifiers so as to permit monitoring from the tape during recording. An FM-MX filter permits recording from stereo broadcasts without interference from the pilot signal or any of its harmonics. The 64X is priced at \$549.00, either 1/4 or 1/2 track.

TEAC is one of the relative newcomers to the U. S. hi-fi market, but their line of recorders is familiar to servicemen from their purchases in the Orient. Of their long line, they are featuring the A-4010S, two-speed model with three motors—a two-speed hysteresis-synchronous motor for capstan drive, and eddy-current motors for reel drive.

The machine has automatic reverse for as much as four hours of continuous music from a single reel of tape, is entirely solid-state, and uses a 100-kHz bias. It incorporates separate line and mic input controls for mixing while recording, and easily readable VU meters. The machine is priced at \$469.30.

The new Viking 433 recorder employs three motors, three heads, and an 8-position master switch which lets you select mono, stereo, record, playback, and sound-on-sound modes. You can also monitor from tape while recording, thus enabling comparison with the source material. Operating at three speeds, the 433 can be mounted horizontally or vertically. The price, \$389.92, with wood base; \$20.00 less without the base; remote pause control is available for \$25.00.

### Speaker Systems

There's more churning going on in the "speaker system" product category than among any other component

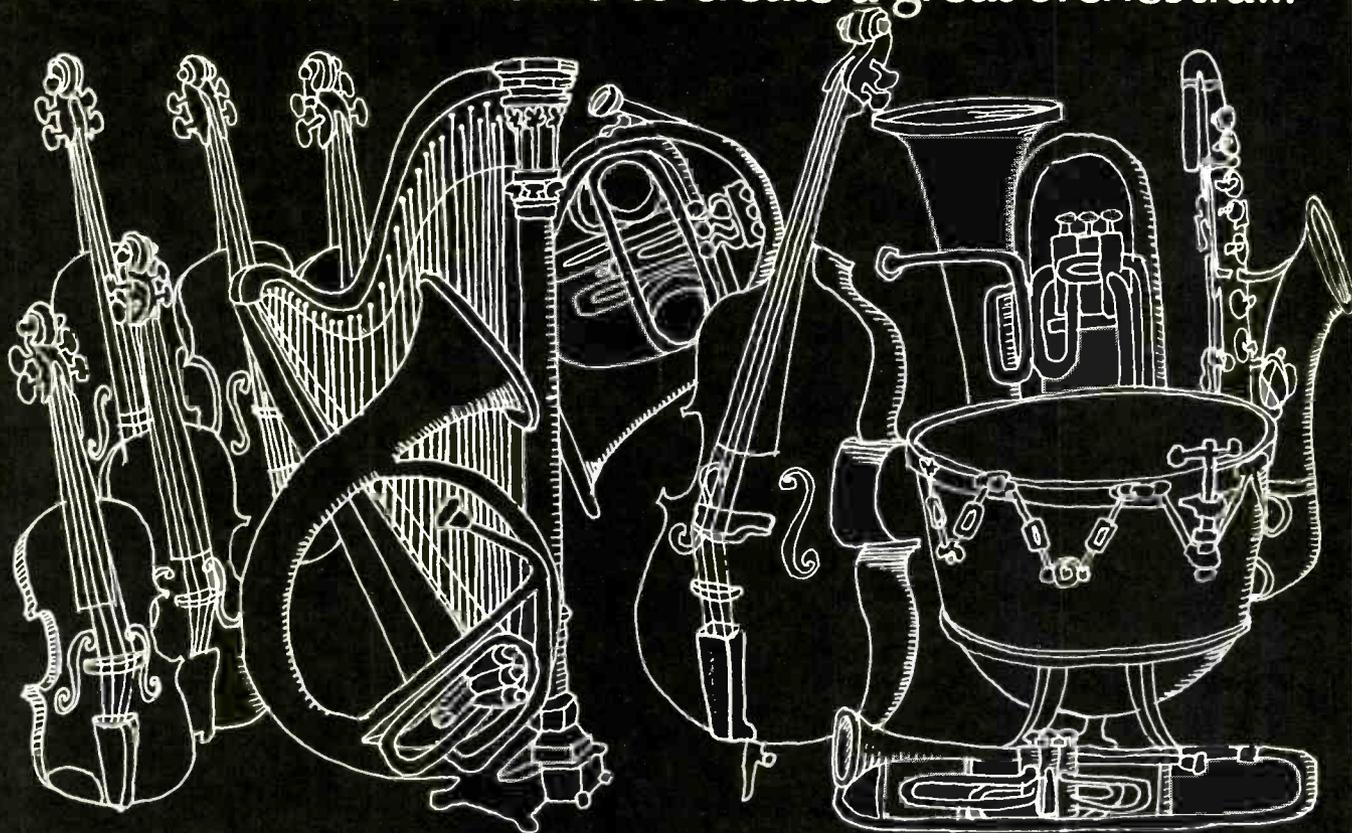
group. At the show, for example, will be new speaker system models, previously introduced models, models atop models from manufacturers who are giants in the speaker business, one or two models each from many companies who are spinning off speakers from other product lines, and so on.

For sure, there will be over 100 speaker system models paraded by manufacturers. All of them will not be "working" models, of course, but you can bet that a substantial percentage of them will be pushing air at some moment. And don't forget about the non-speaker manufacturers who use speaker systems to demonstrate their products, be they cartridges, record players, etc. Accordingly, you may be sure that a library atmosphere will not prevail at the show.

*Acoustic Research* promises to reveal its new AR-5 speaker system for the first time. The bookshelf speaker will feature a new 10" woofer (first since 1956), plus essentially the same mid- and high-frequency elements as in the

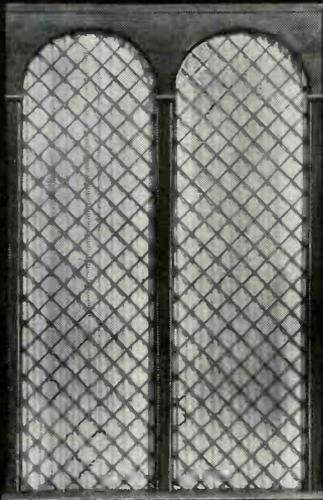
AR-3a. Thus, it appears that the speaker system will fall somewhere between the AR2a and the AR-3a in performance. Price is expected to be \$175.00, going down to \$150.00 for an unfinished cabinet version. ■ *Altec Lansing* will introduce a wide assortment of new speaker systems. These will include four new furniture commode speaker systems that are designed to serve double duty as end tables or occasional pieces. Two are constructed of Mediterranean oak with decorative grillework (one is a square-shaped commode; the other hexagonal). A matching two-section and three-section equipment cabinet will also be available separately. The two other commodes follow the same concept, except that they feature a contemporary, oiled-walnut design. Both styles use the *Altec* 601C 12", coaxial speaker that includes a two-section dividing network. Also to be entered by *Altec* at the show will be more conventional-looking speaker systems, including a bookshelf-sized two-way speaker system, the "Corona" Model

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893A, at under \$90.00, and the "Magnificent" Model A7-500W-II floor-standing speaker that houses the A7-500 "The Voice of the Theatre"® speaker system which features a 15" woofer. ■ *Bozak* will display its full line of speakers, both bookshelf and floor models, as well as matching equipment cabinets, all in a variety of stylings. The *Bozak* B-310/410 (the Concert Grand Series) speaker system will be available in a Moorish enclosure. ■ *Bose* exhibits here for the first time with the Model 901 speaker system that utilizes direct and reflected sound. (Priced at \$476 for two speaker systems and solid-state equalizer.) ■ At least three new *EMI* speaker systems will be shown in Benjamin Sound's exhibit room. The *EMI* Model 55, the most compact bookshelf speaker system in the line, is a two-way speaker system that employs a new elliptical woofer (10" x 6 $\frac{5}{8}$ ") and a 3 $\frac{3}{8}$ " tweeter, with an L/C crossover network. The 18" x 10 $\frac{1}{4}$ " x 7 $\frac{1}{2}$ " system lists for \$54.95. At the other end of the size spectrum is the largest bookshelf speaker designed by *EMI*, the \$225.00, three-speaker Model 205, with separate switch controls for tweeter and mid-range. Size is 24 $\frac{3}{4}$ " x 14 $\frac{1}{4}$ " x 13 $\frac{3}{4}$ ". In addition, two models of a floor-standing speaker system, with a 15" woofer, 7" x 10" mid-range, and two compression-type tweeters will be shown. About \$350.00. ■ *Electro-Voice's* imposing line of speakers and speaker systems will no doubt be led by its massive Patrician 800, that \$1095.00 unit with a 30" woofer. The company will add a new bookshelf speaker to its line, the E-V Four A. This system, measuring 14" x 15" x 13", is designed with a 12" woofer, 6" mid-range, and 2 $\frac{1}{2}$ " tweeter. According to E-V, design was aided by a computer.

■ *Elite* will make its bow (to the public, that is) at this show with its line of *Goodmans* speaker systems and speaker mechanisms. Old Timers will surely recall this brand of British speakers,

which, at the show, will lead with the extremely compact "Maxim" speaker system. The 10 $\frac{1}{2}$ " x 7 $\frac{1}{4}$ " x 5 $\frac{1}{2}$ " system, priced at \$59.95, features a 4" woofer and a 3 $\frac{1}{2}$ " tweeter. ■ *Empire* will focus on its marble-topped Model 7000M, a \$209.95 three-way system that features a 12-in., high-compliance woofer, a 4" direct radiator for mid-range, and a domed tweeter. The latter two speakers are coupled to wide-angle acoustic lenses. There's a three-position treble control switch, while a "Dynamic Reflex Stop System" permits adjustment of bass-frequency response. Overall dimensions are: diameter, 19"; height, 26 $\frac{1}{2}$ ". The system is also available with a hand-rubbed walnut top as Model 7000. ■ *Fisher* will star its XP-15B Console, a three-way speaker system with a 15" bass speaker, 8" mid-range speaker, 1 $\frac{1}{2}$ " soft-dome treble speaker. The \$269.95 system measures 27" x 27" x 14 $\frac{3}{4}$ " deep. ■ *Hartley's* \$730.00 Model V-a Concertmaster features a 24" woofer, 10" mid-range, 7" tweeter. Crossover points are at 300 Hz and 3000 Hz. "Smaller" Concertmasters will also be demonstrated, utilizing 18" woofers. ■ *Harman-Kardon* will introduce its new HK50 "Omni-directional" speaker systems (see "compact music systems"), which face speakers upward rather than toward the listener. They are expected to sell for \$100.00. ■ *Jensen Manufacturing* plans to bow with three new bookshelf speaker systems, leading with the TF3B, a 4-speaker, 3-way system at \$122.00. A two-speaker system, the TF-25 (\$89.50), and *Jensen's* "Mini-Mite" two-speaker system (\$44.40) will also be introduced, in addition to showing of its other bookshelf and console systems. ■ A modestly sized bookshelf speaker system, the L75 "Minuet," will be in the limelight at *JBL's* exhibit. The system has a full-range LE8T loudspeaker and a matching passive radiator (to enhance bass response). Priced at \$108.00. ■ *KLH* will doubtlessly show its line of acoustic-suspension systems.

