

# AUDIO

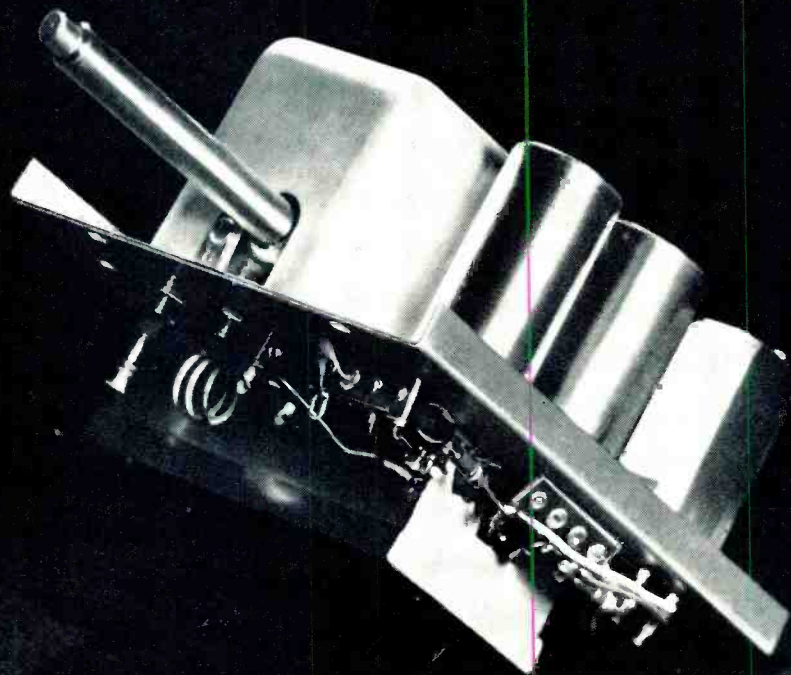
DECEMBER, 1963

60¢

*...the original magazine about high fidelity!*







## EXTRAVAGANCE?

Is it an extravagance to silver-plate the critical Radio Frequency circuit (front-end) of an FM tuner? Scott doesn't think so . . . and neither do the editors of the leading hi-fi magazines.

For example . . . Audio reporting on the Scott 4310, said, "Without question, this tuner is one of the finest extant. It pulled in more stations, loud and clear, than any other tuner we have tested. The record now stands at 40 stations."\*

What makes Scott tuners pull in more stations, loud and clear, than any other tuners? Is it the exclusive Scott Time-Switching multiplex circuitry . . . the Scott Wide-Band design? Partly.

It is also the fact that Scott, and only Scott, goes to the extra expense and trouble of silver plating Radio Frequency circuits. Silver is a far better conductor of electricity than steel or aluminum, the materials commonly used by most tuner manufacturers. With this greater conductivity the tiny signal received by the tuner

(often just a few microvolts), is not subject to signal losses or the addition of noise. As a result, Scott tuners can receive many more stations, cleanly, and without distortion.

Scott tuners are used in the most critical professional applications. It was a Scott tuner that was selected by Bell Laboratories for the famous Telstar Tests. Most broadcasting stations use Scott tuners for monitoring their own broadcasts and for relay applications. These professionals recognize the advantages of Scott's scrupulous attention to details like the silver-plated front end . . . details that make Scott the ideal choice for enjoying FM stereo in your home as well.

Scott tuners are available in all price ranges, in factory assembled or in kit form. Prices start at \$119.95.

Write today for complete details.

\*Audio, September 1963.



**350 C FM Stereo Tuner \$224.95**  
Prices slightly higher west of Rockies

**SCOTT®**

H. H. SCOTT, INC., 111 POWDERMILL RD., MAYNARD, MASS.

Export: Morhan Exporting Corp., 458 Broadway, New York, N. Y. • Canada: Atlas Radio Corp., 50 Wingold Avenue, Toronto.

# AUDIO

DECEMBER, 1963 VOL. 47, No. 12

Successor to **RADIO**, Est. 1917

C. G. McPROUD • *Publisher*

DAVID SASLAW • *Editor*

JANET M. DURGIN  
*Production Manager*

## Contributing Editors

EDWARD TATNALL CANBY

JOSEPH GIOVANELLI

HAROLD LAWRENCE

CHESTER SANTON

HERMAN BURSTEIN

HENRY A. SCHOBER  
*Business Manager*

SANFORD L. CAHN  
*Advertising Director*

EDGAR E. NEWMAN  
*Circulation Director*

## Representatives

Bill Pattis & Associates,  
4761 West Touhy Ave.,  
Lincolnwood 46, Ill.

James C. Galloway,  
6535 Wilshire Blvd.,  
Los Angeles 48, Calif.

Warren Birkenhead, Inc.,  
No. 25, 2-chome, Shiba Hama-  
matsu-cho,  
Mitato-ku, Tokyo, Japan

Controlling Sound-Reinforcement Systems	19
The Auditioner	24
An Open Baffle Parallel-Series Array	30

Light Listening	6
Jazz and all that	36
Record Revue	46

Heathkit Transistor Tester	38
Korting "Mozart" Tape Recorder	38
Fisher FM-Stereo Receiver	44
Sherwood FM-Stereo Tuner	44
Shure Stereo Studio Dynetic	59

Audioclinic	2
Letters	8
Audio ETC	10
Editor's Review	16
Tape Guide	34
About Music	50
New Products	56
Cover Story	60
Annual Index	66
Advertising Index	68

## AUDIO Articles

David L. Klepper

John Whitacre

R. S. Oakley, Jr.

## AUDIO Reviews

Chester Santon

Bert Stanleigh

Edward Tatnall Canby

## AUDIO Profiles

Model IM-30

Model 3000

Model 500-C

Model S-3000V

Model M222

## AUDIO in General

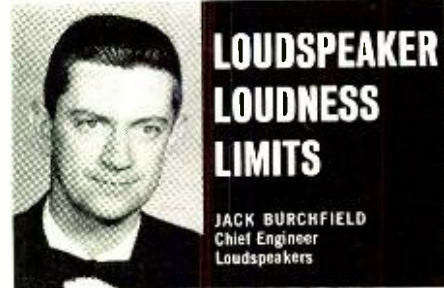
Joseph Giovanelli

Edward Tatnall Canby

Herman Burstein

Harold Lawrence

Number 4 in a series of discussions  
by Electro-Voice engineers



We are frequently asked how loudly a specific loudspeaker can be played without distortion or danger of destruction. This question is not easily answered when asked in regard to home or studio music reproduction.

If the material to be reproduced is a simple sine wave, voice coil heating is the normal controlling factor, and the point where excessive heat (or excessive voice coil travel) is reached can be simply determined. However, steady-state sine waves are not typical of most program material, and this power limit is unrealistic when applied to musical reproduction.

One outstanding characteristic of musical energy is its transient nature. Even when an orchestra plays a sustained high level chord with no audible variation, the combined waveform shows markedly fluctuating peak energies. These peaks are formed when each constantly changing waveform adds to the energy of other waveforms.

Typically, energy peaks in music will reach a level up to ten times the average or R.M.S. value. The relatively low average level tends to protect the speaker from high heat build-up even at extremely high listening levels.

In laboratory studies, we have applied up to 100 watts of musical program material to E-V high fidelity speakers with no apparent distortion and no signs of immediate failure due to heat or fatigue. One fact became quickly evident. The absolute loudness limit for most high fidelity systems lies not with the speaker, but rather with the amplifier.

Careful oscilloscope analysis revealed that waveform distortion appeared first at the amplifier output, usually in the form of clipping. The loudspeaker faithfully reproduced this distorted waveform, giving rise to the subjective analysis that the speaker was being "overdriven." Substitution of a more powerful amplifier, with greater reserve power at the same acoustic output, eliminated the "speaker distortion" completely!

The problem of maximum loudness in any system is further complicated by the growing trend toward speaker systems of medium or low efficiency. If a speaker system, by design, trades six or eight db of efficiency for other benefits (wider range or smoother response), it necessarily places a heavier burden on the amplifier to provide a clean signal at high levels.

The absolute limitations of any speaker system based on peak performance requirements are very difficult to objectively state. Listening tests have proved to have the greatest validity to date, yet results vary from listener to listener, and with the frequency and duration of the peaks.

A realistic rating for most small speaker systems would be in the order of eighty to one hundred watts peak handling power. To realize this potential requires an amplifier of forty to fifty watts rating (based on peak performance twice that of the steady-state rating).

For technical data on any E-V product, write:  
ELECTRO-VOICE, INC., Dept. 1233A  
Buchanan, Michigan



AUDIO (title registered U. S. Pat. Off.) is published monthly by Radio Magazines, Inc., Henry A. Schober, President; C. G. McProud, Secretary; Executive and Editorial Offices, 204 Front St., Mineola, N. Y. Subscription rates—U. S. Possessions, Canada, and Mexico, \$5.00 for one year, \$9.00 for two years; all other countries \$6.00 per year. Single copies 60¢. Printed in U.S.A. at 10 McGovern Ave., Lancaster, Pa. All rights reserved. Entire contents copyrighted 1963 by Radio Magazines, Inc. Second Class postage paid at Lancaster, Pa.



RADIO MAGAZINES, INC., P. O. Box 629, MINEOLA, N. Y.  
Postmaster: Send Form 3579 to AUDIO, P. O. Box 629, Mineola, N. Y.



# Coming NEXT Month

## Construction . . .

● A Ton-and-a quarter of Sound. Walter Wysoczanski describes a curved-mouth concrete horn stereo speaker system he built in his home, each side of the stereo pair weighing over 1200 pounds without drivers.

● Very Low Voltage Relay Operation. Ronald L. Ives. A way of using the 5-volt filament tap on a power transformer, made available by replacing the rectifier tube by a solid-state rectifier, to power a low-voltage relay.

## General . . .

● The Transient Performance of Loudspeaker Dividing Networks. Robert M. Mitchell describes the classical solution for dividing networks and demonstrates the inadequacies of that solution. Instead he proposes a method whereby one network will do what two do now—and better.

and

## Equipment Profiles . . .

Stanton Model 800B Stereotable  
H. H. Scott 340B FM-stereo tuner-amplifier

## In the January Issue

On the newsstands, at your favorite audio dealer's, or in your own mailbox.

# AUDIO CLINIC

Joseph Giovanelli



Send questions to:

Joseph Giovanelli  
2819 Newkirk Ave.  
Brooklyn 26, N. Y.

Include stamped, self-addressed envelope.

### Lower Amplifier Output

*Q. Recently I noticed a marked loss of volume in my left speaker. I suspected my output tubes might be weak. I replaced all four. I still do not have equal volume in each channel.*

*Do I need to replace the remaining tubes in my amplifier? Name withheld, Bronx, New York.*

A. If your preamplifier is separate from the amplifier, do not assume that the difficulty will be found in the amplifier. Any check suggested later in this answer should also be applied to the preamplifier.

If you have two separate amplifiers in the stereo system, it is possible that the rectifier in one of them has gone bad, thus causing the drop in volume. (I know that you mentioned that your particular system was an integrated amplifier, meaning that two amplifiers were mounted on a single chassis, and perhaps the preamplifier is included as well. However, in order to make this material fit the many amplifier-pre-amplifier possibilities, I am being more general than your particular problem called for.)

If you are using an integrated system, first check the remainder of the tubes. If all tubes check normal on a dynamic tube checker, you will then have to work from the voltage and resistance chart supplied with most amplifiers. If no such chart has been provided, work from the schematic and do some guessing. The causes for this condition are multitudinous. If you have a signal tracer, work back from the output stage. Another trick which you can try is to pull the tubes out, starting from the output stage. Compare the sound when doing this against that produced by an equivalent tube pulled out of the working channel. This is a primitive method, but the results are often obtained more quickly than with more scientific checking.

You will finally come upon a stage where pulling out a tube in the defective channel does not sound the same as a tube removed from the operating channel. You will then know that the trouble you are having is in this area of the amplifier. Now when I refer to the sound made with a tube removed, I refer to the "thump" or "bang" which is produced when the tube is in the process of being removed.

Once you have pinpointed the area where trouble is present, you then can use the more conventional methods for determining the exact nature of the trouble. Check such things as lack of plate or cathode voltage. As a further check in this same regard,

make your checks from plate to cathode rather than from plate to ground.

I referred earlier to the use of a signal tracer. There are two types and I use them both at one time or another. One type of tracer is nothing more than amplifier which is fitted with test leads at its input. These test leads can be placed in the various grid, plate, and cathode circuits of an amplifier. As this device is moved from the input to the output, there should be an increase in signal output from this tracer amplifier at each successive stage. If one stage does not provide its share of gain or perhaps introduces a loss, then you will know that this stage is the one which is defective and must be further investigated to determine the cause of the malfunction. Remember that a cathode follower; possesses approximately unity gain, so if you connect your tracer to the output of such a stage, no gain will be produced over that provided by the preceding stage. Further, connecting your tracer to the plate circuit of such a stage will provide no signal because of the intentional bypassing of this circuit with large capacitors.

The other type of tracer is one which is actually a source of signal. Such devices are very often self-contained units employing transistors or miniature buzzers. They are often shaped like a pen. Connecting the tip of this kind of tracer to the various points in the amplifier or preamplifier will produce a signal in the output, and the amount of signal obtained will be dependent upon the gain of the amplifier at the point where the signal is introduced. When using this probe, note that moving the device from input toward the output will result in less and less gain with each stage. I prefer, when using this instrument, to work from output to input.

Remember that the tools you use will not solve your problems—they are only aids. When properly used, they are useful diagnostic aids. Do not use any test instrument until you understand its operation. Do not connect it into a circuit until you are certain of its probable action and the results you should expect. In other words, do not use a tool haphazardly with the idea that you "may turn up something."

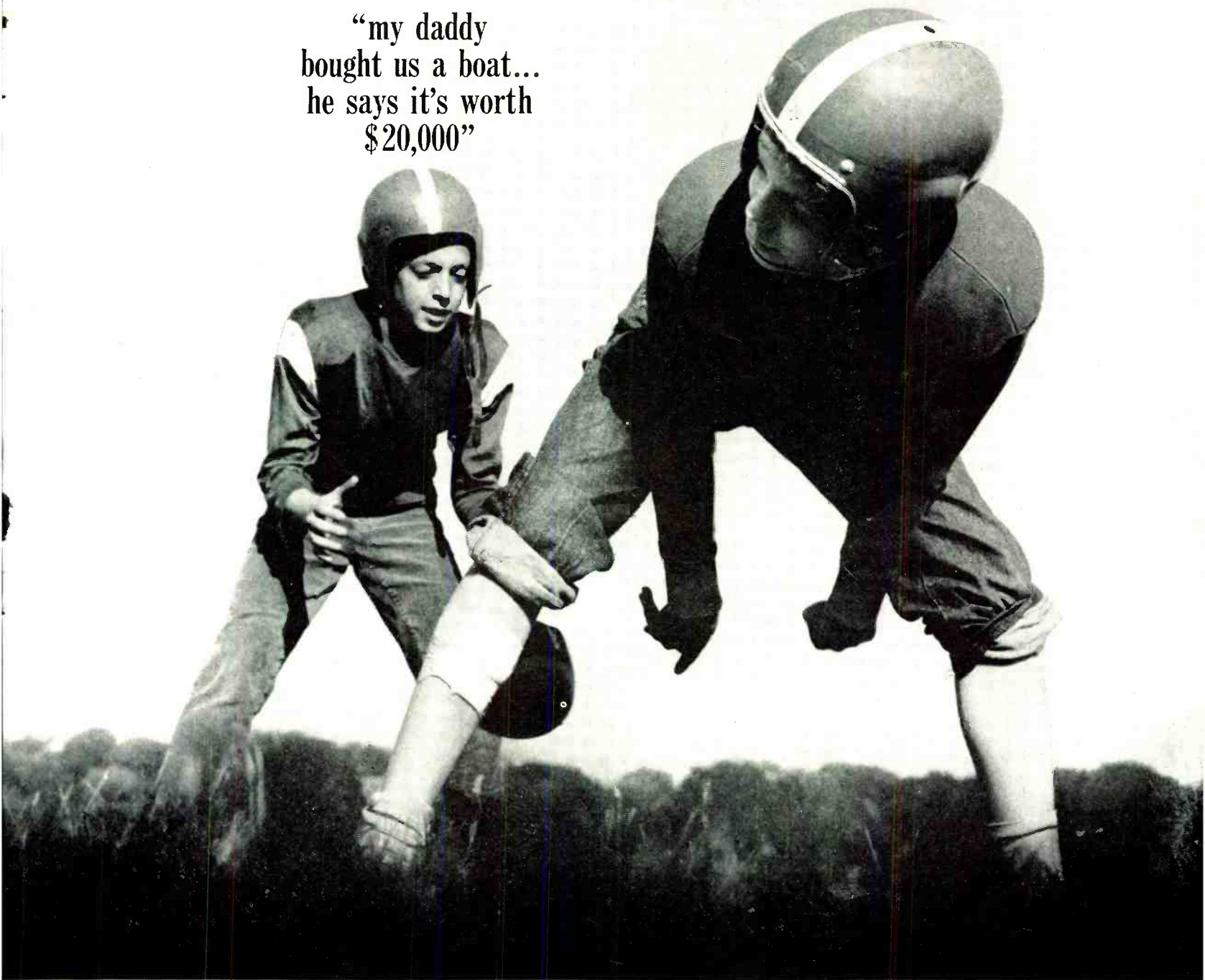
By thinking and observing, you, the experimenter, will learn far more about the subject of sound reproduction. Further, you will be able to bring about the results you seek in a more scientific manner and will usually bring them about more quickly.

To illustrate this point, recall my simple process whereby a tube is removed from a channel, one at a time to listen to the "bang" produced. How many of you took me at face value and did not question what might happen in certain instances. You should have asked me some of the following questions or at least have asked yourself these questions:

1. Will my speaker be damaged by the transient clicks produced by the removal of a tube?

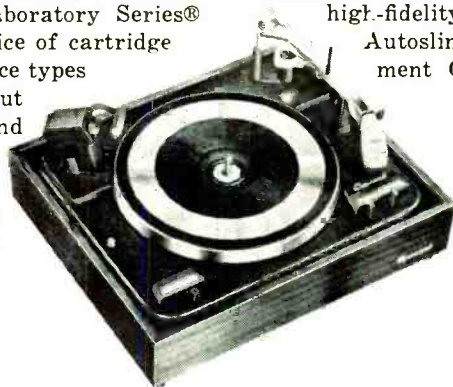
“my daddy bought us  
a Garrard Automatic  
Turntable...he says  
it's worth a million!”

“my daddy  
bought us a boat...  
he says it's worth  
\$20,000”



What makes a Garrard worth a million? Pleasure . . . the pleasure of an incomparable experience in sound. Why? Because the Garrard Automatic Turntable integrates a dynamically balanced tone arm, counter-weight adjusted . . . a full size turntable, cast heavy and balanced . . . correct torque stemming from the Garrard Laboratory Series® motor. The Garrard arm takes your choice of cartridge . . . even the ultra-sensitive, high-compliance types labeled “professional”. This arm brings out the best in any cartridge . . . tracking and tripping at the lowest pressure specified by the cartridge manufacturer. The unit is quiet . . . speed even . . . sound pure, undefiled by rumble or resonance.

Garrard offers the convenience of automatic play and automatic shut-off even after single records. And, should your Garrard ever need maintenance, you will find that it is supported by the industry's best stocked, best trained, authorized service network. There is a Garrard for every high-fidelity system. Type A, \$79.50; AT6, \$54.50; Autoslim, \$39.50. For literature, write Department GX-13, Garrard, Port Washington, N.Y.



**Garrard**<sup>®</sup>  
WORLD'S FINEST



# NEW! ENGINEERING BREAKTHROUGH ROBERTS CROSS FIELD®

## "770"

records automatically—

15 high fidelity  
stereo albums  
for the price of one



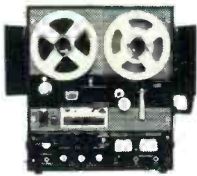
Now, 8 hours of full-range, true, high fidelity stereophonic music, or 16 monaural hours, can be yours on one 7" reel, with the revolutionary new Roberts Cross Field "770" Tape Recorder. The average tape cost per album: only 33¢. The "770" has an exclusive patented third head, the Cross Field Head, which separates recording and biasing functions. The result: the "770" records 40 to 22,000 cps, producing true fidelity at 1 7/8 ips and preserving the high frequency harmonics that breathe life into music playback. The Cross Field playback head has a gap width of only 40 micro-inches, the smallest, most responsive head ever engineered. For this head, Roberts employs NC-88, a new alloy, that is practically wear-proof. Other features: 2-speed, electrically-switched, heavy-duty hysteresis synchronous motor, minuscule wow and flutter at slow speeds; special ventilation system keeps the "770" cool even after 8 hours; two 5" x 7" self-contained elliptical, extended-range, heavy-duty Alnico V-magnet speakers; new automatic total shut-off switch.

Today, see the Roberts Cross Field "770" Tape Recorder at better music and camera centers. \$499.95.

**Specifications:** 7 1/2, 3 3/4, 1 7/8 ips. Power Amplifier Output: 12 watts • Frequency response: at 7 1/2 ips, 40 to 22,000 cps ±2 db; at 3 3/4 ips, 40 to 18,000 cps ±2 db; at 1 7/8 ips, 40 to 13,000 cps ±3 db • signal to noise ratio: —55 below 0 recorded level • Wow and flutter: at 7 1/2 ips, less than 0.12% rms; at 3 3/4 ips, less than 0.20%; at 1 7/8 ips, less than 0.30% • Blower vent system • 2 large stereo 5" x 7" elliptical, extended range, heavy duty Alnico V magnet speakers • Hysteresis synchronous instantaneous electrically controlled 2 speed motor • Automatic total shutoff • Operates Horizontally or Vertically.



**New Model 330:** Another achievement of Roberts' electronic engineering. Sound-on-sound multiple recording, 3 heads for separate record, playback, erase; two 7" full-range speakers. Special biasing for FM Multiplex Recording Systems. Speeds: 7 1/2, 3 3/4 ips. 27 lbs. \$349.95.



**New Professional Model 455:** Has three electrically switched, dual-speed motors, separate bass controls, 4 simultaneous mixing inputs, playback loudness controls, track selector, two full range 5" x 7" speakers. 7 1/2, 3 3/4 ips. \$599.95; Remote control, \$49.95.

See the entire line of Roberts professional and home tape recorders from \$269.95 at better music and photo centers.



FREE BOOKLET! "40 AND MORE WAYS TO USE A ROBERTS TAPE RECORDER"

Roberts Electronics, Inc.  
5978 Bowcroft, Dept. A12, Los Angeles 16, Calif.

Please send free booklet

Please send me complete information about Roberts Tape Recorders.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

IN CANADA: J. M. Nelson Electronics Ltd., 7725 Adera St., Vancouver 14, B. C. (Prices slightly higher in Canada)

2. Where should the volume control be set?

3. Are there any direct-coupled stages in the circuit which might be adversely affected by this procedure?

The answer to Question 1, depends upon the wattage of your amplifier and the wattage of the speakers connected across it. If there is likely to be damage as a result of this procedure, pad down the speaker so it will not receive sufficient power to ruin it.

The answer to Question 2, is that the volume control will have to be set at its fully advanced position or you will not obtain much output from the phono stage being removed. Further, if you are comparing one channel against the other, the balance control must be set at the same points on each channel.

Question 3, cannot be answered for you. You will have to consult the schematic of the amplifier you are working on.

### Equipment Performance and Line Frequency

*Q. I am assembling a high fidelity system consisting of preamplifier, amplifier, turntable, tape recorder, and two speaker systems. All of this equipment is rated at 60-cps 110-120 volts. The turntable can be used at 50-cps. The tape recorder can be converted to 50-cps. In the future I will be living in areas where power line ratings are 220 volts at 50-cps.*

*These are my questions: 1. Can this system be utilized at both 60-cps 120 volts and 50-cps 220 volts? 2. What changes, if any, should be made and in what pieces of equipment to cope with these requirements? J. Schiller, Midland, Mich.*

A. Whenever operation of a particular piece of equipment is to be changed from one line frequency and voltage to another, it is well to check with its manufacturer to obtain his views on the matter before buying the equipment.

In the case of the amplifier and pre-amplifier, you have no real worry about frequency as long as the equipment has been conservatively rated and designed—especially the power transformers. No changes will be required. No detrimental effects should be expected.

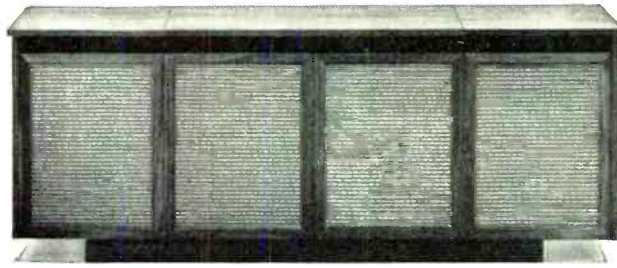
However, in the case of the turntable and the tape recorder, line frequency is a problem. Not only must the motor be capable of operating at reduced frequency, but also there must be a means provided to allow the turntable to run at proper speed. The speed of the motor varies with applied frequency. The lower the frequency applied to the input of the motor, the lower will be the speed of rotation of the motor shaft. You need some kind of separate or variable pulley arrangement if the line frequency is to be changed during the time you own the equipment.

Similarly, the tape recorder drive mechanism must be provided with suitable pulleys if correct tape speed is to be maintained when the supply line frequency is changed.

Because most equipment will not be provided with tapped transformers and motors, you will need a transformer which will convert the 220 volts found in Europe to the 120 volts required by American-made equipment. This transformer must have a power-handling capacity somewhat greater than the total amount of power required by the equipment it feeds. In addition, the transformer must be capable of operating at 50 cps.

AE





## No Larger Than A Record Changer . . . Every Inch A Troubador

The New Empire 488 . . . tailor made for console or equipment cabinets. It is well known that acoustic feedback has been harassing playback equipment in console cabinets for years. This is due in large measure to the close proximity of turntable to speaker. Not too long ago, Audio Magazine tested the Empire Troubador . . . they reported: "We tried to induce acoustic feedback by placing the turntable on top of our large speaker system and turning up the gain—we were unsuccessful." Other factors important to cabinet owners are stability and level surfaces, the jars and jolts of heavy footsteps or accidental bumps can jump some arms even in the most stable cabinets. Stability under virtually

any conceivable situation is now assured by Empire's sensational "Dyna-Mount" (vibration-absorbing multiple floating suspension system) found only in the new Empire 488. The Famous Empire 398 . . . professionals' turntable—too perfectly engineered for even a whisper of distortion . . . too handsome to hide behind cabinet doors. Hi Fidelity reports: "The Troubador represents a precision-engineered product of the highest quality . . . wow, flutter and rumble completely negligible . . . speed accuracy very good . . . maximum tracking error of the arm judged to be negligibly small . . . very low needle talk, minimum hum pick-up . . . clean response . . . one of the finest, handsomest record players available."

**EMPIRE**

"World's Most Perfect Record Playback System."

Empire 3-speed "silent" turntable, only 2 moving parts.

Empire 980 dynamically balanced playback arm with the sensational Dyna-Lift\*

Empire 880p mono-stereo cartridge featuring the virtually indestructible Dyna-Life\* stylus

Dimensions: Minimum space requirements 15 7/8" wide x 13 1/4" deep . . . height required above mounting board 2 3/4"; depth required below turntable base plate 3 1/2".

Prices: 488 complete with walnut mounting board: \$192. Walnut base optional (\$15). 398 complete with handsome walnut base: \$210.

\*Patent Pending

Empire Scientific Corp. • 845 Stewart Ave., Garden City, L. I., N. Y. / Export: EMEC, Plainview, L. I., N. Y. • Canada, Empire Scientific Corp., Ltd., 1476 Eglinton West, Toronto





**Dick Leibert: The Happy Hits of Christmas**

**RCA Victor LSP 2771**

Ordinarily, Christmas releases very seldom arrive in time to make Light Listening's December column. This gloomy fact has tended to cast this corner in a light that has been far from flattering, indicating to some a Scrooge-like nature on the part of your reviewer that is thoroughly unjustified. This year, luckily, RCA Victor has come to the rescue with an earlier-than-usual release of a Christmas album worthy of gracing any sound fancier's stocking. This stereo recording featuring Dick Leibert at the console of the Radio City Music Hall Wurlitzer organ is the sort of item that, in former years, would have been mentioned a month later in the January issue because it definitely rates recognition as a seasonal release, even on a delayed basis.

The encouraging thing in this stereo release is the way in which the organ at Radio City manages to override the slight limitations still present in the RCA Dynagroove process. The frequency range of this album almost reaches that of the conventional RCA Victor stereo record. Despite the closer-than-average position of the mikes, the very lowest pedal notes do not extend to the region where they would be felt rather than heard. There is some cone pushing below 80 cycles or so but it is not the best bass response you can get these days with today's stereo cutters. What saves the day is the close position of the mike (or mikes) at the particular loft containing the organ's largest pipes. Located on each side of the giant Music Hall stage, the Wurlitzer's pipes range in size from a tiny tube no larger than an ordinary lead pencil to the largest member of the family extending some thirty-two feet in length. The same mikes, however, deliver a treble range of gratifying energy, giving the illusion of total response in the high end. Dick Leibert, Chief Organist at the Music Hall for the past thirty years, is probably the only man alive with a total command of all the tricky combinations possible on the world's largest theatre organ. He uses a good percentage of them in creating the busload of effects that are part of *Jingle Bells*, *I Heard the Bells on Christmas Day* and Leroy Anderson's *Sleigh Ride*. For all his generosity in novel effects, Leibert still manages to save the best goodies in his bag for the scintillating arrangement of the *Parade of the Wooden Soldiers* that closes the album.

**Peter Sellers: Fool Britannia**

**Acappella AC - 1**

**Presenting Jerry Stiller and Anne Meara  
Verve V-15038**

In recent months the record industry has been discovering that it's far easier to release a comedy record than it is to get someone to laugh at it. To be even moderately successful these days, humor on records requires a personality capable of projecting to full advantage the bright material that has always been needed to draw laughs in any medium of show business. These two comedy releases should prove diverting to a fairly wide audience of record buyers. In view of the fact that Peter Sellers fans have had to be content so far with only two albums in the catalog, this third release may stir interest that exceeds the actual merit of the disc itself. Unlike his earlier records on the Angel label, "Fool Britannia" is not an exclusive Peter Sellers production throughout its length. The script for these sketches on England's Profumo vice scandal

## LIGHT LISTENING

**Chester Santon**

was written by Anthony Newley and Leslie Bricusse of "Stop the World" fame. Along with Joan Collins (Mrs. Newley), Daniel Massey and Michael Lipton, they assist Sellers in a collection of vignettes calculated to further unnerve an already shaking establishment back in the home country. Much of the material reflects the speed with which Newley and Bricusse threw it together since there was no way of knowing whether the Profumo-Keeler case would still be in the news by the time the record came on the market. Some of the blows struck in the cause of satire only glance the subject yet the cast applies more venom to its task than any non-British crew would dare. Sellers spearheads the attack with a blistering five minute impersonation of Prime Minister Macmillan. As the record continues, however, the gibes at Macmillan take on an air of warm geniality once the cast takes on the British scandal press and other institutions trying to turn a profit over the Profumo affair. Sellers does his best character work in skits dealing with a newspaper tycoon and a shady film producer. It is hardly necessary to remind anyone familiar with this comedian's work that even a lightweight Sellers effort can be substantially more amusing than that of many of his competitors.

The Verve comedy record starring Jerry Stiller and Anne Meara would possibly have attracted more attention during a month that didn't see the release of a Peter Sellers disc. This new comedy team, recorded before an audience at the hungry i in San Francisco, is already on its way to a very promising career on the basis of this diverting disc. Their material is original and delivered in a key low enough to hold the attention of today's sophisticated audience. The New York accent, in all its rich forms, is their specialty and they use it with cutting effect in most of their skits. Miss Meara is particularly versatile, equally at home in a Greenwich Village coffeehouse, lampooning TV commercials, arguing with her husband or ribbing the life out of commentator Pauline Frederick in a delicious sketch called "The Whale." Good husband and wife teams are still a comparative rarity in the comedy field. Stiller and Meara should have no difficulty going to the top—if they keep up the pace they have set in this recording.

**Miltinho: Rhythm and Sound of Bossa Nova**

**Audio Fidelity AFSD 5984**

**Mariachi Nacional: El Hombre Mexicano  
Audio Fidelity AFSD 6116**

Audio Fidelity's latest excursion below the border covers just about the whole gamut of Latin American music in the very latest sound. The predictable nature of AF's sound quality is not the least of the engaging features in these releases. At a time when just about any established label is apt to spring a sound gimmick aimed at the very widest mass market, it is a genuine pleasure to place a compliant stylus assembly into the lead-in groove of these well made, no-nonsense stereo discs.

Taking the newer material first—the Bossa Nova album stars the subtle talents of the great Brazilian drummer Antonio Da Souza, internationally known as simply "Miltinho." Following several seasons as a featured member of Joao Gilberto's famous group, Miltinho bears unquestioned credentials for his own starring album. Working here with the Oscar Castro-Neves orchestra, he never overshadows the smooth efforts of the solo instrumentalists. The result is a Bossa Nova album with a

**Piaf and Sarapo at the Bobino**

**Capitol ST 10348**

There is mild irony in the fact that Edith Piaf's first record in which she talks to an audience in the introduction of her songs appeared a day or so after her death in Paris early in October. Capitol Records may have other recordings by France's unique song stylist still in the vaults but this release will draw exceptional attention while stories of her almost incredible career are carried in newspapers and magazines. Side One of this release, recorded before a very appreciative audience at the Bobino in Paris, finds the great Piaf still in full voice while Side Two introduces Theo Sarapo in his North American disc debut. He is the young Greek singer who became Piaf's husband in 1962. His is a light voice, employed in a half dozen songs that betray considerable evidence of Piaf coaching.

musical quality fully as satisfying as the impeccable sound.

The Mariachi album is by no means the first of its kind produced by Audio Fidelity's far-ranging Latin department. Unlike many of the previous releases by the ubiquitous street musicians of Mexico, this one offers a good deal of vocal as well as instrumental fare. The four guitarists, three violinists and two trumpeters of the Mariachi Nacional are directed by Arcadio Elias in a typical program of South American favorites. The selections most familiar to our ears include *Adios Mariquita Linda*, *Guadalajara* and the specialty of bull fight bands, *La Virgen de la Macarena*.

**Morton Gould: Spirituals for Strings**

**RCA Victor LSC 2686**

If you value magnificent string playing by an orchestra of experts as heard in just about the best string sound available today, don't miss this truly outstanding release. Any string fan whose record budget for the year is at the point of depletion should make this recording the first order of business in the year ahead. Stirring spirituals such as *Deep River*, *Go Down Moses* and *Sometimes I Feel Like a Motherless Child* have never sounded better. Morton Gould is fortunate that his string orchestra has not been subjected to the Dynagroove process in this recording. Despite the fact that the Dynagroove system has been watered down and is now relatively innocuous in some releases, even in its mildest form it still introduces top end distortion that this Gould recording does not have. Appraised on decent equipment, this recording is the most convincing argument RCA has produced to date for the total abandonment of the whole Dynagroove concept.

**Anna Moffo/Sergio Franchi: The Dream Duet**

**RCA Victor LSC 2675**

It should be obvious to anyone that this joint venture with soprano Anna Moffo is the nicest thing that has happened to Sergio Franchi since he arrived here from Italy in September 1962. Miss Moffo, one of the most appealing young stars of the Metropolitan Opera Company, has the voice and talent to provide more than fifty percent of the dream in any Dream Duet. She is an unflinching delight in the highly thought of operetta duets that Jeannette MacDonald and Nelson Eddy used to do in the Thirties. With the exception of some of the repertoire, there is nothing whatever in the work of these present-day artists to remind one of the bygone MacDonald-Eddy team. Anna Moffo is a sophisticated woman of the world with precious little of the older-girlish charm that was Miss MacDonald's hallmark. As for Sergio Franchi, it will take you a while to get used to his Italian accent in the lyrics of a Herbert or Friml tune. Miss Moffo, a native of this country, has no such difficulty. If you can accept the touch of incongruity in the Franchi accent, you'll find much to admire in the smooth blend of voices backed by the stylish arrangements of Henri Renés orchestra.



**“Without question, the SA-1000 is one of the finest amplifiers we have ever tested. In addition, it reproduces music as well as it tests...this is due to the unusually excellent transient response in conjunction with its unusually excellent everything else.”**

-AUDIO / September, 1963

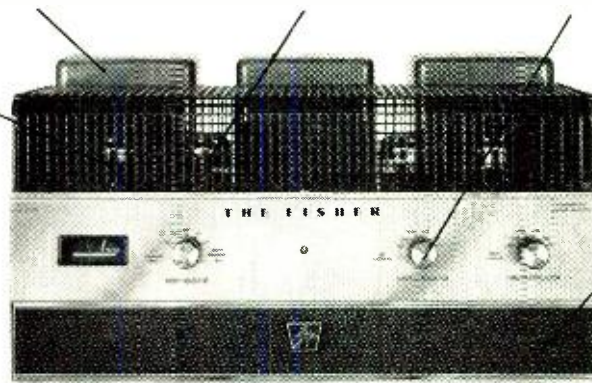
Type 8417 output pentodes with cavity anode design.