■ *Marantz* joins a long list of companies that have added speaker systems to its line of other components. The company will introduce its two "Imperial Speaker Systems," differing only in enclosure styles. (The Imperial I has a walnut cabinet with hand-rubbed French lacquer finish; the Imperial II features a distressed antique finish. Prices are \$299 and \$369, respectively.) The floor-standing systems are three-way designs with five speakers headed by a 12-in. woofer which crosses over at 700 Hz to a pair of mid-range drivers, crossing again at 6000 Hz to two high-frequency units. ■ *JVC Nivico*, an old-timer in the electronic home entertainment field, but a newcomer to the component field here, will show its imaginative non-directional speaker system, the round-ball-styled Model 5303. It can hang from the ceiling by a link chain or perch on a pedestal. Four woofers and four horn-type tweeters are used in a hermetically-sealed metal enclosure, with a crossover at 5000 Hz. Lists for \$199.95. ■ *Rectilinear* will feature its \$279.00 Model III 4-way speaker system. ■ *H. H. Scott* will show, among other speaker systems, its Model S-15. The 3-speaker system, which employs an air suspension-type enclosure, is priced at \$119.95. Measures 23 $\frac{1}{2}$ " x 11 $\frac{3}{4}$ " x 9" deep. ■ *Sony Corp. of America* will exhibit a line of bookshelf and console speaker systems. The line includes the \$229.50 Model 3100, a relatively compact system with three speakers, including a 12" woofer. This is a high-efficiency type system, using a bass reflex enclosure design. ■ *Pioneer* plans to debut its CS-5 2-way bookshelf speaker system, a \$59.00 air-suspension type, along with other speaker systems. ■ *Tannoy's* \$440.00, rear-horn-loaded Model "GRF Windsor" floor-standing speaker system features the company's 15" concentric loudspeaker. The 41" H x 18 $\frac{1}{2}$ " D x 25 $\frac{1}{8}$ " W enclosure is said to provide effective horn loading down to 35 Hz. Efficiency is 8%, which is quite high. ■

*Utah* will show its line of speaker systems, which includes furniture-styled floor-standing units. ■ The *Wharfedale* Model W60D from British Industries utilizes a new "super" tweeter for 1968-1969. The three-speaker system's new tweeter has an added "diffuser" to further enhance the upper treble range's response and dispersion. In addition to the new tweeter, the system contains a 12 $\frac{1}{2}$ " woofer with a 9 $\frac{1}{2}$  lb. magnet assembly, and an acoustically isolated 5" mid-range speaker. The sand-filled (to make the cabinet inert), oiled-walnut cabinet features a removable front grille to make decorative changes. Used as a bookshelf speaker or a small console when fitted with matching legs, the W60D Achromatic speaker system is priced at \$147.00. ■ *Yamaha* will debut its compact systems, with elliptical speakers, at the N. Y. show.

In addition to the foregoing companies, all of which employ moving-coil speakers, three companies at the show are expected to display electrostatic speakers: *Koss* its *Acoustech X*, *KLH* its Model Nine, *JansZen* its combination electrostatic tweeter and moving-coil woofer.

Also expected to show some speaker system models are *Bogen*, *IMF* (acoustic labyrinth systems), *Sansui*, *Sherwood*, *Tandberg*, *TEAC*, and *Viking* (combination speaker/amplifier), among others.

## Systems, Headphones, etc.

The popular compact music systems will be very much at the center of things. For example, *Benjamin Electronic Sound Corp.* is featuring its Model 1020 "International Portable," which consists of a Miracord 620B automatic turntable, a 32-watt stereo amplifier, and a pair of small, two-way *EMI* speakers. This model, the lowest priced in the line, is combined in a luggage-type case, and retails for \$229.50. A similar compact with an FM stereo tuner is priced at \$299.50.

*Fisher* will show the Model 125 AM/FM-Stereo phono-



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# NEW

## Computer Logic Control Pro 800 Transport

In the league of nimble-fingered tape-handlers there exists a recurrent problem. It has been demonstrated time and again that anyone can ruin a valuable tape by absentmindedly outsmarting the interlock system of an otherwise safe tape recorder.

In answer to this problem and similar problems arising in automated and remote control applications, the *CROWN Pro 800* was designed. This recorder has a computer logic system using IC's which prohibit all such destructive operations.

The CROWN computer stores the last command given it in its memory (forgetting all previous commands) and by a continuous knowledge of the operating state of the machine (motion and direction), it takes all the necessary measures and executes the command. This is all done *without* time-wasting delay mechanisms.

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graph music center. Using a BSR turntable and a 20 watt/channel amplifier, this system is compact, with two matching speakers in walnut-finished cabinets. Retail at \$329.95. A similar unit, Model 120, is FM-stereo only, at \$299.95.

Harman-Kardon's SC-2350 is an AM/FM stereo compact with a pair of newly designed omnidirectional speakers, the latter, model HK-50, being available separately for \$100.00. These enclosures are finished on four sides so they may be used any place in the room. This model, with speakers, is priced at \$440.00.

As its entry in the compact sweepstakes, Nivico combines an AM/FM-stereo receiver (10 watts/channel) with an 8-track stereo cartridge player and a pair of matching speakers. Price, \$179.95.

Pioneer's Model IS-31 incorporates a semi-automatic turntable with an AM/FM-stereo tuner and a preamplifier which may be used with a basic power amplifier and a pair of speakers, or with Pioneer's IS-80 amplifier/speakers. The IS-31 music programmer is priced at \$395.00, and includes a plastic cover slip-hinged to the unit's case.

H. H. Scott's new "Scottie" AM/FM-stereo system is ideal for the boating or camping enthusiast who often wants to take his music along. The unit operates from either 117-V. a.c. or from a 12-V. battery, and is equipped with specially designed speakers to complement the system. It is priced at \$199.95, and is available in either walnut or teak finishes.

There will be a plenitude of stereo headphones at the show. David Clark Company is introducing its new Clark/300 stereo headset (\$19.00). The transducers are permanent magnetic, and claim a frequency range of 20 to 17,000 Hz. They have a nominal impedance of 8 ohms, and a maximum input of 1 watt per phone.

Koss is first with an electrostatic model, ESP-6, which is complete with a fitted portable carrying case and an individually measured response curve. The diaphragms are self-energized, and it is claimed that the headset provides a frequency response not obtainable by conventional dynamic phones. Price, \$95.00.

Superex' ST-PRO B head-

phones utilize the two-way principle, with a dynamic woofer and a ceramic tweeter to provide a wide-range response. This model is priced at \$50.00, and may be had in a variety of impedances—600, 2000, 15,000, and 15,000 ohms—at an additional cost of \$5.00. They will also show their Model ST-C—a single-element system priced at \$19.95, or in high impedance (10,000 ohms) at \$24.95.

Telex will show the Encore stereophones at the modest price of \$9.95. These phones have a range of 50 to 18,000 Hz, and are light in weight. The housings are of Cyclocac plastic, and they are equipped with removable foam-filled vinyl cushions and an 8-ft. cord.

Elpa Marketing is showing its wide range of record and tape accessories, which includes the manual model of Cecil Watts' Parastat, \$15.00, and its related Preener, (\$3.50), both designed to remove dust, grit, and residue from record grooves, as well as the original "Dust Bug," which removes dust and static as the record plays. Among the tape accessories are the EDITall tape editing and

splicing system which includes the EDITall splicing block, splicing tabs, a demagnetized razor blade, and an instruction book. The complete kit is priced at \$3.50, and EDITabs are available separately at \$1.50 for 50 tabs.

The EICO "Cortina" 3440 solid-state color organ is an item which will attract many a viewer. It employs three bands, each of which may be at the user's choice of colors, and the coloration is completely controllable, while intensity of illumination is a function of the signal strength in each band. Furnished in kit form for 3-hour construction at \$49.95, or factory-wired at \$79.95.

The Toujay "Sound-X-Pander" consoles are designed to accommodate a receiver and a phono turntable, as well as a number of records, and in addition, a pair of speaker enclosures can be accommodated in a way which permits them to be directed so as to converge or expand the sound. These cabinets are made of selected oak, and are available in Classic, Spanish-Mediterranean, or Italian-Provincial styles. The model shown is priced at \$799.00.

# AUDIO MUSIC REVIEW

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Jazz .....	108
Recorded Tapes .....	112

## Classical Record Reviews

EDWARD TATNALL CANBY

### Mozart

Mozart: The Fifteen Sonatas for Violin and Piano, Vol. 1. (K. 296, 301, 302, 304, 305, 306, 377, 380). Joseph Szigeti; Mieczyslaw Horszowski, Georg. Vanguard Everyman SRV 262/3/4 SD stereo (\$7.50)

Here's a novel addition to the low-priced Everyman series, which normally reissues the superbly recorded earlier Vanguard releases, abetted by some items that are brand new and previously unheard. This album reissues recordings made originally by Columbia records, who turned Szigeti out to pasture quite some time ago.

Szigeti was no second-rate fiddler. In

his prime he was one of the top violinists of the world, though of a more serious and exacting nature than fiddlers such as Kreisler or even the flamboyant Heifetz. He was superb in such then-difficult music as Prokofiev or Bartók, and did the more stringent violin classics with glittering perfection. Alas, a turning point came when a curious waver, like a slow palsy, crept into his violin tone. Though he kept on playing, and played well, the Szigeti sound was never quite the same again.

In these recordings, that waver is just barely evident, and is not much of an impediment to some very good Mozart, with the aid of another first-rate old-timers, Horszowski. (Two late sonatas in Vol. 2 are played by George Szell at the piano.) At the Everyman price, the album is a good bargain. The "re-channeled" electronic stereo is circumspect and helpful with a minimum of added distortion.

Performances: B      Sound: B-

(Continued on page 96)

# AUDIO's Guide to the 1968 N. Y. HIGH FIDELITY MUSIC SHOW

PLACE: Statler Hilton Hotel (33rd St. and Seventh Ave., N. Y. C.)

### TIMETABLE:

September 19 (Thursday)	4:00 p.m. to 10:30 p.m.
September 20 (Friday)	4:00 p.m. to 10:30 p.m.
September 21 (Saturday)	1:00 p.m. to 10:30 p.m.
September 22 (Sunday)	1:00 p.m. to 9:00 p.m.

### LIST OF EXHIBITORS

EXHIBITOR	ROOM	EXHIBITOR	ROOM
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BSR (USA) Limited	271	Rectilinear Research Corp.	274
David Clark Co., Inc.	206	Sansui Electronics	287
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Craig	309A	Seeburg Corporation	293
Crown Int'l	312A, 314A	Sharpe Instruments	226
Dynaco, Inc.	259	Sherwood Elect. Labs	310A
EICO	227	Shure Brothers, Inc.	313A
Electro-Voice, Inc.	239, 240	Sony Corp. of America	343, 345
Elpa Marketing Industries	254, 258	Stanton Magnetics, Inc.	364
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Fisher Radio Corp.	244, 248	Superscope, Inc.	232, 235, 236
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## SEMINAR SCHEDULE

### THURSDAY, SEPT. 19

6:30-7:30 P.M. — Novice Symposium, "Introduction to Hi-Fi Components"

7:45-8:45 P.M.—"Changers, Turntables & Cartridges"

### FRIDAY, SEPT. 20

6:30-7:30 P.M. — Novice Symposium (same as above)

7:45-8:45 P.M.—"The Jazz & Classical Recording Scenes"

### SATURDAY, SEPT. 21

2:00-3:00 P.M. — "Tape & Tape Recorders"

3:15-4:15 P.M. — "Stereo & The Listener"

6:30-7:30 P.M. — Novice Symposium (same as above)

7:45-8:45 P.M.—"The Listening Faculty"

### SUNDAY, SEPT. 22

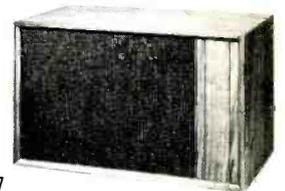
1:30-2:30 P.M. — "Speakers & Amplifiers"

2:45-3:45 P.M. — Novice Symposium (same as above)

**ATTENTION WEST COASTERS!**  
**THE 1968 SAN FRANCISCO HIGH FIDELITY MUSIC SHOW TIMETABLE**  
Civic Auditorium, 99 Grove St., San Francisco, Calif.

October 31 (Thursday)	4:00 p.m. to 10:30 p.m.
November 1 (Friday)	4:00 p.m. to 10:30 p.m.
November 2 (Saturday)	1:00 p.m. to 10:30 p.m.
November 3 (Sunday)	1:00 p.m. to 9:00 p.m.

## ADDENDA TO AUDIO'S ANNUAL PRODUCT DIRECTORY (August 1968)



Maximus 7

MANUFACTURER (Circled numbers indicate adv. page)	WOOFER				MID-RANGE			TWEETER		Enclosure Dimensions W x D x H, In.	Wood Finish	Grille Material Color	Overall Freq. Response, Hz.	Crossover Freqs., kHz	Impedance, Ohms	Weight, Lbs.	Price	SPECIAL FEATURES
	Model	Diameter, In.	Resonance, Hz.	Cone Material	Diameter, In.	Diaphragm Material	Type	Diameter, In.	Diaphragm Material									
AXIMUS UTC Sound Div. TRW, Inc.)	7	12	26	Vinyl Paper	3 1/2	Paper	Cone	Horn	—	24 x 14 x 12	Oil Wal.	Cloth Seran	25-35k	1 8	8	58	\$189.00	Controls up front behind Velcro-removable grilles.
	5	12	28	Vinyl Paper	5	Paper	Cone	Lens	—	24 x 14 x 12	Oil Wal.	Cloth Seran	25-25k	1 5	8	52	129.00	Same as above.
	55	12	32	Paper	6	Paper	Cone	3 Cone	Paper	24 x 14 x 12	Oil Wal.	Cloth Seran	30-20k	2 5	5	39	99.50	Same as above.
	33	8	32	Paper	—	—	—	3 Cone	Paper	18 x 11 x 9	Oil Wal.	Cloth Seran	35-18k	2	8	25	56.00	Same as above.



## Edison Cylinder Recordings on LP Disc

EDWARD TATNALL CANBY

Odyssey's recent LP, "The Fabulous Edison Cylinder" has stirred up an unusual amount of interest in a time when reissues of acoustic-era records are overwhelmingly profuse. Easy enough to understand. Virtually all the others are from elderly disc records. Here, we have the actual sound of the once-supreme cylinder, which is a rare sound indeed.

You can't play a cylinder on any turntable, professional or otherwise. You play it on the original machine—unless, perhaps, you're a mechanical genius with a rotary lathe (silent) in your basement workshop and you can figure a way to mount an overhead screw drive mechanism to carry an electrical pickup cartridge sidewise at the exact proper rate, keeping in step with the cylinder grooves. Nor are cylinders always compatible with each other—far from it. Even if the record fits a playing machine, the pitch of the screw drive may be wrong, either too coarse or too fine; in that case, the stylus simply ploughs its way through the sides of the grooves, making its own new ones. Not surprisingly, there aren't many undamaged cylinder records still around.

Odyssey's fabulous cylinders are a very special kind, the late Edison Amberola type, last of the breed and the best, designed to out-compete the more popular disc by sheer engineering virtuosity. The disc won, but the cylinder system, losing out, was forced into a remarkable perfection of design before it died. Odyssey's playback, of course, is an Edison Amberola phonograph, with the cylinder "lathe," permanent-stylus pickup (remember the crude disc-type "needles"?) and acoustic horn, all built in. But what most distinguishes the Odyssey recording is the sound, which is the actual sound of this phonograph in the act of playing. All they did was to stick a mike in front of it.

Now in terms of normal audio practice this might seem an outrageously amateurish procedure for an LP transfer. After all, not even the corniest tape beginner still takes down broadcasts and recordings by

holding his mike up to a loudspeaker. Yet in this case the procedure has its points. First, it neatly bypasses the business of mounting an electrical pickup on an Edison drive mechanism. Second, the resulting sound is excellent.

Keep in mind that there is no pickup "arm" as such in the cylinder playback system, only a sort of stump; nor does the stylus do the necessary moving of the head, following the grooves. The traveling carrier of the screw drive system does it. The mechanism is, of course, direct ancestor to our present disc-cutting machines, but there is a major difference; the cylinder stylus travels in grooves already present—it is a passive transducer, not a groove-creator. Quite a tricky mechanical set-up.

The screw drive is a kind of power steering. It takes on the heavier sidewise motion of the playing head but leaves enough slack (with enough accuracy) so that the stylus moves in effect only its own weight. Thus the groove walls are never broken down by sidewise drag. Well—hardly ever.

To mount an electrical pickup into such a system isn't exactly ultra-simple. Might be easier to try a good lightweight arm a couple of yards long (to approximate straight-line sidewise travel) and let the grooves do all the work.

Would electrical transfer have produced a superior sound for Odyssey's LP? I'm inclined to doubt it. Yes, the modern pickup is a wide-range transducer, etc., etc., and its transfer is at least 99.44 pure. It picks up everything—including all forms of unwanted noise, sometimes well over 100 per cent of that in the original recording. Thereby hangs a related experience on my part with Edison *disc* records (which also used vertical-cut grooving much like those on the cylinder).

For a recent broadcast I set about playing these discs electrically, in this case using a normal disc playback system. The conical 5-mil LP stylus fitted Edison's sharp, narrow grooves remarkably well (V grooves, presumably) and my adjustable-speed turntable could jack up 78 rpm to the 80 rpm required by the Edison discs. A stereo cartridge, of course, responds to both vertical and lateral groove modulation. So was I in business? Not quite. My cartridge had been wired for mono—the two

channels paralleled so that the vertical response cancelled out. Predictably, the Edisons produced an astonishing amount of loud hiss and no music whatsoever. Edison's groove is *really* vertical.

When I reversed one pair of leads, to cancel lateral response and leave the vertical, the records played out loud and clear, and the hiss went down to a smooth, creamy background, not at all unpleasant—until one cartridge lead came loose. Then the hiss suddenly increased to an overpowering level, though the music still played.

Explanation: with one channel inoperative, the other reproduced vertical *and* lateral. And Edison seems to have concentrated his noise in the lateral direction, keeping it remarkably low in the vertical plane where the message was. Clever of him. It dawned on me that a normal stereo playback would give this same result—all the noise in both vertical and lateral dimensions. Whereas the *original* playback machine reproduced only that in one dimension—and minus highs.

How many amateurs—how many pros—have tried playing the old acoustics, any type, on a normal stereo system only to be bombarded with excessive noise? Most of us would instantly blame the hi fi. Not necessarily true. Connect the stereo cartridge for one-dimensional response, canceling out the unwanted type, and the noise is often more than halved, as in my Edison discs. It should work with cylinders too, as well as with the old lateral-cut platters.

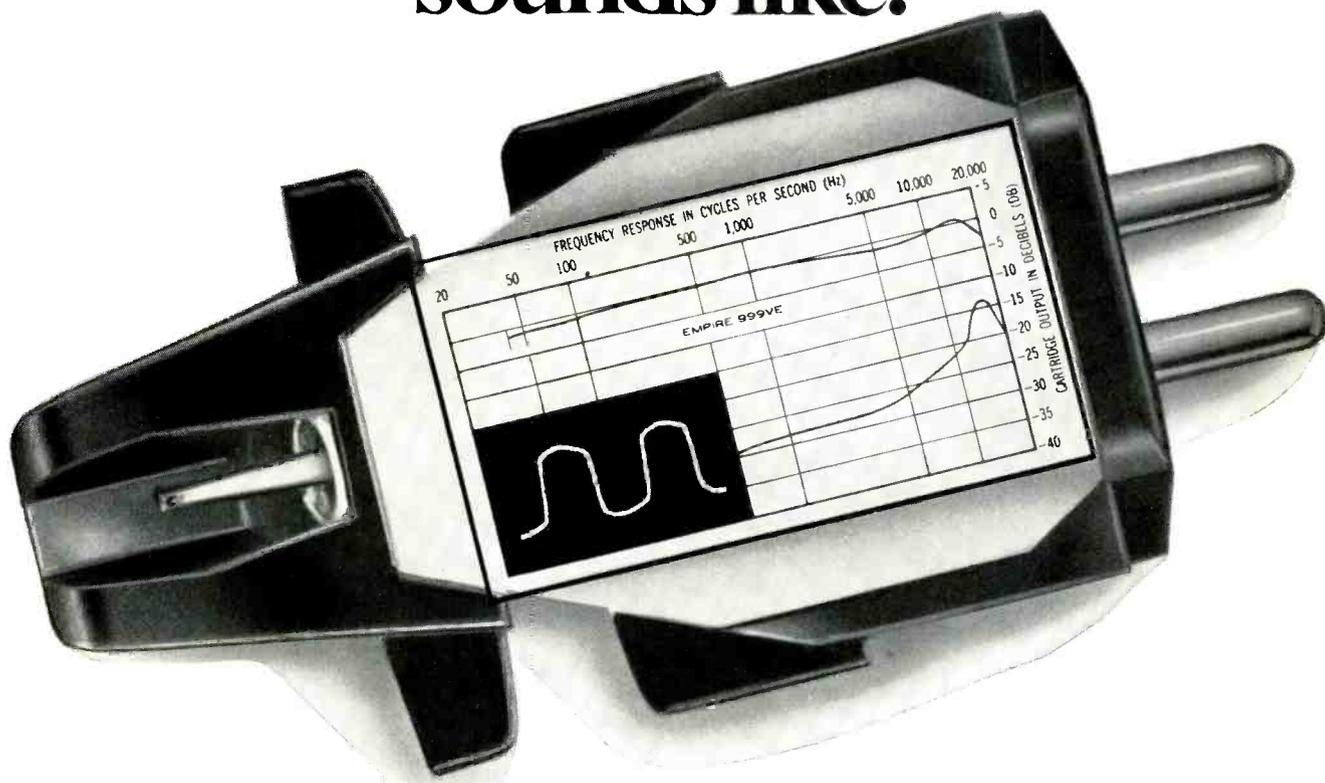
But, to return to my beginning, do not under-estimate the Edison Amberola's own reproducing system. In those fighting last days of cylinder recording it was a very sophisticated playback chain, precisely matched to the characteristics of the equally sophisticated Amberola cylinders themselves. No highs, no lows, and no spatial sense in the recording. But what sound there is definitely rates as clean.

I suspect that Odyssey's direct-mike pickup is as good as anything that could be done electrically. And think of the simplicity! If you are curious, try these Edison opera singers for size.

**The Fabulous Edison Cylinder.** Voices of Arral, Bonci, Bori, Constantino, Delna, Hempel, Slezak, and others, 1908-1922. Odyssey 32 16 0207.

(Continued on page 98)

# Since you don't buy a cartridge for looks, we'll show you what the #1 light-tracking cartridge sounds like.



This is the EMPIRE 999VE as *HiFi/Stereo Review* sees it.

This is also the #1 cartridge in lightweight tracking ability as *HiFi/Stereo Review* ranks them. Spectacular no matter how you look at it.

Frequency response, for instance.

*HiFi/Stereo Review* shows it on the 0 dB line of the chart. *High Fidelity* describes it as "a very smooth curve that remains, on the left channel, within +2.5, -1.5 dB, on the right channel, within +2.5, -2.0 dB from 20 to 20,000 Hz."

Or stereo separation.

On the chart above, the lower curve.

In *High Fidelity's* words: "Separation on either

channel reaches better than 30 dB at mid-frequencies, and remains better than 15dB from about 30 Hz up to 18,000 Hz."

Or that all-important tracking ability.

*HiFi/Stereo Review* tested and compared *all* of today's light-tracking cartridges before it rated the 999VE #1.

*High Fidelity* reported that "the 999VE required only 0.8-gram stylus force to track the demanding bands 6 & 7 of CBS test record STR-120 and the glide tone bands of STR-100."

Add it all up, and you reach an inescapable conclusion. The 999VE is the best all-around stereo cartridge you can buy.

And you don't even have to take our word for it.

## THE EMPIRE 999VE

The Long-Playing Cartridge

Empire Scientific Corp., 1055 Stewart Ave., Garden City, N.Y. 11530



## Classical Record Reviews (continued)

**Mozart: The Complete String Quintets** (K. 174, 406, 515, 516, 593, 614). The Heutling Quartet and Heinz-Otto Graf, viola.