Totally resonance-free ultra-wide-band output transformers.

Triode-connected dual power-pentode driver stage.

Oscilloscope-type cathode-follower input stage with compensated attenuator.

Hinged cover for rarely used controls (bias and balance).

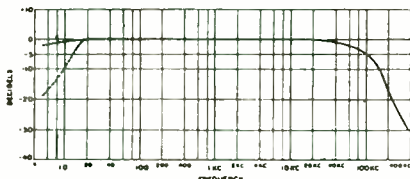


## 150-watts of power!

THE SA-1000 represents Fisher's first entry in the highly specialized class of extremely high-powered dual-channel basic amplifiers. There has been no scarcity of advanced equipment in this heavy-weight category; excellent high-wattage stereo power amplifiers of well-known makes have been available at prices starting in the \$230-to-\$270 range (for factory-wired kits) and rising all the way up to \$764 (for a pair of single-channel models of very de luxe construction). What does it mean, then, when Fisher finally decides to match its own contender against such formidable competition and sets the price at \$329.50?

To those who know Fisher, it can mean only one thing: Fisher has exhaustively tested, measured and evaluated all these other power amplifiers in its own laboratories and finds the SA-1000 to be distinctly superior to *all* of them, regardless of price. As for the price tag, it happens to be in the low 300's rather than the 400's or 500's solely as a result of Fisher's unusually large and technically unmatched manufacturing facilities, geared for heavy initial production in anticipation of demand.

Frequency Response (0 db = 4 watts)  
Subsonic Filter: Dotted Line

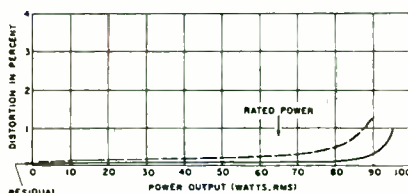


The Fisher SA-1000 is a challenge to the severest critics and most discriminating judges of professional sound reproducing equipment, both as to specifications and listening quality. Its music power rating is 150 watts IHF Standard, with *both* channels driven. The RMS power rating, again with both channels driven, is 130 watts (65 watts per channel). However, as a glance at the intermodulation curve will show, each channel will deliver 80 watts at 0.5% IM

distortion, thus indicating the extreme conservatism of the official rating.

The output stage of the SA-1000 is engineered around the newly developed 8417 beam power pentodes, *never before used in any electronic device*. Designed specifically for use in this amplifier, the 8417 offers extreme linearity, resulting in greatly reduced distortion, and has unusually low drive-voltage requirements, permitting the previous stages to 'coast' at their lowest possible distortion levels.

Total Harmonic Distortion at 1 kc: Solid Line  
Intermodulation Distortion (60 cps/7 kc, 4:1):  
Dotted Line



Each pair of 8417's in the SA-1000 drives a giant output transformer via plate-cathode coupling—a modified and improved 'ultra-linear' configuration that provides 12 db of the most desirable and stable type of negative feedback in the output stage.

The driver stage, too, is entirely novel. A triode-connected 6HU8/ELL80 dual power pentode circuit developed by Fisher engineers is capable of delivering 40% more drive to the output stage than is required—and at a remarkably low impedance. The result is very low distortion, the fastest possible recovery time, great stability and hence outstanding transient response.

The input stage of the SA-1000 is of a type widely used in laboratory oscilloscopes but never before in high-fidelity amplifiers. A compensated input attenuator in conjunction with a cathode-follower circuit permits adjustment of the input signal from 0 db to -12 db in closely calibrated 3 db steps without the slightest effect on input impedance and frequency response.

The power supply of the SA-1000 is one

of the most elaborate ever used in a stereo power amplifier. Regulation and filtering are of the highest order and all silicon diodes as well as filter capacitors are most conservatively operated.

Bias and balance are readily adjustable on each channel by means of the built-in laboratory-type calibration meter, but the controls for these rarely needed adjustments are ingeniously concealed behind an attractive hinged cover—another Fisher exclusive.

These are the most important facts and figures. You cannot fully evaluate the Fisher SA-1000, however, simply by reading about it. A comparative listening test at your dealer is an absolute must in this case. *Then* you will know that, even in this exalted category, not all power amplifiers sound exactly alike—and that the most flawless of them all costs only \$329.50.\* It is also available in StrataKit form as the K-1000, priced at only \$279.50.\* Both carry the famous Fisher Warranty for all tubes, diodes and parts for one year from date of purchase. Industry wide standard: 90 days.

\$1.00 VALUE! ONLY 25¢!

The new 1964 edition of The Fisher Handbook, a comprehensively illustrated 52-page reference guide, component catalogue, and idea book for custom stereo, plus detailed information on the Fisher SA-1000 Stereo Power Amplifier. I enclose 25¢, double-wrapped, to cover cost of handling and mailing.

FISHER RADIO CORPORATION  
21-29 44th Drive, Long Island City 1, N.Y.

Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_  
Zone \_\_\_\_\_ State \_\_\_\_\_



## The Fisher

\*SLIGHTLY HIGHER IN THE FAR WEST. EXPORT: FISHER RADIO INTERNATIONAL, INC., LONG ISLAND CITY 1, N. Y. CANADA: TRI-TEL ASSOCIATES, LTD., WILLOWDALE, ONT.,



# CONCERTONE 605



**If you're willing to pay anything for professional quality.....but would rather not**

The Concertone 605 is for the one man in several who can't stand less than perfection...but can't see why professional quality should cost so much. Never before have so many features and so much professional quality been available at this price. Read ahead carefully and see: Precision plug-in head assembly...includes four precision heads; Separate microphone and line controls (input can be mixed); Delay memory control circuit (never spill or break tape); Automatic glass tape lifters, including electric cue feature; Sound on sound and add sound; Solenoid operated brakes; Three motors, including 2-speed hysteresis synchronous drive; Automatic rewind; Exclusive Reverse-O-Matic®. Learn all about the 605 in complete detail. Ask your dealer for a demonstration or send for free literature today.



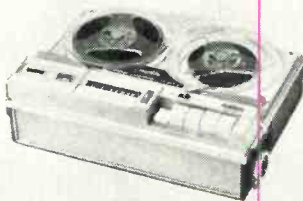
## CONCERTONE 607

*Broadcast version*

The Concertone 607 with higher impedance is for the true professional or broadcaster. Remote control optional. This superb tape recorder is constructed to 19" x 14" dimensions, permitting it to be used as an exact replacement for old or outdated tape recorders.

## CONCERTONE 400 COSMOPOLITAN

For people on the go...it's the Cosmopolitan - Combination Tape Recorder with AM Radio. A versatile companion and co-worker for business or pleasure travels. 5" reel capacity. Push-button operation. Amazing fidelity. Remote mike. Foot-pedal control. This all-transistorized recorder has big recorder features in miniature form.



for further  
information  
write:



**AMERICAN CONCERTONE, INC.**  
A DIVISION OF ASTRO-SCIENCE CORP.  
9449 W. JEFFERSON BLVD. • CULVER CITY • CALIF.

Export: J. D. Marshall International, 170 W. Washington, Chicago, Illinois

# LETTERS

## Electron Flow Revisited

SIR:

Going over some back issues of AUDIO, I came across a most inane controversy, concerning electric current and the movement of charge. It began in the April 1960 issue and appears to have petered out unresolved with a rather vituperative letter against engineers in the July 1961 issue.

First off, I think we should deal with some of the factual errors in Mr. Tonelli's July 1961 letter. I examined a few physics textbooks (most engineers I know got their basics from elementary physics courses) as well as a number of engineering texts, and the only definitions I could find of an ampere were in terms of the forces existing between two wires when they were carrying said ampere (defining something called an Absolute Ampere) or in terms of the amount of metal moved across an electrolyte in a given period of time (defining something called an International Ampere). Nothing about electrons!! And those who computed the equivalent of the Absolute Ampere in terms of the number of electrons passing a given point in a given time came out with a value of  $6.2421 \pm .0013 \times 10^{18}$  electrons. He should not marvel that it comes out "exactly  $2\pi \times 10^{18}$  electrons" since this came out of his head.

Mr. Nissen does have a point though. However, I find if I follow his suggestions, I get some rather ludicrous results. For example, a pound of copper contains  $43 \times 10^{23}$  atoms. The nuclei of these atoms carry a charge of  $2 \times 10^7$  coulombs. If I walk down the street at 4 miles an hour, carrying a pound of copper, I generate  $3.6 \times 10^7$  amperes because I'm moving this mass of charged nuclei. In addition, I generate another  $3.6 \times 10^7$  amperes from moving the electrons associated with these nuclei. I assume that currents are still capable of being added in Mr. Nissen's world, so merely by walking with a pound of copper, I generate 72 million amperes. The magnetic field surrounding me sucks in automobiles and topples the steel framework of buildings. Or rather, because my walking is the source of power, I find that the pound of copper is frozen in place in space. Every time it moves, it generates terrific magnetic fields that, acting on the objects around it, oppose its movement, or hastens it, who knows.

Also, since Mr. Nissen cannot conceive of a current without something moving (an electron, an ion, and so forth), we'll have to do away with Mr. Goeller's "displacement current," which is a movement of nothing, even though it creates and carries with it (Mr. Goeller might claim) a magnetic field. And with the elimination of the displacement current, poor J. C. Maxwell is left out in the cold; he can no longer rely on his "conceptually based" current to see him through to the development of his wave equations and the fiction-based hypothesis of electromagnetic radiation. But wait!! Without electromagnetic radiation, Mr. Nissen is out of work! The power KQED pumps into its antenna serves to heat the transmission line and nothing more. Worse, the sun can only deliver energy to the earth in the form of charged particles. I can't see!!! there's no light! And no growing things, no me!!! What has existence become???

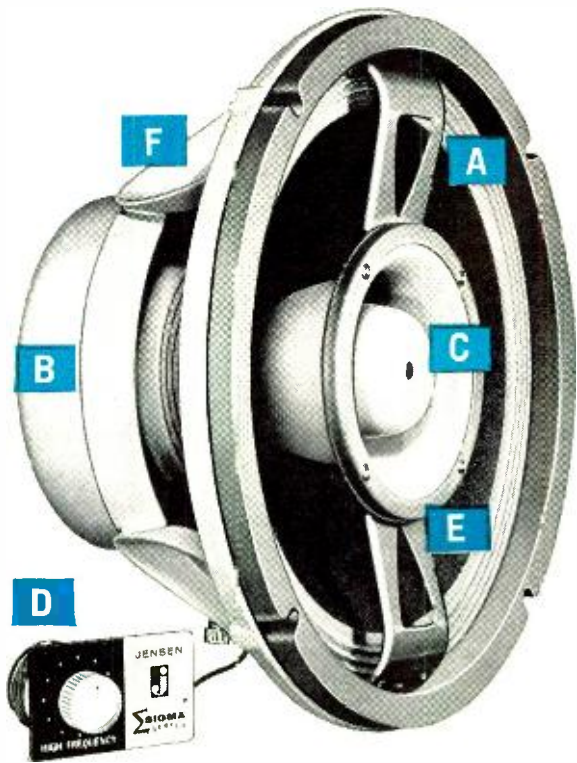
LOUIS L. SEMPREBON  
5 South Park St.  
Hanover, N. H. 03755

AUDIO • DECEMBER, 1963



# NEW **SIGMA**<sup>TM</sup> SERIES By **JENSEN**

## 7 SUPERB HIGH FIDELITY LOUDSPEAKERS









**SG-223 REFLEX HORN COAXIAL 12" SPEAKER.** Jensen's finest unitary. A true 2-way speaker with our unique horn-loaded reflex tweeter and high-compliance low-resonance **FLEXAIR**<sup>®</sup> woofer. Net .....\$69.50

The brilliant new Jensen SIGMA Series incorporates the newest advances in electro-acoustic design, plus performance and reliability that set new standards for high fidelity unitary loudspeakers. Note these outstanding features:

- A** FLEXAIR<sup>®</sup> suspensions permit improved bass response even in compact enclosures.
- B** High-energy SYNTOX-6<sup>®</sup> magnetic structures for high power capacity and low distortion.
- C** Exclusive design low-crossover tweeters (2,000-cycle) provide excellent m-f and h-f response.
- D** Separate HF control with all coaxials permits custom-balancing of frequency response.
- E** Carefully formulated cones retain strength and shape even after long service.
- F** Heavy-duty die-cast frames give rigidity, permanently accurate alignment of moving system.

Jensen's full-time research and development program has consistently produced significant advances in loudspeaker design. Recent developments have dictated numerous changes in the construction of loudspeakers to take advantage of new performance possibilities. The 7 speakers in the new SIGMA Series incorporate all of those refinements and changes which have been proven effective. The SIGMA Series represents the first completely new loudspeaker group redesign in the industry in a number of years. It makes available a comprehensive range of types most often requested for unitary requirements at reasonable prices.

					
SG-80 DUAL CONE 8-INCH FLEXAIR <sup>®</sup> SPEAKER. Net .....\$16.50	SG-84 3-ELEMENT 3-INCH FLEXAIR <sup>®</sup> COAXIAL. Net .....\$24.50	SG-88 COMPRES-SION-HORN 8-INCH FLEXAIR <sup>®</sup> COAXIAL. Net. ....\$36.50	SG-210 3-ELEMENT 12-INCH FLEXAIR <sup>®</sup> COAXIAL. Net .....\$37.50	SG-220 COMPRES-SION-HORN 12-INCH FLEXAIR <sup>®</sup> COAXIAL. Net \$49.50	SG-222 MULTICELL HORN 12-INCH COAXIAL. Net .....\$59.50



*For complete information on SIGMA Series speakers write for Catalog C-165.*

JENSEN MANUFACTURING COMPANY / DIVISION OF THE MUTER COMPANY / 6601 SOUTH LARAMIE AVENUE, CHICAGO 38, ILLINOIS  
Canada: Radio Speakers of Canada, Ltd., Toronto • Argentina: Ucoa Radio, S. A., Buenos Aires • Mexico: Fapartel, S. A., Naucalpan, Mex.



# AUDIO ETC.

Edward Tatnall Canby



## BEST SEAT IN THE ORCHESTRA

My first, this month, is going to be, for a change, in pictures rather than words. Well—a few words. Just to pin down the pictures.

You see, so many people are blabbing around about hi fi and stereo offering the best seat in the concert hall and all that, I wonder sometimes how many of our less technical readers know what those “concert hall” recordings look alike.

I assure you (and them), they don't look like what they sound like. Not a wee little bit. Unless, of course, you're a recording engineer or an A & R man yourself and thus are able to take a look at a particular recording set-up and instantly “audualize” the sound that might result.

(Hey—what is the word I want? If we have “visible” and “audible,” then why not “visual” and “audual”?)

Many of our readers are entirely familiar with the looks of a recording date. But then, again, most home listeners—and probably some of our friends here—aren't at all. A recording made in, say, Carnegie Hall, is to them, as far as they can imagine it, like a concert in Carnegie Hall. Or, say, a “live” broadcast. Rows of seats out front, maybe empty for the recording. Orchestra on stage, soloists up front, with conductor. Chorus, if any, ranked back of the orchestra, banked up against the rear.

Well, it ain't necessarily so. In fact it is very seldom so. Many a “concert hall” for recording is actually a shabby hotel ballroom, an ancient town hall, brewery, gymnasium or what have you. And many are ex-theatres or auditoria which have given up the living ghost in favor of the canned. Yet real concert halls are often enough in-

involved too. What is astounding is not the hall but the lay-out within the hall.

Talk of the best seat in the concert hall—I beg you to examine these photos and decide for yourself who sits there, if anybody. Who, but the orchestra itself! Where, then, do you, the enthralled stereo listener, consider your own ears to be? Where do you place your living room throne?

It should quickly be evident that “you” are everywhere, all over. You are cocking an ear, in triplicate mikes, from the sides, from in front, from on-stage and on the floor, from above and below, inside sound-proof boxes, cornered by sound-trap panels like big telephone booths; and not a one of these many locations is “it”—the best seat in the house! There ain't no sech thing.

Figure 1 shows the famed Concertgebouw Orchestra of Amsterdam recording for London in a relatively conservative set-up. I.e., the orchestra is seated *en masse* roughly in the way it plays for a concert. But look where it sits. In the area normally occupied by seats and listening people which, oddly enough, we often call the orchestra. For once, the term is apt, literal and accurate. As for the stage, they didn't even bother to pull open the curtain.

You can't see them, but there are in addition to the mikes up front on booms, at least two other sets of mikes in the middle of the orchestra, one low pair directly in front of the tympani, the other, high, just



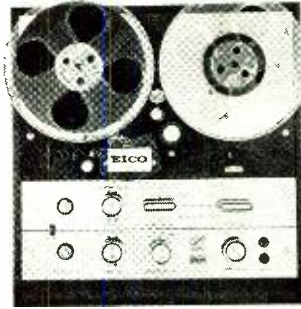
Fig. 3. “Greenwillow” being recorded at Webster Hall in New York. (Photo courtesy RCA Victor.)



Fig. 1. Concertgebouw Orchestra during recording session. (Photo courtesy London Records.) Fig. 2. (right) Session with Charles Munch conducting the Berlioz “Requiem” in Symphony Hall, Boston. (Photo courtesy RCA Victor.)



## Here's what you get for under \$270 with the new Eico 2400 tape deck

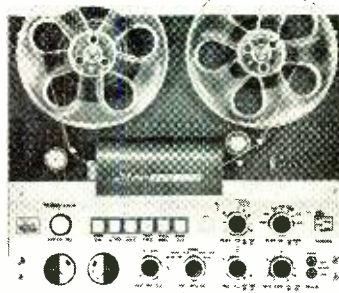


(\$199.95 as a kit)

- Three extra-powered 4-pole, shaded pole motors: two reel motors, and a capstan motor with enclosed fan to stabilize winding temperature and torque.
- Built-in heavy gauge spring steel structural panel for permanent accuracy of mechanical alignment. Provides the structural strength which, together with proper balance of all the transport parts, permits either vertical or horizontal operation of the recorder.
- Hardened stainless steel capstan shaft, ground within  $\pm .00015$  inch drives tape on uncoated side to eliminate wear. Non-magnetic stainless steel tape guide.
- Huge, steel bar stock capstan flywheel turned and bored in one operation for perfect concentricity and dynamic balance to reduce wow and flutter to inaudibility.
- Seamless Neoprene capstan drive belt provided an elastic coupling between the capstan motor dual-speed pulley and the capstan flywheel to filter out motor vibration and provide the correct speed transformation. Optimum belt size and composition for inaudible wow.
- Jam-proof belt shift mechanism selects  $7\frac{1}{2}$  or  $3\frac{3}{4}$  ips tape speed.
- Smooth, fast electro-dynamic braking (DC applied to reel motors) eliminates the problems of mechanical brake deterioration.
- Constant hold-back tension and mechanical filtering of supply reel motor "poling" is obtained by passing the tape between a felt disc pressing against a guide post located between the supply reel and the combination head. AC voltage applied to the supply reel motor provides hold-back of the supply reel itself. Precise control of tape tension and lowest flutter are achieved by careful proportioning of these two sources of hold-back tension.
- The curved tape path around the combination head, plus precisely controlled tape tension, eliminates need for troublesome pressure pads.
- Four position function switch: FAST WINDING, STOP (STANDBY), PLAY, RECORD. At FAST WINDING, a separate control normally at neutral, is used to select rewind or fast forward (1200 feet in 30 seconds). At STOP,

the reels are electrically braked and the capstan turns at the selected tape speed (the amplifiers are set for playback to permit cueing). At either PLAY or RECORD, the pinch-roller presses the tape against the capstan and the felt disc presses the tape against the guide post to provide instantaneous, slur-free, smooth tape drive. A relay provides momentary extra-power to the tape-up reel motor to avoid slack forming between it and the capstan. Even when starting with a practically full tape-up reel, there is no risk of spillage or tape bounce that can mar the first moments of recording or playback. A mechanical release button must be pressed to turn to RECORD, thus preventing accidental erasure. This control system prevents direct transition from one transport mode to another, thus eliminating the most common cause of tape spillage.

- Automatic end-of-tape stop switch turns off take-up reel motor when tape runs out during recording or playback.
- Digital turns counter permits easy indexing of selections on a tape.
- Provides 4-track stereo erase, record, and playback, plus 2 track mono playback.
- Stacked narrow gap (100 micro-inch) laminated record-playback head (mu-metal shielded), combined with double gap (double erasure) stacked erase head, Professional, 4-point head mount permits adjustment in all planes.
- Dual electron-ray indicator tubes for stereo recording.
- Separate line and microphone mixing level controls in each channel.
- Recording levels may be pre-set while the function switch is set at STOP (stand-by).
- Push-pull 70 kc oscillator.
- Correct record and playback equalization at both the  $7\frac{1}{2}$  and  $3\frac{3}{4}$  ips.
- In kit—Tape transport supplied assembled & tested—only electrical controls & amplifier need be wired.
- Hand-rubbed walnut base included in the price of both kit and wired unit. Eico 2400, semi-kit \$199.95, wired \$269.95.

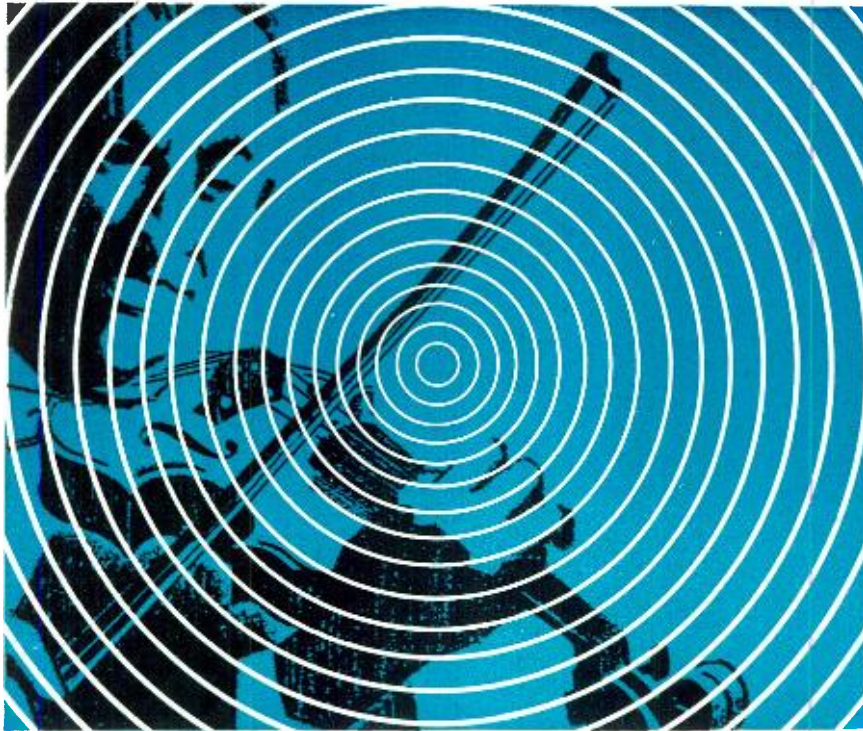


If these aren't enough performance features, then you're ready for the studio quality EICO RP-100 Transistor 4 Track Stereo/Mono Tape Recorder. 3 motors include hysteresis synchronous capstan motor and electro-dynamic (d-c) braking;  $7\frac{1}{2}$  &  $3\frac{3}{4}$  ips tape speeds; 3 heads, hyperbolic ground for superior tape contact, adjustable in all planes; all-electric push-button operation with 2 solenoids; automatic tape lifters, end-of-tape switch; independent transistor record and play amps for off-the-tape monitoring and sound-on-sound recording; mixing mic & line level controls; dual recording level meters. Semi-kit (transport assembled & tested) \$299.95; wired \$450. Both the 2400 and RP-100 are made in the U.S.A. Ask your dealer to demonstrate the new EICO 2400 or the professional quality RP-100 today.

**EICO**

EICO ELECTRONIC INSTRUMENT CO., INC., 131-01 39TH AVENUE, FLUSHING, N. Y. 11352  
EXPORT: ROBUERN AGENCIES INC. 431 GREENWICH STREET, NEW YORK 13, N. Y.





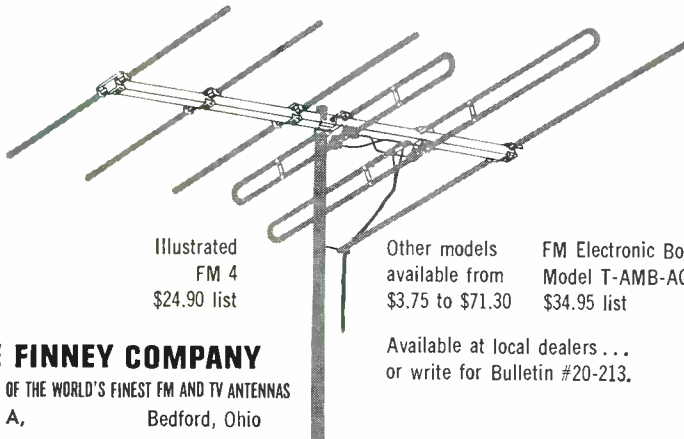
# achieve THRILLING LIVING PRESENCE

WITH THE **FINCO**<sup>®</sup>  
AWARD-WINNING FM ANTENNA

Broadcasting authorities agree that an outdoor antenna is absolutely essential for the reception of full quality monaural and multiplex FM sound.

A *FINCO* FM antenna will deliver a clean, undistorted signal and bring in more stations, regardless of location.

Guarantee yourself the best seat in the house for tonight's FM concert . . . install a fidelity-phased *FINCO* FM antenna.



Illustrated  
FM 4  
\$24.90 list

Other models available from \$3.75 to \$71.30  
FM Electronic Booster Model T-AMB-AC \$34.95 list

Available at local dealers . . .  
or write for Bulletin #20-213.

**THE FINNEY COMPANY**  
PRODUCERS OF THE WORLD'S FINEST FM AND TV ANTENNAS  
Dept. A, Bedford, Ohio

beyond the keyboard of the celesta, near the orchestra's right rear.

The main stereo "ears," up front, are mounted on high booms, gracefully dipping downward to right and left like tall, bowing artists. The rear mikes undoubtedly act as accent mikes, sharpening up color and presence via careful admixture of near-to sounds into the over-all pickup from the front.

Figure 2 is American classical recording, in Symphony Hall, Boston. It makes use of the radically different American approach, three-track throughout, with wide separation of the musical components into spaced-out groupings, each with its own set of microphones. Again, the audience seats are gone and the orchestra sits in the audience's usual spot. But here the spacing is much freer, almost surrounding the conductor, Charles Munch, who is recording the Berlioz "Requiem" for RCA Victor. The chorus, you'll note, is far removed, occupying the normal concert stage. High-rise microphones tower everywhere, like antenna masts in some zany indoor transmitting station. There is a dual set-up, one array for the stereo recording and another for the mono version. Mikes clutter the stage, and the floor too; chorus and orchestra each have their own. The powerful percussion instruments, you'll note, are grouped along the left side in front of heavy sound-dampening screens. (But what happens to their low tones?) (Or are they reflecting screens?)

Opposed groups of trombones are seen high at the sides in the second balcony. Berlioz calls for four groups at the four corners of the hall but here two are placed high on each side. The fourth group is off-camera to the left.

There is a lone tenor solo in the work; at press time I still hadn't been able to find him.

Yes—there's an organ, in operating condition. Console and player to the left on stage, organ in its usual place. That's one thing they couldn't change.

Figure 3 is a "Pops" recording which has traditionally been far out and technically ahead of "classical" in the use of new means for picking up sound. This is RCA Victor's Webster Hall recording spot in New York and the show is "Greenwillow" with Tony Perkins; the song being recorded is *He Died Good*, in case you have the disc.

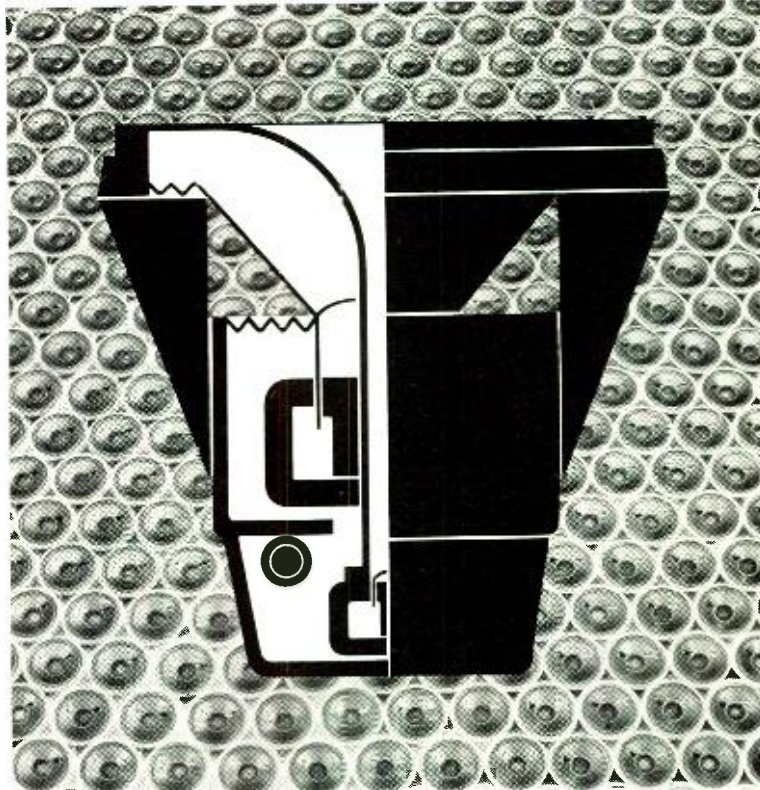
This is a more radical instance of the type of recording used by RCA Victor in Symphony Hall with the Boston Symphony Orchestra, Fig. 2. Again, the instruments are spread out in groups, with multiple mikes, but you will notice that here the microphones are placed near to individuals or small clumps of players, clearly for a more selective close-up effect. More of those upright sound panels, to isolate individual blocks of sound. The harp is off by itself, apparently with a private mike, and next to it the double-bass plays towards what looks like a huge open book and is probably, if my eyes aren't too dim, a specialized reflector.

The vocal soloists, of course, are 'way off up there on the stage, with their own set of mikes right in front of them. They live, acoustically, in their own semi-private sound-environment, hemmed in by the stage dimensions.

Don't overlook—if you can see them—those tall, thin white lines ascending from the two side balconies. They could very well be topped with more mikes, intended to pick up the over-all room-sound and fuse all the disparate elements into one.

RCA notes that the conductor, Abba Bogin, is seen at lower right "directing all the musical activity." Well, I never thought





## FROM THE DIMINUTIVE TO THE GIGANTIC... PIONEER MAKES IT!!

Typical of Japan's world-renowned electronic industry is the Pioneer Electronic Corporation. During the quarter of a century that has elapsed since it came into being, Pioneer has built up an enviable reputation in the production of quality loudspeakers, a reputation based upon relentless research and the latest production methods.

In particular, Pioneer has in recent years become the undisputed leader in the production of the miniature loudspeakers used in the tiny transistorized radio or television sets that are the star performers in Japan's current export trade.

Pioneer produces loudspeakers of every size, ranging from tiny 1½" models to gigantic 32" models. It has the largest production capacity in the world — 1,200,000 units per month. Uniformly outstanding in performance, and sturdy and reliable in durability, these speakers are also used by well over a 100 top manufacturers of electronic appliances around the world, including such world-famous names as Hitachi, Toshiba, or Sony.

Yet Pioneer's comprehensive line of loudspeakers is but one of its highly diversified activities in the audio world. Pioneer-made high fidelity amplifiers and other quality audio components are equally well known among both professional and enthusiast alike.

So whatever the requirement is, be it commercial, professional or home, Pioneer can help — help bring to the discerning better sound.



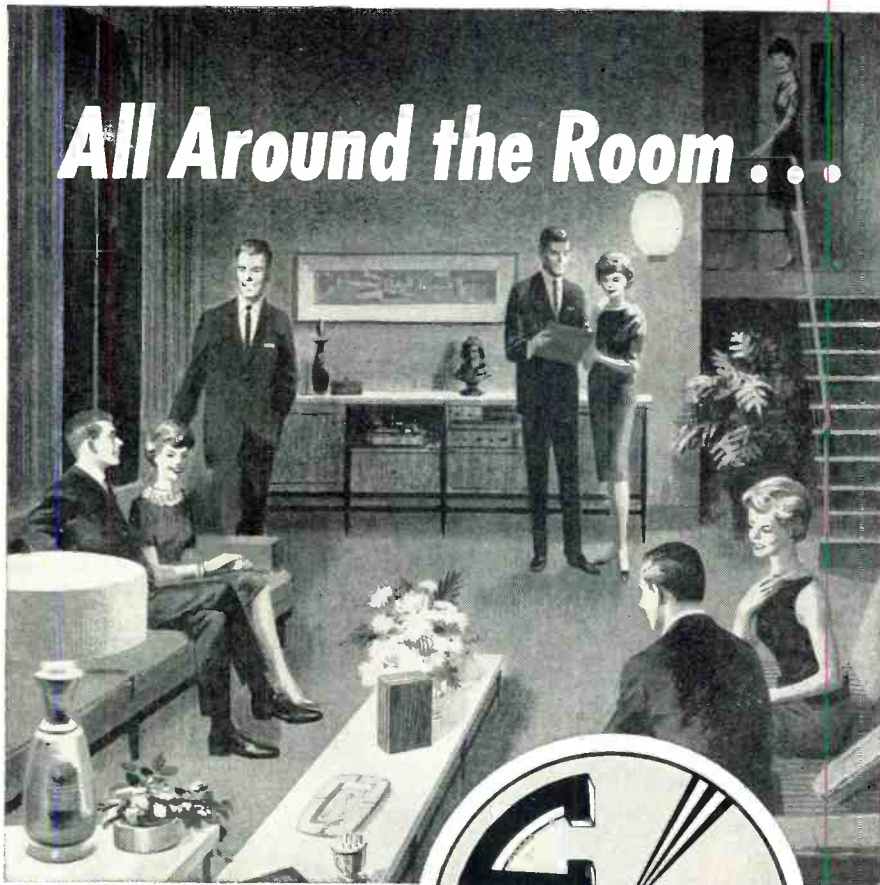
# PIONEER®

## PIONEER ELECTRONIC CORPORATION

5 Otowacho 6-chome, Bunkyo-ku, Tokyo, Japan  
Cable Address: PIONEER TOKYO

Distributors: Canada - Importhouse of Canada, 2939 Eglinton Ave. E., Scarboro, Ont.

# All Around the Room...



NEW DECOR AND SIZE NEW PERFORMANCE

**CAVITY  
GENERATED  
SPHERICAL**

**SOUND is Everywhere!**



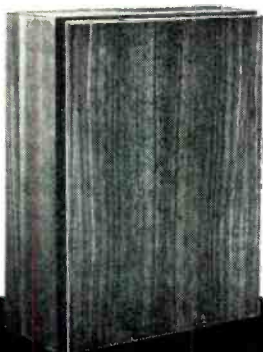
NEW LISTENING PLEASURE NEW PRINCIPLE

These people are enjoying an exciting new principle in sound reproduction. Everyone is receiving a uniform intensity of program material from this single Murray-Tone Cavity Generator Spherical Sound System regardless of his relative position or distance from the instrument!

True 360° spherical propagation is but one of the unique principles built into this quality instrument and offered to the listener for the first time from a single sound source.

"CG's" spherical principle and compact design encourage complete flexibility of placement — even under or behind furnishings — without distortion of performance in either monaural or stereo application.

The use of a single driver in Murray-Tone "CG" systems produces balanced, full-range sound with a new dimension of timbre, presence and response.



Introducing the  
**CAMILLE SERIES**  
Size: 11"x8"x4 1/4"—Full Frequency Range (without boom).  
Power: 8 Watts (measured).  
Propagation: 360 Spherical Degrees.  
**OPTIONAL FINISHES:**  
OILED WALNUT, HARVEST MAPLE OR LIMED OAK  
Moderately Priced at \$39.95

*Murray-Carson Corporation*

2424 E. 55th STREET DEPT. A, INDIANAPOLIS 20, INDIANA

**SEND FOR LITERATURE AND  
DEALER INFORMATION**

I'd see the day when it had to be explained that the conductor of a piece of music directed "all" the musical activity going on! That's recording for you.

Some time before this recording session, I attended a strikingly similar one in the same place at which a "classical" opera was taken down. Classical or no, the lay-out was the same, with the orchestra clumped here and there about the floor (the harpsichord off by itself) and the opera soloists standing on the same stage with their own mikes. In that case, too, there were separate systems for mono and stereo, with even a separate recording and control booth for each system. Only one conductor—the present conductor of the Boston Symphony (Leinsdorf). But lots and lots of people had their fingers and voices in the musical pie, via talk-back loudspeakers all over the place.

All in all, a recording session is not very much like a concert.