Seraphim SIC 6028 (3) stereo (\$7.50)

The home of the string chamber music ensemble is greater Germany, including Austria, where Mozart lived, not to mention Schubert and Beethoven. Here is the quartet-plus-one form *par excellence* (a second viola) and the half-dozen works Mozart wrote for the expanded medium over a span of a good many years. All that the Mozart lover need ask is—is it good Mozart playing?

The answer, from a German quartet and its guest violist, is a clear yes. I sampled the later and more profound quintets, not having time for all three discs, and found them first rate in ensemble, in tasteful execution and in awareness of the depths which abound beneath the urbane Mozart exterior. As the engineers say, no problems.

Not many problems in the sound, either, which seems to be up to date. Merely because we are over here and do not know the names of and reputations of the German Quartet groups, this one comes to us in bargain pricing. Let's stay ignorant!

---

Performance: A                      Sound: B+

---

**The Art of Dennis Brain, Album 2.** (Mozart: Quintet in E Flat, K. 452; Berkeley: Trio for Violin, Horn, and Piano, Op. 44.) Seraphim 6003 mono (\$2.50)

Dennis Brain's grandfather played horn. His father, Aubrey Brain, was the finest hornist in England for many years. Dennis, who ran into a tree and killed himself in 1957, was already at 36 one of the world's greatest players on the same instrument. Two of his uncles also played it.

These recordings from the summer of 1953 show Dennis Brain, along with a group of ensemble players, at the top of his career, a horn wizard. For most of us, this simply means that the Brain horn *never* makes even a trace of a blooper—as most horns do, the instrument being notoriously fickle—and his articulation of notes and phrases sounds as though he had recorded at 45 and was being played back at 45. Sharp, clear, fantastically accurate.

The Mozart Horn Quintet is a favorite (along with the several Brahms works), comparable to the familiar horn concerti that were also recorded by Brain. Lennox Berkeley is one of those local composers who is eminent at home and unknown abroad—at least hereabouts. The quite brilliant music is

very much of the Thirties, the neo-classic school of middle Stravinsky, Copland et al. Not bad listening at all.

---

Performances: A—                      Sound: B—

---

### Haydn

**Haydn: Eleven Symphonies** (Nos. 82-92); *Sinfonia Concertante, Op. 94.* Orchestra of Naples, Denis Vaughan.

RCA Victor LSC 6805 (6) stereo

Odd how recordings are issued in shoals—music long neglected suddenly appears not in one, but in two or three versions. Who spied on whom? Probably just an accidental meeting of minds; the time and the sales situation were ripe.

The six "Paris" Symphonies of Haydn, included in this mammoth set, have thus appeared in four major recordings in something like a year, where previously they were mostly unknown. This version is top rank, perhaps in the over-all the most successful, though I still love the English recordings with Leslie Jones on Nonesuch, which are a bit warmer if no more musical. Unlike the other sets, this one carries on well beyond the "Paris" group through several other very-seldom-heard works and as far as the "Oxford," No. 92, the first of the famous well known late symphonies (which run on numerically through the last, the "London," No. 104). A splendid dividend here is the unusual *Sinfonia Concertante*, which stands interestingly beside the pair by Mozart from the same period.

If you like your Haydn schmalztier, and with a more conventional, larger-orchestra sound, turn to Columbia's "Paris" group with Bernstein—or to London's with the ever-solid Ansermet and his Suisse Romande (French Swiss) Orchestra. If the big sound isn't your *forte*, you'll find the low-cost Nonesuch album with Leslie Jones both more intimate and more authentic in its small-orchestra sound. (Small, that is, compared with a modern symphony orchestra.) The present album, by a crack group of Neapolitan players under an English conductor, lies nicely in between. It is intense, very accurate in the playing, somewhat on the cool side but impeccably, beautifully tailored and phrased throughout.

If Haydn is for you, the sheer size of the collection should not scare you away, nor the top "first line" price. You'll get your money's worth, in the long playing.

---

Performances: A—                      Sound: B—

---

**Michael Haydn: Mass S. Hieronymi** (1777). Andreas Hofer: *Te Deum.* Univ. of Missouri Collegium Musicum, Minor. (17", (1) 12" stereo (Univ. of Missouri Press, Columbia, Mo.)

Quite outside of the vast commercial recording field there is a large "underground" production of records made on a custom basis for limited sale. Nominally, these discs usually fare best among those directly involved, but many of them, this set included, are on public sale for those who want them. This curious pair of records, an LP plus an insert seven-inch stereo, show the virtues and faults of such enterprises.

The virtues are considerable—an important and very listenable Mass by the Salzburg Haydn, younger brother of the more famous Josef, done in a Salzburg style as of the 1770s—which means that for most ears today it sounds a lot like Mozart's church music (and somewhat less like the Masses of the older Haydn brother). The Mass in that time was at its most florid and operatic, with orchestra, solo singers and chorus. The small record contains an earlier work by another Salzburger, composed in the multi-chorus "colossal" style which developed in the 17th century at St. Peter's in Rome.

The faults in this recording are both musical and technical, those of a semi-professional student performance under an academic-minded conductor, the whole taken down by the local engineer with good sound quality but a relatively amateurish microphone technique, for a poor sonic balance between the musical elements and a very muddy texture.

Student performances of this sort are splendid in their place as part of the active musical life of a university, within an academic community, combining student and professional endeavor in one co-operative venture. But on records, the less accomplished solo performers—the students, perhaps?—tend to sound amateurish, and are out of place in the objectivity of a recording. And in this performance, moreover, there is a pounding lack of phrasing and a rigidity of tempo that comes near to ruining a good deal of the magic of such easy, graceful music. Definitely not up to professional *recorded* calibre.

As for the microphoning, old pros in the field know that in such music the elements, the chorus, orchestra, soloists, must be *very* carefully placed and balanced for any sort of real musical clarity in recorded terms. Here, the chorus is too far away, the orchestra too close (perhaps it is a "live" perfor-

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mance), and the solo singers are poorly defined and off-mike. Probably it could not be helped, but that, alas, is not our concern. If you make a record for publication, you must make it right.

These hopefully constructive remarks shouldn't deter those who would like to hear two very unusual pieces, not audible elsewhere at all.

---

*Performances:* C+      *Sound:* C+

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**Haydn: Two Violin Concertos (No. 1 in C, No. 4 in G).** Herman Krebbers; Amsterdam Chamber Orch., Andre Rieu.

Crossroads 22 16 0206 stereo (\$2.50)

First-rate performances of these two early Haydn concertos — it would be hard to imagine a more attractive presentation. But the recorded sound somehow picked up a bit scratchy distortion en route from Amsterdam to us. Don't worry too much about it; the music gets through.

The two works are much alike, in that easy, light hearted *galant* style popular in the years when Mozart was a small boy and old Handel was barely dead — these were composed in the 1760s. The soloist, Herman Krebbers, may carry an unknown name (hereabouts) but he is excellent, one of those violinists who play everything perfectly in tune, no matter how complicated the double-stops. His fiddle sings, his melodic lines are beautifully phrased and shaped. The orchestra is quite passionate, but never in the least out of style — just properly expressive, in music that the conductor and players obviously respect. That's the way it should be.

---

*Performance:* A—      *Sound:* C—

---

## Prokofiev/Godounov

**Prokofiev: Symphony No. 6 in E Flat Minor, Op. 111.** Moscow Radio Symphony Orch., Rozhdestvensky.

Melodiya Angel SR 40046 stereo (\$5.79)

In 1937 Prokofiev said (as quoted on this record jacket), "Today vast crowds of people have come face to face with serious music and are waiting with eager impatience. Composers take heed of this: if you repel these crowds they will turn away from you . . . But if you can hold them you will win an audience such as the world has never seen." That, remember, was long before the LP record had made its enormous amplification of the world audience.

The Sixth Symphony, written along with the popular Fifth at the end of World War II, seemed difficult at the

time; for us today it is merely somewhat heavier and sterner than other Prokofiev works, with an over-all darkish tone. It hardly sounds "modern"—just not old fashioned. And though stern, it is very easily listenable, as per the statement above. There is a lot, too, of that hard, driving orchestration that scares the daylights out of delighted Shostakovich audiences but Prokofiev has more to say, and he is much less long-winded in saying it.

The Russians have a way of bringing out the somber, heavy bass, the thumps and bumps of the Soviet styling, which beats other orchestras — they know their own product and how to put it over in sonic terms.

---

*Performance:* A—      *Sound:* B+

---

**Prokofiev: Symphony-Concerto for Cello and Orch. Respighi: Adagio con Variazioni for Cello and Orch.** Andre Navarra; Czech Philharmonic, Ancerl.

Crossroads 22 16 0200 stereo (\$2.50)

A big Prokofiev work here and a good one, filling up all but the end of side 2, which contains the short Respighi variations. First question in such music is, how does the cellist play (and how is he recorded)? So many of the big artists grunt and groan and play out of tune, according to the bravura style that went with the cello in the earlier part of our century. And so many cellists are recorded close-up, like musical elephants! Dreadful sound if you aren't a cello specialist.

Not here. Rest assured, this cellist is tastefully miked to blend with his orchestra, and you can listen to his music without pain—he plays every note in tune and turns out a beautifully delicate melodic line.

As for the Prokofiev music, the piece is a composite and a good one, composed originally in the thirties, then re-composed in 1951 as one of Prokofiev's last efforts before his death. It combines the taut content of the later period with the ease and lush melody of the earlier time. Note that the work is modelled after the 18th century *sinfonia concertante*, part symphony, part concerto. It even follows the prototype (notably Mozart) in its rather spread-out and leisurely shaping, long for a symphony, more relaxed than a true solo concerto.

As for the Respighi variations, they date from 1921 and sound much earlier, a pleasant, old fashioned bit of late-late Impressionism totally untouched by the modern sounds of the 1920s.

---

*Performances:* A—      *Sound:* B+

---

**Prokofiev. War and Peace—Highlights.**

Stars of the Bolshoi Opera, Chorus and Orch., Alexander Melik-Pashayev.

Melodiya Angel SR 40053 stereo (\$5.79)

**Mussorgsky: Boris Godounov—Highlights.**

Stars of the Bolshoi Opera, Chorus and Orch., Alexander Melik-Pashayev.

Melodiya Angel SR 40049 stereo (\$5.79)

Strange—with almost identical labels and approximately the same personnel, these two highlight records are utterly different, or so I heard them.

I found the Prokofiev "War and Peace" disc one of the most exciting records to come out of Moscow so far. This large-scale opera has all of the immense scope, the grand traditional Russian operatic splendor, of "Boris" and other earlier operas. Fulfilling Prokofiev's own ambition, it is both popular in an easy-to-hear idiom, and subtle, the music of first rate quality in spite of its seeming simplicity. Even without the story (as printed in the complete Russian-English booklet) the grand line of the plot was abundantly clear in the listening—the stupendous design of Tolstoy's War and Peace, based on the invasion of Russia by Napoleon, the music composed at the time the Nazi invasion and full of that very suggestive parallel.

We hear the tantalizingly bitter-sweet waltzes of the "peace" opening, the elite nobility dancing in the face of an unreal invasion; we hear the glorious military preparations—shades of "Gone with the Wind"—and then some of the battling, and we are let in on the final celebrations of the difficult victory—all this in terms of superb solo singing and the usual ever-present Russian chorus.

I found "War and Peace" in this abstract both moving and remarkably complete, a wise, carefully tailored excerpting from the unmanageably long original opera. Performance is no less than superb, both in the quality of dedication and exuberance, and in the excellence of the performers and the grand Russian styling, super-authentic. The recording itself is equally good, placing chorus, solos, and orchestra all in the proper musical balance.

Strange, then, that the parallel Mussorgsky "Boris" struck me as most unsatisfactory. Mainly it was that the sombre hero, Boris himself, projects his big-bass music, throughout, in an exaggerated close-up, enormously magnified. Gratifying and well sung; but all else, except a few other solos, is subordinated to the solo vocal sound. Not a fair balance. When the grand chorus music arrives, the famed Coronation Scene, complete with Russian bells, it is sadly bungled in the recording—the

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## New Miracord 620

chorus is drowned out, as it should never be, and the total sound is a mess.

I felt, too, that the Bolshoi "Boris" has too much of the old Rimsky-Korsakov revisions in it for our taste. Over-lush and too Romantic.

It is quite possible that these two discs were made under near-identical circumstances. Nevertheless, the differences are there in the listening. Possibly they are inherent in the music itself. Every piece has its own best recording technique, no matter how many "rules" we set up for a standardized recording procedure.

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Performances: A; B+ Sound: A-; B-

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## Spain Organ Tour

Historic Organs of Spain. E. Powers Biggs.  
Columbia MS 7109 stereo (\$5.79)

Columbia, with the aid of extensive reissues, has been running a kind of "artist of the month" show lately. One of the months, it was the irrepressible Mr. Biggs' turn—the man who first popularized the now-familiar "Baroque" organ and its literature. The Biggs flood includes an armful of reissues, in part reshuffled in content, as is Columbia's way, plus some new material, notably this disc, product of a typical Biggs organ tour through Spain. The organs are interesting and the playing, as always when Biggs is on tour, seems better than his routine home-type product. Most of the music is inconsequential, to say the least, though interesting in the sound of the organs themselves.

Main feature of Spanish organs, it seems, is the fondness for trumpet stops—those brassy, show-off big reed pipes that make a fine, snarling, dress-parade sound for assorted state occasions. Mr. Biggs plays on these—plays *with* them, I should say—until our ears are full of snarls. Bit too much for my taste; but a little at a time is just fine.

---

Performances: B Sound: B+

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## Baroque

Orch., B.B.C. Chorus, Klemperer.  
Angel SC 3720 (3) stereo

Styles in Baroque performance have changed enormously in the past thirty-odd years. The great Otto Klemperer, one of the last of the old-line Romantic conductors, antedates that change. If you know the Bach Mass in more recent stylings, this one will flabbergast you. On the other hand—if *your* B Minor is of the traditional variety, as it always used to be done and still is

widely)—you'll love this one.

Easy to describe. Concessions in detail to modernity do not really affect the whole, which sounds perfectly huge, moves at a turgid snail's pace in all the slower parts, stresses the great "Romantic" moments (where modern performances skip past them as though slightly embarrassed) and generally relates big Bach to big Mahler and the like.

I found it just plain intolerable. The opening Kyrie takes well over half of a long LP side, so slow that you'll scarcely recognize its famous theme. The solo arias tend to be equally monolithic. If you're for modern "authentic" Bach, then, stay far, far away! And yet, of course, coming from Klemperer, the performance is not unmusical. Just nineteenth century.

---

Performance: B- Sound: B-

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**Bach: Selections from the Musical Notebook for Anna Magdalena.** Gustav Leonhardt, hps., Elly Ameling, sop., Hans-Martin Linde, bar., with continuo, boy-choir.

RCA Victrola VICS 1317 stereo (\$2.50)

The famed Notebook, a sort of handwritten "family album" of little works compiled for family use by Bach and his second wife, is here sampled for two sides' worth of material, much of it pleasingly familiar. The bulk of the music is, in short, harpsichord pieces, a number of them well known to all children who start piano lessons. (I played the little Minuet in G at around eight—maybe you did too.)

There are also brief songs and chorals (hymns), with continuo accompaniment, here sung by a lovely and gently accurate soprano voice, a joy in the listening (Elly Ameling). Appropriately, one song about tobacco and a favorite pipe is taken over by a baritone—surely Mrs. Bach didn't get to sing *this* one herself.

Not all the music is by Bach. Various other worthies are represented, including some of his own sons, and the quick ear will note the changes in style. One piece by François Couperin stands out most interestingly—so typically French and so unlike Bach. A handful of more elaborate works are included, one recitative and aria from a cantata, and the well known theme of the (later) "Goldberg" Variations. Very nicely presented, all this music, and particularly the many keyboard works as played by the well-seasoned harpsichordist, Gustav Leonhardt.

Boychoir? No doubt a snazzy translation of the German *Knabenchor*. The Tölzer boys (and men) appear only

once, singing a brief chorale or hymn, very ineptly and quite flat. Fortunately, it lasts only a moment. The continuo accompaniments are mostly on the harpsichord with gamba or cello; a few are on the organ.

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Performance: B+ Sound: B

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## The Art of Ornamentation and Embellishment in the Renaissance and Baroque.

Assorted soloists, Ambrosian Singers (Denis Stevens), Deller Consort, Jaye Consort of Viols, Wenzinger Consort, Vienna Baroque Players, etc, etc.

Vanguard BGS 70697/8 (2) stereo

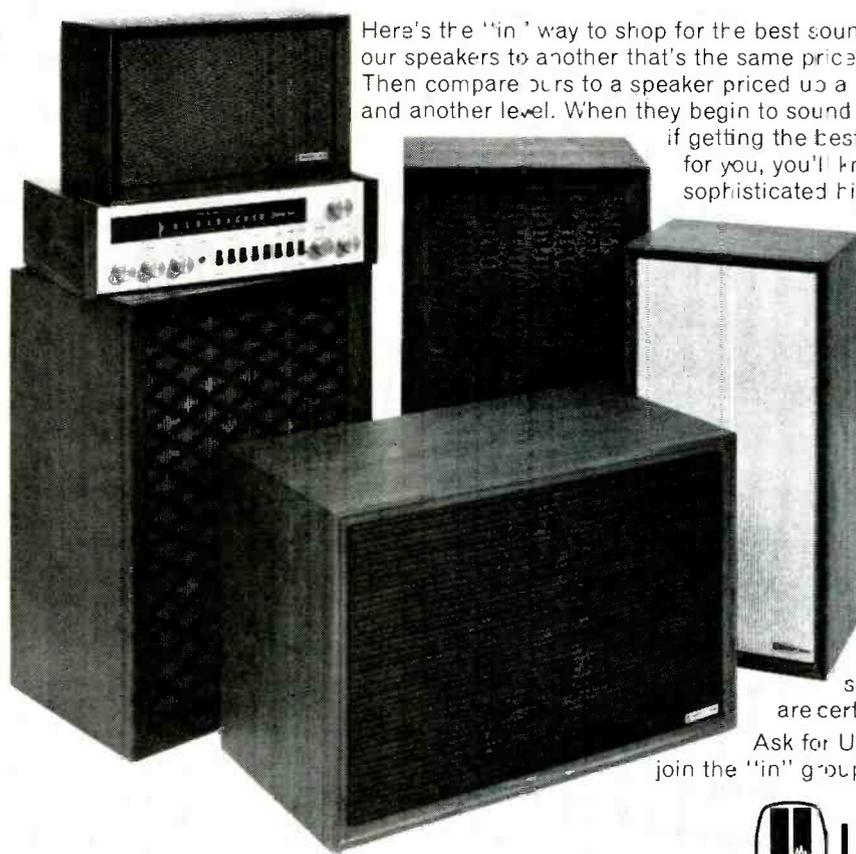
This formidable 2-disc album, ranging from the sixteenth century through the Bach period, sets up pairs of examples, music unornamented and the same decked out with trills and frills in the styles of the time. It makes a fine, long, recorded concert, if uneven in quality and confusing in its multiplicity of performers. Those who enjoy this early music will gain useful musical insight into the ornamentation procedures which were so important in earlier music. We'd call it improvisation—we still do it extensively in our various kinds of pops music.

The big problem is that most such ornamenting was done *ad lib*, not from notes, though according to very rigid rules of style. However, many well known works were borrowed for elaboration, transcribed, we might say (just as our pop tunes are "arranged"), and often these versions *were* written down, ornaments and all. Most of the examples on these four sides, many out of a book on the subject by Ernst T. Ferand, are such written-out works, directly compared with their originals in A-B performances. But the extensive writings of the times on ornament practices are also heavily consulted, as is proper in modern musicology.

The examples seem to have been pulled together from all sorts of sources, the specially recorded material perhaps matched up to available existing recordings—it was a mighty project, all right. Thus the multiplicity of performers is also reflected in a somewhat uneven technical quality. The job is well done, nevertheless, all things considered.

I'd suggest acquiring this album mainly as a straight musical acquisition, assuming you like older music of these kinds, both vocal and instrumental. Treat the fancy comparisons casually, let them slide into the ear on their own persuasion, if and when. The ear will do its own wonders, given time; and in the meantime there are many lovely items to keep you happy

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*Performance:* B+ to C+

*Sound:* B to B-

**Machaut: Notre Dame Mass and Gregorian Proper for the Feast of the Assumption.**

London Ambrosian Singers, Vienna Renaissance Players, McCarthy.

Nonesuch H-71184 stereo (\$2.50)

Those of us, non-Catholic, who think that the Mass is a kind of concert music will be doubly interested in this

record of the very first musical Mass known to have been composed by a single composer, dating from some six hundred years ago.

In all those centuries, segments of the actual Mass service have been set in varying complex musical form, ranging all the way up to the mammoth works of the nineteenth century and the big ones of the eighteenth with orchestra, chorus and solo singers. But much else, notably the "proper" or special sections for a given occasion, were *not* so set, though there is Gre-

gorian chant to go with them, dating back to the Middle Ages. In musical performances, these intervening sections are rarely included. Conversely, in actual Mass services very few of the great musical settings of the past are used, many being technically impractical or forbidden by later changes in the rules of procedure, or unknown to parochial minds.

The LP records allows room for a longer Mass, including either an actual service's numerous "extra" sections or, at least, the official Gregorian chant that would have intervened in these areas between segments of the specific musical setting. This one combines the six movements of the "Notre Dame" Mass of Machaut with long segments of the Gregorian chant proper to the Feast of the Assumption of Mary ("Our Lady"—Notre Dame), for a complete Mass of eleven sections, those which might have been sung as the music was actually put to use 600 years ago. It makes for good listening and a much better idea of this strange early music than is possible in the shorter form.

Remarkable that the Machaut music is even recognizable as an entity, considering the insubstantially ancient notation and the total lack of specific directions as to instruments, tempi, expression. Just the pitch and rhythm relationships are specific. All the rest is via indirect scholarship, for better or worse, plus "interpretation"—intuitive shaping. Yet the music is recognizable, even in wildly different interpretations. And so it exists, so to speak.

This performance is up to date, which means that while arbitrary in its choice of specific instrumental and vocal combinations, they are possible within 14th century parameters—it might have sounded this way, among other ways. The tempo is usually fast, solo voices are mixed with instruments of the period, the sort known to have been used in such music, and the whole is given a veneer of reasonable and musical-minded phrasing and shaping. No more can be done, at such a remove.

The mixture and contrast of Gregorian chant, unaccompanied, and the oddly raucous Machaut is convincing throughout. The Gregorian is nicely sung and the problem of pitch is well handled; discrepancies are few and not too obvious, as instrumental music alternates with music sung entirely without accompaniment.

Strange—this record has a close relative in another complete Mass, the recording of President John Kennedy's funeral, which includes the movements of the Mozart Requiem Mass along

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with the rest of the funeral service as it actually happened. There, too, the Mozart setting is only a part of the whole proceedings.

Performance: B+ Sound: B

**Telemann: Musique de Table, Production III; Vol. 1, The Concerted Works; Vol. 2, the Chamber Works.** Concentus Musicus, dir. Nikolaus Harnoncourt. Vanguard Cardinal VCS 10008, 9 stereo (\$3.50 ea.)