## THE SOUND OF CONFUSION

Some months ago I tore a hunk of clipping out of the *New York Times*. It was an ad several feet high from the famous emporium that rivals Macy's, down in New York's Herald Square. For reasons of delicacy I'll call them Thimble's. "Thimble's has the Stereo!", it began somewhat cryptically.

Well, Thimble's was full of enthusiasm for "the stereo." Its adman was surely amiable, friendly, set upon his virtuous job of selling. And yet—I heard in his genial words the tell-tale beginnings of devastating confusion. There's entirely too much confusion going around these days.

I accidentally ripped off a couple of words—the lead line on my clipping reads "Nobody has — exactly — ke yours." Easy to interpolate: the motto was "Nobody has ears exactly like yours" and Thimble's goes on to explain, "From that fascinating fact (electronics discovered it) you get your clue to choosing stereo: it must sound right for *you*."

Well, so it must, I suppose. If this last gambit sounds like a number of other ads that shout "Designed for YOU!" and "We asked you what *you* wanted—here it is," we still must admit that any stereo we buy must be right for *us*. For particular ears. But Thimble's isn't ready to stop there, and perhaps that is why I find myself writing here.

You see, an ad that is merely innocuous and noninformative doesn't bother anybody. It's when an advertisement begins to suggest a concrete idea in a liquid sort of way that we begin to get agitated. Nobody bats an eye at total newness and richer, fuller everything, nor do we jump when we are asked to "Hear the Difference," or to "Find Out," or "Judge for Ourselves." Water off a duck's back for all of us. But when an ad . . . well, look further at Thimble's:

"To choose the proper stereo, *listen*. But you need to listen to several sets to know which fits you. Thimble's has great names, and scores of models . . . Your ear may get concert fullness from a set at \$149—then that's your buy. You may have ears so sensitive that only the delicate mechanism in a \$1200 set gives you full musical pleasure. Thimble's has sets so fine that what the electronics people call distortion runs as low as 2 per cent—that's below what most people can possibly hear."

Whoa, there—just a moment. Not so fast! Now you and I know that this is merely the purplish prose of an inoffensive and well-meaning ad writer and we can guess that he's not exactly a hi fi expert,

(Continued on page 61)



# Condenser Microphone with Transistorized RF Circuitry

...INNOVATION by  
**SENNHEISER**

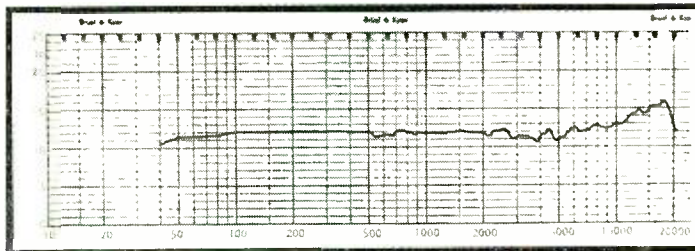


Actual size of  
Sennheiser  
Condenser  
Microphone  
Model MKH 104.  
Professional  
Net \$195.

Actual size of  
Battery Adapter  
Model MZA 6.  
Professional  
Net \$18.



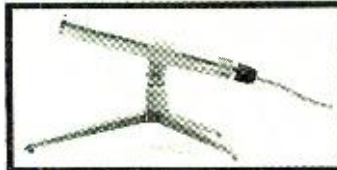
For complete technical specifications,  
call or write Sennheiser Electronic Cor-  
poration (N.Y.).



This response curve is not a theoretical projection. It was individually plotted for a random-picked Sennheiser Model MKH 104 Condenser Microphone, and it is virtually identical in shape and output level to the separately plotted, signed curves provided with all Sennheiser Transistorized RF Condenser Microphones in this series. (All Sennheiser professional microphones are packaged with individually plotted curves.) Note the broad frequency response, exceptional flatness and the controlled peak at the upper-frequency extreme. Also note the absence of peaks and dips in the critical portions of the spectrum. Need we say more?

The actual size photographs on this page are not simply of the microphone itself; they depict the entire system, including the compact, low-voltage, power supply. The microphone barrel contains a transistorized, 10 mc RF push-pull oscillator feeding a bridge circuit. The output of the bridge circuit is then amplified by an additional stage before being applied to the microphone terminals. This Sennheiser configuration guarantees stability, noise suppression, and smooth extended response at good output levels.

Low-impedance circuit design renders the system insensitive to interference from magnetic fields. The rugged, meticulously designed structure assures insensitivity to mechanical noise, air-pressure shock waves, and high humidity.



Versatile mounting of the MKH 104, with or without the Battery Adapter connected, adapts the microphone to any conventional arrangement. The light-weight, collapsible desk tripod shown here is an optional accessory.

Power for the MKH 104 Transistorized RF Condenser Microphone is readily furnished by Battery Adapter MZA 6. The adapter may be plugged directly into the microphone base or anywhere along the microphone cable. It holds 6 miniature mercury cells of the hearing-aid type, Mallory RM-625 or equivalent. One set provides 50 to 60 hours of continuous operation.

WHO IS SENNHEISER? If you have worked with quality microphone systems, you are familiar with Sennheiser products. Established in 1945, Sennheiser Electronic has become Europe's largest manufacturer of quality microphones, supplying them to world renowned manufacturers who have been marketing these products under their own brand names for use in professional recording and broadcasting, high fidelity systems, tape recorders, dictating machines, hearing aids, and many other applications. "Sennheiser" is synonymous with leadership in microphone engineering.

#### TECHNICAL DATA

Acoustic system:	pressure responsive
Directional characteristic:	spherical (omnidirectional)
Frequency range:	20 to 20,000 cps
No-load transmission coefficient at 1000 cps (Sensitivity measured in anechoic chamber):	approx. 2mv/dyne/cm <sup>2</sup>
Impedance:	approx. 800 ohms, unbalanced, ungrounded (accessory cable-transformer matches to 200 ohms)
Noise voltage:	approx. 10 μv
Distortion at sound pressures to 100 dynes/cm <sup>2</sup> :	1%
Overload level:	approx. 300 dynes/cm <sup>2</sup>
Power-supply voltage:	8 V ± 1 V
Operating current:	approx. 5 ma
Temperature range:	-10° to +70°C (+14° to +158°F)
Dimensions:	3/4 in. diameter; 5 in. long
Weight:	3 oz.



**SENNHEISER**  
*electronic*  
CORPORATION (N.Y.)

25 West 43rd Street, New York 36, N.Y. • (212) LOnacre 4-0433

Plant: Bissendorf/Hannover, West Germany

# EDITOR'S REVIEW

---

## WHY DOESN'T SOMEONE . . .

. . . make a VU meter with a built-in "eye tube"? Over the years there has been much argument about the relative virtues of both these devices. Frankly, both have virtues and defects, although on balance, if we had to choose one or the other we would prefer the VU meter. But why need it be a choice between the two? Why not combine them so that we can read peaks quickly (eye tube) and at the same time have a damped meter which provides reproducible readings? In our opinion there is every reason *for* combining these two indicating devices in one housing. Certainly the cost would not be great, and the added information would more than offset a slight increase in cost.

. . . design a tuning device for FM tuners similar to the signal-seeking devices used on some car radios? Considering the increased need for accurate tuning, and the existing devices for automatically setting tuners to the stereo or mono modes, it would seem to be a logical next step for FM tuners. The design problem is certainly not too difficult. For example, one could use a detector nulling scheme, such as used by Sherwood, and drive the tuning dial by means of a small motor until it reached a null point. In concept this is similar to a servo system. It might be too costly to be practical, or it might not. We hope someone tries it anyhow.

. . . join us in asking manufacturers to color code input and output connectors. For years audiophans have been struggling with a maze of sockets which invite disaster when one has to work in cramped or poorly-lit quarters. It is about time that manufacturers agreed on a standard color code, and it is up to audiophans to insist that they do. Don't wait, insist!

. . . make a logging scale for the bass and treble controls of audio amplifiers? Since it is sometimes necessary to adjust bass and treble with different recordings, it might be worthwhile to log the values for a particular record so that the next time it is played we need not repeat ourselves. This is definitely not a major problem, but it is one we have all experienced from time to time.

## SHELLS FOR CONCERT HALLS

In this issue we present an article by Harold Lawrence wherein a system is described for improving sound projection in concert halls. This system employs Fiberglas shells erected at the rear and sides of the stage to provide a "properly balanced" projection. (Of course the question comes to mind as to what is meant by "properly balanced," but that is another

line of thought.) We wish to make it clear that this article is presented in order to inform readers as to what is being done in concert hall acoustics currently, rather than to suggest a method. Hopefully, in the future, we will present other views as to the proper way to achieve excellent acoustics in concert halls.

## THAT GENT WITH THE WHITE BEARD

**I**S THERE REALLY A GENT WITH A WHITE BEARD? Every year about this time that question is raised anew by countless little children and audiophans all over the world. It's traditional and expected. But what about those who assert that the idea was conceived by an advertising man to unload bulging warehouses? In a way they have a point there. Just read a few of the ads you see around White Beard time and you will be convinced that the copy writer pictured that luxurious white beard as a cover-up for some dark thoughts. But that doesn't mean White Beard was invented for that purpose; it just works out that way.

Anyhow, as purveyors of truth and enlightenment, we will attempt to answer some of the questions which are implicit in the doubts of children and cynics. You see, at AUDIO we *know* that there is a man with a white beard.

*Question 1.* Where does he get those millions and millions of toys?

*Answer.* Discarded audio projects.

*Question 2.* How does he get into houses without chimneys?

*Answer.* FM. (The bag is multiplexed.)

*Question 3.* Will he come to my house this year?

*Answer.* If you have an FM receiver. (Multiplex if you want goodies.)

*Question 4.* How does he get about so quickly?

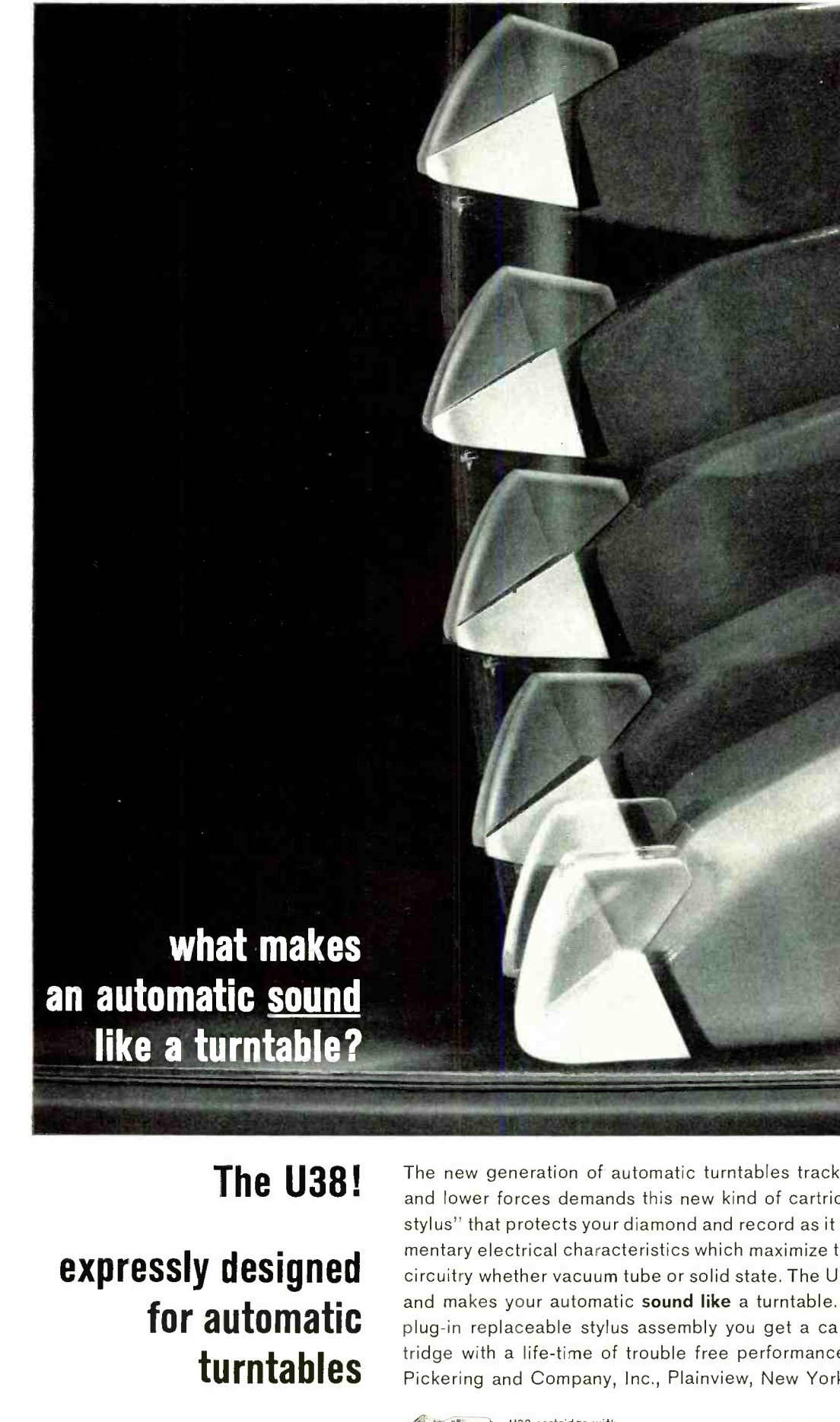
*Answer.* Credit cards.

*Question 5.* Will he say anything?

*Answer.* Certainly, and the staff of AUDIO joins him:

**Merry Christmas  
and  
Happy New Year**





what makes  
an automatic sound  
like a turntable?

**The U38!**  
**expressly designed**  
**for automatic**  
**turntables**

The new generation of automatic turntables tracking and tripping at lower and lower forces demands this new kind of cartridge. Demands a "floating stylus" that protects your diamond and record as it plays...demands complementary electrical characteristics which maximize the use of forward-looking circuitry whether vacuum tube or solid state. The U-38 meets these demands and makes your automatic **sound like** a turntable. With Pickering's famous plug-in replaceable stylus assembly you get a cartridge with a life-time of trouble free performance. Pickering and Company, Inc., Plainview, New York.

**Pickering**



U38 cartridge with  
AT Stylus... 2.5 grams tracking force  
ATG... 1-3 grams



Plug-in head assembly for  
Garrard Type A and Model AT6

should Sherwood increase its prices by 20%

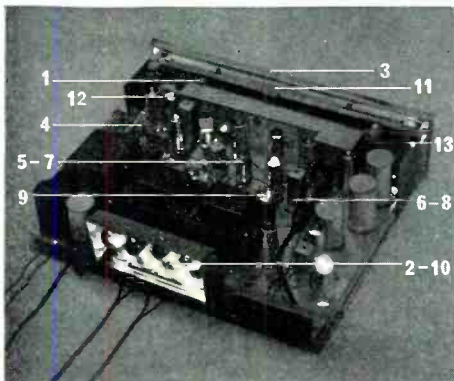


the superlative new S-8000 III FM stereo receiver priced at \$319.50



Years ago, Sherwood high-fidelity tuners and amplifiers were evaluated by highly-respected, totally-impartial research companies as either the finest designed or the best valued on the market. ■ Although we were pleased by such endorsements of pure quality in design and performance, the really significant fact was that *other leading components carried higher price tags.* ■ *Subsequent Sherwood components have received ratings indicating features and performance equal or superior to brands carrying price tags at least 20% higher.* ■ A current example of Sherwood design superiority is our new S-8000 III receiver. Sensitivity is rated at 1.8 microvolts. Capture effect is an *outstanding 2.4 db.* ■ No other FM receiver can claim the 80-watt music-power rating of the S-8000 III, and only one other (priced \$50 higher) offers the professional D'Arsonval zero-center tuning meter that's standard with Sherwood. ■ We still believe that our old-fashioned policy of superior engineering and realistic prices is best for both you and Sherwood.

SOME OF THE S-8000 III FEATURES THAT MAKE THE DIFFERENCE



1. Zero-center tuning
2. 80-watt music power
3. Complete stereo control center
4. 1.8  $\mu$ v. (IHF) sensitivity
5. Wide-band 3-mc. gated beam limiter
6. 1-mc. band pass balanced ratio detector
7. 2.4db. capture effect
8. 1/3% distortion at 100% modulation
9. Interchannel hush
10. Long-life Novar output tubes
11. 8-inch professional-type tuning scale
12. Silk-smooth flywheel tuning
13. Positive stereo broadcast identification

For your free copy of our complete catalog, write Dept. A-12  
SHERWOOD ELECTRONIC LABORATORIES, INC.  
4300 North California Ave. Chicago 18, Illinois

**Sherwood**  
HIGH FIDELITY

STEREO RECEIVERS ■ TUNERS ■ AMPLIFIERS ■ STEREO INDICATOR LIGHTS ■ SPEAKER SYSTEMS ■ CONTEMPORARY CABINETRY



# Controlling Sound-Reinforcement Systems

DAVID L. KLEPPER\*

Control equipment for sound-reinforcement systems is often selected on the basis of a "line" of equipment and price rather than an engineering analysis of the problems. This article reviews the functional requirements of control systems and the application of some basic principles in meeting these requirements. Manual systems are described in this article. Future articles will discuss automatic equipment.

The control equipment for sound-reinforcement systems usually accomplishes one or more of the following functions:

- a. selection of the signal input
- b. control of level ("gain" of reinforcement)
- c. control of level for auxiliary systems, broadcast lines, and/or tape recorder feeds
- d. remote operation of tape recorders or reproducers
- e. deliberate distortion of the signal: frequency response, limiting, compression or expansion.

\* *Bolt, Beranek and Newman, Inc., 50 Moulton St., Cambridge, Mass.*

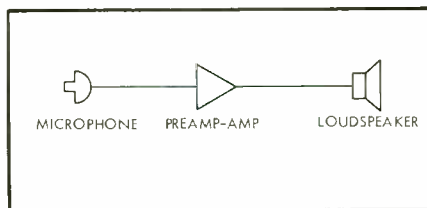


Fig. 2. Simplest sound-reinforcement system.

In planning controls to accomplish these functions, there are four points which are extremely important:

1. correct location of the control console

2. satisfactory electronic performance standards
3. proper signal flow through the control system
4. location of the individual controls for the operator's convenience

Even the simplest systems require attention to the first and second points.

## Control Location

Most sound-reinforcement systems provide reinforcement for speakers with both weak and strong voices who stand varying distances from the microphone. Obviously, an adjustable level control is necessary. Unfortunately, many sound-reinforcement systems do not locate this level control in a really satisfactory position. A typical church sound-amplification system may have the controls in the sacristy, the basement, or a similar location, while the most common control locations for a school auditorium sound system are the side-stage area or the principal's office. These locations are analogous to placing drivers of automobiles in the trunk.

This point cannot be emphasized too often: sound-amplification-system controls should be placed in a location where the operator can hear the sound he controls and see the individuals producing the live sound that is being amplified. While a properly adjusted monitor loudspeaker can provide an indication of the sound-system performance, it does not continuously alert the operator to room acoustics and noise conditions. Correctly located controls allow the operator to hear the "mix" of live and amplified sound heard by the audience. The usefulness of an operator's listening position in the audience area is demonstrated every time an audience takes a few minutes "to get settled" at the start of a show. The operator, hearing the noise, live sound, and amplified sound, will automatically raise the level of amplified sound to provide high in-

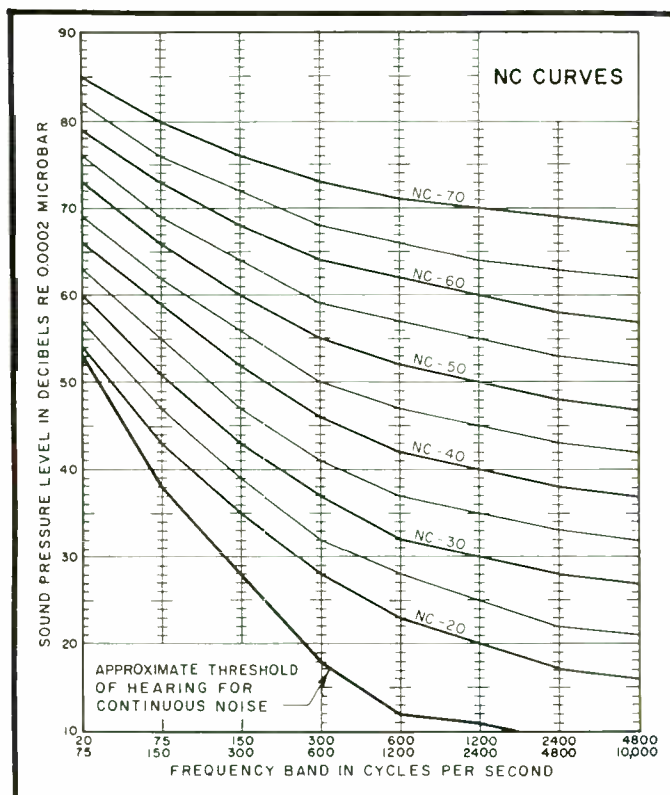


Fig. 1. Noise criteria curves show allowable noise level in each octave band for a variety of spaces. Churches should meet NC-25 or NC-30, concert halls NC-20.

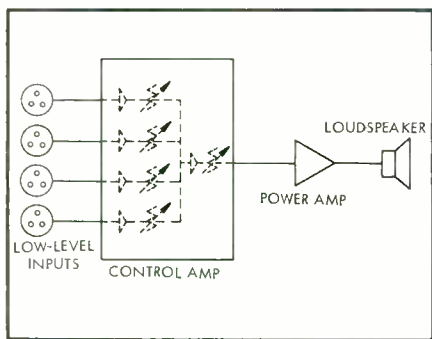


Fig. 3. Simple multi-input sound reinforcement system.

telligibility; yet later, when the audience is quiet and attentive, the high levels will sound unnatural, and the operator will reduce gain. Similarly, in large coliseum and exhibition spaces, crowd noise may require a sudden increase in amplified signal. Or a weak-voiced guest minister may require more amplification, which must be matched to reverberant acoustics of a church. As a last example, a singer's voice will invariably require more amplification with louder orchestral accompaniment; judging this balance requires, obviously, a well-trained operator, but also one who hears both the live sound and the amplified sound he controls.

The level control for any reinforcement system belongs, therefore, within or adjacent to the audience area. Assuming that an auditorium sound-reinforcement system is well designed and provides reasonably even coverage, this may be an inconspicuous location along the side or rear wall. Likewise, the level controls for a church sound-reinforcement system may be located in the back of a pew, in a balcony railing or in the side or rear walls of the church.

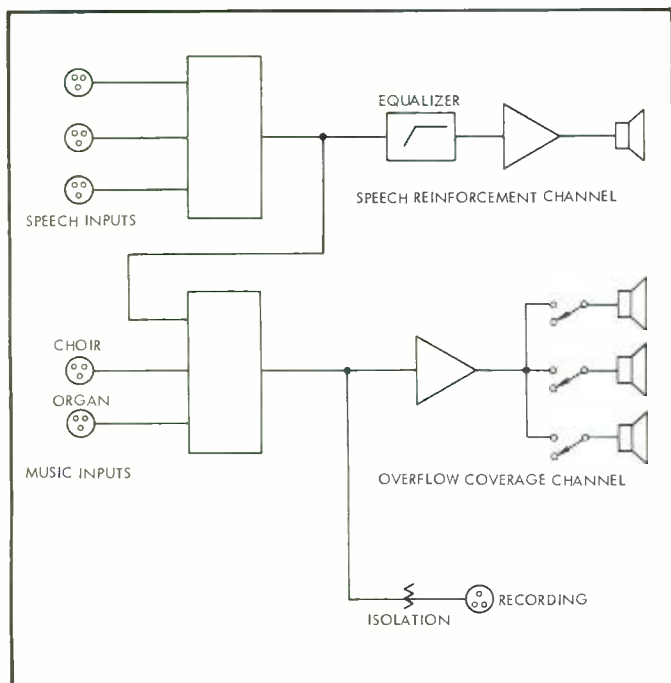


Fig. 4. Typical church sound amplification system with channels for speech reinforcement, overflow coverage, and recording.

The correct location of level controls may involve: a. locating preamplifiers and power amplifiers (either integrated or separate), with level controls, at the control position; b. locating the preamplifier at the control location, with a 600-ohm line to a separate power amplifier; c. employing a 600-ohm line from the preamplifier to the remote level-control position, a 600-ohm L- or T-attenuator pad at the control position, and another 600-ohm line from the control position back to the power amplifier; or d. use of control wiring between the preamplifier-power amplifier and special remote level-control equipment.<sup>1</sup>

### Electronic Performance

We have often heard that the performance of electronic sound-reinforcement equipment need not be as excellent as home high-fidelity equipment or broadcast audio equipment. Our experience is that high-quality installations require electronic equipment meeting high performance standards, and typical performance specifications for a control console might be as follows:

- a. Gain: 90 db
- b. Power Output: +18 dbm at less than 1/2 percent thd, 100-15,000 cps.
- c. Frequency Response:  $\pm 1.5$  db, 30-15,000 cps
- d. Source Impedance: 30/50, 125/150, 250/300 ohms mic. inputs

<sup>1</sup>The most satisfactory of the remote level-control equipment now being manufactured uses a photocell as the resistance element with the remote level control actually controlling the amount of d.c. to a light bulb which varies the intensity of light and thus the resistance of the photocell. Two examples of this type of equipment are Fairechild's "Lumiten" and Altec Lansing's "Revocon."

- e. Load Impedance: 600 ohms
- f. Noise Level: 70 db below +18 dbm output (mixer and master controls adjusted for 68-db net gain).

The performance characteristic where less expensive mixer units, or units custom-built by contractors, often falls down is signal-to-noise ratio. A speech-reinforcement system should be able to deliver approximately 85 db (when the lecturer or actor shouts) to the seating area. If the system is employed for music reinforcement, then 95 or 100 db without noticeable distortion would be a good level. To predict the permissible background noise level, we may refer to criteria already established for air-handling system noise for spaces of different types.

The noise level of a good concert hall, lecture room, theater, or church rarely exceeds the NC-25 curve (see Fig. 1), and often is as low as NC-20. These noise criteria curves correspond in most cases to "A" scale (weighted broad band) sound level meter readings of 30-35 db and 25-30 db, respectively. Considering that tube noise (high-frequency noise) is the main component in control equipment background noise, the requirement of a 70-db signal-to-noise ratio does not appear excessive. The realism of even the best acoustically designed sound-reinforcement system can be spoiled by a constant hiss emerging from the loudspeakers.

### Which Signal Goes Where

A line diagram of the simplest possible sound-reinforcement system is shown in Fig. 2. A microphone is connected to the input of a combined preamplifier-power amplifier, which is connected to a loudspeaker. Only one microphone is employed, so the "selection" function is eliminated. It might be a simple church reinforcement system where amplification is provided for the pulpit position only, or it may be a reinforcement system in a small school auditorium, where only weak-voiced lecturers (or the principal) require reinforcement.

The first step in the expansion of a simple system would be the addition of several microphone inputs (Fig. 3). Now the system controls must select the proper input as well as control level. The most straightforward approach to providing such controls is the use of separate mixer-amplifiers which generally provide four low-level microphone inputs and usually include four input gain controls and one master gain control.

Use of a separate control amplifier or mixer unit has several advantages over the use of an integrated mixer-power amplifier. Heat from power output tubes does not affect critical resistors in tube-type low-level stages or the transistors



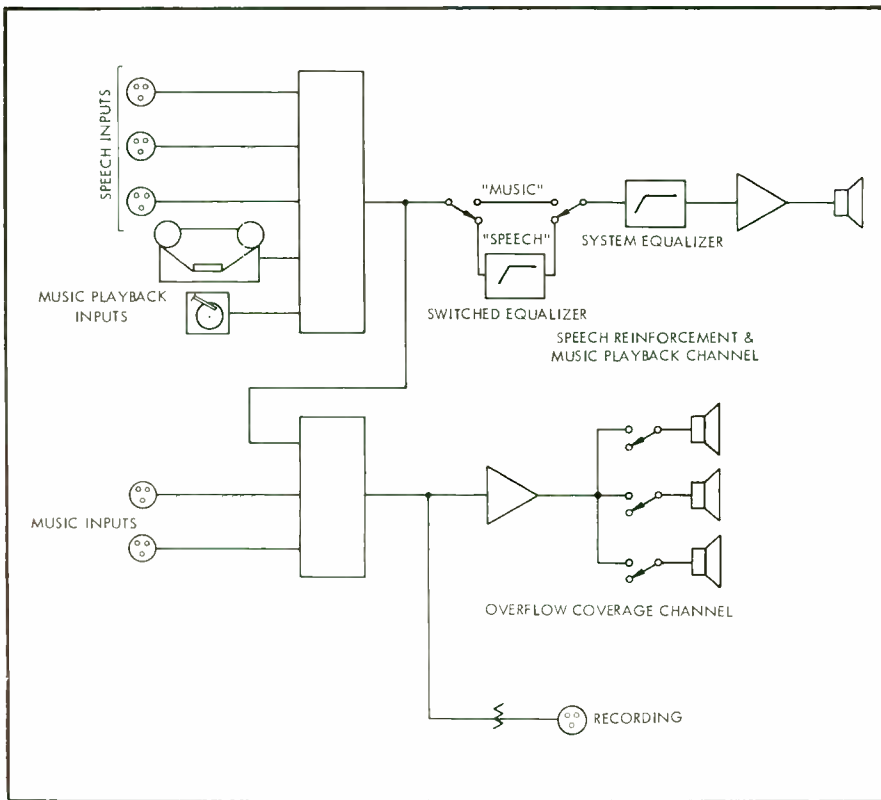


Fig. 5. Sound reinforcement system for church or multi-purpose auditorium such as a theater or concert hall.

becoming more prominent in these devices. In addition, the separate mixers are usually somewhat smaller than integrated mixer-power amplifiers with the same number of inputs; consequently, they may be more easily located in the ideal position acoustically, without creating an undue architectural problem. Finally, over-all system equalization may be easily installed between the mixer output and the preamplifier input.

If the availability of conduit for microphone lines is limited, as would (often) be the case for new systems in existing construction, then control wiring and the special control devices discussed earlier may be useful.

When the sound-system controls are required to provide an auxiliary output for broadcasting or recording purposes, then principles of signal flow must be considered. The author has run into a considerable number of sound-amplification systems having seriously compromised performance, because the same control and amplification system was expected to deliver a signal to a reinforcement loudspeaker system in a church nave, overflow loudspeakers in surrounding vestibules, chapels, or classrooms, and finally a feed for tape recording or broadcasting. Often, each of these outputs demanded different microphone pickup requirements, different level requirements, and different over-all equalization.

Straightforward control of "which

signal goes where" to such systems may be seen in Fig. 4. The output of the speech-reinforcement mixer provides a speech signal for broadcasting and/or recording. However, the equalization applied to the sound-reinforcement system does not affect recording or broadcasting. Music (choir, organ, and congregational singing), is picked up for transmission to the overflow coverage loudspeakers in the narthex and chapel, but these signals are not amplified in

the nave. Finally, mixing of the speech and music signals is accomplished by the broadcast and recording operator, who hears the signals via a monitor loudspeaker in a separate control room, isolated from the nave, and somewhat duplicating the acoustical conditions found in the narthex and chapel (complete isolation from the live sound in the nave). Finally, this operator can also double as the radio-broadcast system announcer, and his announcements will not be amplified within the church. One integrated mixer-power amplifier unit could not satisfy the control functions that this set of engineered components provides!

We may note that such a system can grow in logical fashion. Perhaps the broadcast and recording functions would be installed first; the overflow coverage and reinforcement added later, or vice versa.

The same functional diagram, with no change, might also apply for a typical small civic or college auditorium. Reinforcement would be provided for lectures. Loudspeaker coverage in lobbies would be provided for dramatic events and symphony concerts, but reinforcement within the auditorium would not be provided for these activities. Finally, any activity, whether reinforced or not, could be recorded or sent out over a broadcasting line.

A further addition to such a system might be provisions for playback of recorded music. In that case, switched equalization might be desirable to optimize the performance of the system for voice reinforcement and music playback, again without affecting the signal fed for overflow coverage or recording and broadcasting. A functional diagram for such a system may be seen in Fig. 5.

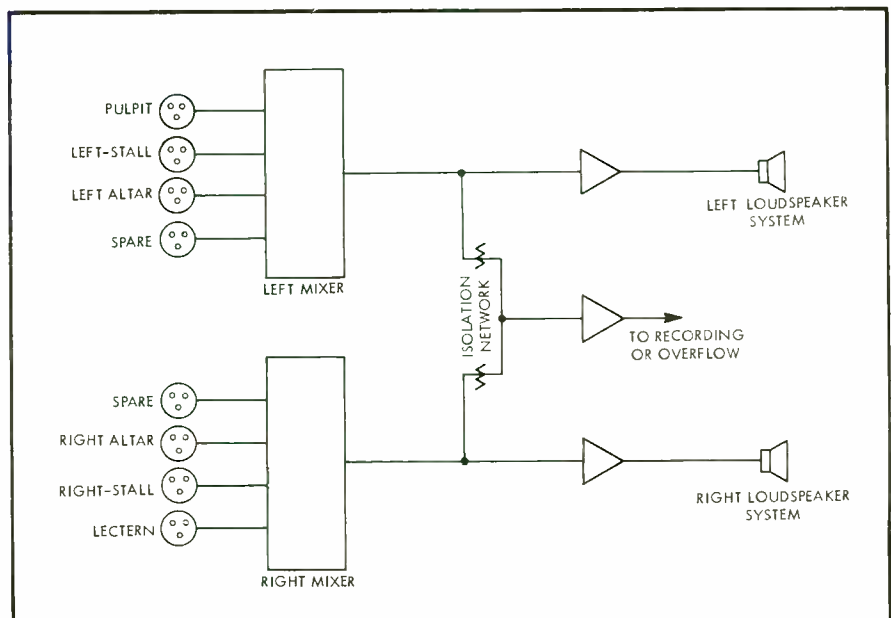


Fig. 6. Simple two-channel reinforcement system.

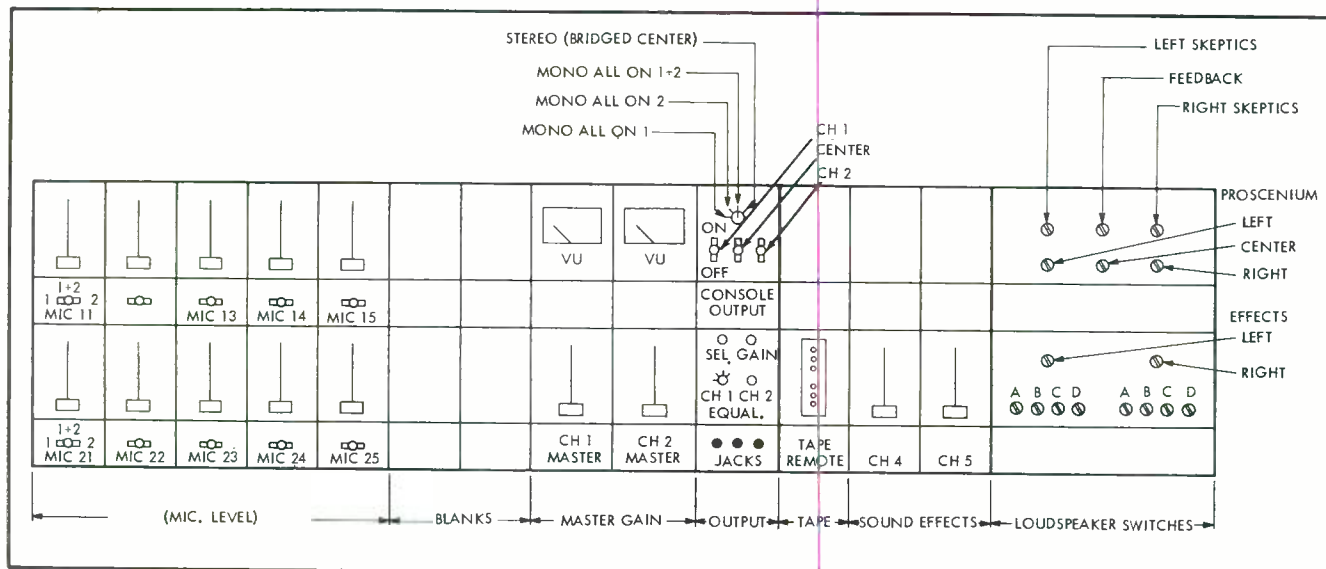


Fig. 7. Bridged center channel reinforcement system.

### Layout

A well-trained or experienced sound-system operator can usually control an auditorium or church system with the neatly located rotary controls of the standard "broadcast" control console. However, best results can be obtained when the principle of "proper location of controls" is followed fully and the microphone positions on the stage can be seen to correspond with the location of the gain controls at the console. This calls for custom-built consoles, and it is often advisable to take one more step towards efficient operation by the use of slide-type attenuators rather than rotating knobs. Figure 6 shows such a control console and the corresponding microphone positions for a typical Broadway show.

A "map of the chancel"<sup>2</sup> control console is one approach for a church sound-reinforcement system. Only one speech microphone is "live" at any one time, and pushbuttons can control the selection of each microphone, with one master gain control. Here the push-buttons are arranged to form a map of the microphone locations in the chancel.

More complicated sound-reinforcement systems require more careful layout of console operating panels to insure easy and straightforward operation.

### Stereo Systems

The simplest stereophonic sound-reinforcement systems are merely two single-channel systems, side-by-side (Fig. 6). One microphone picks up speech at

<sup>2</sup> Dr. Paul S. Venklasen calls these "geographical" consoles.



Fig. 8. Altec Lansing 1567A mixer-amplifier.

the pulpit and transmits it to the loudspeaker over the pulpit; another picks up speech at the lectern and transmits it to a loudspeaker above the lectern. Is this a stereo system? Let the reader supply his own definition. In any case, it is obvious the controls merely double those usual to the simplest single-channel system.

At the opposite extreme are the control panels for some large music halls. There pan-potentiometers allow a gradual transition of any sound sourced from one loudspeaker system to an adjacent system. The controls are laid out to simplify operation as much as possible; yet there is no question but that a very skilled operator is required.

Somewhat intermediate is the control console shown in Fig. 7. In the stereo mode of operation, the system is basically two channel, but with both channels feeding a bridged center-channel amplifier and loudspeaker system. The console is not much more difficult to operate under these circumstances than as a single-channel system. Nevertheless, both to simplify operation and also due to the satisfactory hall acoustics where this system is installed, the system is most frequently operated as a single-channel system, with the stereo side channels "patched" for sound effects.

In all these examples, equalizers, compressors, and patch panels are deliberately left off the console operating panel. The author feels very strongly that only the controls operated during a program should be located on the operating panel. In other words, it should be kept as simple and straightforward as possible. Accessory devices are best located in a sound-equipment rack, located behind the operator; and all patching and switching that can be accomplished before a program begins may be performed conveniently, assuming that the rack is intelligently laid out. The good procedure is to locate rack-mounted con-

trols, including patch fields, at a convenient height, between three and six feet off the floor, with extreme upper and lower spaces reserved for unattended equipment, such as power amplifiers, power supplies, and fans.

The author's experience is that limiter amplifiers and equalizers are best located in the equipment rack, not on the control console where they are all-too-often adjusted when unnecessary. There are exceptions, such as portable sound system consoles that must be used in a variety of acoustical environments. However, the broadcast and recording practice of one



Fig. 9. RCA BN-6B mixer-amplifier.

equalizer for each microphone input is usually unnecessary in a sound-reinforcement system with microphones having approximately the same frequency response when employed for their proper functions.

Intelligent planning is, obviously, only a part of good sound-system controls. Great credit must go to the electronic engineers and designers who have created today's highly reliable equipment and to the better sound-system contractors whose installations are truly works of art. The lines on paper that represent the planning discussed here are, perhaps, a small part of the total effort, but an important part.

### Equipment

Manufactured input mixer assemblies often represent an economical way of obtaining high quality control units. On the other hand, use of individual pre-amplifier, line amplifier, and power-supply units usually will result in a



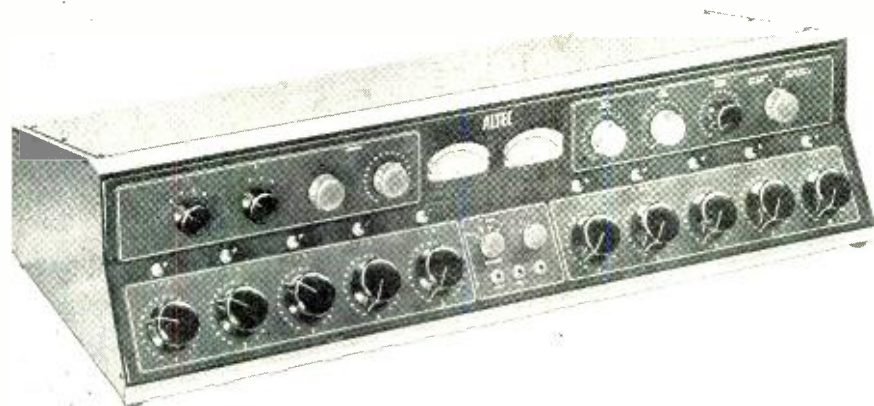


Fig. 10. Altec Lansing 250SU stereo console.

more expensive control unit, if the additional labor costs necessitated by high-quality workmanship are included. However, too often the placement of controls on manufactured mixer units and control consoles complicates operation of the sound-reinforcement system.

The performance characteristics discussed earlier are achieved by different techniques in the mixer-preamplifiers shown in *Fig. 8* and *9*. The Altec Lansing unit employs vacuum tubes, with high-level mixing following the input pre-amplifier stages. The RCA unit employs transistors in advanced amplification circuits that result in extremely low distortion.

Either of these mixers can provide excellent results when used properly. To feed more than one power amplifier, or tape recorder, isolation amplifiers, and so on, the best practice is to match impedances employing isolating (or "build-out") resistors, but using the balanced output connected for 150 or 600 ohms.

Larger sound-reinforcement systems may require mixer preamplifiers capable of controlling gain on more than four or five inputs simultaneously. Such requirements are sometimes met by using two or more of the small mixer-preamplifiers discussed above, with the outputs wired together through isolation networks. This can only be considered a compromise solution, because the advantage of a single master gain control built into the unit is lost with such an arrangement, and the presence of two or more master gain controls adds an unnecessary complexity to the operation of the sound-reinforcement system. The best approach, where the layout of the controls is suitable, is to use one of the control consoles manufactured for both radio broadcasting and sound-amplification system use. The best of such units employ plug-in preamplifiers and line amplifiers. *Figure 10* and *11* show typical control consoles. The plug-in construction of such control consoles allows them to be tailored with reasonable ease to particular signal-flow requirements. The two-channel versions can usually handle the simultaneous functions of sound re-

inforcement within a hall or church, and amplification to exterior spaces or recording and broadcasting simultaneously, and without interference.

The plug-in units themselves have been subject to miniaturization over the past few years. At the same time, their reliability and performance has increased markedly. Through the use of specially-designed transformers, the Altec Lansing preamplifier employs only two tubes, and a few resistors, yet provides a complete push-pull input-to-output preamplifier that does not permit failure of a single tube to interrupt a program. These appear to currently represent the ultimate in tube-type plug-in amplifier design, and the Langevin "Nova" line is somewhat similar. The RCA plug-in preamplifier employs transistors in advanced, low-distortion circuits similar to those employed in the four-input mixer discussed earlier.

#### Theater Systems

There are two different (and opposed) schools of theater sound-system design and operation: the touring system school and the permanent system school. *The Touring Sound System (Old School)*

Most "Broadway" touring shows rent all equipment for voice reinforcement and for sound-effects playback; this equipment remains with the show for the duration of its run, both on Broad-

way and on tour. Low cost seems a prime requirement for this rental equipment, and this factor is an automatic limit on the quality of the equipment. The most important limitation of such rental systems is the lack of an "acoustical match" between the entire sound system, particularly the loudspeakers, and most of the auditoriums where the shows play, but that is not a subject for this particular article. In any case, these touring systems generally contain rack-mounted control facilities which are positioned at the right or left wings of the stage where the sound-system operator can follow the same cues as the lighting control operator. For some shows, these are the same person!

The members of the stage-hands union who are called upon to act as sound-system operators for such shows usually have considerable experience in this activity. Therefore, they are able to get unusually satisfactory results, considering equipment and conditions with which they have to work. Rather than depending upon what they hear during a particular performance of the show in a particular auditorium, they work from a cue sheet usually first established during initial rehearsals of the show, and then modified according to the experience of the producer and director who listen from the audience area. While such a control system allows no modification for varying auditorium acoustics, it does have the advantage of placing sound control directly under the direction of the producer and director.

The results of such sound-system control are not completely evident to listeners of plays in New York City. However, when shows which have played to 1800-2200 seat theaters in New York are taken to auditoriums either much larger or having very different acoustical conditions, the results can be disastrous and even ludicrous.

#### *The Permanent Reinforcement System (New School)*

A well-designed "house" reinforcement  
(Continued on page 60)

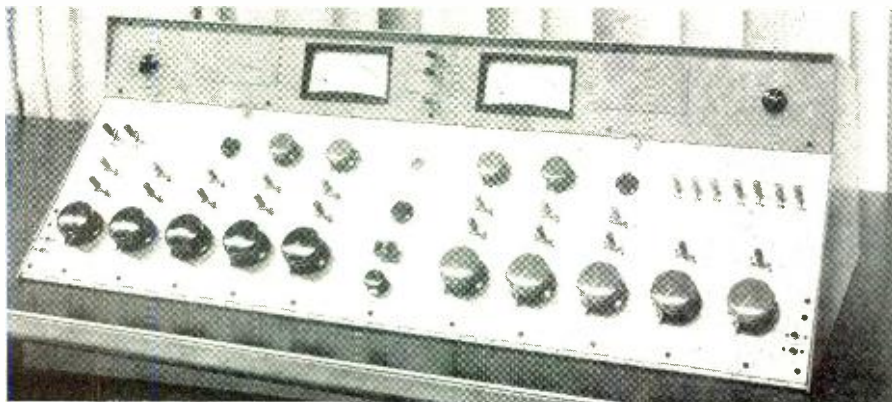


Fig. 11. RCA BC-7 stereo console.

# The Auditioner

JOHN WHITACRE\*

A record and tape playback unit which permits copywriters and others interested in integrating words and music to audition at their desks.

**T**HE MODERN RADIO STATION uses many sound effects, music bridges, background music, and other attention-getting devices to produce commercials and programs.

The copy writing department is charged with the responsibility of putting the right words with the various sound effects or music.

For many years the copy department at WILS needed only a phonograph to play agency commercials and sound effects. Gradually some of the commercials and other programming material began arriving on recording tape. Finally, late in 1959 our engineers built the "Fidelimatic Tape Recording System."<sup>1</sup> Now all the commercials, music bridges, and station identifications are recorded on tape cartridges before being played on the air.

The copy department was being forced to audition most of their material in the auxiliary control room. This not only took them away from their telephone and typewriter, but many times they had to wait their turn to use the equipment. Needless to say, a great deal of valuable time was lost.

\* 2609 Devonshire, Lansing 10, Mich.

<sup>1</sup> John Whitacre, "The Fidelimatic Tape Recording System," *AUDIO*, October 1961.

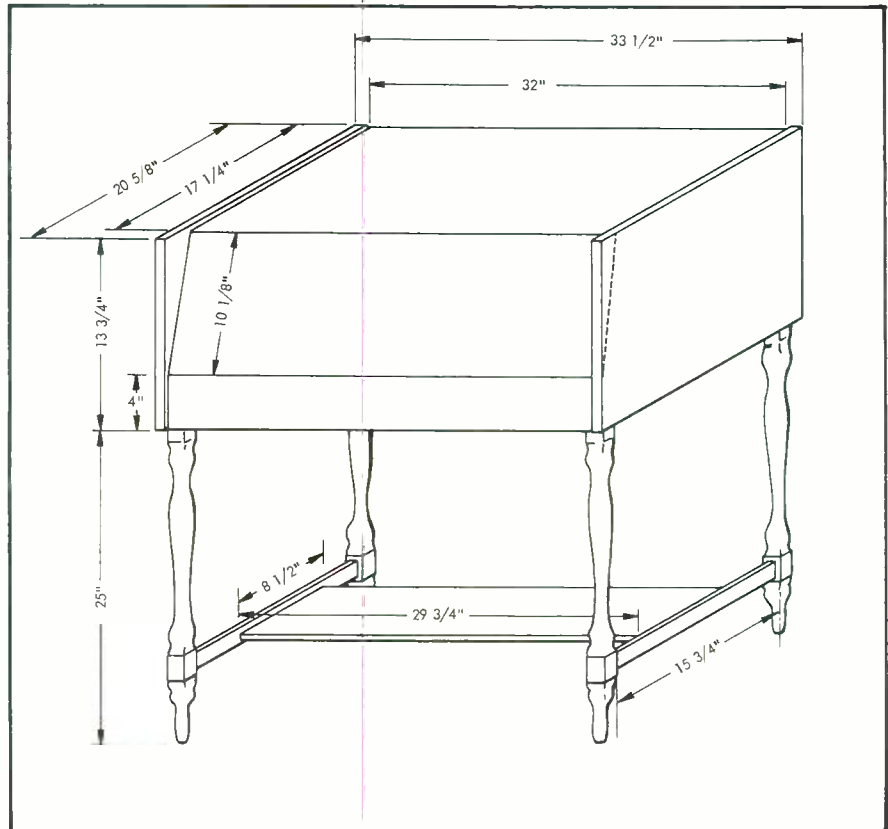


Fig. 2. The wood may be ordered cut to size if you wish to assemble it yourself.



Fig. 1. The completed Auditioner (on the left).

The Auditioner you see pictured here (*Fig. 1*) came to fruition as a result of this problem. No longer do they waste time "going to" the equipment. We have brought the equipment "to them."

Conceived and built by the WILS engineering department, the Auditioner not only does a good job for the copy department, but it pleases the eyes and ears of all who use it.

## The Cabinet

The cabinet was difficult to design. It was built so that the user doesn't have to bend over too far when threading tapes on the recorder. At the same time, if the top was made too high it would be troublesome cuing-up records or playing tape cartridges.

Although we were fortunate in having our engineer, Francis Schafer, design and build the cabinet, I believe you could order the wood cut to exact size by a local lumber company and assemble it yourself. If you observe *Fig. 1* and 2



# The sound from this new Shure cartridge is awesome in its vitality & clarity

## A NIGHT-AND-DAY DIFFERENCE

From the very first prototype, the sound from the new Shure Series M44 Stereo 15° Dynetic Cartridge was incredible. Even skeptical high fidelity critics have expressed unconcealed surprise at the audible increase in brilliance, clarity, transparency, presence, fullness and smoothness of this amazing new Shure development. A close analysis of its performance reveals startling differences in this cartridge—although not extraordinarily improved in the “usual” areas of frequency response (still a virtually flat 20-20,000 cps) or in compliance ( $25 \times 10^{-6}$  cm/dyne)—rather it is in the distortion measurements where Shure engineers have achieved a highly significant and dramatic reduction of 75% to 90% in IM and harmonic distortion from even such admirably distortion-free cartridges as earlier versions of the Shure Stereo Dynetic. Further, cross-talk between channels has been effectively negated in the critical low frequency and mid ranges . . . providing superior channel separation throughout the audible spectrum.

## SCRATCH-PROOF RETRACTILE STYLUS

And, as if that were not enough, the new 15° cartridge incorporates a totally efficient retractile stylus that momentarily retracts whenever excessive forces are applied to the tone arm. It cannot scratch records—even if bounced onto the record or dragged across the grooves.

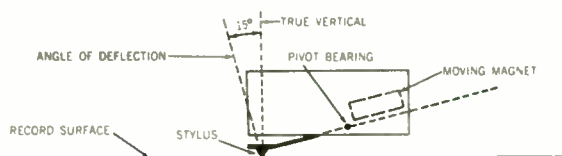
## PERFECTION IS A MATTER OF DEGREE

It has been known for some years that a difference between the angle used to cut stereo records and the angle of the stylus of the cartridge used to play them would result in an increase in IM and harmonic distortion audible on certain records. With widely different cutting angles employed by the record companies, the effective angle of the playback cartridge stylus had of necessity to be a compromise so as to provide the best possible results from records of all makes.

Recently, industry attention was focused on this problem by a series of technical articles ascribing the difference in effective vertical angles between the cutter stylus and the playback cartridge stylus as a cause of distortion and urging the adoption of a standard effective angle to which records would be cut.

Major record companies have now begun to use an effective cutting angle of 15°, which is the proposed standard of the RIAA (Record Industry Association of America) and EIA (Electronic Industries Association).

With the emergence of the single standard effective vertical tracking angle for cutting records, Shure engineers immediately began what seemed on the surface the seemingly simple but in actuality the arduous and exacting task of converting their formidable Stereo Dynetic cartridge to the 15° effective tracking angle. It couldn't be done. So Shure designed this radically new moving-magnet cartridge that will track at an effective angle of 15°. Graphically, this is the kind of cartridge geometry involved in the new Shure Series M44 15° Stereo Dynetic Cartridge:



## THE ULTIMATE TEST

You must hear this cartridge to appreciate the totality of the sound improvement. It will be instantly recognizable to the ear without the necessity for elaborate test instruments or A-B listening tests—although we assure you, instruments and A-B tests will more than substantiate our claims.

### M44 SERIES SPECIFICATIONS

	M44-5	M44-7
Frequency Response:	20-20,000 cps	20-20,000 cps
Output Voltage at 1000 cps (Per Channel, at 5 cm/sec peak velocity):	6 millivolts	9 millivolts
Channel Separation (at 1000 cps):	Greater than 25 db	Greater than 25 db
Recommended Load Impedance:	47,000 Ohms	47,000 Ohms
Compliance:	$25 \times 10^{-6}$ cm/dyne	$20 \times 10^{-6}$ cm/dyne
Tracking Range:	¼ to 1½ Grams	1½ to 3 Grams
Inductance (Per Channel):	680 millihenries	680 millihenries
D.C. Resistance (Per Channel):	650 Ohms	650 Ohms
Stylus:	.0005" diamond	.0007" diamond
Stylus Replacement:	N44-5	N44-7
Cartridge Price, Net (Including stylus):	\$49.50	\$44.50
Replacement Stylus Price, Net:	\$21.75	\$16.75

### Monophonic Styli:

Model N44-1—For monophonic LP records, with .001" diamond \$16.75 net  
 Model N44-3—For 78 rpm records, with .0025" diamond \$14.25 net

**SHURE**

*Stereo* **15°** *Dynetic*®

**SERIES M44 SCRATCH-PROOF CARTRIDGE WITH RETRACTILE STYLUS**

the new standard  
in distortion-free  
hi-fi cartridges



LITERATURE: Shure Brothers, Inc. 222 Hartrey Avenue, Evanston, Illinois

Manufactured under U.S. Patents 3,055,988; 3,077,521 and 3,077,522. Other Patents Pending

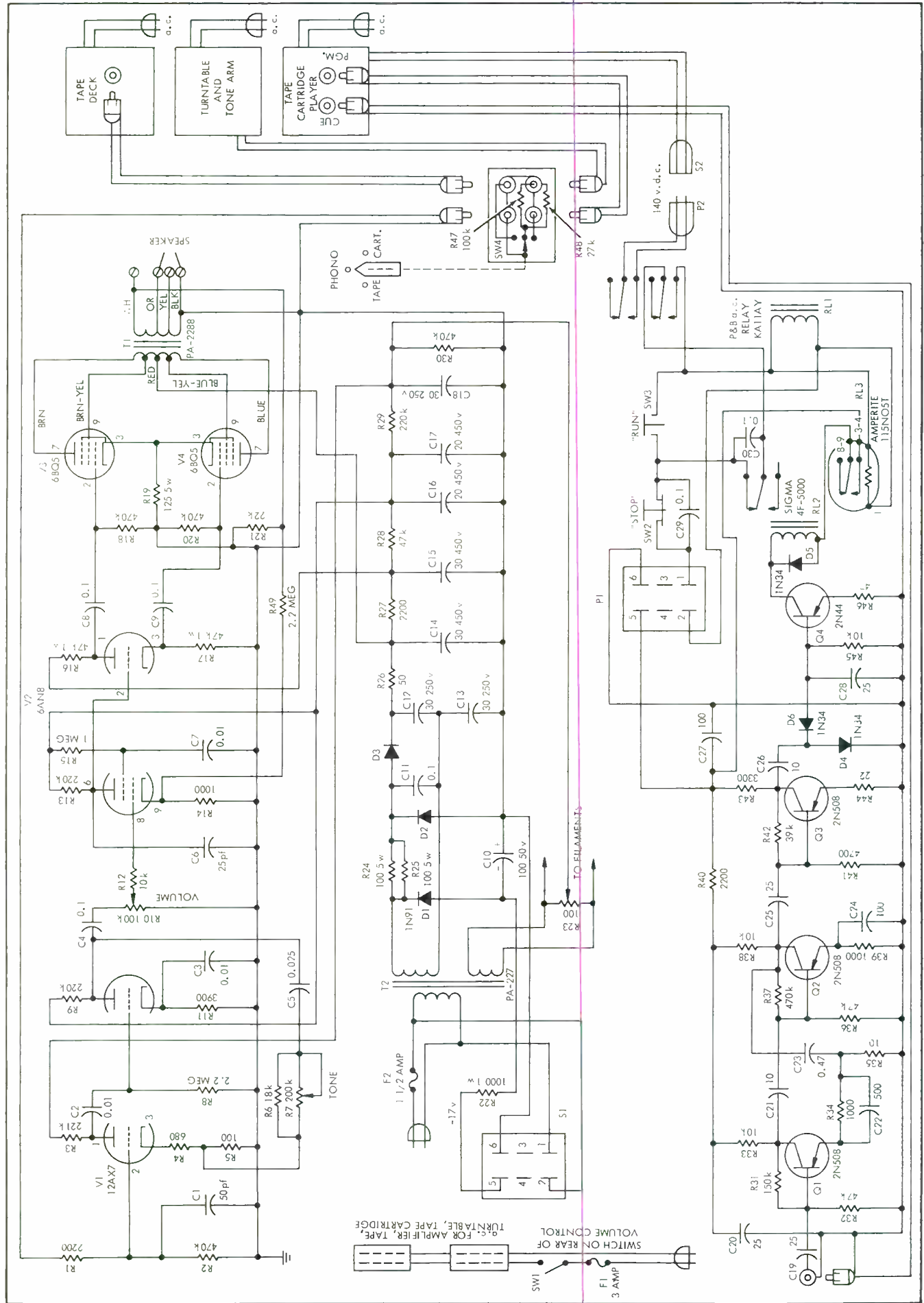
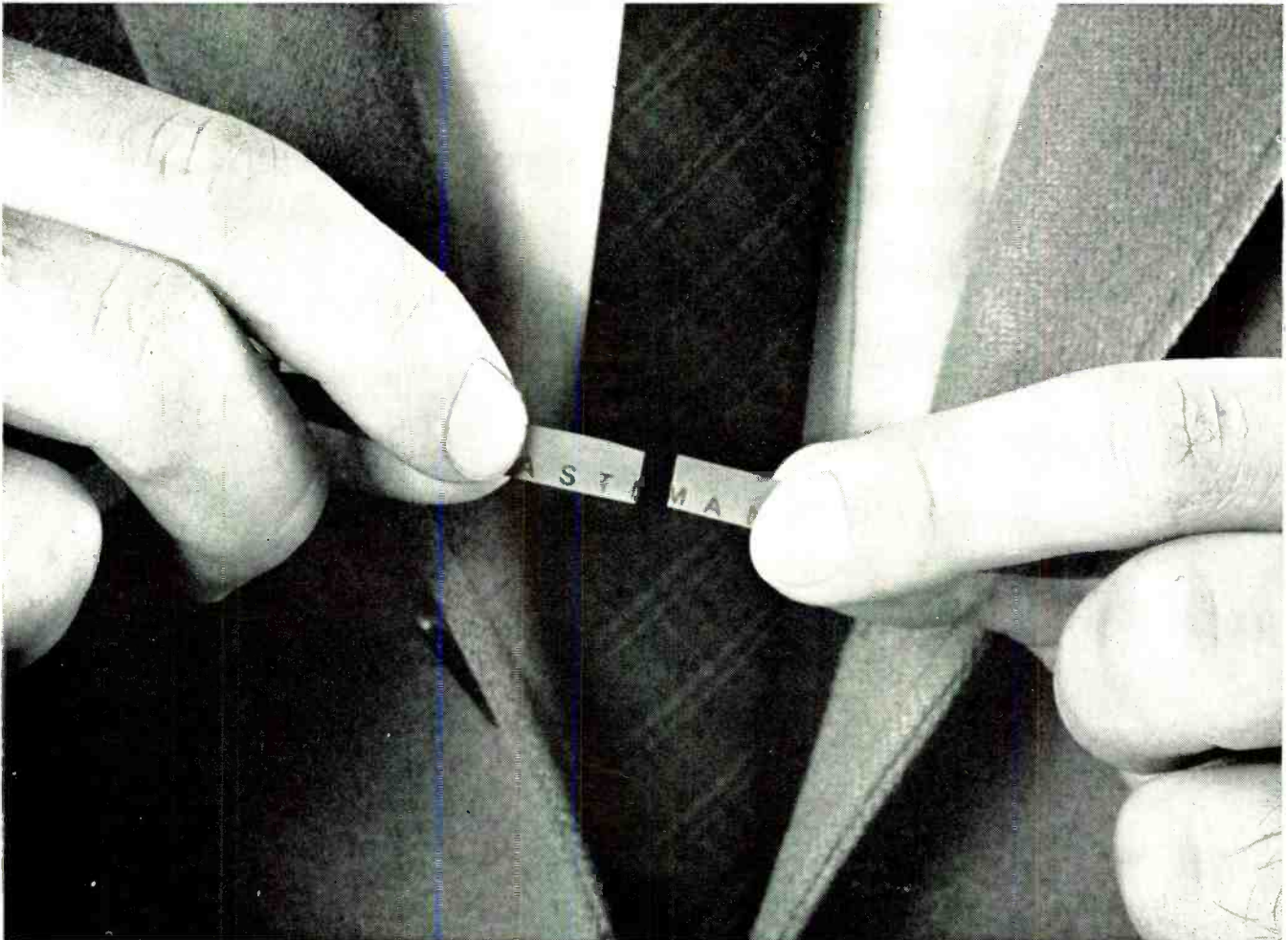


Fig. 3. Schematic of the electronics.



## Now...a new EASTMAN Sound Recording Tape!



Take a piece of the new Eastman tape. See how tough it is... how clean it breaks under stress.

### Look! No stretch...when it breaks—it breaks clean!

**NEW!** Support material for EASTMAN Sound Recording Tapes is DUROL Base. A specially prepared form of cellulose triacetate—smooth, tough, durable, highly flexible—provides high strength with low elongation. When equipment accidents happen, it breaks clean. Splices are made easily, quickly—with minimum program loss.

**Another important feature:** "Lifetime Coding," your assurance of highest quality. Printed on the back of all EASTMAN Sound Recording Tapes is a continuously repeated, permanent legend. This identifies Eastman Kodak Company as the manufacturer and provides a convenient means of indexing these tapes.

For information, see your electronic supplier or write  
Magnetic Products Sales

**EASTMAN KODAK COMPANY**  
**Rochester 4, N.Y.**

AUDIO • DECEMBER, 1963

**New "R-type" binder.** This gives a smoother, tougher surface, thereby reducing tape noise and distortion. In addition, it provides extreme abrasion resistance, preventing oxide build-up at the head. Even more important, however, are the amazing magnetic properties of coatings of "R-type" binder which make possible two superlative tapes—both available now...

**At leading electronic supply houses:** Type A303, a vastly superior low-print tape with output comparable to a fine general-purpose tape... also Type A304, a high-output tape with remarkably low print-through.

© Eastman Kodak Company, MCM LXI



Unique ultra-handly Thread Easy Reel with indexing scale and built-in splicing jig.

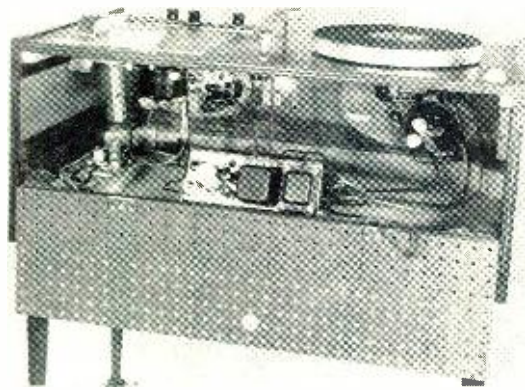


Fig. 4. Back view of the completed unit.

closely you won't have too much difficulty.

American black walnut was selected for the cabinet material. Except for the bottom plate, legs, leg braces, speaker trim, and pegboard, it is constructed of 3/4-in. walnut plywood. Clamps, wood blocks, screws, and glue were used to guarantee solid, square, corners. Triangular-shaped wooden blocks are glued firmly against the legs to give them maximum strength. To make the cabinet more sturdy, the legs were joined near the bottom with a solid walnut brace. The two braces are joined together by a piece of walnut plywood. This not only makes the cabinet more rigid, but forms a useful storage shelf. The legs were mitered to accept the braces and the braces were mitered for the shelf. All mitering was done with a wood bit and chisel. The joints so formed were glued in place.

The fine walnut grain is enhanced and protected by two coats of Vitrolene. Vitrolene is a varnish-like wood finish distributed by Minnesota Paints, Inc., of Minneapolis, Minnesota. Although they recommend it for a durable gymnasium floor finish, we have used it quite successfully for some time now to finish cabinets that are likely to be abused.

In a home you probably wouldn't need leg levelers, but in a radio station experience has taught us to put levelers under mobile cabinets. The Auditioner has been so equipped.

#### The Equipment

When it was decided to build a complete auditioning unit, one of the very first items salvaged from the old phonograph was the Rek-O-Kut Model LP-743 turntable. It was taken apart, cleaned, lubricated, and reassembled. A new motor starting switch and capacitor were installed.

A Viking Model 75 Tape Deck was taken out of service by a nearby radio station. I purchased it for \$20 without even inspecting it. It was disassembled, cleaned, lubricated, and some worn parts replaced. It works very well.

Left over from our earlier experiments with "The Fidelimatic Tape Recording System" was a Viking Model 36

Cartridge Playback deck. Unlike the Model 35 Cartridge deck, it uses a solenoid to hold the pressure roller against the capstan instead of a mechanical latching system. The solenoid feature would make it easy for us to re-cue tape cartridges on this deck. We certainly don't want any cartridges appearing in the control room unless they are cued-up and ready for use on the air!

Viking built the power amplifier we are using in the Auditioner. It was part of a Viking Model 36. An NAB tape playback equalization network is already incorporated in the amplifier circuit. To get a better bass response from the amplifier when being fed from the three sources, we changed capacitor  $C_5$  from 0.01  $\mu\text{f}$  to 0.025  $\mu\text{f}$  and bridged the tone control,  $R_7$ , with an 18,000-ohm resistor ( $R_6$ ).

The General Electric VR-II cartridge initially used with the Gray transcription arm would over-drive the first stage in the Viking amplifier. A voltage divider consisting of  $R_{47}$  and  $R_{48}$  dropped the signal appearing at the grid of  $V_1$  to a value equal to that being generated by the tape heads.

Viking of Minneapolis designed the first three stages in our cue-sensing amplifier circuit. We modified it to fit this application. For instance, the tuned feedback loop from the collector of  $Q_2$  to the emitter of  $Q_1$  is designed to roll off most of the higher frequencies.

The Amperite thermal relay,  $RL_2$ , is used to delay application of voltage to the collector of  $Q_4$ , the triggering or cue-tripping circuit. If this were not done, it would be necessary to hold down on the "Run" switch until all the cue burst had been pulled past the cue-sensing head.

Power for the cue-sensing amplifier and the relay control circuit is taken from the existing power transformer in the power amplifier. This was done by adding one diode,  $D_1$ , and two capacitors,  $C_{10}$  and  $C_{27}$ .

The speaker grill shown in Fig. 1 and the two speakers you see in Fig. 3 were removed from a used Ampro tape recorder. The small speaker is electrically coupled across the large one through an electrolytic capacitor. It sounded well this way so it was not changed.

A black anodized aluminum panel was engraved with the various controls nomenclature. On this panel are the VOLUME control, TONE control, INPUT switch, ON-OFF indicator, and STOP-START switches for the cartridge mechanism.

#### Performance

Now, about the fidelity of the AUDITIONER. First let me point out it was not designed for use as a high-fidelity mechanism. It was designed as a "work horse" for the copy department. However, measurements have been made using an Ampex alignment tape on the tape deck and cartridge deck. The speakers were disconnected from the amplifier output and a 5-ohm wirewound resistor was placed across the amplifier output terminals. A number of measurements with a Barker & Williamson distortion meter across the 5-ohm resistor indicated a frequency response of plus or minus 2 db from 50 cps to 10,000 cps. Since an RIAA network is not incorporated in the amplifier, it is unfair to expect a good response from the General Electric cartridge. But a slight adjustment of the tone control yields a

(Continued on page 54)

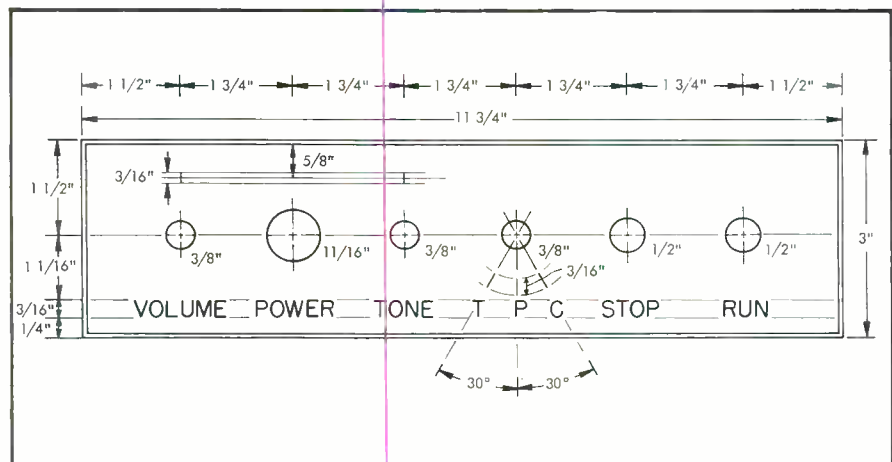


Fig. 5. Lettering and dial calibration marks were engraved in the 1/16-in. thick black-anodized aluminum panel.





“...by combining this unit, Citation A, with a *solid state basic amplifier* of comparable quality, a sound path could be set up that approaches the classic goal of amplifier design—a straight wire with gain.”

—HIGH FIDELITY MAGAZINE

## THE NEW CITATION B

PROFESSIONAL 80 WATT SOLID STATE STEREO BASIC AMPLIFIER



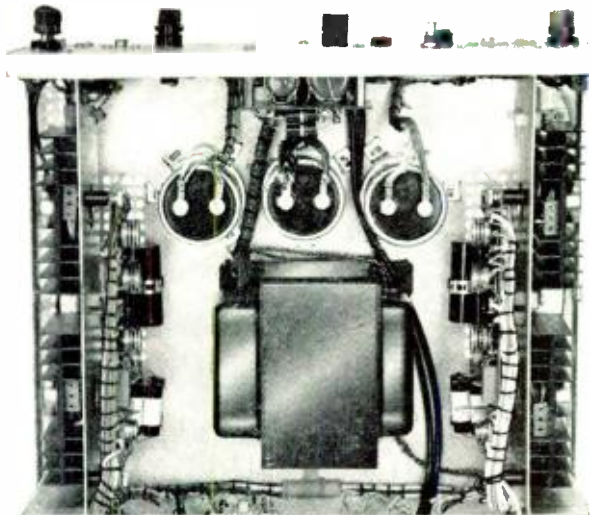
Handsome front panel; facilitates custom installation. Features include current-adjustment meter, on/off switch with pilot light and low-cut filter. Removable bottom panel conceals idling adjustment controls.



Computer-grade silicon output transistors: heavy-duty, solid state devices, virtually impervious to abuse. Will take 100% more power than their use in Citation B will ever demand.



Driver stage: Wideband silicon driver transistors are mounted on rugged, military-type epoxy glass board. Board pivots for easy accessibility or removal.



Top view of chassis: computer construction throughout. Five sub-assemblies assure easy accessibility and minimum operating temperature through efficient heat dissipation; laced military wiring harness couples each stage.



Electrolytic capacitors: engineered to computer-grade specifications for unlimited shelf life and consistent, long-term performance.



"Heat sink": heavy-duty finned aluminum device which rapidly draws heat away from output transistors—insuring long life, fail-safe performance.

The "classic goal of amplifier design" is now reality. The big "B" is here. The Citation B. A power-packed "brute" loaded with 80 watts of flawless performance—a true product of the computer age. • The "B" has the widest frequency response of any basic amplifier—1 to 100,000 cps. • The "B" has the best square wave response—less than one microsecond rise time. • The "B" has the highest damping factor—50 to 1 at 10 cps. (No other power amplifier is even close.) • The big "B" is the only power amplifier completely free of hangover or clipping at full power output.

The Citation B reflects Harman-Kardon's solid state leadership in every way—performance, design and construction. "A straight wire with gain" when matched with Citation A, the big "B" will also enhance the performance of any other high quality stereo preamplifier. For more information—write Citation Division, Harman-Kardon, Inc., Plainview, N.Y., Dept. A-12.

**harman kardon**

A subsidiary of THE JERROLD CORPORATION

# An Open Baffle Parallel-Series Array

Taking advantage of the excellent midrange of multiple speaker arrays, and the space saving of an open-backed infinite baffle, an economical (money and space) and good sounding speaker system can be constructed.