Only a few years ago Telemann was unknown to most music listeners; now he commands pages in the catalogues; the formally published collections of his works known as "Musique de Table" literally Table Music, better translated as entertainment music) are widely sampled on various labels. Here is the whole of Production III (read Collection No. 3) spread out on two records.

Like the others, "Production III" is a composite collection, a cross section of Baroque ranging from large works with orchestra through the in-between areas—the most important Baroque sound—to sonatas for single instruments and accompaniment. Vanguard accurately designates the larger works as "concerted"; they feature solo groupings against a larger orchestral background in the characteristic concerto-suite style. The "chamber" works, closer, more intimate but just as brilliant, are without the orchestral framework, just solo players. They also tend towards a more complex and thoughtful texture than the more outward-aimed works with orchestra.

On records, where volume levels are approximately the same regardless of the size of the ensembles, the Chamber works are the most colorful pieces and make the showiest hi fi.

The "concerted" record features two works, a big suite with many movements and a shorter Baroque-style concerto featuring two natural horns as solos. No valves. That one is necessarily rather bumptuous and bucolic, the horns being of the hunting variety, country-squire style. The big suite features two oboes and two violins as a solo group, the oboes being authentic instruments of the period in this recording and thus unusually interesting in their rich, slightly raw tone color.

On the "chamber" record there are three varied works (Telemann's characteristically Baroque intention was to show off not only variety in form but in Baroque instrumental color—excellent for hi fi!). The finest of all is the sonata for solo oboe and continuo, gorgeously played on the old-style oboe

by one Jürg Schaeftlein. Who needs modern refinement when this music can be played so skillfully on an instrument actually made about 1700? There is a quartet, flute, and violin and cello with harpsichord (never try to count instruments in Baroque music—they always come out the wrong number, unless you know the lingo) and a Trio for two flutes and accompaniment. Here, again are genuine old flutes, mid-18th century, and the sound is intriguing, very breathy and puffy but well blended and just right for the music.

As to performance, throughout both discs, it is very musical, the old-instrument techniques astonishingly well developed, the interpretations rather gentle and sometimes on the slack side, often in very slow tempo, lacking tension. Ploppy Baroque, I call it. Much better, however, than the unmusical super-tensity of some hard-bitten Baroque on records! If I am right, this is rather characteristic Viennese music making. Vienna is where the group mostly hangs out.

Performance: B to B+ Sound: B+

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## Light Listening

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### RCA Bats .500 in Broadway Show League

**Golden Rainbow:** Steve Lawrence, Edyie Gorme, Scott Jacoby, & other members of original Broadway cast. RCA/Calendar KOM/KOS-1001 (\$5.79)

Composer-lyricist Walter Marks, whose first Broadway venture was "Bajour," that tuneful triumph which fizzled out quickly a few seasons back, has returned to pen the songs for this musical version of Max Shulman's "A Hole In the Head." If there's anything even resembling a distinguished tune in this score, it has certainly escaped my ear.

"Golden Rainbow" is strictly for Lawrence and Gorme fans and, as a glorified night club act (which is what it is), it's fine—but passing it off as a Broadway musical with a twelve-dollar top is something else again.

---

*Performance:* B      *Sound:* B+

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**Your Own Thing:** Rusty Thacker, Leland Palmer, Marcia Rodd, Tom Ligon, Danny Apolinar, & other members of orig. cast; Charles Schneider, cond. RCA Victor LOC/LSO-1148 (\$5.79)

"Your Own Thing" is billed as a "rock musical," but in reality, the score is not pure rock any more than the libretto is pure Shakespeare. Therein lies the basic ingenuity of this delightful off-Broadway show. Donald Driver's book (a very free adaptation of "Twelfth Night") has the admirable audacity to accept or reject the material from its source at will to suit its own purposes. The Bard's mistaken identity plot is retained, as are most of the characters' names. The time is updated to the present, with Illyria becoming New York City. Of the four principals—Sebastian and Viola are pop singers, Olivia operates a discotheque, and Orson (Orsino) is an agent for a rock quartet.

The songs by Hal Hester and Danny Apolinar are not likely to create a new teenage audience of show buffs.

Two of the numbers, "Come Away, Death" and "She Never Told Her Love," have a plaintive, folk-

song quality, with lyrics deriving directly from the "Twelfth Night" text. Others, such as "The Middle Years" and "Young and In Love," are ballads that come closest in style to the standard types of show tunes exemplified by Richard Rodgers.

No matter the style or technique, everything works—and works well; and the cast is comprised of a talented group of young people who can really sing. To do "your own thing," is to follow your own course, which is precisely what this show does, making it the freshest and most original musical comedy in town!

---

*Performance:* A      *Sound:* B+

---

**Darling Of the Day:** Vincent Price, Patricia Routledge, Brenda Forbes, Peter Woodthorpe, and other members of orig. Broadway cast; chorus & orch./Buster Davis. RCA Victor LOC/LSO-1149 (\$5.79)

I'm willing to admit right at the outset that "Darling Of the Day" may be a much better show than I think it is. The problem is one of anticipation far exceeding realization. For when it was first announced that two of the theatre's most distinguished writers, composer Jule Styne and lyricist E. Y. Harburg, would join forces for the first time, expectation naturally ran high. Their resultant collaboration on a musical version of Arnold Bennett's novel and play, "Buried Alive," turns out to be a routine and humdrum affair.

The story, set in Edwardian England, is about a talented, but shy painter, who fools the world into thinking he's dead by assuming the identity of his late valet, and thus escapes the foibles of his arty milieu. Vincent Price (ex-movie villain and real life art connoisseur), in the central role is really no better or no worse than most of the "singing" actors who have become fashionable in today's Broadway musicals. Patricia Routledge, on the other hand, as the young widow the painter falls in love with, makes a very strong impression with her fine singing voice. The rest of the cast do the best they can with weak material.

Every now and then, there's a flash of Styne's flair for writing theatre music and Harburg's facile inventiveness with words, but the glimmers are all too few.

Good sound with effective use of

stereo, but alas, not good enough to enhance a disappointing effort that once looked so good on paper.

---

*Performance:* B      *Sound:* B+

---

**The Happy Time:** Robert Goulet, David Wayne, Mike Rupert, Julie Gregg, & other members of orig. Broadway cast; chorus and orchestra cond. by Oscar Kosarin. RCA Victor LOC/LSO-1144 (\$5.79)

"The Happy Time" is the story of a French-Canadian photographer who makes good in a cold, competitive world, but returns to his small home town to find real happiness. N. Richard Nash's musical version of the play by Samuel Taylor has the virtue of a charming and amiable score by John Kander and Fred Ebb, the writers of "Cabaret." Since their initial collaboration some five years ago on the hit song, "My Coloring Book," Kander and Ebb have shown steady growth and maturity in their work, and the songs they've provided for "The Happy Time" grow increasingly attractive on repeated hearings.

Robert Goulet, in the principal role of Jacques Bonnard, is appearing in his first Broadway show since "Camelot," in 1960. He happily reminds us what a really fine baritone he can be, when he's not crooning his songs. Of the dozen numbers in the score, Goulet is involved in seven of them, not including the Finale. His best songs, are the wistful "I Don't Remember You" and the nostalgic "Among My Yesterdays"; both first-class ballads.

Other highlights include the title song (a special bravo to the composer for being courageous enough to write a good waltz); "Tomorrow Morning," a bubbly trio for Goulet, David Wayne, and Mike Rupert; and the duet, "Seeing Things," beautifully sung by Goulet and Julie Gregg, a newcomer with a lovely voice who should have been given more to do.

David Wayne, in the role of Grandpère, is delightful in his big number, "The Life of the Party," an ingratiating vaudeville strut, which in all candor (or is it Kander?), I found uncomfortably reminiscent of "Come Along With Me," from Cole Porter's "Can-Can."

A final note of praise for Don Walker's imaginative orchestrations and RCA's appropriately bright and vivid stereo sound.

---

*Performance:* A      *Sound:* A

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## Two-Disc Operetta

**Joan Sutherland: The Golden Age of Operetta**—Joan Sutherland, soprano; Ambrosian Light Opera Chorus & New Philharmonia Orchestra/Richard Bonygne. London OSA-1268 (\$11.58)

Joan Sutherland has undertaken an ambitious foray into the world of operetta, though, sadly, the results are decidedly uneven. Attempting a cross-section of the genre, representing America, England, France, and Austria, several of the selections are ill-chosen, in my view.

The first of the four sides, devoted entirely to American music, is the poorest. With the exception of the lovely and unduly-neglected "And Love Was Born," from Kern's "Music in the Air," which is given the best performance in this group, the songs are overly-familiar and are available elsewhere in superior renditions.

"Deep in My Heart, Dear," "Indian Love Call," "Make Believe," and "The Desert Song," all written as duets, do not profit from Miss Sutherland's solo treatments. (My quarrel is not with the operettas represented, only with the specific selections chosen from them.) For example, far more appropriate choices from "The Desert Song" would have been the "Romance" (a display piece for soprano solo); or "The French Military Marching Song" (soprano and chorus), in which the Ambrosian Singers could have been advantageously employed. The inclusion of "Falling in Love with Love" from Rodgers' and Hart's "The Boys from Syracuse," as a sampling of American operetta, is irresponsible. On the other hand, Victor Herbert, the dean of light opera in this country, is represented only by "When You're Away."

Miss Sutherland impresses as being curiously uninvolved and unaware of both style and content. She seems to be pre-occupied only with making beautiful sounds, which indeed she does—although it is virtually impossible to understand the lyrics. And surely not helping any are Douglas Gamley's unimaginative and commonplace arrangements. Rarely does he take the opportunity to exploit the large forces at his disposal.

The remainder of the program, spread over three sides, offers selections from popular stage successes of London, Paris and Vienna. The soprano is most at home in the British and French repertoire, and consequently, these are her best performances. The medley from Offenbach's "La Périchole" is altogether charming, as is a fascinating little aria from Mas-

senet's light opera, "Chérubin" . . . in all likelihood, never before recorded.

Discounting the inevitable unintelligibility of the words, the English operetta selections (unfortunately and inexplicably, there are only three) are the highlights of this collection. The Waltz Song, "For Tonight," from Edward German's "Tom Jones," and the numbers from "Maid Of the Mountains" and "Balalaika," are exceptionally well-sung, with a real sense of style. The "Balalaika" excerpts represent one of the rare instances when arranger Gamley rises to the occasion.

The Viennese selections are drawn from the works of Léo Fall, Franz Lehár, Oscar Straus, etc. In these, Miss Sutherland fares poorly in recorded competition with Schwarzkopf, Gueden, Tauber, Wunderlich, and others. The original German texts are used, except in the extracts from "The Du Barry," "The Merry Widow," "Paganini," and "The Chocolate Soldier," which are done in the familiar English versions.

The Ambrosian Light Opera Chorus performs well in the few demands made

upon it, while Richard Bonygne leads a meager-sounding New Philharmonia Orchestra in accommodating and serviceable accompaniments. Reproduction is full-bodied and clean; stereo effects are discreet. Included with the set, is an excellent brochure containing historical notes on the operettas and the lyrics of most of the songs.

Performance: B

Sound: B+

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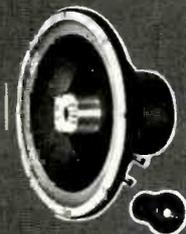
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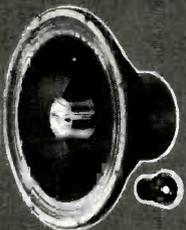
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## Jazz & Blues

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### BLUES & ELLA

**Jimmy Rushing:** *Livin' the Blues*  
BluesWay Stereo 6017 (\$4.79)

The first BluesWay set with Jimmy Rushing singing to a group that featured Dickie Wells' trombone was too good to let the matter stop right there. The two former Basie men are featured again with another old timer from the Count's group, tenor Buddy Tate. Rushing is a singer who works solidly with a good instrumental backing, and he gets just that in this well paced set. At 65 this blues singer is still able to use his voice flexibly, and no one can match him for style and feeling.