R. S. OAKLEY, JR.\*

**A** MULTIPLE SPEAKER ARRAY consists of a number of small speakers in a single enclosure or baffle. Since multiple speaker arrays appeared on the scene several years ago their stock has risen and fallen severely as different authors voiced opinions on them and presented fact about them.<sup>1-8</sup> Much has been clarified during this time, and more and more designers are developing arrays. Still, there are some areas where theory and practice differ, and some questions which have not yet been settled.

It is generally agreed that multiple speaker arrays do perform well in the midrange frequencies. Particularly low transient distortion in the midrange has been noted. Increased radiating area decreases cone excursion and voice coil velocity, resulting in lower distortion. Low-frequency response, however, is still limited by array fundamental resonance. In addition, low-frequency distortion can be minimized only by using high quality speakers. Similarly, high-frequency response suffers to a degree from interference effects, but is also limited by voice coil quality.

Almost all multiple speaker array designs use inexpensive 6-in. speakers and have tweeters to extend their response on the high end. Different approaches

\* 101 Montclair Ave., Waltham, Mass.

- 1 Norman H. Crowhurst, "Pillar of Sound," *Hi-Fi Systems*, Autumn, 1959.
- 2 C. F. Mahler, Jr., "Hi-Fi Performance from Small Speakers," *AUDIO*, December, 1959.
- 3 Norman H. Crowhurst, "Acoustic Matrixing—A Basis for New Loudspeaker Developments," *AUDIO*, November, 1960.
- 4 C. F. Mahler, Jr., "The Series-Parallel Speaker Array," *AUDIO*, November, 1960.
- 5 Jim Kyle, "Sweet Sixteen," *Popular Electronics*, January, 1961.
- 6 Jim Kyle, "Sweeter with a Tweeter," *Popular Electronics*, April, 1961.
- 7 James F. Novak, "Performance of Series-Parallel Speaker Arrays," *AUDIO*, September, 1961.
- 8 John W. Ward, "Another Word on Multiple Speakers," *AUDIO*, December, 1962.

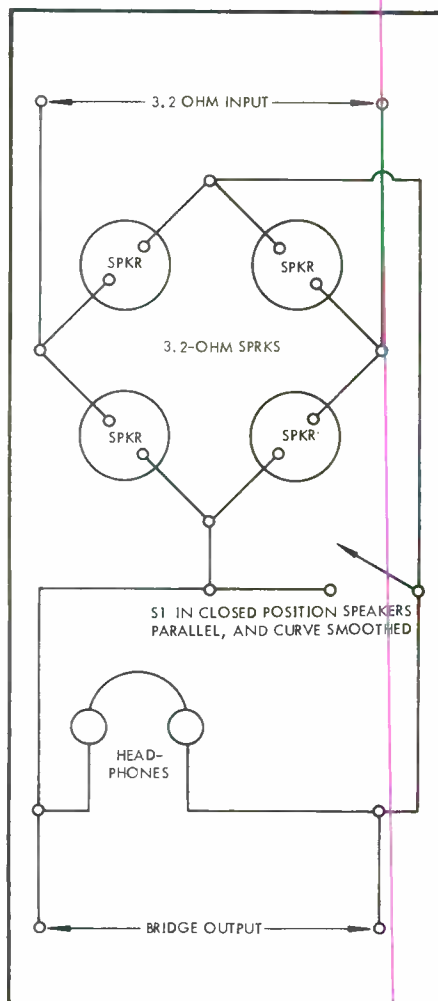


Fig. 1. Parallel-series test setup.

have been used, however, in the following aspects of array design: number of speakers employed; electrical connection of speakers; enclosure or baffle design; orientation of speakers; and, placement and control of fundamental resonance.

## Number of Speakers Employed

Arrays to date have employed as few as three and as many as 32 small speakers. The number chosen depends on de-

sired nominal impedance, and enclosure or baffle design. Three factors, however, are basically related only to the number of speakers used in an array: power handling capacity, cone excursion; and, increase of efficiency in the midrange.

In an array of  $N$  speakers, power handling capacity is  $N$  times that of the individual speaker. This is accomplished without any loss of speaker efficiency, and allows an added margin of  $10 \log N$  db between the power required to drive the array and the power the array can handle. Cone excursion, at the same time, is reduced by a factor of  $\sqrt{N}$ . A proportionate reduction of distortion over most of the range of the array is thus made possible because suspension non-linearity is a major cause of distortion.

Actual increase of efficiency is restricted to the midrange. This results from mutual coupling between speakers at midrange frequencies. Maximum theoretical boost varies as power handling capacity margin, and is expressed as  $10 \log N$  db. Increase of  $N$ , therefore, is good for increasing power handling and reducing distortion, but it is bad in the middle frequencies where mutual coupling boosts efficiency and produces a hump in the response curve. Table 1 gives values of  $10 \log N$  db and  $\sqrt{N}$  for various array complements.

## Electrical Connection of Speakers

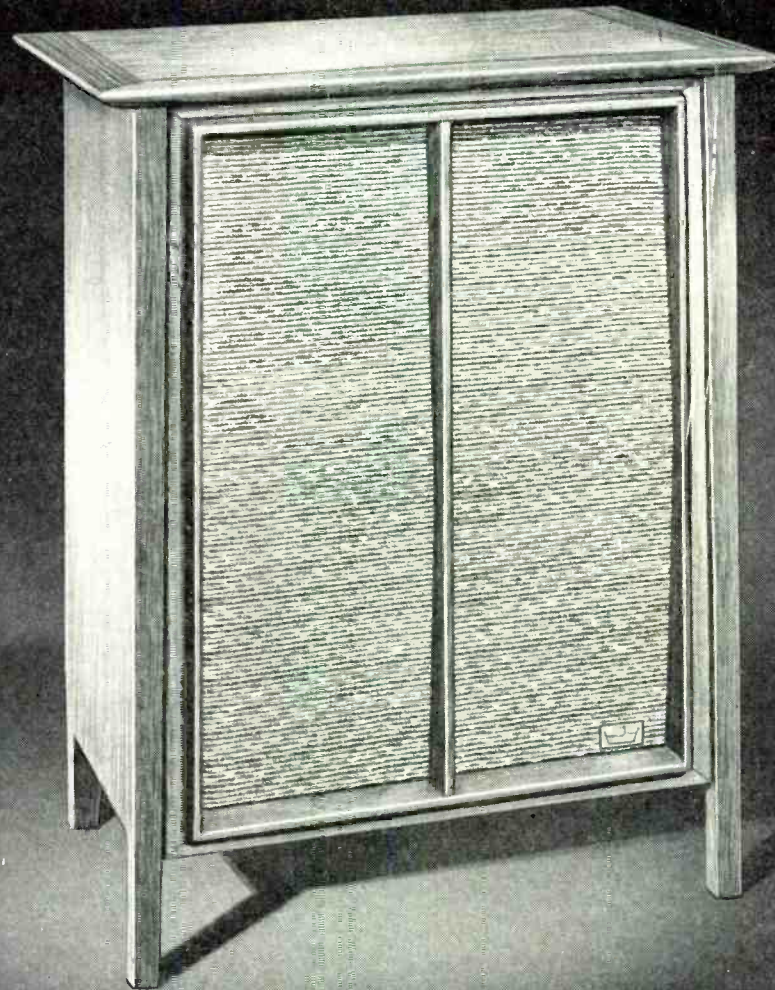
One factor in the choice of the number of speakers in an array is the electrical connection of the speakers. In an array of  $N$  speakers, the nominal impedance could be as high as  $N$  times the single speaker impedance, or as low as  $1/N$  times single speaker impedance. Practical values of array nominal impedance do not allow straight parallel or series connection because most amplifiers are designed to operate best with 4, 8, or 16-ohm nominal impedance loads. Since most arrays use speakers with 3.2-ohm voice coils, practical means of con-





If not for University's Classic Mark II...

this would be the finest speaker system of them all—



## the new Classic Dual-12

the three-way system with two 12" speakers—plus!

From the first moment of its appearance, the Classic Mark II won instant and unanimous acclaim as the most exciting new instrument in the world of music reproduction. Its range, its presence, its spaciousness and dimension are truly outstanding, even when compared with the so-called "world's bests." Its reputation, however, posed this immediate challenge: Could University now create a speaker system with the essential qualities of the Mark II, but in a more compact size... and at a more moderate price? Could University now bring the pleasure of uncompromising big system high fidelity to a broader range of music lovers?

The challenge has been answered with the new Classic Dual-12, created by a totally new approach to the design

of speaker systems. Instead of the conventional 3-speaker arrangement, University's Dual-12 incorporates two 12" speakers...plus the Sphericon Super Tweeter! One 12" speaker is a woofer specifically designed for optimum reproduction of the ultra-low frequencies (down to 25 cps); the other, a woofer/mid-range, reinforces the woofer, removes the peaks and valleys that cause harsh, strident sounds in ordinary systems and provides flawless mid-range performance. The renowned Sphericon is included to assure silky, transparent highs soaring effortlessly up to 40,000 cps! Power Requirements: 10 watts. Size: 23<sup>3</sup>/<sub>4</sub>" x 31<sup>1</sup>/<sub>4</sub>" x 15<sup>1</sup>/<sub>2</sub>". Oiled walnut finish. **\$229.95** Hear it at your hi-fi dealer, or write: Desk R-12.

 **UNIVERSITY  
LOUDSPEAKERS**  
OKLAHOMA CITY, OKLAHOMA  
A Division of Ling-Temco-Vought, Inc.



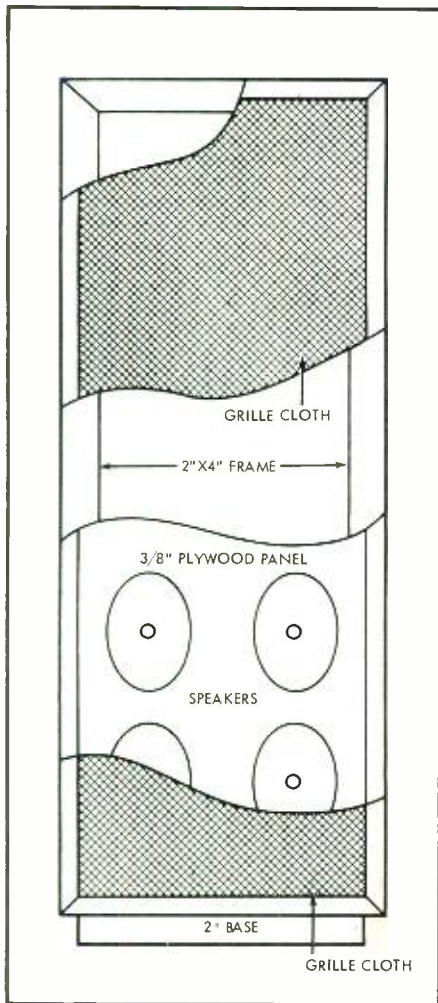


Fig. 2. Cutaway of "Sonic Screen."

nection are fairly limited. In addition, it has been found desirable to connect arrays in parallel-series rather than in series-parallel, so that the parallel connection will smooth the impedance curve of the array.

In the simple test setup shown in *Fig. 1*, consisting of four identical 3.2-ohm speakers wired in series-parallel, the array impedance is 3.2 ohms. Assuming that the four speakers are truly identical, there should be no current through the wire which converts the array from series-parallel to parallel-series, because the circuit is a balanced bridge. A sensitive pair of earphones connected across the bridge, however, indicate that there is a considerable amount of current, and that therefore parallel-series connection is more desirable for the array. Table 1 gives preferred and alternate values of array impedance.

#### Enclosure or Baffle Design

The terms "enclosure" and "baffle" have been used interchangeably by many writers on sound reproduction. Here a distinction is made between the two terms. Enclosures which are suitable

No.	10 log N	$\sqrt{N}$	Preferred Z (Nom.)	Alternate Z
3	4.8 db	1.7	—	9.6 (3.2 × 3)
4	6.0 db	2.0	3.2 (3.2 ÷ 2 × 2)	12.8 (3.2 × 4)
5	7.0 db	2.2	—	16.0 (3.2 × 5)
6	7.8 db	2.4	4.8 (3.2 ÷ 2 × 3)	19.2 (3.2 × 6)
8	9.0 db	2.8	6.4 (3.2 ÷ 2 × 4)	—
10	10.0 db	3.1	8.0 (3.2 ÷ 2 × 5)	—
12	10.8 db	3.4	9.6 (3.2 ÷ 2 × 6)	—
16	12.0 db	4.0	3.2 (3.2 ÷ 4 × 4)	12.8 (3.2 ÷ 2 × 8)
20	13.0 db	4.5	4.0 (3.2 ÷ 4 × 5)	16.0 (3.2 ÷ 2 × 10)
24	13.8 db	4.9	4.8 (3.2 ÷ 4 × 6)	19.2 (3.2 ÷ 2 × 12)
32	15.0 db	5.6	6.4 (3.2 ÷ 4 × 8)	—

for use with multiple speaker arrays include the "infinite baffle" (which is neither infinite nor a baffle), the simple bass reflex, and the ducted port bass reflex. The "infinite baffle" is the simplest enclosure design. It can be of almost any proportions as long as its enclosed volume is such that the resonant frequency of the system remains relatively unchanged. Too small an enclosure will add stiffness to the mechanical system of the loudspeakers and raise the resonant frequency. The "infinite baffle" has three disadvantages: its relatively large size, its waste of the backwave of the speakers, and its lack of control over the resonance of the speakers.

The bass reflex overcomes these disadvantages to an extent. The ideal proportions of a bass reflex enclosure are around 3:2:1.5, and its enclosed volume is determined by the radiating area and the resonant frequency of the speakers enclosed. In general the bass reflex is a large enclosure, but not as large as the "infinite baffle." The bass reflex utilizes speaker backwave at low frequencies, and is designed to reduce and distribute the system resonance. Using a ducted port makes the bass reflex still smaller, but requires better damped speakers than the simple bass reflex. Both the bass reflex and the "infinite baffle" are of limited value for use with large arrays because of their size, but with small arrays (of three to six speakers) they are quite practical.

For larger arrays a baffle is the only answer. The true infinite baffle usually consists of a wall of the listening room, with the speakers' backwave radiating into another room or large closet. Its permanent nature makes it rather impractical for most audiofans, and it has

no control over speaker resonance. The open baffle allows the backwave to radiate into the listening area, essentially doubling speaker efficiency, however it too has no control over resonance. Considerable ingenuity is required to disguise the basically poor appearance of the open baffle.

An open backed enclosure can be designed to at least partially overcome the disadvantages of the open baffle. Sides need only be extended back far enough so that the speakers are hidden. Also backwave radiation can be controlled to some extent. The open-backed enclosure, then, is basically an improved open baffle—suitable for home use. The major disadvantage of this design is that considerable care must be exercised in placing the system in the listening room because of the backwave radiation.

#### Orientation of Speakers

Speaker orientation in an array consists of center-to-center spacing and the number of speakers placed in a line. The center-to-center spacing determines at what frequency maximum midrange boost will occur, and at what frequency destructive interference will begin. The number of speakers in a line determines how much of the theoretical maximum boost will be encountered in practice, and the polar response of the array. Speaker orientation for small arrays is not nearly as important as with large arrays because the theoretical maximum boost in the midrange is not as great, and because destructive interference will not be so severe.

Mutual coupling between speakers occurs at frequencies for which speaker

(Continued on page 53)

	6.5"	7.0"	7.5"	8.0"	8.5"	9.0"	
<b>Midrange boost frequencies</b>							
	256.1	232.7	217.2	203.6	191.5	171.3	1/8th
	655.0	593.4	553.9	519.2	488.3	436.7	max
	1280.5	1163.3	1086.0	1018.0	957.5	856.4	5/8th
<b>High-frequency interference</b>							
	2004.9	1861.7	1737.6	1629.0	1532.0	1370.2	1 wave
	4009.8	3723.4	3475.2	3258.0	3064.0	2740.4	2 "
	8019.6	7446.8	6950.4	6516.0	6128.0	5480.8	4 "



# plays your precious records with a light, gentle touch

Whether you use your Miracord as a manual turntable, an automatic turntable or an automatic changer; whether you play stereo or mono; you enjoy the same gentle quality, the same flawless performance that has made Miracord first choice in the finest consoles and component systems.

It is the only unit of its type obtainable with self-regulated, constant-speed hysteresis motor, the only one with a one-piece, 12-inch turntable and mass-balanced tone arm employing no springs, and the only one with feather-touch pushbutton controls

Incredibly quiet, smooth and gentle, the Miracord brings out the best in your records with every play, and preserves that quality for long-lasting enjoyment.

Before you choose a record player for your system, be sure to see and hear the Miracord at your high fidelity dealer. Model 10H with hysteresis motor, \$99.50; model 10 with 4-pole induction motor, \$89.50 (less cartridge and base). For complete details, write to:

**BENJAMIN  
MIRACORD**





HERMAN BURSTEIN\*

(Note: To facilitate a prompt reply, please enclose a stamped, self-addressed envelope with your question.)

### Changing to a VU Meter

*Q. I am building a stereo recording amplifier utilizing printed circuit boards made available by Tandberg as replacement parts for their Model 6 tape deck. Would it be possible to substitute an inexpensive VU meter for the magic eye indicator? If so, where should the meter connections be made? Would additional circuitry be necessary to obtain reasonably accurate readings?*

**A.** A VU meter has to be driven by a low-impedance source, such as a cathode follower. The signal to the magic eye tube in the Tandberg is provided by a high-impedance source, that is the plate of a 12AX7 amplifier. The signal is taken from the arm of a 0.5-megohm pot connected via a capacitor to the plate. This arm should be connected to the input grid of a cathode follower, and the output of the cathode follower should be connected to the VU meter via a series 3600-ohm resistor.

You will of course have to calibrate the meter, which means adjusting the arm of the pot so that the meter reads 0-VU when a 400 cps tone is recorded at a level 6-db below that which produces 3 per cent harmonic distortion on the tape. Identify the recording level, at 400 cps, which causes the magic eye to barely close. At 6-db below this recording level, the VU meter should read 0.

### Recording from One Tape Machine to Another

*Q. I recently purchased an EMI recorder, model L2B, and would like to build a battery eliminator so that the machine may also be used for playback taping with a second recorder which I own. I would also like to eliminate the playback electronics when taping with the second machine. Would it be all right to take the output directly from the playback head of the EMI, and if so what impedance should it work into?*

**A.** Your question concerning a battery eliminator is outside my scope, but you can try writing to the companies that make silicon and germanium rectifiers; some of them publish schematics for power supplies. Also write to the manufacturer of your tape recorder.

As for your second question, the playback head in a typical home machine should work into an impedance of about 500,000 ohms. You cannot feed the signal from the playback head of one machine

directly into the input jack of a second machine because the signal must first be amplified and equalized; equalization involves a large amount of bass boost in order to provide flat response.

### Hummy Tape Machine

*Q. Recently I purchased a used \*\*\* tape recorder at a very reasonable price. The machine works superbly as a self-contained unit but has defied all efforts to integrate it into my audio system in a satisfactory way. The only external outputs are through the audio output stage, and these have higher distortion and some hum. I tried tapping off the plates of the driver stage and again got too much hum. The cathodes are bypassed so that I cannot obtain a signal off them. As a last resort I took the signal from the playback head and fed it into the tape head input of my external preamp. Even this results in hum. The hum ceases when the power switch of the tape recorder is turned off. From all of this it appears that the main cause of hum is the power transformer. Is there any way to correct this?*

**A.** The first models of your tape machine had considerably more hum than later models. Quite possibly you are right in stating that the power transformer in the machine is responsible. Replacement with a better shielded unit might help. An alternative is to remove the power transformer completely from the machine and reconnect it via long leads. If hum is your principal objection to deriving the signal after the audio output transformer, try loading this transformer with a 4-ohm resistor; I have been informed by the manufacturer's representative that there is no load on the output transformer when you switch off the internal speaker, and that the hum level may drop if you put in a load resistor.

### Frequency Response Specifications

*Q. In tape recorder specifications, as published by manufacturers, it occurs to me that there are three possible meanings that may be attached to the figures for frequency response. 1. If a signal is recorded and played back through the self-contained preamps, the signal output is down from the original signal by the number of decibels specified by the manufacturer. 2. With a recorded tape, the output of the playback preamp is down from the signal originally impressed on the tape. 3. The response of the heads only, without the preamps. Which of these systems is in use; and is it governed by an industry code of some sort?*

**A.** The frequency response specification of a tape recorder has nothing to do with the decrease or increase of over-all signal level as the signal passes through the tape recorder or any part of it. It simply in-

dicates the extent to which flat response is maintained, using 1000 cps as a reference frequency. To illustrate, assume that the manufacturer specifies record-playback response at 7.5 ips as  $\pm 2$  db between 40 and 14,000 cps. This means that if signals of equal magnitude are fed into the tape recorder at all audio frequencies, those between 40 and 14,000 cps coming out of the recorder are within 2 db (above or below) of the magnitude of the 1000-cps frequency reproduced by the machine. If the 1000-cps signal is amplified 10 times by the machine, then all frequencies between 40 and 14,000 cps are also amplified within 2 db of 10 times; that is, between 8 and 12 times.

### Varying Volume with Tape Grade

*Q. For some time I have been transferring my record collection to tape. The other day I read in a book on tape recording: "The correct setting of the volume control varies according to the grade of magnetic tape you are using, and the recorder may have been set for a different grade." Is the quoted statement true, and to what degree?*

**A.** In the early days of tape recording there were substantial differences among the magnetic oxides used for coating the tape, especially between the black and red oxides. Accordingly, the recording level for a given amount of distortion on the tape varied a good deal. Today, however, if you use the conventional tape of virtually any reputable manufacturer, you will find that the maximum recording level—resulting in 3 per cent tape distortion at 400 cps cycles—is about the same (that is, within 1 or 2 db). The single exception I know about concerns high output tape, made by one or two companies, which permits a maximum recording level several db higher than does conventional tape.

### Unwanted Bass Boost

*Q. I own a tape player which is fed into a preamplifier. Unfortunately, this combination produces a noticeable but not serious boost of the bass frequencies and a lesser dip in the extreme highs. Recently, however, when using this setup in conjunction with a friend's tape recorder for copying tapes, I noticed that this effect becomes worse when I play a copied tape on my machine. Now the tapes are noticeably "bassy" and unnatural. Since I feel that my tape player is one of the best, I would rather try to modify its equalization than buy a different player—unless absolutely necessary. Now, if at all possible, would you recommend going about changing the equalization? My limited knowledge of this field requires a very specific and scaled down explanation in great detail.*

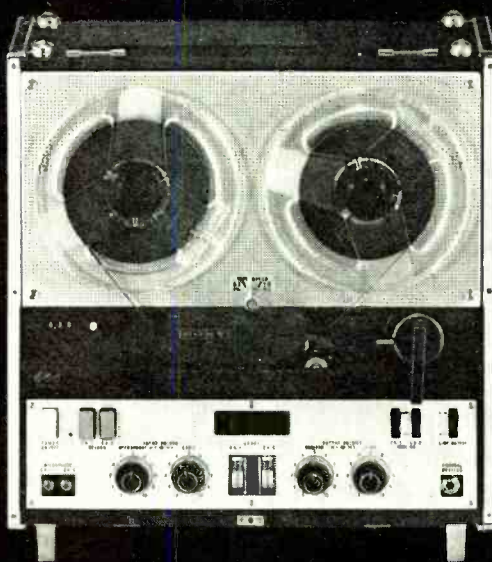
**A.** What you describe as "bassy" reproduction may really be loss of highs rather than emphasis of bass. Such loss could be due to widening of the gap in the playback head or to azimuth misalignment. When you play a tape on your machine, copy it on your friend's tape recorder, and play it back on your machine, you are repeating the original frequency imbalance, so that the effect is worse than before.

Hence the first step is to have a competent technician check for head misalignment and head wear. However, if equalization is indeed at fault, which may well be, this must be remedied by a technician and not by you. Changing equalization is a technical business requiring an accurate audio oscillator, a good VTVM, and an understanding of tape machines and their equalization circuits.

\* 280 Twin Lane E., Wantagh, N. Y.



The commanding presence of Sony sound



Now enter the world of the professional. With the **Sony Sterecorder 600**, a superbly engineered instrument with 3-head design, you are master of the most exacting stereophonic tape recording techniques.

Professional in every detail, from its modular circuitry to its 3-head design, this superb 4-track stereophonic and monophonic recording and playback unit provides such versatile features as: ■ vertical and horizontal operating positions ■ sound on sound ■ tape and source monitor switch ■ full 7" reel capacity ■ microphone and line mixing ■ magnetic phono and FM stereo inputs ■ 2 V.U. meters ■ hysteresis-synchronous drive motors ■ dynamically balanced capstan flywheel ■ automatic shut off ■ pause control and digital tape counter—all indispensable to the discriminating recording enthusiast. Less than \$450,\* complete with carrying case and two Sony F-87 cardioid dynamic microphones.



Multiplex Ready!  
\* Yes, less than \$450!

Sony tape recorders, the most complete line of quality recording equipment in the world, start at less than \$79.50. For literature or name of nearest dealer, write Superscope, Inc., Dept. 7 Sun Valley, Calif. In New York, visit the Sony Salon, 585 Fifth Avenue.

# JAZZ AND ALL THAT

BERT STANLEIGH

## Mint Mulligan

Gerry Mulligan, one of the most popular and widely recorded of modern jazzmen, is well known for his approach to small band writing and arranging. Unquestionably he has greatly influenced all modern groups since the late forties. Equally, his mastery of the baritone sax rank him at the very top of his profession.

Recently we had the rare pleasure of attending the final recording session for his latest LP, a sextet featuring Mulligan on baritone and piano, Bob Brookmeyer, valve trombone, Art Farmer, flugelhorn, Jim Hall, electric guitar, Bill Crow, bass, and Dave Bailey, drums. The session was at the Nola Penthouse Studio in New York; Hal Mooney was recording director, and Tom Nola was the engineer.

The stereo master tapes were recorded in a conventional manner conforming to current studio technique; the musicians were deployed in a circular arrangement with the guitar in the center and the other instruments placed about a circle with a 6-foot radius. A U47 microphone was placed about a foot from each of the three wind instruments, and a fourth was suspended just above the drummer's head, over the cymbals and snare drum; BK-44s were used for the bass and the output of the guitar's sound system; one 666 picked up the bass drum, and a second in the center of the circle at a height of about nine feet, was used to catch overall sound, fed through an EMT reverberation unit, and then split equally between the two channels of the master tape.

Trombone, flugelhorn, and drums were fed from the mixing console into the left channel of the two Ampex 300s, while the right channel received the baritone, bass, and guitar. The resulting sound was close up with a solid center. Once levels had been set, Tom Nola made no attempt to keep his VU meters at the zero mark. He did ride the gain a bit on solos, but just to make sure they didn't run into the red. As a result, these recordings have a broader soft to loud dynamic range than is generally encountered on jazz discs, and this wide range is of particular benefit because of the exceptionally sensitive performances achieved on this release.

None of the tension, so often present at record sessions, was evident. A happy, easy going atmosphere prevailed in both the control room and the studio, and the musicians were clearly so pleased with the results they were getting that the session ran an extra two hours, continually building with no letdown at the end. The resulting recording is not only one of the best of Mulligan's many, but one of the best examples of modern jazz on discs. Rarely has a studio recording conveyed so much excitement and successful collaboration.

The recording has just been released by Philips and is entitled "Night Lights" PHS 600 108.

## Gerry Mulligan Quartet: Spring Is Sprung Philips Mono PHM 200-077

Mulligan's first contribution to the Philips label is a quartet waxing that pairs Mulligan and Bob Brookmeyer in highly polished baritone, valve trombone duets and also features

each of these men as pianist, a rarity and pleasant surprise. Both musicians acquit themselves well on their new instrument, with Gerry winning top honors for a fine, strutting chorus in *Spring Is Sprung*.

## Paul Desmond: Take Ten RCA Victor Stereo LSP-2569

Full programs of jazz solos by leading sidemen are an innovation recently popular on discs but rarely encountered in live performances. Such recordings have a great deal to recommend them, particularly if the tunes selected offer sufficient contrast to present a cross section of the soloists' ideas, and most importantly, if the soloists have the necessary inventiveness to sustain an entire program without resorting to repetition of the same devices.

Paul Desmond makes it abundantly clear on his new Dynagroove release that he has more than enough thoughts to fill an LP. With the assistance of Jim Hall, guitar, Gene Cherico, bass, and Connie Kay, drums, Desmond plies his tenor sax in eloquent, delicate, and soul searching variations on such themes as *Black Orpheus*, *Samba de Orfeu*, *Alone Together*, and his own *Take Ten*. Throughout the record he maintains a simple, straightforward manner of speaking from the heart that helps to build the selections into a unified suite that demands full listening attention from beginning to end. The end, incidentally, provides this set's sole disappointment. *The One I Love*, which closes side B, is faded out instead of ending as a complete statement. Surely this was unnecessary on a 20-minute side. Sound on this splendid record is superbly matched to the performance. The four instruments are well spread out, solos are not too far forward, and the wide dynamic range is particularly appealing in its soft passages. One more feature, too pleasant to omit mentioning, is the witty set of liner notes that Desmond contributes to this project. Articulate writing is a rarity among jazzmen.

## Martial Solal: at Newport '63 RCA Victor Stereo LSP-2777

A pleasant solo recital by a French pianist, this album is the first American recording of a musician whose work has received high acclaim from Duke Ellington and Dizzy Gillespie. Like a number of his compatriots, Solal favors his right hand over his left, and his playing is rich in decorative embellishment but somewhat lacking in strong rhythmic bass. His inventions are misty and impressionistic, and the rather distant sound pickup helps to make this an enjoyable disc for background listening. The only hitch is that since it was recorded at the 1963 Newport Festival, applause follows each number. Monsieur Solal's voice is heard announcing each selection, and an MC chimes in with a closing announcement at the end of side B. Since Solal's appearance at the Festival was not long enough for a full LP, additional numbers were recorded at rehearsal, and audience cheers were dubbed in after each of the added selections.

## Kai Winding: Solo Kai Winding Verve V-8525

Another set of solos is offered by Kai Winding. One of the most frequently recorded of modern jazz trombonists, Winding has previously been waxed playing with other horns. Now he can be heard with just a piano and rhythm background as he improvises freely on familiar tunes like *Hey There*, *I Believe in You*, *How Are Things in Glocca Morra*, and a couple of unfamiliar numbers whose titles give a clue to Kai's present em-

ployment as musical director of New York's Playboy Club: *Playboy's Theme* and *I'm Your Bunny*. Always an expressive musician, he makes full use of the opportunity this album provides for extended expression. Some of his former impetuosity is missing, replaced by a more relaxed, free swinging manner and an uncomplicated directness that makes this set an appealing portrait of this modern master.

## Cal Tjader: Several Shades of Jade Verve Stereo V-8507

This album is a distinct departure from jazz vibraphonist Cal Tjader's other representations on discs, and on first hearing I was keenly disappointed by arrangements whose Orientalisms are reminiscent of Kotelby's *In a Chinese Temple Garden*—only at first, however. We had been playing the disc in mono, since there was no stereo marking on either the jacket or label; happily, it was given a second try in stereo. What a difference! The tight, constricted quality disappeared and was replaced by a delicate, spread-out pattern of shimmering sound. And the music itself sounded quite different with the voices emerging from individual locations instead of overlapping each other. In addition to Tjader, personnel includes Lalo Schifrin, conductor and piano, Phil Kraus, reeds and woodwinds, George Berg, bassoon and bass clarinet, Don Butterfield, tuba, Jack Del Rio, tamborine and conga, George Duvivier, bass, Urbie Green, trombone, Irving Horowitz and Leon Cohen, oboe, Walter Levinsky, flute, Robert Northern, French horn, Johnny Rae, timbales and percussion, Jimmy Raney, guitar, Ernie Royal and Clark Terry, trumpet, Stan Webb, woodwind, Arnold Eidus, Leo Kruczek and Emanuel Vardi, violin, Charles McCracken, cello, and Robert Maxwell, harp. Not all of these men appear on each selection, but the wide variety of instrumental timbre is an important contribution to this collection of Asiatic-sounding jazz whose varying moods and rhythms are linked together by the deft and sensitive playing of Tjader.

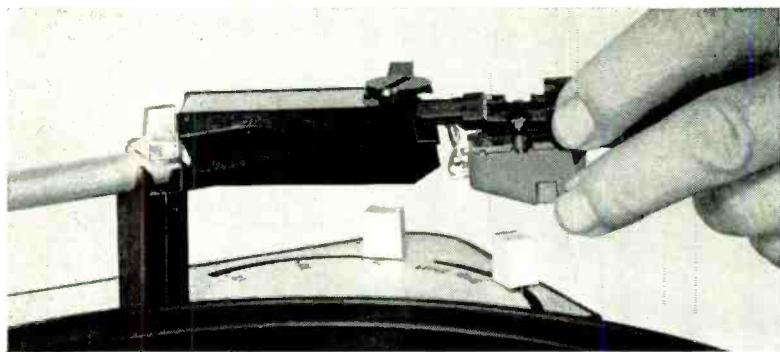
## Kimio Eto: Koto Master World Pacific 1428

From oriental-flavored jazz to Japanese koto music is less of a leap than you might suspect, particularly if you start with *Kensetsu No Hibiki* (The Sound of Construction and Progress), a composition by Mr. Eto, on this fascinating new record. Although the piece is essentially Eastern in color, Mr. Eto has clearly been influenced by European musicians, and the result is a work that blends Oriental and Occidental so successfully that it provides an excellent bridge to the somewhat more obscure compositions that follow. While their style may be unfamiliar to most listeners, it is by no means forbidding, and the rich, plucked sound of the koto is fascinating in Kimio Eto's virtuoso performances. Of the five pieces represented on this release, four are duets. Presumably they are sound-on-sound recordings by Eto, since no mention is made on either the label or liner of another musician. Recording is excellent with lots of presence but none of those irksome, rasping sounds that usually occur when plucked strings are too closely miked.

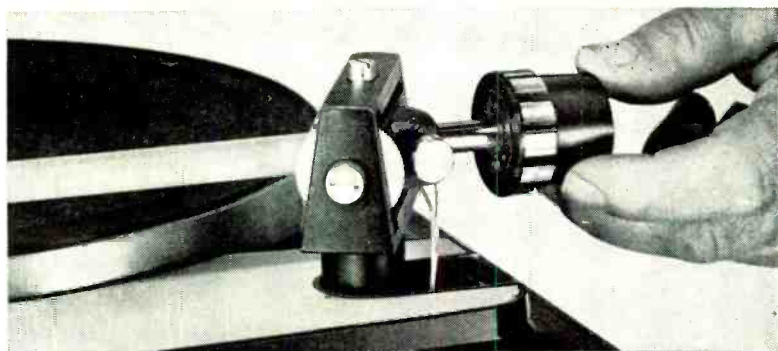
## Eric Weissberg, Marshall Brickman: Banjo & Bluegrass Elektra EKL-238

The plucked strings of the native American banjo offer a fascinating contrast to those of the koto. These two quite different recordings have much more in common than plucked notes, however. Each is a remarkable virtuoso experience, and the wise selection on this record of banjo solos, duets, and numbers with fiddle, guitar, or mandolin accompaniment, makes its program a bright, merry listening delight. Unabashedly *country* music, these performances are so direct and appealing that they manage to avoid all of the arch, cornball mannerisms that make so much music of this variety insufferable. Weissberg and Brickman have turned out a disc that serves both as a practical demonstration of traditional Scruggs style banjo playing and as an example of how pleasing and genuine Bluegrass music can sound.