Performance: A      Sound: B+

**Ella Fitzgerald:** *Ella Live*  
Verve Stereo V6-8748 (\$5.79)

If you don't already have these performances, and you're an Ella fancier, this is an absolute must! Assembled on one platter are some of the numbers that have had greatest impact on audiences at jazz festivals in Europe and at Los Angeles. *Gone with the Wind, The Man I Love, Summertime, The Lady Is a Tramp, The Girl from Ipanema, That Old Black Magic, Just Sittin' and A-Rockin', They Can't Take That Away from Me, I've Got You Under My Skin, Body and Soul, St. Louis Blues, and Stompin' at the Savoy* each send an audience into a frenzy. It means you have to take a lot of whistling, clapping, and foot stamping along with your music, but Ella is one of those great musicians who really responds to an excited audience, and this record captures that excitement at its very best.

Performance: A      Sound: B

Presenting Isaac Hayes. Enterprise Mono  
13-100 (\$4.79)

Memphis Sound is a very special cup of tea. Possibly the reason Isaac Hayes sounds so good to me is that he seems less like the Memphis-style musicians I'm familiar with, and more like a traditional rhythm-and-blues singer and pianist. A composer and veteran performer, Hayes is slick, rather than profound, but his skillful way with a slightly off-color blues number is in the grand tradition of some of the finest jazz entertainers. For those who may have a bit of trouble locating the Enterprise label, it is distributed by Atlantic.

Performance: A—      Sound: A—

**Johnny Hodges:** *Triple Play*. RCA Victor  
Stereo LSP-3867 (\$4.79)

For the latest Johnny Hodges release, RCA Victor had the clever thought of featuring his alto with three entirely different supporting groups. Three separate eight-man combos were utilized at three sessions, all recorded in the same studio with the same engineer. Many of the sidemen were old associates from the Ellington band, among them Paul Gonsalves, Lawrence Brown, and Ray Nance. Even for Hodges, this is a superior set.

Performance: A      Sound: A

**Phil Wilson Quartet:** *Prodigal Son*. Free-  
form Compatible Stereo No. 101 (\$4.98)

The Phil Wilson quartet consists of Lennie Hochman, saxophone, flute, and woodwinds; Tony Sarni, drums; George Moyer, bass; and Wilson on trombone. While none of the performers has attracted particular attention in the past, each has had a respectable professional background, playing with prominent bands and in small groups. Since 1964 the group has been working together, playing free-form jazz.

They are heard here in a Christian Worship service in which prayer and readings from Scripture alternate with improvisations that purport to be direct interpretation of the preceding text. The live recording was made at an actual service at Central Congregational Church, Providence, R. I. The overall effect, considering this record as a jazz performance (which it is only in part) is a trifle uneven, but quite impressive in some sections. Record-

(Continued on page 110)

## The Duke

A release of two Ellington albums, one on the Vintage series of reissues from 78s, the other a brand new set of Billy Strayhorn compositions, released in tribute to the Duke's long-time collaborator, offer not only some room for reflection on the loss to music of composer-arranger Strayhorn, but also on the direction that the Ellington group has taken in the twenty-two year span covered by these two sets. All of the 16 numbers on the Vintage reissue were originally recorded between May 1945 and September 1946, at a time when the Ellington band was still a magnificent team of performers. However, it was a bad time for big bands, many had folded or were about to disband, and even the Ellington group felt obliged to indulge popular tastes in an effort to keep going.

An unusually high percentage of the reissues feature vocals. Ray Nance, Al Hibbler, Joya Sherrill, and Marian Cox were all singing



with Ellington in those days, and these discs serve to emphasize the masterly job that Ellington has always done in providing background for a singer. In order to please the public, Ellington felt compelled to offer more standards than was his usual practice. *My Honey's Lovin' Arms*, *Back Home Again in Indiana*, and *J. C. Handy's Memphis Blues*, *St. Louis Blues*, and *Beale Street Blues* are all included in the set. They certainly help to present a picture of what the Ellington band was doing in the middle Forties, but they serve to emphasize that this was not one of the brightest times in the group's long history.

On a higher level of inspiration than the rest of this reissue are two piano duets by Strayhorn and Ellington playing their jointly written *Tonk* and Strayhorn's *Drawing Room Blues*.

The new recordings, with a band containing a large group of the men from the earlier set—Cat Anderson, Lawrence Brown, Johnny Hodges, Russell Procope, Jimmy Hamilton, and Harry Carney—is a brighter, finer achievement. Clearly these are better days for the group, and their spirits soar as they play eleven Strayhorn originals that include *Snibor*, *Charpoy*, *The Intimacy of the Blues*, *Rain Check*, *Day-Dream*, and *Rock Skippin' at the Blue Note*. A touching Ellington solo of Strayhorn's *Lotus Blossom* is a fine final tribute to the great composer and arranger who worked closely with Ellington for almost thirty years.

By no means the least virtue of this new Ellington set is the superb sound of the package. Recorded in late August and early September in New York in RCA's Studio "A" and in San Francisco in mid November, there is no discernable difference in the clean, bright, well-spread-out stereo produced on either coast. There are a few differences in personnel, most notable is the presence of one time Ellingtonian, Clark Terry, whose fluegelhorn is prominently featured in *U.M.M.G.* This is the trumpet solo that was originally recorded in 1956 with Willie Cook, followed three years later with Dizzy Gillespie. Terry has an opportunity to exercise his justly famous plunger mute on another solo in *Boo-Dah*.

This latest Ellington album is a notably fine accomplishment on all counts—great sound, great performances, wonderful music, and a fitting memorial to a man who continues to live in the work of the Ellington band.

**Duke Ellington:** *Pretty Woman*  
RCA Victor Mono LPV-553 (\$5.79)

Performance: A                      Sound: C

**Duke Ellington:** *And his Mother Called*  
*Called Him Bill*  
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Performance: A+                      Sound: A

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## JAZZ & BLUES

(Continued from page 109)

ing is good, but the trombone is a bit more forward than the rest of the performers. The record, which may be difficult to obtain locally, can be ordered from Freeform Records, c/o Concert Recordings, Inc., 164 Park Ave., Cranston, R. I.

Performance: B— Sound: A—

Marion Brown: Three for Shepp. Impulse Stereo A9139 (\$5.98)

Altoist Marion Brown, who has played with Archie Shepp on a couple of earlier Impulse releases, heads a platter of his own and devotes one side to a trio of Shepp's compositions: *Spooks*, *West India*, and *Delicado*. The second side is made up of three of Brown's own numbers: *New Blue*, *Fortunato*, and *The Shadow Knows*.

Surprisingly, Impulse, a label that generally does a conscientious and meticulous job of tying each musician to the selections on which he is heard and the dates on which the sessions took place, gives us a half-dozen photos and names of sidemen, but it is clear from the music that all performers shown on the liner do not perform in each selection. Norris Jones, bass; Bobby Capp, drums; Dave Burrell, piano; Grachan Moncure III, trombone; Beaver Harris, drums; and Stanley Cowell, piano, are heard in one or another combination with Brown. The performances are quite splendid, abounding in youthful vigor with both emotional intensity and strong control. The sound is good for a recording that is obviously of pre-Dolby vintage.

Performance: A Sound: A—

## REISSUES

Chu Chu Berry and his Stomp Stevedores. Epic Mono EE22007

Tenor sax man Berry is heard in recordings dating from 1936 to 1941. Eight tunes are with his own group, seven with the Cab Calloway Orchestra, and one number with Teddy Wilson's Orchestra. Hot Lips Page, Buster Bailey, and Jonah Jones are among the other greats on this well-reproduced collector's item.

Performance: B+ Sound: B

Big Maybelle: Gabbin Blues. Epic Stereo EE22012

This is a re-issue of a singer I had never encountered when her releases were current from 1952 to 1955. It's

clear from this set that I had missed a lot, and the scant success that she has won makes one wonder just what went wrong. It certainly wasn't in the way she was recorded. These Okeh originals featuring arrangements by Leroy Kirkland and Danny Mendelssohn include some of the best performers around: Joe Wilder and Taft Jordan, trumpet; Sam "The Man" Taylor, tenor; Brownie McGhee and Mickey Baker, guitar. They are just a few of the solid performers who back up Big Maybelle. And what style and talent this blues shouter has. From the notes, I gather she's still about.

Performance: A

Sound: A

Jimmy Lunceford: Lunceford Special. Columbia Stereo CS2715 (\$4.79)

For its Hall of Fame Series, Columbia has transferred a mixed bag of Lunceford 78s to stereo LP. Two hitherto unreleased 1933 masters, *Flaming Reeds and Screaming Brass* and *While Love Lasts*, are of particular interest. They feature Eddie Wilcox arrangements, although Sy Oliver was already a member of the band, and they serve as an interesting comparison with the five Oliver arrangements recorded between January and April, 1939, before Oliver's departure to the Tommy Dorsey band. The balance of the disc contains eight tunes cut between September, 1939, and the following February. Maybe they don't have the ultimate refinement of the Oliver-arranged numbers, but they still display the same rare precision and enthusiasm that were the hallmark of this great band. Included are *T'Ain't What You Do*, *Baby Won't You Please Come Home*, *Ain't She Sweet*, *Uptown Blues*, and *Lunceford Special*. The "electronically rechanneled for stereo" version seems to consist of a simple emphasis of highs on the left and lows on the right.

Performance: B+

Sound: C

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# Recorded Tape Reviews

BERT WHYTE

Not too many years ago, a reviewer who specialized in pre-recorded tape was hard pressed to find enough tapes to fill his column. Some months, the output of the entire record industry was as little as 4 or 5 tapes.

How times have changed!

A recent Ampex tape release for a single month consisted of 42 open-reel pop tapes, 27 open-reel classical tapes, and 137 cassettes! In addition to this there were substantial tape releases from RCA Victor, Columbia, Angel/Capitol, and others. Now the question is, how does one cope with such a torrent of tapes? Selectivity is a great help . . . you choose material which for your readership is interesting and appropriate. Admittedly, this causes one to be somewhat presumptuous, but it can't be helped. Another restrictive influence is the amount of space allotted to a column each month. Unfortunately, it all boils down to a question of format. Detailed, lengthy reviews mean fewer tape reviews each month. Capsule reviews permit broader coverage, but is this quantitative approach adequate? What is a good compromise? Perhaps it might combine several "feature" in-depth reviews, with a number of capsule reviews. I would welcome

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your comments on this matter. In the meanwhile I will exercise my prerogative and try out the "feature/capsule" combination.

## Piano Concertos

**Prokofiev: Concerto for Piano & Orchestra No. 3 in C Major, Opus 26.**

**Ravel: Concerto for Piano & Orchestra in G Major.** Martha Argerich, Piano. Claudio Abbado cond. the Berlin Philharmonic Orch.  
Ampex/DGG DGC9349, 4 tr., open reel, 7 1/2 ips (\$7.95)

There is no scarcity of recordings of Prokofiev's brilliant 3rd piano concerto, nor of Ravel's G-major concerto. Thus, for a relatively unknown pianist like Martha Argerich to tackle such formidable opposition as John Browning, Van Cliburn, Byron Janis, etc., some DGG music director must have had quite a respect for her talents. It would be nice to say that Miss Argerich comes out on top . . . but she doesn't quite make it.

She has tremendous technique and, for a woman, great power. Her playing is ebullient, dynamic, exciting. But her panache is not leavened with much maturity. For example, her tempestuous first movement of the Prokofiev is almost a minute shorter than Cliburn's and Browning's recordings. In the slower sections, she plays most expressively, but nonetheless rushes things a little. Her finale is almost frenetic. Credit is due her and Maestro Abbado for keeping everything in perspective in spite of the headlong pace. However, give this girl a few more years and we should be hearing some great things from her.