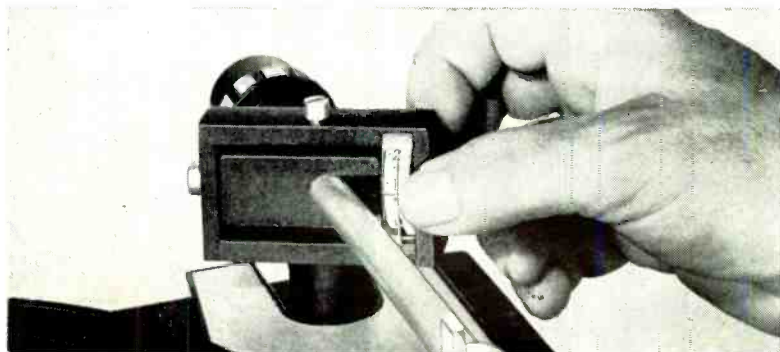




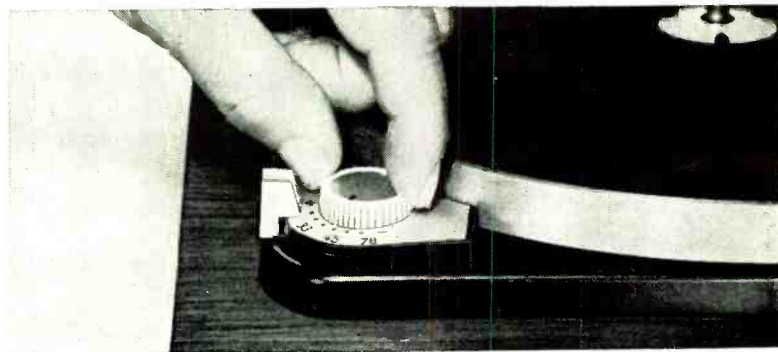
welcomes highest compliance cartridges for flawless tracking even at 1/2 gram or under



precise tonearm balance with rubber cushioned fine-thread rotating counterweight



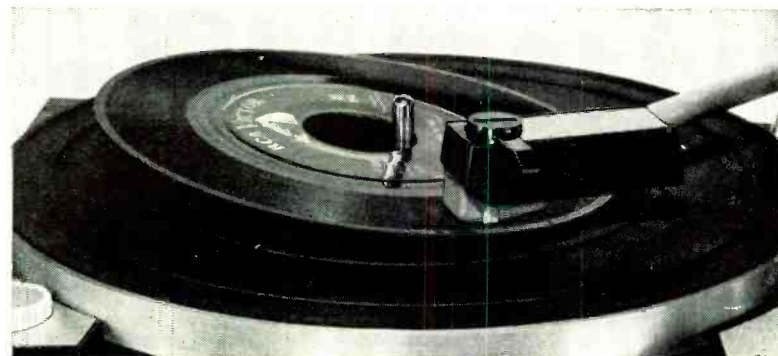
stylus force applied directly at pivot preserves perfect mass balance of tonearm



perfect pitch for the most critical ears with 6% variable range for all four speeds



superb over-all engineering permits tilt to almost 90° without spilling a note



"warped" and eccentric tracking dramatizes frictionless bearings, low tonearm mass

## No wonder the new **Dual 1009 Auto/Professional** obsoletes every turntable and changer ever made...at any price!

Standards of performance once associated with professional turntables and separate tonearms have now been matched or surpassed by a remarkable new record playing instrument . . . the Dual 1009 Auto/Professional by United Audio. Consider this achievement: A dynamically balanced automatic tonearm that tracks and trips below 1/2 gram . . . resonance below 8 cps, tracking error below .5°/inch. A solid non-ferrous platter machined to electronically controlled tolerances, then dynamically balanced . . . final weight 7 1/2 lbs. A powerful high-torque motor that maintains speed accuracy with one record or ten . . . and acts like a hysteresis in resisting voltage variations (even beyond ± 10%.) For a convincing demonstration of flawless automatic tonearm tracking with the finest high compliance cartridges, visit your United Audio dealer today. At \$94.75, you'll find the strikingly handsome Auto/Professional a value that welcomes comparison with equipment at \$100 more!

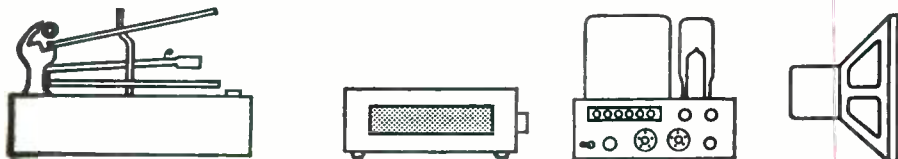


UNITED AUDIO  DUAL  
12 West 18th St. N.Y. 11

famous  
elevator-action  
changer spindle



# EQUIPMENT



# PROFILE

## HEATHKIT MODEL IM-30 TRANSISTOR TESTER

While the use of tube testers has been commonplace for many years, there has been so far a dearth of transistor test instruments that were capable of providing the same sort of information that a comprehensive tube analyzer does. True, there have been simple units which gave the most elementary information, and even many tube testers are equipped with transistor sockets and terminals so that it is possible to make some sort of comparative test on the solid-state devices.

The Heathkit IM-30 transistor tester actually gives much more information than a quality check on transistor gain and a means of measuring element currents, and should probably have been called an analyzer. Actually it does nothing that an experimenter cannot set up using a few connecting wires, batteries, and a meter, but it does simplify the measurement of transistor characteristics so that it is only necessary to operate a few switches to set up practically any d.c. measurement desired. And while the measurements are all in terms of d.c. values, the a.c. characteristics can be determined quite readily by making a few measurements and putting the values into simple equations.

In the words of the manual accompanying the unit, the instrument "tests transistors and diodes under conditions that correspond to actual d.c. operating conditions," and "a.c. operating conditions can be read-

ily found by testing the transistor at two different bias points and calculating the desired a.c. operating condition."

### Description

The IM-30 tester is a neat and attractive unit measuring 10¾ in. wide, 10¼ in. deep, and 5½ in. high, and weighing 8 lbs complete with its seven "D" cells which power all of the measurements. Along the top are nine binding posts—three for connections to the transistor or diode under test, and two each for external bias supply, external collector-voltage supply, and external leakage-voltage supply, with maximum values of 5, 50, and 150 volts respectively. A 15- $\mu$ a zero-center meter indicates all of the measured currents and voltages, as well as the null point for gain measurements. The top three knobs, from left to right, control polarity, collector voltage, and leak voltage. The polarity switch has three positions—NPN or DIODE FWD, OFF, and PNP or DIODE REV. The collector-voltage switch selects internal batteries in 1.5-volt increments up to 9 volts or switches in the externally supplied voltage up to 50 volts, and at the same time selects the proper meter multiplier for measuring the actual voltage. The leak-voltage switch performs the same function for leak voltage. The second row of knobs are the bias control, collector-current switch, and leak-current switch. The bias control adjusts collector current to any desired value from 0 to 15 amps. The two current switches select meter ranges from

15  $\mu$ a to 1.5 amps in decade steps for leak current, and from 150  $\mu$ a to 15 amps for collector current.

Along the lower left of the panel are four spring-return lever switches which set up the measuring circuits for the various tests and apply the element voltages—in no case are any voltages applied to the transistor or diode unless one of these four switches is operated. The first switch on the left is pushed upward to measure base current and pulled downward to measure gain—about which more will be said. The second switch measures collector voltage or collector current; the third measures leak voltage and short-test current—a precaution taken before making any other measurements. The fourth switch is used for diode testing or for measurement of collector to emitter leakage ( $I_{ceo}$ ) and for collector to base leakage ( $I_{cbo}$ ). Just above the lever switches is a socket for small transistors.

The large knob at the lower right is the gain indicator, calibrated in two ranges—0 to 150, and 150 to 300, the desired range being selected by a slide switch at the right. To make a gain measurement, the element voltages are set up and the GAIN lever pulled; the gain knob is then adjusted to obtain a null indication on the meter, and the Beta (or Alpha) read directly off the scale. The alpha ranges are from 0 to 0.993, and from 0.993 to 0.9966, thus covering practically any possible condition.

For ease in connecting transistors to the binding posts along the top, two alligator clips with banana plug ends are provided for the collector and emitter posts, and a third clip is provided on a short connecting wire for the base.

The batteries used to power the instrument are carried in a compartment at the rear and accessible by simply removing a cover plate.

### Construction

Those who enjoy building kits—as we do—will find this one simple, and not even much of a challenge. It builds quite easily, and aside from the final connections to the battery-case section is neat and business-like in appearance. In view of the heavy currents which must be accommodated for power transistor tests, the major part of the wiring is with fairly heavy wire, which naturally stays in place well. We added some lacing to the panel wiring just because we enjoy making a "professional" appearing unit, but it is not at all necessary. The over-all time required should be less than six hours, and both construction and checkout instructions are exceptionally clear and accurate throughout. The information on the use of the instrument is equally clear and concise, and amounts to a treatise on transistor testing. The IM-30 transistor tester is an instrument which should be in the test equipment array of every serious experimenter—particularly since the list of transistors is growing so rapidly that it is difficult to keep an up-to-date file of transistor characteristics. With this unit it is possible to obtain the characteristics of any transistor in just a few minutes, without the need for knowing anything further than the maximum collector voltage and current which should be applied, and these parameters usually appear in any catalog listing, even though the others do not. For diode testing alone it is well worth its cost. M-1



Fig. 5. Heathkit Model IM-30 Transistor Tester.

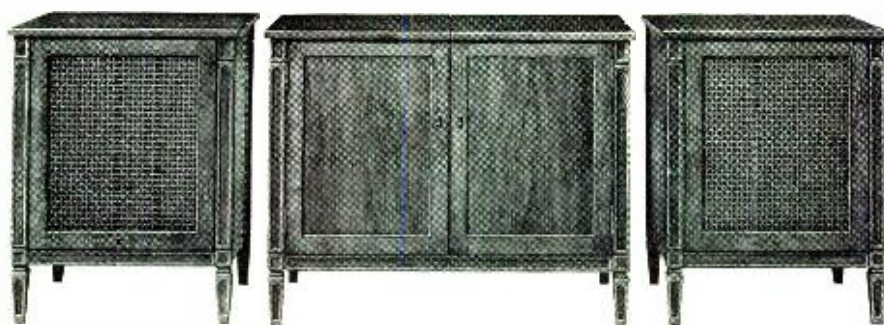
## KORTING "MOZART" MODEL 3000

The Korting "Mozart" 3000 is a 2-speed, quarter-track stereo tape recorder that is neat in appearance, gives the impression



FROM **BOZAK** . . . FOR THE DISCRIMINATING

superior cabinetwork/sound beyond words



Supplementing the established French Provincials and Urbans, here are Bozak's new Italian Provincial and Early American Ensembles of Equipment and Speaker Cabinets. For details, write for catalog or see and hear them at your Franchised Bozak Dealer.



DARIEN / CONNECTICUT

of a sturdily-built, serviceable machine, and performs well on the whole. It is fully self-contained, having two single-ended power amplifiers, built-in speakers facing left and right, and two dynamic microphones. A readily accessible compartment provides roomy space for microphones, power cord, cables, and so on. It has the most easily removable yet secure lid the reviewer has seen, and though the machine is somewhat on the bulky side because of all it contains, nevertheless it still weighs in at less than 30 pounds and therefore is readily portable. Priced at approximately \$300, it offers commensurate value to the person who is interested in good quality.

### Functions and Features

Operating speeds are 7.5 and 3.75 ips. The speed selector is coupled with the power switch so that speed can be changed only when power is off, thereby protecting the mechanism. A single record-playback head is used, which is still the rule for machines in this price category. A three-digit counter is provided. The record-level indicator is a single magic-eye tube connected to both channels. The eye is strongly damped in order to maintain the reading at signal peaks and facilitate proper setting of record level. Use of one rather than two record-level indicators in a stereo machine is something one might quarrel with.

Although the 3000 is self-contained, abundant provision exists for connecting its output to external playback equipment. Through jacks located on the top or rear panel one can derive the output signal at the tape head, after voltage amplifier, or at the output transformer of the power amplifier. Output after the voltage amplifier is across 33k impedance, so that a cable of about 5 to 6-feet long can be used between the 3000 and an external amplifier.

An input jack marked Tuner-Phono accommodates high-level signal sources. An input jack marked Radio has extremely high sensitivity and apparently is designed to accommodate European tuners that have very low signal output. The input impedance of the jack is rather low, but apparently could work satisfactorily with a high-impedance dynamic microphone. The microphone jacks are intended for low-impedance mikes and feed into 200-ohm step-up transformers, which is a very unusual arrangement for non-professional tape recorders.

All the input and output jacks are of the European (Hirschmann) type, which presents something of a problem in making connections to American home equipment that ordinarily uses phone and phone jacks and plugs. The European jacks, however, are of rugged construction and have the advantage that one jack can accommodate two (stereo) channels. The 3000 comes with one double cable having a European plug at one end and two phono plugs at the other. To permit simultaneous input and output connections to external equipment, the manufacturer should have provided two double cables.

The mechanical and electrical functions are principally and intelligently controlled by nine pushbuttons neatly arranged in horizontal rows of three or two. Tape motion is controlled by a group of three marked Rewind, Start, and Forward, which should be self-explanatory. Underneath is a Stop button, and alongside the latter a Record button. When the tape is moving at operating speed (Start button down) it can be stopped either by the Stop button or by slightly depressing either the Rewind

or Forward button. When the tape is moving at high speed (Rewind or Forward button down) it can be stopped either by the Stop button or by slightly depressing the Start button. Hence the Stop button seems almost superfluous. However, it has a second and vital function: It must be held down in order to depress the Record button and thereby put the machine into the record mode. When the Record button is up, the machine returns to the playback mode. As an extra safeguard against accidentally going into the record mode and thereby erasing a tape, substantially more pressure is needed on the Record button than on any of the others. Furthermore, if the machine is stopped by the Stop, Rewind, or Forward button, it is automatically disengaged from the record mode. However, if the operator wants to halt the tape but remain in the record mode, he can push a Pause lever.

When recording, two track selector push-buttons, marked L and R, determine which incoming signal goes on which tape track. If only button L is depressed (for mono recording), both the left and right inputs are fed to the upper section of the tape head (which records track 1 or 4). If only button R is depressed, inputs L and R both go to the lower section of the head (track 3 or 2). If both buttons are depressed (for stereo recording), input L goes to the upper section of the head, and input R to the lower section.

The converse takes place in playback. If only button L or only button R is depressed, the signal from either the upper section of the tape head or from the lower section goes to both the L and R outputs. If both track selector buttons are down, the signals of the upper and lower sections respectively go to the L and R outputs.

A single gain control governs all inputs and outputs and both channels in the record and playback modes. Concentrically mounted is a balance control for varying the relative levels of the left and right internal speakers in playback. The balance control affects the signal only at the power amplifier stage.

To monitor the incoming signal when recording or to permit the machine to be

used as a public address system, incoming L and R signals are both fed into the right speaker. The balance control can be used to vary the level of the right speaker without affecting recording level.

The 3000 does not permit recording on one channel while playing the other, so that true sound-on-sound recording, which involves exact synchronization between successive signals, is not feasible. However, it is possible to superimpose any number of recordings on one track, albeit without synchronization, by means of a Trick lever, which simply pushes the erase head away from the tape.

A substantial amount of treble cut can be introduced at the power amplifier stage by means of a two-position switch.

### Electrical Performance

Frequency response is rated at "30 to 18,000 cycles at 7.5 ips" and "40 to 14,000 cycles at 3.75 ips," but nothing is said in the specifications about flatness of response. The reviewer's measurements, although confined to the range of 50 to 15,000 cps, leave no doubt of substantially extended response at both speeds; they also show more than the  $\pm 3$ -db deviation from flat response which is usually considered the maximum consistent with quality reproduction.

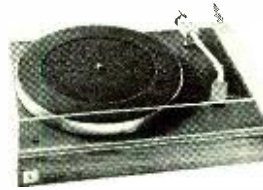
Following are the measurements of playback response at 7.5 ips, using Ampex test tape 31321-01 and based on response at 1000 cps as 0 db:

Frequency (cps)	Left Channel	Right Channel
50	-2.5 db	-0.5 db
100	-0.5	2.0
250	-1.0	0
500	-0.5	-0.5
700	-0.5	-0.5
1000	0	0
2500	1.5	1.5
5000	2.5	3.5
7500	3.0	3.5
10,000	3.0	4.0
12,000	4.0	5.0
15,000	6.5	8.0



Fig. 2. Korting "Mozart," Model 3000.





The AR turntable

# good for the money?

## SPEED ACCURACY

high fidelity

"... showed the lowest speed error that has been encountered in *{fixed speed}* turntables"

## WOW AND FLUTTER

**HiFi/Stereo** review (Julian D. Hirsch)

"The wow and flutter were the lowest I have ever measured on a turntable."

## RUMBLE

AUDIO

"The AR turntable introduces as little 'signal' of its own as any turntable we have had occasion to test."

## ACOUSTIC FEEDBACK

**MODERN HI-FI** (John Milder)

"... the best answer so far to the interrelated problems of rumble and acoustic feedback in stereo-record playing"

## SAFETY



The AR turntable is listed under Reexamination Service of Underwriters' Laboratories, Inc. We do not know of any other current non-automatic separate turntable or record player so listed.

The AR turntable is guaranteed for one year; the guarantee covers both repairs and reimbursement of any freight costs.

Literature, including a list of dealers in your area, is available on request. The AR turntable and AR speakers are on continuous demonstration at AR Music Rooms, on the west balcony of Grand Central Terminal, N.Y.C., and at 52 Brattle Street, Cambridge, Massachusetts. No sales are made or initiated at these showrooms.

**\$68<sup>00</sup>** complete with arm, oiled walnut base, and dust cover, but less cartridge, 33 $\frac{1}{3}$  and 45 rpm

(33 $\frac{1}{3}$  only, \$66)

The price of the one-speed turntable has been increased from the original \$58. This price increase, made necessary by manufacturing costs, is the first in AR's nine-year history.

5% higher in the West and Deep South

**ACOUSTIC RESEARCH, INC., 24 Thorndike Street, Cambridge 41, Massachusetts**

On a record playback basis, substantially less high-frequency peaking was measured at 7.5 ips. In fact, the 50-15,000 cycle record-playback response at 7.5 ips may be described as close to excellent. Following are the measurements, made 20-db below peak recording level (corresponding to magic-eye closure at 400 cps) and using Audio 1861 tape (1-mil Mylar):

Frequency (cps)	Left Channel	Right Channel
50	-0.5 db	0 db
100	2.5	1.5
250	-0.5	0.5
500	0	-0.5
700	0	0
1000	0	0
2500	0.5	0
5000	1.0	0.5
7500	1.0	1.0
10,000	2.0	1.5
12,000	2.5	2.5
15,000	4.0	4.0

At 3.75 ips, record-playback response extended substantially to 15,000 cps, but at the cost of appreciable peaking in the range of about 8,000 to 12,000 cps, where it is quite noticeable. Following are the measurements of record-playback response at 3.75 ips using Audio 1861 tape:

Frequency (cps)	Left Channel	Right Channel
50	3.0 db	3.5 db
100	1.5	2.0
250	0.5	0.5
500	0	0
700	0	0
1000	0	0
2500	0.5	0
5000	2.5	1.5
7500	4.5	2.5
10,000	6.5	4.0
12,000	7.0	4.0
15,000	-2.0	-4.0

Signal-to-noise ratio in home tape recorders is customarily measured (by such as Ampex, Tandberg, and others) on the basis of a 400-cps tone recorded at a level that produces 3 per cent harmonic distortion on the tape. When a magic-eye is the record-level indicator, the eye should close at the 3 per cent harmonic distortion point for a 400-cps signal. In the case of the Korting 3000, eye closure corresponded to distortion between 3.2 and 3.4 per cent, depending upon which speed and which recording channel was used. The deviation from 3 per cent distortion is probably negligible. Signal-to-noise ratio, measured at 400 cps on the basis of eye closure, varied from 46 to 48 db, depending on tape speed and channel. This checks well with the manufacturer's specification of 40 db based upon 1 per cent harmonic distortion, which represents a recording level about 6 to 8-db below that which produces 3 per cent distortion. A signal-to-noise ratio of 46-48 db is between fair and good.

Crosstalk, evaluated by recording a 400-cps signal at peak level (eye closure) on one channel and listening for it in playback on the other channel, was virtually inaudible. Crosstalk couldn't be measured because it was well below the noise level.

Input sensitivity measured about 65 mv on the Tuner-Phono input. It is slightly over 1 mv on the Radio input. Microphone input sensitivity (for a low-impedance dynamic mike) is rated at 0.1 mv. Peak output is roughly 1 volt. Using a full-track test tape, output on the left channel measured about 1.5 db more than on the right

channel. The machine's balance control does not correct this unless the output is taken after the power amplifier stage.

### Mechanical Performance

The Korting 3000 handles tape as nicely as any home machine this reviewer has yet seen. It starts without appreciable slurring or bounce, and it stops promptly without spilling or jerking tape. One can alternate immediately among the three transport modes—rewind, forward, and normal—without spilling or jerking tape. The reviewer couldn't spill or break tape no matter what he tried. The machine even withstood the most difficult test of all: yanking the power cord with the tape in motion; whether in the rewind, forward, or normal mode, the reels smoothly coasted to a stop with the tape intact. The main thing one might wish for with respect to tape handling would be the inclusion of an automatic stop in case the tape breaks or runs out.

When the tape is in the rewind or forward mode it is spaced slightly away from the record-playback head, thereby minimizing head wear. However, it does remain in contact with the erase head, where the consequences of head wear are less important. If desired, one can space the tape away from the tape during rewind or forward wind by pushing the Trick lever, but then he must remember to restore the erase head to operating position before recording again.

Wow and flutter were judged by listening to a 3000-cps tone recorded and played back on the 3000. It sounded good. Strangely, it sounded slightly better on 3.75 ips than at 7.5 ips, although the reverse is ordinarily true.

The principal mechanical fault one can find concerns speed accuracy. At 7.5 ips the 3000 measured 3 per cent fast. While this is of no consequence when recording and playing on the same machine, a speed error of this magnitude will probably jar a musical ear when playing recorded tape.

### Circuitry

The chief item of interest here is that the Korting 3000 is a hybrid, using both transistors and tubes. In each channel one set of electronics is used for both recording and playback, with switching to meet the different equalization requirements of the two modes. When speed is changed, equalization is automatically changed.

In each channel the first four amplification stages are transistorized, with feedback equalization between stages 4 and 1. The fifth stage is a tube that drives the tape head when recording and is a single-ended power output tube when playing back. When recording, the left channel's power output tube is converted into a high-frequency oscillator that supplies bias current to the record head and erase current to the erase head. The right channel's power output tube continues to drive the right speaker in the record mode for monitoring of P.A. purposes.

Filament current for the tubes is a.c., with each side of the power transformer's filament winding grounded through a 47-ohm resistor to reduce hum. A single d.c. power supply employing four diodes meets the varying d.c. requirements of both the transistors and tubes.

Internal adjustments are provided for equalization and bias current. To protect the output transformers, load resistors are switched in when the internal speakers are switched out.

## What's new from Ampex?

### Collector's Library



Here's good news for people who care how their sounds sound—and how their tape collection looks. It's Collector's Library—a new tape from Ampex. It's ideal for all general recording needs and for building an attractive tape library. Here's why: 1) An exclusive Ferro-Sheen\* oxide surface gives maximum frequency response, clean operation and low head wear. 2) The new book-like design on the box gives your tapes a matched set appearance. Just five or six boxes look like a collector's library. In addition to this each box comes with famous "Signature Binding"—the simulated leather binding and gold foil strip for custom labeling of your tapes. 3) Collector's Library is economically priced. You'll save money on every box of tape you buy. Available on Mylar\*\* and acetate bases in all popular sizes. Collector's Library is the latest addition to the fine line of Ampex precision tape. Ampex Corp., Redwood City, California.

\*TM Ampex Corp.

\*\*TM for Dupont Polyester Film







What new recorder is virtually custom-built?

AMPEX F-44

The F-44 is a brand new 4-track stereo recorder from Ampex. It's Ampex through and through. And there's this, too: at every stage of manufacture Ampex tunes, adjusts and aligns each F-44 to obtain its maximum performance — far beyond minimum specifications. Thus, no two F-44s are quite alike. Each is virtually a custom-built recorder. Each performs to the utmost of its capabilities. And each gives you the best possible sounds today — and for many years to come. As an F-44 owner, you'll receive from Ampex a record of the individual performance specifications of your own F-44. This record shows the frequency



response curve, the signal-to-noise ratio, the flutter and wow, and the crosstalk rejection measurement. And it is signed by the Ampex engineers who tuned and adjusted your recorder. The new Ampex Fine Line F-44 also features a new special design hysteresis motor for smooth, quiet, accurate operation; an easy-to-read point-to-point record level meter for each channel; multiple sound-on-sound capability; new simplified controls; and the Ampex one year warranty. See and hear the new F-44 at your local Ampex dealer. Brochure? Write: Ampex Corporation, Redwood City, California. Sales and service throughout the world.





Fig. 3. Fisher 500-C FM-Stereo Receiver.

### FISHER 75-WATT FM-STEREO RECEIVER, MODEL 500-C

The Fisher 500-C is the latest in a series of receivers that goes back many years—the first 500 was introduced in 1957 if our memory serves us correctly. Then the 500 included an AM tuner (in effect the current model 800) and was mono.

The current 500(-C) incorporates a 75-watt (IHF) stereo amplifier, and FM-stereo tuner, and an audio control center all on one 36.5-lb. chassis. The features offered by the 500-C are rather interesting since they are the measure of the 1963-4 audiofan; a surprisingly far cry from his 1957 predecessor. In a way, the 500-C is a catalog of conveniences since most of the "features" are in that category.

The most convenient feature is automatic switching between stereo and mono FM reception; all one does is tune in an FM station and the 500-C does the rest: If the broadcast is monophonic, the receiver sets itself for monophonic playback; if the broadcast is stereo, the receiver automatically switches to stereo playback, and turns on a light to tell you about it. No, the 500-C doesn't turn itself on and off, but once it's on. . . .

In addition to the usual complement of audio controls the 500-C provides a method of prime and auxiliary speaker control which permits two pairs of speakers to be operated simultaneously, or either pair separately. (We found this arrangement ideal for AB'ing speaker systems.) Combining this ability to operate four individual speaker systems with the center-channel output of the 500-C enables the user to operate, and control, five speaker systems at the same time; truly an exciting prospect for audiofans who like to surround themselves with sound. (And don't forget the reverberation facilities.) For those who prefer headphone listening, the jack is conveniently located on the front panel. The headphone circuitry is arranged so that it can be used for direct monitoring during tape recording.

#### Circuit Description

**FM:** The antenna input connections provide two options: local or normal. The local connection reduces signal level by means of a 270-ohm series resistor, the normal connection feeds directly to the tuned antenna coil. The signal then goes to an r.f. circuit Fisher calls "Golden Synchrode" (neutrode in engineerese). This circuit is unusual in the sense that it is not commonly used, although not new. The neutrode configuration is theoretically lower in noise than the usual cascode since it uses one triode instead of two. Of course, to take advantage

of theory it is necessary to use a tube with a very low noise figure and sufficiently high  $G_m$ . The tube used is a new type, the 6HA5, which seems to have the required attributes.

The oscillator and mixer stages are 6CW4 Nuvistors. The rigid mechanical structure of the Nuvistor should help to make the oscillator more stable, indeed we found that the tuner drifted less than 0.01 per cent. Next comes the four i.f. stages, the last two providing limiting. The ratio detector also limits. The signal, upon leaving the detector, goes through the multiplex circuitry (time division) if the signal is stereo and bypasses this section if it is mono. From there, on to the amplifier!

**Amplifier:** The amplifier has six pairs of inputs and two pairs of outputs, not counting the speaker connections. (Tuner inputs are internally connected.) One set of inputs and outputs are for a reverberation device; three sets of inputs are low level (tape head and two phono) and the remainder are high level (aux, monitor in). The remaining set of outputs are for recording.

The amplifier circuitry is standard, utilizing 12AX7's for the various preamps and tone drivers, as well as for the phase inverter. Each output stage uses a pair of 7591 pentodes with fixed bias. The output transformers are quite husky (we have a strained back to document that), and the 4-ohm taps are grounded, rather than the common, in order to derive the center channel.

#### Performance

By implication, and sometimes overtly, we have been led to believe that separate components are inherently better than integrated components. Well, 'taint necessarily so. In fact, it is our opinion that one would have to pay considerably more to get performance equal to the 500-C in separate components.

For example consider the performance of the amplifier section: Power output, 75 watts (IHF) or 60 watts rms (0.6 per cent harmonic distortion, both channels driven); harmonic distortion, 0.6 per cent (1000 cps, rated output); IM distortion, 0.7 per cent; phono sensitivity, 3.5 mv; tape head sensitivity, 2.3 mv; aux sensitivity, 210 mv; response 20-20,000 cps  $\pm 1$  db; channel separation 55 db at 1000 cps; hum and noise (high level input) 82-db below rated output.

Or consider the FM section: FM harmonic distortion, (400 cps), 0.5 per cent; signal-to-noise ratio, 70 db; capture ratio, 2.3 db; separation, 33 db at 1000 cps; sensitivity, 1.8  $\mu$ v (IHF). In addition it pulled in 36 stations, loud and clear, using our standard antenna.

Considering the performance, and the many features, and the quality of the parts, we doubt that you could do better in separate components at anywhere near the price of the 500-C. Don't misunderstand us now, we firmly believe that it is the component design approach that makes such an excellent value possible. On the other hand it should be clear from the performance statistics that the Fisher 500-C is an excellent instrument by *any* standards.

One thing more: the Fisher 500-C is an unusually fine sounding unit, a fact not necessarily revealed by statistics. We must admit we took an instant liking to it.

In sum, we suggest that the Fisher 500-C may well fill the needs of those audiofans who want their FM and audio system electronics in one neat package. Look into it.

### SHERWOOD FM-STEREO TUNER, MODEL S-3000V

Sherwood is well known as a manufacturer of high quality tuners and amplifiers. Indeed, over the years they have achieved an exceptional reputation amongst audiofans for producing fine products and at reasonable prices. The Sherwood S-3000V is no exception to this rule; it is an FM tuner which performs exceedingly well in receiving mono and stereo broadcasts. In addition it is put together in such manner that it may be expected to retain its performance level for a long time.

The S-3000V, in common with other new Sherwood models, features a zero-center tuning meter. This tuning meter operates to indicate the point at which the detector is nulled so that it is possible to tune very accurately. In fact, we found this tuning system to be one of the most accurate and convenient we have encountered for achieving minimum distortion.

The Sherwood S-3000V also provides a stereo indicator light which automatically glows when a stereo broadcast is being

(Continued on page 58)

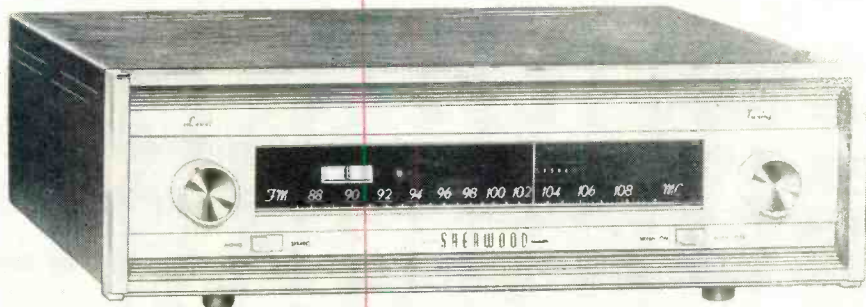


Fig. 4. Sherwood FM-Stereo Tuner, Model S-3000V.



The JBL Energizer/Transducer raises audio reproduction to a degree of perfection and precision never before available to the home listener. You hear music re-created in all its detail, rich and splendid, life size, without hum or distortion. The Energizer/Transducer sets new standards for fully controlled bass, completely realistic mid-range, immaculate highs, and transient reproduction without equal.

An Energizer/Transducer has its own source of power: the Energizer. The Energizer is exactly matched to the specific loudspeaker-and-enclosure system in which it is used. Energizer and transducer are engineered as a unit. Given a flat, pure signal from a preamplifier, the Energizer/Transducer delivers sound that is perfectly flat and pure — an exact replica

## NOW! ALL ARE AVAILABLE SELF- ENERGIZED

— with exactly the right amount of damping at all frequencies. No other home high fidelity equipment can give you these results.

The JBL Energizer is a stereophonic all-solid-state device of scientific-instrument quality. Devoid of microphonics, generating negligible heat, it can be mounted within an acoustical enclosure. All JBL loudspeaker systems are available as Energizer/Transducers. The JBL loudspeaker system you now own can be made into an Energizer/Transducer. When ordering your matched Energizer, you need only provide your Audio Specialist with the complete model number of your system. Write for your free copy of the new Energizer/Transducer six-page brochure.

**JBL SOLID STATE  
ENERGIZER**

Energized C38

Energized C53

Energized Olympus

Back view of Energized Olympus

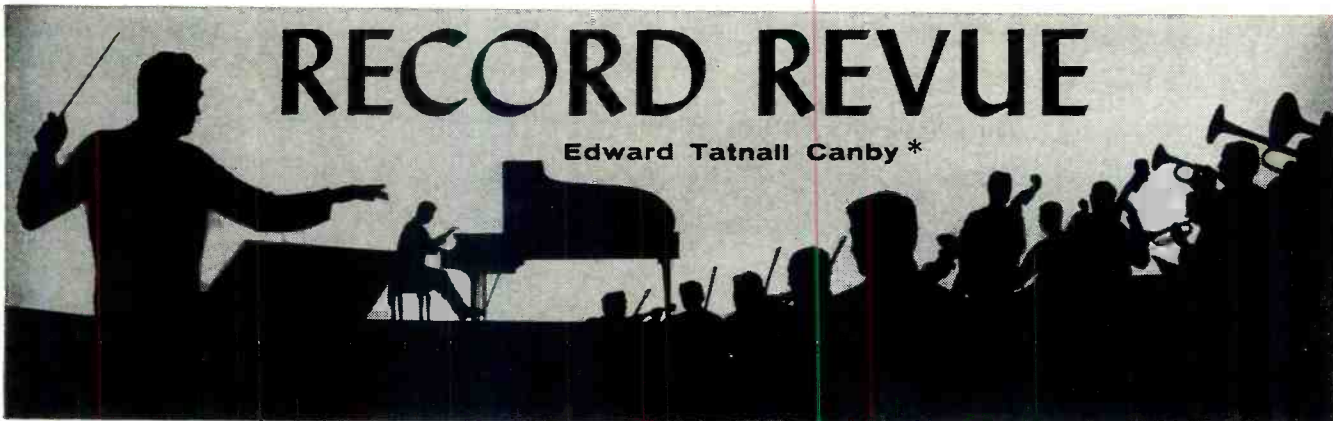
Energized Paragon

Energized Trimline 54

James B. Lansing Sound, Inc., L.A. 39. 

# RECORD REVUE

Edward Tatnall Canby \*



## For Xmas: Grreat!

**Bach's Greatest Hits. The Creative Swingle Singers, Ward Swingle. Philips PHS 600-097 stereo**

This is the recording of the century—or a lot of people think so. Johann Sebastian Bach's keyboard works, sung, note for note, by the most extraordinary ensemble of wild young people you'll ever hear. We are not shown their pictures but the album says they're French and they sound like *les Beatniks* for sure, probably with beards, berets and black stockings.

No matter! Such an immediately dramatic, intensely felt, enormously skillful sort of jazz (if it really is jazz) has seldom been heard and the composing credit is purely to Bach himself. Only the addition of a roving plucked double bass and a mild accompanying rhythm section augment the actual notes of numerous items from the Preludes and Fugues from the famed "Well Tempered Clavier," the organ works and various harpsichord pieces, not to mention one of the most complex and rapid fugues from Bach's last great work, the "Art of the Fugue!" Astonishing.

Everything is sung, even including the correct ornaments. The jazzy feel to the lines of eighth notes is, oddly, quite proper Baroque-period practice and more authentic than the solemn, literal playing of generations of classical pianists and organists. The "doppa-doppa" and "boopy-do" syllables the singers use to help themselves (and give a jazz effect) are entirely reasonable, adding instrumental *ictus* (transient attack). But best of all is the sheer musicianship—the superb musical phrasing, the perfect harmony chords, beating any barbershop ensemble, the impeccable stylistic sense of color and planes, good enough to out-Bach many a highly professional Bach keyboard artist.

You can call it jazz, but for me it is Bach—about as splendid as it comes.

(And a quick P.S.—this disc was at press deadline 98th on the 100 best selling LP records.)

## Solo Recital

**Gina Bachauer Queen of the Keyboard. Mercury SR 90349 stereo**

I should say she is! This lady is a one-woman orchestra all on her own. The piano transcription of scenes from "Petrovichka" which opens this record is absolutely startling in its dimension, as though the huge orchestra were playing in all its hundreds straight through her fingers. You can hear the trumpets, clarinets, strings—and of course, the piano. An astonishing illusion if you know the Petrovichka music in its original orchestral sound.

She is a big, hearty, utterly musical pianist (see cover) of fabulous powers, one of those great souls who seem to use the piano merely

as a means to bigger things—music itself. Paradoxically, thus, her technique is so extraordinary that you will quite forget the piano itself in favor of what it says; it is a "transparent" medium. A stunning illusion and only the greatest musicians can pull it off.

After the immense sounds of Petrovichka's orchestra comes big Chopin, the Polonaise in A Flat, joyous and free-swinging as an 18-year-old-prodigy performance, yet impeccably musical too. And on the obverse, a Liszt Rhapsody and Book Two of the youthful Brahms "Paganini Variations." What a woman!! What a record.

**Schumann: Cello Concerto. Lalo: Cello Concerto. Janos Starker; London Symphony, Skrowaczewski.**

**Mercury SR 90347 stereo**

—And here's another in this really splendid Mercury series of solo discs, each with a big black-and-white portrait of the artist on the cover under the 35 mm. banner-spread across the top. Too many solo recordings are just specialist-recitals, or sleazy would-be pops offerings, full of insipidity. Especially, I must emphasize, cello solo records! Not this one.

For here you have good music, good cello music, an intelligent, musical, communicative cellist and a superbly understanding orchestra. Just as important—there's Mercury, which puts the cello back from you, in its rightful place where it can sound human and blend into the rest of the musical fabric where it should, or sing out at a distance in the cello's finest manner.

If only the hardened big-outfit recordmen would learn to treat cello music this way—instead of smearing such as that great ham Piatigorsky all over the mikes, giant-size, breathing down your neck, against a faint and distant accompaniment somewhere off in the background! Only seasoned cello-worshippers love that stuff. There are millions of them, alas.

So—buy this one with confidence, and learn what this wonderfully expressive old instrument can do in good company, for you.