She has one thing going for her, even if her performance isn't yet top rank, and that is the beautiful recording DGG has lavished on these concertoes. Dynamic and frequency range is far wider than in any other recording. The moderately broad acoustics and the medium-close miking afford a natural-sounding presence. The piano is neatly centered and well projected. Piano/orchestra balance was generally good, although the piano covered the orchestra on several occasions. The piano sound was clean and transient response very good, but a little more brilliance from the piano would have been helpful. (I suspect a European piano was used, as American Steinways and Baldwins usually record more brilliantly than their European counterparts.

This recording should be played at relatively high level for best balance. At those levels, the hiss was moderate, there was some print-through but very little crosstalk. The Ravel gets a fast-paced, high-tension reading that generates a lot of excitement. The miking was closer than the Prokofiev and the piano more brilliant in spite of somewhat more spacious acoustics. This is a very big sound, with wide dynamics, good transient response. Piano very clean and piano/orchestra balance just right. Tape hiss fairly low, some print-through, crosstalk no problem.

In summation, if you like these concertoes played with a lot of pizzazz at the expense of some warmth, or if top quality sound is your major consideration, you can't go wrong with this tape.

## 7 1/2"-ips "Pop"

**The Golden Trumpet of Harry James.**

Ampex/London LPL74109, 4 tr., open reel, 7 1/2 ips (\$7.95)

Harry James proves here that he can still blow up a storm. His tone is very full and maintains its punch, although not quite as steady as in the old days. The arrangements of such familiar numbers as "You Made Me Love You," "Two O'clock Jump," "Sleepy Lagoon," "Ciribiribin," etc., are all somewhat changed, but the James parts and all his trumpet tricks are pretty much the same as in his "swing-in'" era. In my copy of this tape, the right channel was down in level and I had to adjust balance. Once this was done, left/right and all other balances were O.K. The somewhat distant pickup plus the use of quite a bit of reverb cut down on the presence. Moderate hiss and some print-through, but very little crosstalk. For nostalgic James fans, a chance to listen to their hero in modern sound.

**Stanley Black: Dimensions in Sound.**

Ampex/London LpL74105, 4 tr., open reel, 7 1/2 ips (\$7.95)

This is a big, often pompous and overblown potpourri of pops, such as "Take the A Train," "Michelle," "A Taste of Honey," etc., which nonetheless is very well done for its type. The sound is the typical spotlighted, larger-than-life *Phase 4*, but all quite clean and ultra-sonorous. Top playing from what must be a thinly disguised version of the London Symphony. The last number on the tape, "Three Blind Mice," is a marvelous tongue-in-the-cheek spoof of the concerto which

takes you through the styles of Mozart, Tchaikovsky (and I thought I detected a little Rachmaninoff), all in a blaze of spectacular sonics.

### 3<sup>3</sup>/<sub>4</sub>-ips "Pop"

**Chet Atkins: Solo Flights/Picks the Best.**  
RCA Victor TP35045, 4 tr., open reel, 3<sup>3</sup>/<sub>4</sub> ips (\$9.95)

If you are a devotee of Chet Atkins, you will surely enjoy this tape. One side is solo work only and features the new "Octabass" guitar developed by Chet and Jimmie Webster, and the other side is a potpourri of numbers associated with Chet, including the "Battle Hymn of the Republic." I believe Chet won a "Grammy" for his unusual treatment of this old standard. Sound is exemplary. Close-up, very clean with a lot of presence. Hiss pleasingly low.

**The Lettermen: Goin' Out of My Head.**  
Capital Y1T2855, 4 tr., open reel, 3<sup>3</sup>/<sub>4</sub> ips (\$5.95)

Smooth, beautifully balanced singing, against some exceptionally well-done arrangements. This top group is really worth a listen in such numbers as "Never My Love," "Our Day Will Come," "The Look of Love," and the title song, "Goin' Out of My Head." Good sound throughout, the singing very articulate. Only a little hiss, print-through, or crosstalk.

**Henry Mancini: The Concert Sound/Encore.**  
RCA Victor TP35038, 4 tr., open reel, 3<sup>3</sup>/<sub>4</sub> ips (\$9.95)

For those who can't get enough of Henry Mancini, this tape should help . . . all eighty-five minutes and thirty-four seconds of it! The music is too numerous to list. Suffice to say that many Mancini originals are here, as well as many other popular pieces, all in Mancini arrangements. Excellent sound of the big, reverbed, multi-mix type.

**The Free Design: Kites Are Fun.**  
Ampex/Project Three, PJX5019, 4 tr., open reel, 3<sup>3</sup>/<sub>4</sub> ips. (\$5.95)

I can't praise this tape too highly. This is one of the most refreshingly talented groups in years. The contrast between their clear, fresh, ultra-musical singing and the phony, pretentious screaming of many "rock" groups is startling.

The group is made up of two brothers, Chris and Bruce Dedrick,

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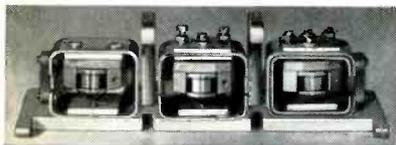
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and their sister, Sandy. All are accomplished musicians. Sandy is teaching music in New York, while brother Chris is working towards his master's degree at the Manhattan School of Music. They write most of their own material, but are also quite adept at new and unusual arrangements of standards. Their version of "Michelle," for example, is almost baroque in feeling. Their own numbers are quite a departure from what one hears today. Full of innovation and structurally interesting, they are above all, highly listenable. One of their works, "Don't Turn Away," is a poignant, haunting piece that makes a very strong impression.

This group blends their voices with great skill and are backed up by some fine instrumental work. This is the first 3 3/4-ips tape for *Project Three*. The sound quality is excellent and highly complementary for this group. The sound is warm, close-up and intimate, and exceptionally clean. The fine sense of presence is aided by the very low hiss level. Don't miss this tape for an unusual musical treat.

**The Pops Goes Latin/The Pops Goes West.**  
RCA Victor TR35028, 4 tr., open reel, 3 3/4 ips (\$9.95)

Here is another long-playing winner from the Boston Pops. It is such a pleasure to hear familiar tunes played with the superb skill of the Boston Pop men. The Latin side is really like a split album, as one section consists of well known numbers of "Spanish" persuasion: "Desafinado," "Dansero," "Spanish Flea," etc., and then we have a splendid performance of Morton Gould's "Latin American Symphonette" and the ubiquitous "Ritual Fire Dance." The other side is strictly "Marlboro Country." If you all dig the wide open spaces, Suh, you will cotton to "High Noon," "The Streets of Laredo," "San Antonio Rose" and others of similar ancestry, including "Deep in the Heart of Texas." Both sides feature top-notch sound, with the only reservation that the percussion sound, while quite clean, lacks the punch and crispness we associate with 7 1/2-ips tapes.

## Sinatra/Jobim on Cassette

Francis Albert Sinatra and Antonio Carlos Jobim. *Reprise/Ampex CFX1021*, 2-tr. stereo cassette (\$5.95)

The diminutive cassette is probably the most controversial of the new tape formats. It has been damned and praised with equal fervor, mostly I

believe by people with other axes to grind. In any case it would appear that the cassette is here to stay and what better evidence of this than a Sinatra recording? This sort of automatically gives any new medium status when it gets the nod from the "Chairman of the Board."

This particular album has been highly praised and deservedly so . . . it is unquestionably one of Frankie's best efforts in quite a while. The program consists of solid standards like "Girl From Ipanema," "Change Partners," "Baubles, Bangles and Beads" and others of this ilk, along with a most attractive new ballad, "Dindi." Clothed in the inimitable Jobim orchestrations and charmingly sung with Sinatra's own patented phrasing and showbiz know-how, the album is outstanding for its sheer value as entertainment. For Sinatra devotees, this is a "must."

Technically, the cassette faces two tests. Ampex asks that it be considered in the light of what it sounds like on the Ampex cassette playback system which sells for \$199.50 versus what a disc of the same music sounds like on \$199.50 worth of disc playback equipment. The other test is to play the cassette through your own high-quality (we hope) system. Well, I didn't have a disc system of \$199.50 calibre available, so I just listened to the little cassette system and then fed the output of the cassette playback unit into my pre-amplifier. I'd be a liar if I said I was greatly impressed in either case. On the small system, the sound was certainly as good as many of those fancy Queen Anne console phonos so beloved by the ladies. (I realize this isn't saying very much.) I had the impression of restriction, not so much from frequency response as from dynamics and, most likely, the small source area of the speakers. Turning up the gain didn't "open up" the music, but further increased the hiss. In the case of the big wide-range system, my conclusion was that the test was just plain unfair. As you can imagine, every defect was glaringly obvious; it is no use cataloguing them because the hiss was so bad that it colors one's opinion of everything.

At its present state of development the cassette cannot stand the merciless exposure of high-quality systems. There is undoubted potential for the cassette, especially since it may also be recorded. It may have ultimate advantages over the 8-track system for mobile use. The kindest word I can say right now is that, given a small apartment, with the usual restrictions on level, the cassette can equal and in

many cases surpass the performance of the garden-variety of home record player.

**Tchaikovsky: Selections from Swan Lake & Sleeping Beauty Ballets.** Leopold Stokowski cond. the New Philharmonia Orch.

London/Ampex LKX94008, Stereo cassette (\$5.95)

Stokowski is justly famous for his interpretation of these popular ballets and his recordings of them for RCA Victor were best sellers for many years. Ampex tells me that the ratio of classical cassettes to pop cassettes is on the order of one in twenty. That is, they issue 20 pop tapes for every classical recording. I hate to be the one to rub salt in a wound, but after listening to this cassette, I can understand the present paucity of classical material.

As I related last month, there is a signal-to-noise ratio problem with the pop cassettes, even with their relatively limited dynamic range. With the much greater dynamics of this classical material, the hiss problem is indeed most formidable. It is a shame, too, for the Maestro's performance is as spritely as ever and the sound is quite good. I played the cassettes through my big wide-range system and through a little integrated Ampex system. In both cases the hiss was too obtrusive when the music was auditioned at a good room-filling level. Cutting back the volume of the little system to "apartment house" level helped the hiss, but the music lost in dimension. On my big system I cut off the response at 9 kHz and, as I suspected, this was of no use. Then I cut at 5 kHz; this did subdue the hiss a little, but rendered the music quite lifeless. I'm very much afraid that until there is a breakthrough with something like chromium-dioxide tape or some other technique to improve the hiss level in cassettes of classical music, the utility of the cassette concept will be confined to pop material.

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**EXPERIENCED HI-FI, HAM, CB** salesmen wanted. J. S. Draper, Lafayette Radio Electronics, All Cape Shoppers Bazaar, Rt. 132, Hyannis, Mass. 02601.

## MAGNETIC TAPE

(Continued from page 48)

### Which tape to choose

To conclude, the best tape for you depends much upon a variety of factors, including recorder fidelity; tape-handling ability, recording signal strength and quality, recording time without changing reels, degree of fidelity required for an application, tape recording permanence, and recorder bias.

Experimentation with a few tapes might help you to decide which tapes are best for what purposes. One way to do this is to purchase one reel of each type and splice lengths of each type together. Then record the same selection on each length, in turn, and play back the results. You may decide that low-noise magnetic tape will serve best for 75% of your recording needs. Perhaps the other 25% will be made up of magnetic tape chosen from among a few other types, say, long-play tape for recordings that promise to consume an inordinate amount of time (conferences, party games, complete broadcasts, etc.). Maybe "white box" tape will be fine for letting friends and relatives hear what they sound like, low-print tape when you intend to store recordings for a long time, and so on.

The judgment will have to be made by *you*, however, because no one knows your recorder or your needs better than you do. Æ

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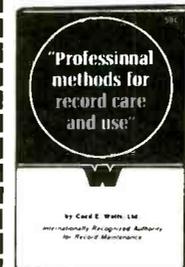
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