**Bach: The Goldberg Variations. George Malcolm, harpsichord.**

**L'Oiseau-Lyre SOL 261/2 stereo**

The great Bach show-piece is played here by Britain's phenomenally brilliant harpsichordist; yet in a curious way the recording isn't very impressive where by rights it ought to be devastating, as have been earlier Malcolm records over the years.

First, poor recording. The sound is not only somewhat strident and peaky but there is an intermittent form of flutter—actually, I think, an electrical distortion rather than actual mechanical flutter—which appears in the more wiry passages to rob the sound of its musical authenticity. And there is an unpleasant clattery sound to the upper notes in the louder registrations; one has the sense that all is not well whenever the intensity creeps above a certain level. The soft portions are lovely.

Second, it becomes more clear here than previously that Malcolm is what might be called an extrovert performer—snappy at the big showy sort of Bach and especially the complex and high-speed music, but less musically impressive in the more introspective

slower music of the aria type, less interested in the longer dramatic shapes than a Landowska—who built these Goldbergs into a towering, almost Wagnerian emotional experience.

It's high-level playing, definitely, and splendid listening, sound-quality aside. But the Goldbergs can be even better.

**Bach: Chromatic Fantasy and Fugue; Fantasia in C mi.; Six Little Preludes; Toccata in D; Prelude, Fugue and Allegro. Fernando Valenti, harpsichord.**

**Columbia MS 6516 stereo**

Evidently Columbia has been looking around for a house harpsichordist. Here's an aimable, accomodating one who has been taken over from Westminster, where he genially set out to record all five million or so Scarlatti harpsichord sonatas and managed to get dozens of LPs out before looking the other way and forgetting the whole business (Columbia's "ex," the famed Ralph Kirkpatrick, edited all of them but managed to produce only one splendid recorded set for the company. He's been working for DG since then.)

Valenti is one of those wholly gracious and pleasing musicians whose product one somehow feels the urge to praise, even when it doesn't merit superlatives. I hate to have to say it, therefore, but I find the Valenti performances as they have been in the past—skillful, highly professional, utterly competent, yet on the whole musically colorless and lacking in real inner drama. If he seems to borrow considerably from such as Wanda Landowska, it is merely that his own concept isn't strong enough to outweigh the great lady whom every harpsichordist emulates in spite of himself.

Nor is the recorded harpsichord sound pleasing. Is it the instrument itself? Or is it more likely Columbia's famed piano recording technique, hard as nails, newly applied to this much more wiry instrument?

I can tell Columbia that if you want a harpsichord to sound mellow, rather than tinny, you first place it in a fine space—dead or live—and then get those mikes back, away from the innards. At close range, the instrument is ugly as all getout. Its brilliant sound is at peak flavor when heard at a mellowing distance, so to speak in musical focus.

**Lieder von Schubert, Schumann, Brahms. Irmgard Seefried, soprano; Erik Werba, pf.**

**Deutsche Gramm. 136.372 stereo**

She is one of the great German sopranos, with a uniquely expressive little-boy voice and an impeccable ear; she has sung countless concerts and made many distinguished recordings. Something was wrong for this one. The music is as lovely as ever, her long-time accompanist as fine as ever; but she wavers, sounds tired, strains, makes near-flubs. Tragic to hear a great artist in such moments of struggle.

Some of the Seefried discs have been "live" concert performances. Might this be one of those, issued in spite of momentary troubles because of its content? Or is there really something wrong? Seefried is far from elderly, so we can hope it was the former and that her next will be as radiant as ever.



# Records that are appreciated...

## at Christmas



A.



B.



C.



D.



\* E.



F.



G.



H.



I.

Please write for FREE complete record catalog.

A. THE BRAVE BULLS, Banda Taurina—Stirring music of the Bullfight Ring. *El Relicario, Cielo Andaluz, La Virgen de la Macarena, others.* AFLP1801/AFSD5801

B. HOME MOVIE SOUND EFFECTS—Will lend startling realism to home movies and slides. Enliven viewing pleasure. Incl: *Baby, Bird & Animal sounds, Indoor & Outdoor sounds, Jet, Ocean Liner, Sports, Crowds, many more.* DFM3018/DFS7018

C. RAILROAD SOUNDS — A vanishing era revisited! Dynamic realism! Perfect model train background. AFLP1843/AFSD5843

D. PATACHOU at Carnegie Hall—Her ebullient French charm was never more appealing. *Ma Fetes A Moi, Que Reste-t-il, A Paris, etc.* AFLP2109/AFSD6109

E. CHRISTMAS MUSIC BOX FAVORITES\*—A truly unique and charming sound in keeping with the joyful Yuletide spirit. *Jingle Bells, Adeste Fidelis, Silent Night, First Noel, etc.* AFLP1982/AFSD5982

F. FAST, FAST, FAST RELIEF FROM TV COMMERCIALS — Hilarious parodies! The public fights back! 34 skits: *Punjab Cigarettes, Greasy Kid Stuff, Biblical Spectacular, etc.* AFLP2112/AFSD6112

G. ROME WITH LOVE, Jo Basile his Accordion & Orch.—Perennial favorite! Musical portrait of the Eternal City. *Luna Rosa, Non Di-*

*menticar, Tarentella, Arrivederci Roma, Torna a Sorrento, etc.* AFLP1822/AFSD5822

H. GREAT MOVIE THEMES, Johnny Puleo & his Harmonica Gang—Loveable, zany group of harmonica experts. Inimitable treatment of: *Moon River, Tonight, Never on Sunday, Exodus, Col. Bogey, etc.* AFLP1969/AFSD5969

I. STEREO SPECTACULAR DEMONSTRATION & SOUND EFFECTS—Fast moving tour of dramatic situational stereo effects. Cited for engineering excellence by Nat'l Academy of Recording Arts & Sciences. DFS 7013—stereo only

\$4.98—MONO or STEREO / AVAILABLE AT LOCAL RECORD SHOPS OR WRITE TO:



## AUDIO FIDELITY RECORDS

770 Eleventh Avenue, New York 19, N. Y.

\*Special Christmas Season Offer: \$2.98, mono or stereo.



**John Hammond accompanying himself on guitar and mouth-harp.**  
Vanguard VSD 2148 stereo

Count singers like this in the solo recital category. That's what this is, folk or no.

An astonishing amount of sheer emotion is going into what passes superficially as folk singing these days. Its significance is far deeper—for, whether good music or punk, this sort of thing is genuine expression via musical means. In the past, all "great" music has come from such an urge. That it should find the peculiar outlets we have in America today, from negro jazz, from gospel hymns, to city blues and college bluegrass, is a thing that sets us off from other parts of the world in very important ways.

Just listen to this 20 year old. He almost weeps with earnestness. He moans. He shouts. He shakes with the passion of his expression. It is for real, and no two ways about it. His music is a bit raw scull, his emoting too literal for the best emotional economy, as every older musician of importance learns in the end. Yet his personal style, still ranging over the folk world, is already pretty subtle and more sophisticated than he knows, I think. He speaks for the wide-open places and the poor and down-trodden—and where does he come from? Well, he went to college, anyhow, like so many of the most eloquent "folk" performers.

It isn't directly what he says (and sings) here that is important, nor his excellent guitar, nor the harmonica that he plays simultaneously, via that thing that holds it in the air in front of his face. It's the sheer emotion that goes into musical sound—raw or no. For there you have a glimpse of what music really is, whatever sort, wherever.

It's significant to me that if it weren't for the accompanying printed texts, you wouldn't be able to understand one word in fifty this boy sings. They are dead in earnest, those words. But it is the music which expresses them.

## Special

**Sir Winston Churchill, First Honorary Citizen of the United States.** Narr. David Perry.

Colpix PS 2000 (2) mono

Maybe this was to cash in on Churchill's recent honor while it was hot (and upon his likely death at any moment)—but the old man himself out-maneuvres any possible commercial taint and makes of this a splendid and astonishingly revealing documentary. It contains 4 entire LP sides of Churchill speech-making, with continuity provided by a quite straightforward commentary; there is much "symphonic" music, as bridge and as background, not important but—thank the Lord—not intrusive or pompous either. In fact it adds to the ease of listening and manages not to interfere a bit with Churchill's words. (It neatly masks the background noise.)

The recordings carry from his first days as Prime Minister through to the war's end, ranging about in time with some freedom; many quotations are spoken briefly by the commentator, to supplement the actual voice of Churchill. Famous words abound—the iron curtain, blood, sweat and tears, and the like—but much of the material will be unfamiliar and new to most listeners.

I think what strikes most significantly here, so long after, is the revelation of Churchill's utterly canny political sense—on an international scale—his extraordinary way with words that hit the weaknesses of his enemies, wheedled his would-be friends, rallied those who faltered (of course) but even more rattled those who were undecided. His wooing of the Italian people over Mussolini's head was downright shameless yet utterly inspired; his honeyed speeches towards France in the war's crucial days, seem now almost calculated, and yet they were not, in the highest sense. Just superb politics.

Most assuredly you'll get a full-sized portrait of this extraordinary old fellow here, a lot broader than any you may have imagined before.

**Parents Magazine Music Appreciation Library: A Young People's Introduction to Haydn. A Young People's Introduction to Schumann** (Also many others). Written by Joseph Machlis; Norman Rose, narrator.

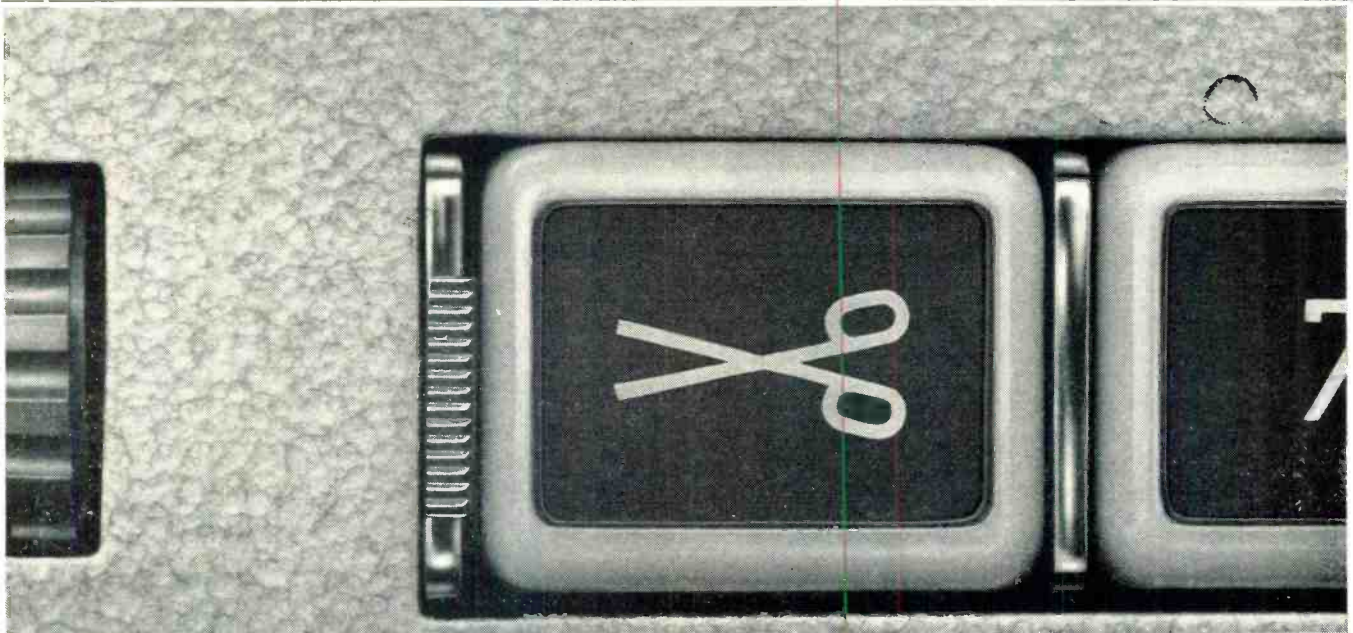
Wonderland 1489; 14 mono

This Appreciation of Music series for children, sponsored by the well known mass-medium journal, combines a safe and entirely conventional approach to the time-worn subject with some modest but useful virtues, notably a large quantity of well-performed music (some of it manhandled) and a reasonably informative if wholly innocuous text featuring the composers' life histories.

A lot more—a very great deal more—could be done for inculcating a love of music in children via the LP record. But within their own strict limitations these discs do profit from the availability of so much more music (and LP space) now than in the past.

Oddly, the treatment is far from uniform in detail though the discs feature the same reader and the same technique of musical examples frequently faded under the speaking voice. The Schumann disc is quite exemplary in its respect for the dignity of the music. The fades are done deftly and the fade-outs or cut-offs are made at reasonable points in the music, without committing undue mayhem. The Haydn disc, though, must have been put together by a less skillful hand (or the same hand on a bad day . . .). Time after time the music is faded just as it reaches climactic interest and the fades are cut, after the voice begins, in very clumsy fashion right in the middle of a phrase or a note or two beyond the obviously intended point. One outrageous example from Haydn's late masterpiece "The Creation" allows a soprano to gulp out only a few phrases of one of the most famous Haydn arias before she is rudely squelched, practically in the middle of a note. Is this an example to set for our children?

If we show such casual disrespect for the very monuments of culture that we are sup-



## Symbol of an attitude...

that considers only industry needs not market size. The EMT STUDER C37 MASTER TAPE RECORDER marks the most significant advance in the state of the tape recording art in more than a decade. And it has proven itself . . . hundreds of these precision

Swiss made machines are in use in critical applications throughout the world. The scissors symbol? It identifies the actuating button for the motor-driven tape cutter, a unique editing convenience, only one of the details characteristic of the C37. The complete story requires an eight page brochure . . . available upon your letterhead request.



**GOTHAM**  
AUDIO CORPORATION

2 WEST 46 STREET, NEW YORK, N.Y., 10036 • 212-CO-5-4111  
In Canada: J-Mar Electronics Ltd., P.O. Box 158, Don Mills, Ontario



posedly "teaching," how can we expect children to learn to understand music for itself? The background-music technique is indeed useful, but never when musical values are ignored, or when the text is irrelevant to the music being heard.

I suggest that every parent who has a mind to try these make a point of pre-auditioning them with an ear for musical treatment. If you don't know the difference, then ask some who does to help you.

The mostly excellent recordings are anonymous—probably good mono tapes from the huge number made obsolete by stereo and now available for licensing.

**Beethoven: Fifth Symphony. "How a Great Symphony Was Written"** (from Bernstein TV). N. Y. Philharmonic, Bernstein.

**Columbia MS 6468 stereo plus 7" bonus disc.**

I didn't get to play the main record here. I was too much interested in the bonus supplement.

This excerpt from Bernstein's TV program, where a group of abortive sketches for the "Fifth," out of Beethoven's sketch books, are put bodily into their presumed places in the work itself, orchestrated to match (the originals are in piano-like format), is designed to show what Beethoven might have done—and didn't.

The project was a brilliant one and particularly with the Philharmonic on hand to do the honors in full-orchestra sound! If it is a wee bit oversimplified, it does make a couple of good hammered-in points: that (a) composers often sweat and fume over their work en route (like engineers) and (b) there are innumerable possible ways towards elusive perfection; only the top guys pick the right one out of the rest even if it may take them years to do it. It did Beethoven. And he considerably wrote out and left behind all the duds, for us to see. Most of us cover up our en-route sketches to save our pride.

Bernstein's "Fifth," you can be sure, is a big, sincere, slightly erratic version, warm, on the clumsy side but penetrating right to the Romantic core of the Beethoven expression. I can say that without hearing it!

**Ravel—The Complete Orchestral Works.** Paris Cons. Orch., Cluytens.

**Angel S3636D (4) stereo**

For people with passionate musical ears there is something elemental in Ravel that carries his impact beyond that of the relatively intellectual Debussy. It takes a fairly sophisticated ear, to be sure, for Ravel's harmonies are enormously complex, his orchestrations extraordinarily subtle. Even so, Ravel had "it" in musical terms.

This is a splendid, a gorgeous stereo album for the Ravel-gorger. It had me thoroughly titillated to the depths of my being, even though not every piece seemed to me exactly to my liking. The disquietingly urbane "Mother Goose" music, for instance, didn't seem right at all—to me, though perhaps not to you. Again, Ravel is a deeply personal composer and interpretations vary in highly personal ways.

It is a great thing, any way you look at it, to be able to hear such a wide span of one composer, all under one musical roof, straight out of the home territory of France itself. Some of it is bound to send you through the ceiling. Especially if you go straight through the album.

**Debussy: La Mer. Ravel: Rapsodie Espagnole.** Boston Symphony, Munch.

**RCA Victrola VICS 1041 stereo**

**Stravinsky: Firebird Suite. Debussy: Three Nocturnes.** Paris Cons. Orch., Boston Symp., Monteux.

**RCA Victrola VICS 1027 stereo**

A new reissue label from RCA with a pleasantly nostalgic name and a useful function in the age of stereo. The execution, judging from these two, is something else again.

For instance, though one of these, the Boston-Munch disc, offers entirely adequate sound quality, the other, featuring two widely separated orchestras, has a uniformly unpleasant, nasally distorted sound on both sides, evidently a common product of the reprocessing job. It's hard to believe the original tapes had this sound in common.

More unpleasant for my ears is the "dynagrooving" of both discs, which evens the loud and soft parts so drastically that at times you can even hear the tape hiss and auditorium background noise coming up with the fainter music. Of course, the label "Dynagroove" is reserved for RCA's first-line product. But does that mean RCA is going to turn off the system when it comes to fixing up its other lines for popular appeal on "average" home equipment? Common sense says if the equipment is there it might as well be put to work! Only don't use the name.

My experience to date suggests that the more "popular" a record is, from RCA, the more blatant is the dynagrooving. Oddly

enough, this means that the really top RCA recordings get a soft-pedalled dynagrooving which is entirely unobjectionable.

So—take a long look at the Victrola label. You won't have to worry about the music. It'll be good, of its type, you can be sure.

**Schoenberg: Serenade for Septet and Bass Voice, Op. 24 (1923).** Melos Ensemble of London, Bruno Maderna.

**L'Oiseau-Lyre SOL 250 stereo**

This tootling, twittery, waltzy little Serenade is not only important in the "12-tone" composer's development but it happens to be one of his most easily listenable works and one that is likely to please almost any hi fi home listener who likes rhythms and tone colors and sharp sounds galore—whether it be Schoenberg or Scheherzade. Don't be worried about the bass solo (John Carol Case); he sings in only one movement, as one of the instruments rather than as a featured solo, and he's good, anyhow.

reproduction so good  
... from an enclosure so small  
... it's almost unbelievable

# Petite

## HIGH FIDELITY SPEAKER SYSTEM



### USE ANYWHERE



Performance of the Petite is unmatched by any enclosure close to its 18" x 12" x 3 3/4" size. Bass notes come through rich and resonant . . . highs clean and brilliant. The secret? Argos system-engineered techniques . . . techniques which precisely coordinate the enclosure with the moving system of two Jensen speakers custom-made to Argos specifications. Trim design and beautiful hand-rubbed 3/4" oiled American walnut veneer cabinetry make the Petite a distinctive addition to any room setting. Graceful solid brass legs, plus wall hangers, make your Petite useable anywhere . . . shelf, table, wall or floor. See it at your hi-fi store, or write direct for descriptive catalog.

Price \$24.95

### ADDITIONAL FEATURES

- Speakers include: custom-designed Jensen high-compliance woofer with 200% more cone travel, and Jensen tweeter with matching network
- Frequency range, 50 to 17,000 cps.
- 8-ohm input
- Screw terminals polarized for stereo
- Volume control recessed into side of cabinet.

# Argos

PRODUCTS COMPANY

Dept. X, Genoa, Illinois





## ABOUT MUSIC

Harold Lawrence

### A New Approach To Acoustical Shell Design

**D**URING THE PAST SUMMER, the New York Philharmonic performed a concert at the Monterey Fair site in California. Ordinarily, the activities of a major orchestra on tour receive only local news coverage, but the circumstances surrounding this event were unusual. The *New York Times* reported that the Philharmonic had ordered an acoustical shell to be flown from Norwalk, Connecticut, especially for the concert.

Having in mind the weight and dimensions of most acoustical shells, I conjured up a picture of the loading operation: bulky segments being inserted into the mouth of a huge U. S. Air Force cargo plane of the type used to transport trucks, troops, and light artillery. Could this be the first time an acoustical symphonic shell had been airborne?

The brief *Times* item engaged in no such speculation. The shell, it stated simply, had been designed and built by the Stagecraft Corporation, whose president, Christopher Jaffe, had flown to Monterey to supervise its installation. Anxious to learn more about the "flying shell," I arranged to meet with Mr. Jaffe on his return home.

An energetic, articulate man with a background in music, chemistry and engineering, Jaffe is a late starter in the business of acoustics, having founded Stagecraft in 1960. Since then, he has been very busy. To his credit are some 18 acoustical shells built for symphony orchestras, as well as more than a score of other shells designed for universities, hotels, and auditoriums.

The rapid emergence of Stagecraft on the acoustical scene grows out of a new awareness on the part of critics and public alike of the importance of acoustics in our

concert life. Stimulated by the controversies surrounding Royal Festival Hall and Philharmonic Hall, and by the attention paid to acoustics in high fidelity sound reproduction, people no longer are willing to accept inferior sound in their concert halls, most of which suffer from multiple sonic illnesses. The question keeps coming up: What can we do about these acoustical invalids?

There are two alternatives. First demolish the old hall and start fresh, utilizing the latest concepts of acoustical design. Second, treat the hall to an acoustical face-lifting.

Obviously, financial reasons dictate the latter course for most communities, although several new concert halls have sprung up in Seattle, New York, Detroit, and Indianapolis during the past decade. But, as everyone knows, newborn halls often emerge with natal defects as serious as those afflicting their predecessors.

Take the case of Detroit's Henry and Edsel Ford Auditorium. Built in 1956 as part of the Motor City's new riverside civic center, the hall seats nearly 3000, has a low ceiling, smooth walls, and at the time of its completion, a shallow plywood and canvas shell. The reverberation period was extremely short, recalling the notorious sound characteristics of N.B.C.'s Studio 8H, and there was virtually no blend of orchestral choirs.

The full impact of the hall's shortcomings hit Detroit's music lovers a couple of years later when the city played host to a convention of music critics. After attending a concert as the Ford Auditorium, critic Harold C. Schonberg deplored the hall's acoustics, saying it was impossible to form an opinion of the performance of the Detroit Symphony under the baton of Paul

Paray on the basis of what he had just heard.

The critics departed, leaving Detroiters in the throes of an agonizing reappraisal. An acoustician's firm was commissioned to design a shell which, it was hoped would lengthen the reverberation time and improve the over-all sound. The shell was installed at a cost of \$110,000 in 1959, and was introduced in time for the new symphonic season. As it turned out, Ford's malady was incurable. True, the strings now produced a slightly brighter if somewhat glassy tone, but the hall's character remained unchanged. All the familiar problems were still there: dryness, slapback, acoustical overload, frequency selectivity and a generally coarse orchestral texture. To make matters worse, the shell caused the overhead organ grille to ring audibly at 580 cps.

For the musicians, too, the Ford Auditorium was no more successful. To overcome the lack of reverberation, the players increased their volume of tone. Had they played at normal dynamic levels, they would have been unable to hear themselves, not to mention their colleagues, at all times. The inevitable result was a narrowing of the dynamic spectrum, with rough, grating string sound, clamorous brass, and the entire sonority robbed of the luster of upper partials.

As musical director of Mercury Records, I supervised several recording sessions in the newly-shelled hall. The hall's acoustical obstacles proved insurmountable, and we moved our operations to the former home of the Detroit Symphony, the Paradise Theatre, now a shabby derelict located on the once-fashionable Woodward Avenue. The hall had been used successively as a movie house, a temple, and finally abandoned to the elements, its proscenium shot through with gaping holes. Acoustically, however, it was still very much alive. In fact, it took the orchestral players a full session to adjust their touch and embouchure to the liveness of the hall.

A parallel situation existed in the Cyrus Northrop Memorial Hall in Minneapolis, the home of the Minneapolis Symphony. For years, concert goers had complained about the uneven sound diffusion and lack of "resonance" in the sprawling 4700 seat auditorium. The orchestral management commissioned Bolt, Beranek & Newman and Theatre Consultant George C. Izenour to design and construct a massive demountable shell. It was a solid piece of work: skins of sheet steel 3/32-inch thick formed the shell, coated on the back with 1/8 inch of damping compound; diagonally intersecting trusses constituted the modulated surface; and Plexiglas sheets (acoustical clouds) were placed out over the audience to help the diffusion of the string sound.

The new Northrop shell was an improvement over the flimsy sponge-like enclosure that had "served" the orchestra in the past. But, like its Detroit counterpart, it fell short of the mark.

More successful was the acoustic renovation of Severance Hall in 1958. For the revamping of the home of the Cleveland Orchestra, the management engaged Heinrich Keilholz as its acoustical consultant. Keilholz, who is one of the four acousticians brought in by Lincoln Center to improve the acoustics of Philharmonic Hall, literally tore Severance Hall apart. Tile replaced carpets, textured non-absorbent fabrics displaced drapery, a light transverse curtain superseded the old velour curtain, and a host of other sound-soakers were banished from the hall. The stage-shell was constructed of convex plywood panels designed to blend orchestral timbres



Fig. 1. Leonard Bernstein conducts New York Philharmonic at Monterey Fair site, August 31, 1963.



**CHOSEN BY**  
**AS THE BEST THAT**  
**MONEY CAN BUY**  
**(WITHOUT FRILLS)**

This photo and caption (the price is an approximation) appeared in the September 1963 POPULAR SCIENCE as part of an article entitled "The Low-Down on Hi-Fi Stereo." It is a picture



of those high fidelity components which, according to a panel of experts, provide the best sound possible today.

The panel carefully considered return-for-the-money, but "where there was a more expensive component that produced a detectable improvement in sound, it was chosen."

These components are recognizable to hi-fi enthusiasts as the AR two-speed turntable, the Dynakit PAS-2 preamplifier, the Dynakit Stereo 70 dual power amplifier, and the AR-3 loudspeakers.\*

\*They have been on demonstration as a system for several years at the AR Music Rooms, on the west balcony of Grand Central Terminal in New York City, and at 52 Brattle St., Cambridge, Mass. No sales are made there; you may ask questions if you like, but most people just come and listen.

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

Please send me literature on Dynakit and AR high fidelity components.

NAME \_\_\_\_\_  
ADDRESS \_\_\_\_\_

on stage. The outcome was an increase in reverberation time of no less than one second, a warm and rich sonority, and a good balance of instrumental choirs. In short, wrote Irving Kolodin, "Severance Hall shows . . . results that appear to be a 'resounding' success."

Most critics agree that the renovation of Severance Hall was a hit. However, against the costly misses and near-misses of Ford Auditorium, Northrop Auditorium, and Philharmonic Hall, it stands out as a dramatic exception. What of the homes of other U.S. orchestras? Not many communities can afford to spend the large sums of money necessary to construct bulk-density shells—much less build new auditoriums. And even those cities capable of supporting extensive renovations should be reluctant to wade into the murky waters

What is wrong with the bulk-density shell?  
"The principle of bulk density is valid when applied to the walls and ceilings of an auditorium, but there is no evidence to justify also applying it to the shell design itself."

Specifically, what do you mean by the "bulk-density principle"?

"The bulk-density principle has its origin in auditorium architectural acoustics. It stresses the importance of equal reflection throughout the frequency range of sound energy from the wall and ceiling surfaces of the hall. In its application to stage-shell design, the aim is to keep all sound energy within the shell confine. This is why bulk-density shells must be designed so large. With equal reflection, the timpani and

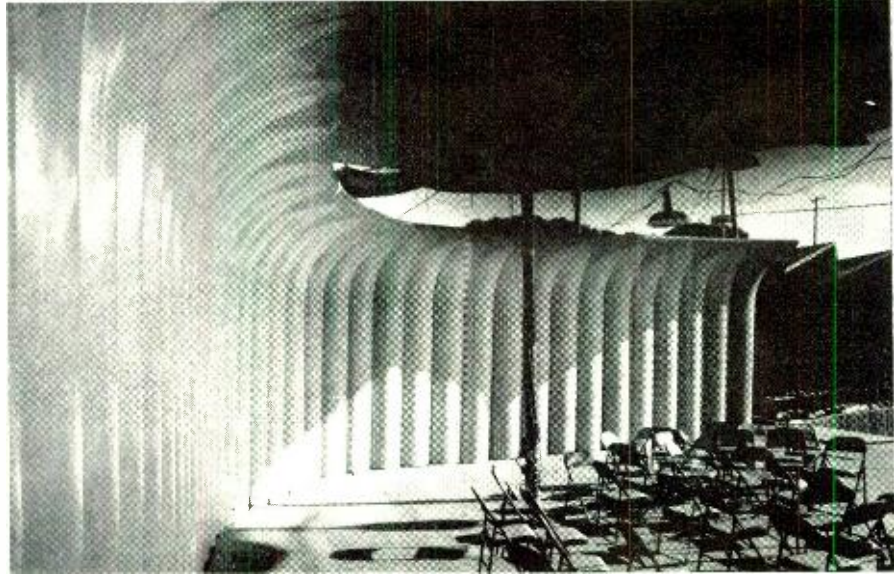


Fig. 2. The Fiberglas acoustical shell used to back up the New York Philharmonic in Monterey.

of acoustical experimentation. (The "tuning" of Philharmonic Hall goes on.) Surely there must be other ways of treating ailing halls.

Chris Jaffe believes he has found a better approach. Through a bold concept that cuts through most of the costs and complexities of traditional methods, he has come up with acoustical shells that are lighter, cheaper, smaller and more versatile than most 'permanent' installations. A case in point is the acoustical shell Stagecraft designed and built for the Cincinnati Symphony. Installed in October 1961 at a cost of \$15,000, the new unit is 33 ft. deep and 58 ft. wide; the wing baffles are 24 ft. high and the rear baffles are 18 ft. high. The shell weighs one and a half tons. That same year, the Minneapolis Symphony installed its new shell. The Northrop unit costs more than \$110,000, weighs 30 tons, and is 30 ft. high. (The width and depth of both shells are approximately the same.)

Both shells were designed for full symphony orchestras. Yet the differences in cost and weight are striking, even after one has taken into account the varying dimensions of Northrop and Music Hall. I asked Jaffe whether these figures represented a sacrifice in quality in the case of the Cincinnati shell. "Don't be misled by the price and specifications," Jaffe warned. "No acoustical compromises were made in Cincinnati. These figures are an outgrowth of years of work in the design, fabrication, and installation of lightweight enclosures, which we feel are actually superior to the heavy bulk-density shell."

brass would predominate in a small shell. The acousticians then cope with the distribution of sound throughout the hall . . . this is where the acoustical clouds come into the picture. After the shell has been installed, there follow the inevitable problems of blend and balance of instrumental sections."

How do your shells differ from the bulk-density shells?

"Bulk-density shell designers attempt to improve the acoustics of a hall by treating the entire area around both the orchestra and the audience in a similar fashion. We attack the orchestral area separately. In most cases, narrow-band sounds tend to be soaked up, while broad-band sounds are hard to get rid of. Our first job is therefore to achieve a correct blend and balance of orchestral instruments on the stage. We have found, after several years of experimentation, that the best way to achieve this is by designing a shell that would absorb the sound energy of certain sections of the orchestra on a selective basis, utilizing materials with a higher-percentage reflection of the mid- and high-frequency sounds."

In other words, you pre-mix the sound of the orchestra before it reaches the audience, like a sort of acoustical pre-amp.

"Exactly. Now, take the case of a hall in which timpani and brass mask the sounds of violins and woodwinds. To obtain more narrow-band sound, we design our shell material to pass frequencies between 60-100 cps. This does not mean that this range

will be lost; such attenuation does not exceed two decibels. And let's not forget that much of this sound energy is being projected *directly* at the audience. What matters is that the winds and strings will now be heard in proper relationship with the rest of the orchestra."

That's all well and good but how would you cope with halls suffering from a lack of broad-band sound, such as Philharmonic Hall, where acousticians have noted that, at one time, frequencies below 250 cps were attenuated 10 to 15 decibels?

"Our selective-absorption shells are extremely versatile. We are able to balance orchestral sections not only by means of the choice of shell material, but by angling the floor and ceiling baffles and making effective use of openings as well. Some double bass energy will be attenuated, it

is true, but only in order to achieve an over-all balance."

Assuming that your selective-absorption shells are in a class with, or superior to, bulk-density shells, what advantages do they offer to theatre and orchestra managers, beyond price and weight?

"A typical Stagecraft shell consists of polyester resin-reinforced interlocking fiberglass segments weighing only from 40 to 80 pounds. The number of musical forces naturally dictates the size of each shell. A symphonic shell for example, incorporates 28 segments, with ceiling baffles. Now the advantages involve portability, storage, ease of installation and durability."

"An average Stagecraft unit can be efficiently moved from one location to another in a small pickup truck, and can be stored in a cubic space of 4-feet by 5-feet by 18-

feet. The full-sized acoustical shell we built for the Oakland Symphony can be erected by a two-man crew in about two hours. I know of one auditorium where a bulk-density shell required an expenditure of \$1200 each time it was erected. Extremely costly special rigging was installed to reduce the high setup expenses. But it still costs \$400 to erect the shell for each concert. The ease of installation and demounting of our acoustical shells also makes structural remodelling totally unnecessary in multi-purpose halls."

A comparison of the specifications of your symphonic shells with those of the bulk-density type reveals that yours are lower and closer to the orchestra.

"Selective absorption makes this possible. The 40-foot-high downstage wing panels normally required in bulk-density shells can be cut in half."

With the shell "hugging" the orchestra, isn't there a danger of producing a boxed-in sound?

"The openings take care of that. Besides, I'd like to point out that, although our shells are lightweight, the material (fiberglass) is actually denser than plywood."

Since he founded Stagecraft three years ago, Jaffe has designed, built, and tuned a large number of acoustical shells. Among his customers are the Atlanta Symphony, the Cincinnati Symphony, the Corning Philharmonic, the Fresno Symphony, the Louisville Symphony, the Oakland Symphony, the South Bend Symphony, and the Wheeling Symphony. In addition, he has designed shells for multi-purpose auditoriums and for outdoor events.

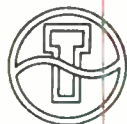
A man of average height with clear blue eyes, a cleft chin, and hands constantly in motion, Jaffe came to the field of acoustical design through theatre design. A graduate of Rensselaer Polytechnic Institute, he had designed an off-Broadway theatre-in-the-round in 1949, called the Circle Theatre. The idea of an arena theatre was new at the time and, as it turned out, shortlived. The place (35th Street) and the play (William Saroyan's *The Son*) spelled commercial failure.

"After my theatrical adventure, I quit show business and turned to engineering. For the next nine years, I worked on new applications of aluminum and magnesium. Light-metal extrusions, you know, represent one of the largest industries to develop after World War II. Extrusions eliminate the need for extensive tooling and make possible the most intricate shapes without heavy industrial dies. Typical of the applications of light-metal extrusions are storm windows, truck-bodies, and aluminum-glass facades for skyscrapers."

During these years, Jaffe never lost his interest in music and theatre design. When N.B.C. took over the Ziegfeld Theatre in the early Fifties, he was called on to design a floor that would not require structural alteration in the theatre. Jaffe drew on his experience with light metals to build a panel-floor made of standard truck-body extrusions, with a magnesium decking, and topped with smooth masonite.

Aware of the need for effective, low-cost acoustical shells, Jaffe applied his engineering and acoustical knowledge to this problem. His work suggests that we are witnessing a new trend in the design of acoustical shells. Whether or not it will outmode the bulk-density shell, just as the aluminum and Fiberglass rowboats have outclassed the wooden ones, remains to be seen. But it is interesting to note that Heinrich Keilholz, the designer of the Severance Hall's acoustical shell, has fabricated a Fiberglass acoustical shell for the San Francisco Symphony. **JE**

# HOW IS THE SOUND



SCHOEPS



Schoeps Microphones exclusively were chosen by Adjutor Theroux sound consultant to Mitch Miller for the recent national "Sing Along With Mitch" tour.

## TRY IT WITH SCHOEPS MICROPHONES

SOUND IS THE CRITICAL FACTOR in your decision about which professional condenser microphone you should select. Technical Data\* . . . Curves . . . NOTHING can give you the sound like hearing it yourself. That is why we offer you the Schoeps Microphone on a 30 day trial, with no obligation. Get one . . . and hear the sound.

\*You will receive Technical Data with your microphone.

Shown: the M221B with MK26 - 3 pattern capsule



INTERNATIONAL ELECTROACOUSTICS INCORPORATED  
333 SIXTH AVENUE NEW YORK 14, N. Y. 212 WA 9-8364



## SPEAKER ARRAY

(from page 32)

spacing is from  $\frac{1}{8}$  wavelength to  $\frac{5}{8}$  wavelength. For instance in an array of 6-in. speakers with center-to-center spacing of 7.5-in., coupling occurs between 217 cps and 1086 cps, with maximum boost at 553 cps. Destructive interference effects are more difficult to measure, but appear to occur in the range of frequencies for which speaker spacing is 1 to 4 wavelengths. Table 2 gives the frequencies affected by various center-to-center spacings.

If a 32-speaker array is arranged in four lines of eight speakers, it is essential that the lines of eight be oriented vertically instead of horizontally if any dispersion of high frequencies in the horizontal plane is desired. Such an arrangement comes within 2 db of the maximum theoretical boost of 15 db. An array of 16 speakers, four in a line, realizes even more of the maximum theoretical boost, and has identical polar response in both planes—which is the worst possible case.

### Control of Fundamental Resonance

The majority of inexpensive 6-in. speakers have a fundamental resonant frequency of around 120 cps. This high a resonance will give poor bass response. In addition, the damping of such speakers is usually poor, so that the array will exhibit a peak in response of as much as 10 db. This makes for "single note" bass which is unmusical at best, and at 120 cps tends to accentuate any hum problems which may exist in the sound system. Using such speakers in a bass reflex enclosure will extend response by half an octave and will damp out the peak at 120 cps.

In an untuned enclosure or baffle, however, it is desirable to have resonance occur half an octave away from troublesome hum frequencies. For an inexpensive speaker system, then, 85 cps would be ideal, and for a more expensive unit 42 cps—falling halfway between 30-cps turntable rumble and 60-cps hum—should be chosen.

In a multiple speaker array the added mass of the air load tends to lower speaker resonance somewhat. In general, however, damping remains the same unless some measure is taken to smooth the impedance curve or add acoustic resistance to the mechanical circuit of the system. One way to smooth impedance is to use speakers with resonances staggered at least a half an octave apart. At 85 cps this would mean 71 and 101 cps which are definitely outside the normal  $\pm 10$  per cent tolerances of a single speaker unit. Acoustic re-

sistance can be added in the case of the open backed enclosure by hanging a Fiberglas curtain behind the speaker array.

### The "Sonic Screen"—A Practical Array

One quite satisfactory version of the multiple speaker array is shown in *Fig. 2*. It is a result (far from an end result) of the author's interest in arrays over the last few years. Although not providing the ultimate in sound reproduction, the "Sonic Screen" does an extremely creditable job for its very low cost. This array consists of ten 5 x 7-in. oval cone speakers with 1.0-oz. magnets mounted on a  $\frac{3}{8}$ -in. grille-cloth-covered plywood panel which is in

turn attached to a 2 x 4-in. frame. The finished system stands 51-in. high, 18-in. wide, and is slightly less than 5-in. deep. Its back panel is identical to the front panel to allow backwave radiation, and in between is placed a Fiberglas curtain.

The speakers are wired in parallel-series so that the amplifiers sees a nominal 8-ohm load, and no tweeter is used (a more expensive version not shown here uses a tweeter and better quality 6-in. speakers to extend high- and low-frequency response). Because this array is quite efficient and because its mid-range transient response is excellent, it is well suited for use with moderate power direct-coupled transistor amplifiers. AE



Audio Magazine couldn't describe it in less than 1,457 words.

**"...practically any use that can be imagined is possible with the Uher 8000."**

Here are some excerpts on the most revolutionary tape recorder to hit the Hi Fi industry in years . . . **Uher 8000 by Martel.**

"There are seven position-four speeds with three OFF positions between. Selecting the speed also adjusts equalization for each. A second switch together with an interlocked RECORD button, controls all of the electronic functions in its eleven positions, which are marked: 1-4—mono record or play on upper track; 2-3—mono record or play on lower track; STEREO—record or play; MULTIPLAY I—permits recording on the upper track from microphone and mixing with material from lower track; MULTIPLAY II—permits recording on lower track and mixing material already recorded on upper track; DIA-PILOT I—used for recording from microphone and/or from phono record or another tape machine on upper track as commentary for slides; DIA-PILOT II—after making recorded commentary on upper track, this position is used to record sub-sonic tone on lower track at points where a slide is to be changed and for playback with slide projector thereafter, with the slide changing at each point when the tone button was depressed in the second run-through; ECHO 1-4—permits adding delayed sound to an original recording on upper track, the amount of delay depending on the speed of the tape; ECHO 2-3—same operation for lower track; SYN-PLAY I—used for recording on one track for later recording another signal in synchronism with the first but on a second track when the switch is turned to the SYN-PLAY II position. Thus, practically any trick type of recording can be made with no external interconnecting or switching.

Akustomat makes it possible to use sound as a controlling medium for the recording operation. The machine can be used as a dictating machine, for example, without the need for a start-stop button—one simply speaks and the machine starts recording, and when the dictator pauses, the machine stops. Thus it may be used to monitor and record sounds of an intermittent nature over a long period of time without actually running except in the presence of some sound. We know no other machine which has this feature.

At the slowest speed and in the echo mode, the machine can be used to check pronunciation in the study of languages. One simply says a word, and then hears it back a fraction of time later. The various features of the machine provide a wide range of facilities useful in the study of music or languages. In short, practically any use that can be imagined is possible with the Uher 8000.

If you're interested in the complete review of the Uher 8000, Write for nearest dealer and reprint of complete review.

**MARTEL ELECTRONICS** / **HOLLYWOOD** 645 N. Martel Avenue Phone (213) 938-2803 / **CHICAGO** 1141 Merchandise Mart Plaza Phone (312) 644-0430 / **NEW YORK CITY** 1199 Broadway Phone (212) 684-0943

# Only **DYNAMIC** **DIMENSION** Control Equipment by **FAIRCHILD** Can Radically Improve Your Broadcast and Recording Sound!

## FAIRCHILD DYNALIZER Model 673

The newest approach for the creation of "apparent loudness"—the Dynalizer is an automatic dynamic audio spectrum equalizer which redistributes frequency response of the channel to compensate for listening response curves as developed by Fletcher-Munson. Adds fullness and body to program material. Completely automatic with flexible controls. Easily integrated into existing equipment.



## FAIRCHILD CONAX Model 602



The world-acknowledged device that eliminates distortion problems caused by pre-emphasis curves. Allows higher average program levels through inaudible control of high frequencies. Invaluable in FM broadcast and disc recording. Eliminates stereo splatter problems in multiplex channels.

## FAIRCHILD LIMITER Model 670

Fast attack stereo limiter (50 microseconds) with low distortion and absence of thumps. Sum and difference limiting position eliminates floating stereo image, despite amount of limiting used in one of the two channels. Also includes regular channel A and B limiting. Dual controls and dual meters provided. Now used throughout the world in recording studios. (Mono model available).



Write to Fairchild—the pacemaker in professional audio products—for complete details.

**FAIRCHILD**  
RECORDING EQUIPMENT CORPORATION  
10-40 45th Ave., Long Island City 1, N.Y.

CIRCLE 54

## AUDITIONEER

(from page 28)

very pleasant listening response. Naturally if you were building the Auditioner for high fidelity, you would want to install the RIAA network along with a switch to put it in the circuit when playing records.

This is what the girls in the copy writing department think of the Auditioner:

We that copy write  
No longer have to fight  
With the boys who like to light  
Out of sight . . .  
in auxiliary control

Thanks to the transmitter boys  
We have a brand new toy  
Life is just pure joy  
Since the boys we don't annoy . . .  
in auxiliary control

Our feet no longer ache  
The earth no longer quakes  
No more do we tremble and shake  
For temper will never again break . . .  
in auxiliary control

Hail to the engineers, one and all  
Hail to the men who answered our call  
In our esteem, you're ten feet tall  
May the boys have a ball . . .  
in auxiliary control

### PARTS LIST

#### Resistors

All resistors  $\frac{1}{2}$  watt unless otherwise noted

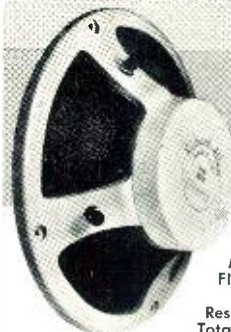
$R_{11}, R_{27}, R_{40}$	2200 ohms
$R_2, R_{18}, R_{20}, R_{30}, R_{37}$	470 k
$R_3$	221 k (deposited carbon)
$R_4$	680 ohms
$R_5$	100 ohms
$R_6$	18 k
$R_7$	200 k pot (tone control)
$R_8$	2.2 Meg.
$R_9, R_{13}, R_{22}$	220 k
$R_{10}$	100 k pot (volume control)
$R_{11}$	3900 ohms
$R_{12}, R_{33}, R_{38}, R_{45}$	10 k
$R_{14}, R_{34}, R_{39}$	1000 ohms
$R_{15}$	1 Meg.
$R_{16}, R_{17}, R_{28}$	47 k, 1 watt
$R_{19}$	125 ohms, 5 watt
$R_{21}$	22 k
$R_{22}$	1000 ohms, 1 watt
$R_{23}$	100 ohms pot (hum balance)
$R_{24}, R_{25}$	100 ohms, 5 watt

PRESENTING THE

## Richard Allan SPEAKER

For the Connoisseur  
at last...

An English Import With  
All the Fine Qualities  
and Crafts-manship  
of Today's Most  
Expensive Speakers!



CG12T — \$55.99  
Size — 12 inches  
Magnet type — Ferroba II  
Flux Density — 14,000 lines  
per sq. cm.  
Response — 25 to 15,000 cps.  
Total Flux — 82,000 Maxwells  
Nat. Cone Resonance — 30 cycles

Richard Allan . . .

HIGH PERFORMANCE SPEAKERS IDEALLY SUITED FOR "SLIMLINE" CABINETS, OFFERING HEAVY CAST FRAME AND CAMBRIC SURROUND. INCORPORATING THE LATEST ADVANCES IN MAGNET DESIGN AND MORE.



THE BRONZE  
8" and 10"  
Robust die-cast  
chassis. Wide  
frequency range.  
Low priced at  
8" . . . \$19.99  
10" . . . \$31.99



THE 1214  
12" (30.5 cm)  
Magnificent construction. Exceptionally smooth frequency response.  
\$51.99

### GOLDEN ERA "860"

8" most popular "workhorse" in the Richard Allan line. \$5.49

Richard Allan

SALES CORPORATION  
P. O. BOX 95  
JERICHO, L. I., N. Y.

Dealer and Manufacturers  
Representatives Inquiries Invited

CIRCLE 69



$R_{26}$	50 ohms, 5 watt
$R_{31}$	150 k
$R_{32}, R_{36}$	47 k
$R_{35}$	10 ohms
$R_{41}$	4700 ohms
$R_{42}$	39 k
$R_{43}$	3300 ohms
$R_{44}$	22 ohms
$R_{46}$	47 ohms
$R_{47}$	100 k
$R_{48}$	27 k
$R_{49}$	2.2 Meg.

**Capacitors**

$C_1$	50 pf disc ceramic
$C_2, C_7$	0.01 $\mu$ f/400 volt, tubular
$C_3$	0.01 $\mu$ f disc ceramic
$C_4, C_8, C_9$	0.1 $\mu$ f/400 volt, tubular
$C_5$	0.025 $\mu$ f/400 volt, tubular
$C_6$	25 pf disc ceramic
$C_{10}$	100 $\mu$ f/50 volt, electrolytic
$C_{11}$	0.1 $\mu$ f/600 volt tubular
$C_{12}, C_{13}, C_{18}$	30 $\mu$ f/250 volt, electrolytic
$C_{14}, C_{15}$ \	30 $\mu$ f/450 volt, electrolytic
CAN	
$C_{16}, C_{17}$ /	20 $\mu$ f/450 volt, electrolytic
$C_{19}, C_{20}, C_{25}, C_{28}$	25 $\mu$ f/25 V. subminiature electrolytic
$C_{21}, C_{26}$	10 $\mu$ f/25 V. subminiature electrolytic
$C_{27}$	100 $\mu$ f/25 V. subminiature electrolytic
$C_{29}, C_{30}$	0.1 $\mu$ f/600 volt, tubular

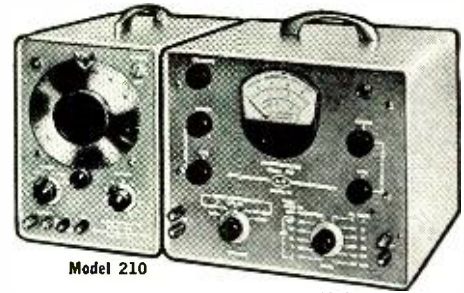
**Miscellaneous**

$D_1$	1N91
$D_2, D_3$	1R 5A4
$D_4, D_5, D_6$	1N34
$Sw_1$	(on volume control)
$Sw_2$	Grayhill 4002
$Sw_3$	Grayhill 4001
$Sw_4$	Centralab PA 1000
$F_1$	Buss AGC 3
$F_2$	Buss AGC 1.5
$S_1$	Jones S-306
$S_2$	Jones S-302
$P_1$	Jones P-306
$P_2$	Jones P-302
$Rl_1$	P&B KA11AY
$Rl_2$	Sigma 4F-5000
$Rl_3$	Amperite 115N05T
$V_1$	12AX7
$V_2$	6AN8
$V_3, V_4$	6BQ5
$Q_1, Q_2, Q_3$	2N508
$Q_4$	2N44
$T_1$	PA2288
$T_2$	PA227

**New!**



**INSTRUMENTS  
for AUDIO  
MEASUREMENTS**



Model 210

Model 410

**MODEL 410 DISTORTION METER**

• Measures audio distortion, noise level and AC voltages • Also a versatile vacuum tube voltmeter. • Distortion levels as low as .1% can be measured on fundamental frequencies from 20 to 20,000 cps, indicates harmonics up to 100,000 cps • Distortion measurements can be made on signal levels of .1 volt to 30 volts rms • The vacuum tube voltmeter

provides an accuracy of  $\pm 5\%$  over a frequency range from 20 cps to 200 KC. For noise and db measurements, the instrument is calibrated in 1 db steps from 0 db to -15 db, the built-in attenuator provides additional ranges from -60 db to +50 db in 10 db steps.

**MODEL 210 AUDIO OSCILLATOR**

• Provides a sine wave signal from 10 cps to 100 kc • Output level within  $\pm 1$  db when working into 600 ohms (reference 5 kv) • Power output, variable to above 150 mw • Hum and noise, -70

db at 5 volts output • Distortion is less than .2% at 5 volts output from 50 to 20,000 cps, slightly higher at higher output and frequency extremes.

**These instruments are supplied with many B.C. station installations for FCC Proof-of Performance tests.**

**BARKER & WILLIAMSON, Inc.**  
Radio Communication Equipment Since 1932  
BRISTOL, PENNSYLVANIA • STIlwell 8-5581



CIRCLE 55

**HERE IS A  
CHECKLIST OF  
MEANINGFUL  
FEATURES  
YOU SHOULD  
LOOK FOR  
IN A FINE  
QUALITY  
HEADSET  
RECEIVER**



**CONSTRUCTION** The headset should be lightweight, yet substantially constructed to withstand continued use. Adjustment on the head should be almost automatic. Cables should be in a plastic jacket and reinforced at junction points to withstand wear. Ideally, it should have an 8-foot cable and a two circuit stereo plug.

**COMFORT** Extreme comfort is essential for many hours of continuous listening pleasure. Ear cushions should be highly compliant to conform to the contours of the head, even if the listener is wearing glasses. Pressure of the ear domes must be precisely set to avoid fatigue.

**COUPLING** Joining of the receiver to the ear is an important characteristic. Close, direct coupling is necessary to assure maximum abatement of external sounds and the reinforcement of bass and treble frequencies.

**PERFORMANCE** Sound quality - frequency and transient response with negligible distortion - must be equal to that of the best high quality speaker system . . . without the problems of room acoustics.

**MORE IMPORTANT** try the DAVID CLARK/100 at the start - for a true quality standard, a reference for judging the performance quality of all headset receivers.

Only the DAVID CLARK/100 features exclusive Direct Acoustical Coupling for truly private listening - provides a rich, natural quality of music only you can hear.

For stereo or mono  
DAVID CLARK/100  
\$39.50

Supplied with 8-foot cable, 2 circuit stereo plug.

At DAVID CLARK franchised dealers.  
FREE! Send for the David Clark Story of Personal Listening. Write Department A-3.

**David Clark** COMPANY  
INCORPORATED  
WORCESTER, MASSACHUSETTS

CIRCLE 70



# NEW PRODUCTS

● **New Line of Speaker Systems.** Electro-Voice has developed a new line of compact loudspeaker systems comprised of three units, the E-V "Two," a wide range, two-way system; the E-V "Four," a three-way unit; and the E-V "Six" (shown), a four-way system utilizing separate drivers. The E-V Two is a two-way high-efficiency unit for use with any amplifier. Component-quality loudspeakers and etched circuit board construction are employed for maximum power-handling capacity and cross-over frequency accuracy. A diffraction horn is used for the high frequencies. The E-V



Four uses three separate drivers. The cabinets for the E-V Two and E-V Four are constructed of ¾-in. hardwood and are finished on four sides to allow use of either vertical or horizontal position. A compression VHF driver and diffraction horn is used in the E-V Six, and a four-way electrical crossover, with crossover frequencies at 250, 800, and 3500 cps. The E-V Six uses an 18-in. low-frequency driver. The E-V Six system, in traditional styling, is available in mahogany or hand-rubbed oiled walnut finish. Electro-Voice, Inc., Buchanan, Michigan. **M-6**

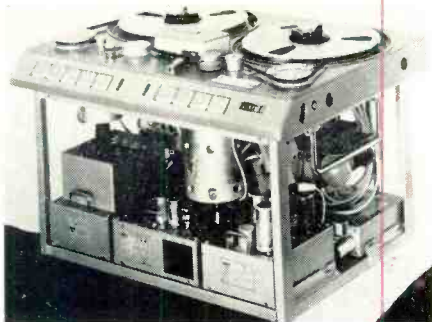
● **Tape Recorder in Teak Cabinet.** A new, completely self-contained stereo tape recorder, the Miranda "Sorrento," completely enclosed in teak cabinetry, marks the entry of Allied Impex into the high-fidelity field. There are no handles or other external hardware to indicate that the cabinet houses a tape recorder. This unique concept makes it possible for the Miranda to become part of the living room decor, rather than having to be concealed behind doors. The Sorrento features solid-state circuitry with 21 transistors and 19 diodes in an OTL circuit and an all-electronic matrix type pushbutton switching system. Tape movement of the Sorrento is controlled by three separate motors, for capstan drive (7½ and 3¾ ips) and auto-



prove the over-all signal-to-noise ratio by increasing receiver limiter action, offering an ideal solution to the problem of stereo (multiplex) reception. The Stereobooster claims to be especially effective with older tuners that do not have sensitive front ends. The unit can be installed indoors near a receiver by means of its patented stripless screws. Blonder-Tongue Laboratories, Inc., 9 Alling Street, Newark 2, N. J. **M-9**

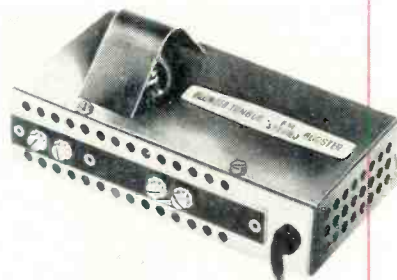
matic shutoff; pushbutton mode controls; individual volume and tone controls for each channel; illuminated VU meters; and two built-in 4×6 speakers. Power output of the Sorrento is rated at 7 watts, 3.5 watts per channel. User net price of the Sorrento is \$399.95. The remote control is \$34.95, dynamic microphones, \$19.95 each. Allied Impex Corporation, 300 Park Avenue South, New York 10, N. Y. **M-7**

● **Professional Tape Recorder.** Gotham Audio Corp. announces the availability of the new EMT Studer C-37 series master tape recorder. The machine, manufactured in Switzerland, has been well tried and proven with over 300 units operating in broadcasting and recording installations throughout the world. Extreme attention has been paid to achieve top performance specifications, operating and maintenance ease, and editing functions. For example, wow and flutter content is ±0.04 per cent rms, signal-to-noise ratio is 66-db unweighted at 15 ips, full track. A unique tape tensioning device allows extremely smooth and uniform tape handling. Electronic and electro-magnetic elements are completely plug-in. Editing features include built-in tape marker, motor-driven cutting scissors, editing indexing, splicing block, and precision tape timer reading directly in minutes and seconds at any speed. The recorder is available as ¼-in. full or two track; ½-in. three or four track; 1-in. four track; as well as film



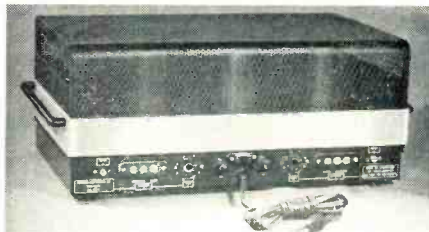
synchronous and preview head models. Four-track machines have complete sync monitoring amplifier and switching. Gotham Audio Corp., 2 West 46 Street, New York 36, N. Y. **M-8**

● **FM-Stereo Booster.** A new, indoor FM booster offering an eight-fold increase in signal strength for FM radio receivers has been introduced by Blonder-Tongue Laboratories, Inc. Called the Stereobooster, model FMB, it has a power gain of 18 db and an unusually low noise figure. List price of the amplifier is \$21.00. A high-gain booster, such as the FMB, can im-



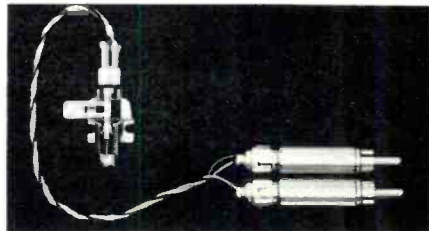
prove the over-all signal-to-noise ratio by increasing receiver limiter action, offering an ideal solution to the problem of stereo (multiplex) reception. The Stereobooster claims to be especially effective with older tuners that do not have sensitive front ends. The unit can be installed indoors near a receiver by means of its patented stripless screws. Blonder-Tongue Laboratories, Inc., 9 Alling Street, Newark 2, N. J. **M-9**

● **100-Watt OTL Stereo Power Amplifier.** The Futterman Model H-3 amplifier has been in development for 10 years and uses advanced vacuum tube circuitry (patent pending). No driver or output transformers are used. The loudspeakers are coupled to the amplifier by large computer-grade electrolytic capacitors. Conservatively rated at 50 watts rms per channel (16-ohm load) the amplifier has more than adequate power for any loudspeaker system. Its square-wave response is claimed to be unequalled by any other amplifier. The H-3 amplifier has a damping factor of 200 and is ultra-stable with all loads, even when driven into heavy overload. Both the harmonic and intermodulation distortion of the H-3 amplifier is so low that it is difficult to measure with even the best of laboratory test instruments. The model H-3 stereo power amplifier is a quality con-



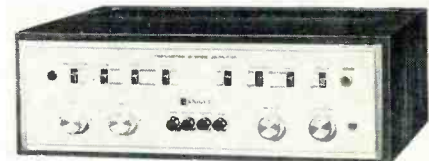
structed instrument. All of its components are of the highest grade and of U. S. manufacture. Extreme care is taken in its construction and tests. Tech Instruments Corp., 58-17 37 Ave., Woodside, N. Y. **M-10**

● **High-Compliance Ceramic Cartridge.** The Electronic Applications Division of Sonotone has just made available a new high-compliance version of its series of "Velicitone" phono cartridges. Designated the "Mark IV," the cartridge offers compliance of 15×10<sup>-6</sup> cm/dyne in all directions, separation of 30 db between channels, and tracking force of 1.5 to 3 grams for professional arms and 3 to 4 grams for changers. The "Mark IV" features Sono-



tone's latest advance in record playing, the Sono-Flex. A unique method of gripping the needle shank in a resilient butyl rubber mount allows the needle to be flexed in any motion, without damage. The "Mark IV" is available in two needle combinations: Diamond with sapphire and a double diamond model. Electronic Applications Division, Sonotone Corporation, Elmsford, New York. **M-11**

● **Transistor 100-Watt Stereo Amplifier.** The Knight KN-999 transistor 100-watt stereo amplifier uses 19 transistors, 8 diodes and temperature control convectors. Controls include pushbuttons to select the program source desired. Other highlights: stereo headphone jack; two-position record-monitor switch; two phase switches; five pairs of stereo inputs (two with level controls); and a massive power transformer.



Price of the KN-999 is \$199.95, less case. Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill. **M-12**





## *your search is over*

You'll never be satisfied with anything less than McIntosh quality once you've heard it. You'll put an end to stepping up to something better in your search for the ultimate, because McIntosh is the best. There are good reasons: Exclusive, patented circuits set new standards in performance. Careful engineering and conservative design practices ensure long term dependability. Consider amplifier output stages, for example, that need no bias or balance adjustment, no tube selection or matching, to deliver rated performance. McIntosh components are devised to fulfill every present need, anticipate your future ones. Like the classics, they endure.

### ILLUSTRATED ABOVE:

Model MX110 Stereo Tuner-Preamplifier and Model MC-240 Dual 40-Watt Power Amplifier. You need only add speakers.

Model MX110: A single chassis combines the quality and flexibility of a separate multiplex tuner in the broadcast-monitor class with a professional stereo control center ----- \$399.00

MC-240: Superb, distortion-free, two channel model, conservatively rated at 40 watts per channel. Flat frequency response well beyond the limits of the audio spectrum with negligible phase shift. ----- \$288.00

# McIntosh

LABORATORY INC.

2 CHAMBERS STREET, BINGHAMTON, N. Y.

Phone—Area Code 607-723-5491

Newest from Telex  
**INTEGRAL CHANNEL CONTROL**  
 with HEADPHONE STEREO



The famous Stereo-Twin® performance is now linked with the most advanced engineering development in the headset field — INTEGRAL CHANNEL CONTROL.

This newest wonder of miniaturization from Telex Stereo Laboratories has moved the stereo controls into the headset itself. No longer is a separate control center required.

With Telex INTEGRAL CHANNEL CONTROL, each channel is controlled individually by convenient, smoothly styled volume control knobs on each earpiece. Nothing to build, solder or hook up. Just plug into your stereo set and adjust each channel separately to the ideal listening

level. It's better, more convenient and costs less because no separate stereo control center is required.

Audiophiles look to Telex for the best in high fidelity performance. Now Stereo-Twin with INTEGRAL CHANNEL CONTROL adds to the list of Telex "firsts" in listening pleasure. \$29.15

A Product of Sound Research

**TELEX** Acoustic Products

COMMUNICATIONS ACCESSORIES

3054 Excelsior Blvd. • Minneapolis 16, Minn.

CIRCLE 58

**SHERWOOD**

(from page 44)

received (stereo-mono switch in stereo position). A stereo-mono switch permits bypassing the multiplex circuitry if mono-only reception is desired (slight reduction in noise level that way).

The remaining controls on the front panel include an interchannel-hush defeat switch plus the power-level control.

The front panel is quite handsome, combining a glossy white-enamel finish with gold borders and knob-fronts plus a rather large slide-rule dial. At night, the green-lighted dial is quite attractive and easy to read.

**Circuit Description**

The circuit is straightforward. We would judge that the S-3000V achieves its excellent performance by means of quality components and conservative practice rather than unusual circuitry.

The 300-ohm antenna input terminals are connected to a balun which in turn feeds the signal to a tuned circuit and then to the cascade r.f. amplifier (a 6BS8). A 6GH8 triode-pentode is used as the oscillator-mixer. The next two stages are 6AU6 i.f. amplifiers which are followed by a 6BN6 limiter. The pentode section of a 6GH8 is used as an FM driver and is followed by a pair of germanium diodes in a ratio detector configuration. If the stereo-mono switch is in the mono position, the signal then goes through the usual de-emphasis network and out. In the stereo position of the switch, the signal goes through the multiplex circuitry which consists of a 19 kc amplifier, a 38 kc oscillator-doubler, a balanced demodulator containing four diodes, de-emphasis and 38 kc filter network, and an audio amplifier. The stereo indicator is a neon bulb which is ignited when a 19 kc signal is present and amplified by means of a 12AT7. The indicator action seems to be relatively insensitive to noise and, since it does not use a relay, very quiet.

**Performance**

FM tuners are extremely difficult to report about simply. It is quite possible to provide lengthy technical reports which would only be understood by an engineer familiar with this field. Obviously we can't do that. Equally we can't say that the product is good, or fine, or excellent and let it go at that. Instead we are constrained to do a little of each.

Thus we can report that the distortion of the S-3000V is extremely low—IM 0.25 per cent and harmonic 0.22 per cent at 400 cps. The capture ratio is 2.1 and the stereo separation is 35 db at 100 cps. Sensitivity, IHF, is 1.8  $\mu$ v. Disregarding measurements, we were able to receive 35 stations loud and clear with our standard antenna system. Also the S-3000V is quite insensitive to impulse noise and other disturbances.

To us the significant factors are that the S-3000V is able to receive a large number of stations easily and with low distortion. That means it is a very fine tuner, up amongst the best. At its relatively modest price (\$165) it is an interesting prospect for anyone needing a tuner.

**SHURE STEREO STUDIO DYN-ETIC, MODEL M222**

The Shure Studio Dynetic was first introduced in the year 1957, and we profiled it in May of that year. The present Studio

**FRAZIER**  
 Speakers

**THE Super Midget**  
 7-3/16" H x 15 7/8" W x 9 1/2" D  
 For limited space or as auxiliary unit.

**THE Mark V**  
 26 1/2" H x 14" W x 11 7/8" D  
 A truly remarkable speaker.

**THE Bel Aire**  
 19" H x 23 3/4" W x 5 3/4" D  
 Thin line styled for wall mounting. Floor stand available.

**THE La Fiesta**  
 10 1/2" H x 23 3/4" W x 11 7/8" D  
 Unique design for bookshelf mounting.

**FOR THE LOVE OF Sound**

From the lowest rumblings of the organ pedal notes to the whispering overtones of the flutes... FRAZIER offers a complete series of full range, two-way, and three-way wide range speaker systems employing both the modified Helmholtz principle, and the exponential horn... Assuring the ultimate in smoothness, balance, and cleanliness from as low as 28 cycles to 22,000 cycles in the larger systems. Oil Walnut hand crafted cabinetry. Some models available unfinished. Complete Music Wall "Playmate" Systems available in Oil Walnut and Burma Teak. Price Range \$26.95 to \$310.00. Write for complete details on all models. Over 350 Dealers in U. S. Alone

**FRAZIER**  
 INCORPORATED

2649 BRENNER DR. DALLAS 20, TEXAS

CIRCLE 85





**PORTABLE...  
PRECISION-MADE!**

**NEW BUTOBA model MT-7F**



Lowest priced modern, battery operated, transistorized portable of superb quality — ideal for music or speech. Built-in remote control facility . . . stop-start switching on the microphone for dictation in the office or car!

**SPECIFICATIONS:**

Records 2 full hours • Power supply: rechargeable battery, or 6/12 V car battery, or AC converter • Push buttons enable easy operation while in carrying case • Safety record lock • Microphone and Radio Phono inputs • Headphones/external speaker connections • Pause control • 3 $\frac{3}{4}$  and 1 $\frac{7}{8}$  ips. • Frequency response: 100-12,000 cycles at 3 $\frac{3}{4}$  ips. • Recording level indicator • 4" x 6" heavy duty loudspeaker • Transistorized speed regulator.

**BUTOBA model MT-5**



**BUTOBA** is a precision tape recorder, quality-engineered and hand-crafted by skilled West German technicians, offering performance and features never before found in portable recorders! **New Reduced Price!**

**UNEQUALLED FEATURES:**

6 hrs. recording on 5 inch reels • Fast forward and rewind • 2 motors with transistorized electronic speed control • tone control • push-pull amplifier • 5" x 7" heavy duty speaker • Tape counter • 40 hrs. on 8 ordinary flashlight batteries • Transistorized, battery or AC.

**SPECIFICATIONS:**

Response: 50-13,000 cps. @ 3 $\frac{3}{4}$  ips., 60-6,000 cps. @ 1 $\frac{7}{8}$  ips. • Half track • Compact • Lightweight • With dynamic mike • Full line of accessories.

**BOOKLET FREE!**  
"25 WAYS TO USE YOUR TAPE RECORDER" and color folder. Yours for the asking. Write...  
**STANFORD INTERNATIONAL**  
569 Laurel Street • San Carlos, Calif.  
Telephone: 591-0339

CIRCLE 59

Dynetic differs from the earlier model mainly in that the cartridge is stereo; the arm itself is virtually identical.

For those who are not familiar with this arm, it can be described as a balance beam mounted on a tapered U-beam. Confused? Let us try to clarify that a bit. The cartridge is mounted on one end of a round shaft several inches long. At the other end of the shaft is a counterweight consisting of an internally threaded sleeve which screws onto the shaft, in or out to balance the cartridge (or unbalance). Toward the center of the shaft there is a cross-shaft which rides in jewel bearings (the cross-shaft is that bump to the rear of the cartridge). Thus we have a balance beam, which is unbalanced by the counterweight to apply the desired tracking force.

But balance beams move vertically only, what about horizontal motion? The remainder of the arm supplies horizontal motion, pivoting about the shaft seen toward the rear of the arm. That bearing is a jewel too.

Thus the major portion of the arm moves horizontally only, and a balance beam a few inches long does all the vertical movement.

How is the cartridge raised and lowered? Simple, press the plastic button on top of the arm and it raises the cartridge as long as it is pressed (it pushes down on the counterweight). Cute.

The main arm is also counterweighted, for obvious reasons, and this counterweight is dynamically damped to roll off response below 20 cps.


By the way, that shaft toward the center and on the outer side is the arm rest. The arm is magnetically attracted to it.

The cartridge employs the moving-magnet principle (Shure holds the patent for that principle) with an easily-replaceable stylus. Its balanced design makes it rather impervious to hum pickup. The stylus-tip radius is 0.5-mil for the M22D cartridge supplied. An advantage of this system is that the arm will accept the M1 (monophonic) cartridge for those who prefer to use a mono cartridge to play mono records. Compliance of the cartridge is quite high, being in the order of  $20 \times 10^{-6}$  cm per dyne.

We found that the M222 tracks quite well at a force of 1.2 grams. Output at 1000 cps and at 5 cm/sec. was 4.2 mv. Frequency response, using the CBS Labs STR-100 test record and a 47k load, was within 2 db from 20-20,000 cps. The response curve was relatively flat out to 6000 cps where it took a 1.5-db dip which started to rise again at 10,000 cps and continued up to a 2.5-db bump. at 15,000 cps. Channel separation was 24 db at 1000 cps, closing up to 6 db at 15,000 cps.

In use, the Shure Stereo Studio Dynetic provided good sound quality, especially in the bass frequencies. Its handling of transients is quite good. An excellent arm-cartridge combination. **M-5**

**COUGH  
COUGH  
COUGH TOO MUCH?  
SHORT OF BREATH?  
BREATHER?  
EITHER?**

You may have a Respiratory Disease. Don't take chances. See your doctor, says your local  Christmas Seal organization.



**WHY ALTEC DROPPED "HI FI" IN FAVOR OF "PLAYBACK"**

There was a time when the term "hi fi" commanded an awed respect; but today its application can be virtually meaningless. So misleading, in fact, that the Federal Trade Commission is attempting to establish a binding definition of "high fidelity"—one on which the FTC can issue a ruling that will protect the buying public against the increasing horde of inferior products that are being advertised as "hi fi."

But a simple, workable definition that would adequately classify truly dedicated high fidelity components is not easy to come by. On request, the EIA composed a definition which was so loose that we understand the FTC found it entirely unacceptable and have now turned to other industry bodies for suggestions in the hopes that someone can come up with an industry solution that can be used to clearly identify those products that are capable of music reproduction above the ordinary.

**WHAT'S THE ANSWER?**

For Altec, the solution was so obvious we're rather embarrassed that we hadn't thought of it before. We simply dropped "hi fi" and replaced it with the original generic term for all Altec recording studio equipment... **PLAYBACK**.

**PLAYBACK** is the one definition that cannot be compromised or falsely exploited. For **PLAYBACK** is the term used in the recording industry to designate the studio sound reproducing equipment relied on by conductors, performing artists and recording engineers to accurately compare the realism of a recording with the live rendition.

Only *genuine* **PLAYBACK** components have been able to meet or surpass these critical demands.

**THE ASSURANCE OF PROFESSIONAL ACCEPTANCE**

Since the beginning of modern sound reproduction, **PLAYBACK** has been directly associated with Altec Lansing. For Altec, and only Altec, sells 80% of its products to the professional usage market. This is your assurance that any Altec component you choose for your home is of genuine studio **PLAYBACK** quality. You need only ask yourself this: Who should be better judge of audio components than the user whose living depends on them?

The more you think about it, the more you'll appreciate why Altec dropped the term "high fidelity" and has returned to its original genre. "Hi fi" is a matter of personal interpretation. **PLAYBACK** is a matter of *fact*.

*Altec Lansing Corporation  
Anaheim, California*

© 1963 ALC

CIRCLE 71

“...major  
step  
forward”



## ACOUSTECH SOLID STATE AMPLIFYING SYSTEM

“... better than the best\*\* ...”  
“... seems to ‘grab hold of’ and control a speaker to a degree that has led many listeners to remark that the speaker itself ‘never sounded better.’\*\* ... the finest square wave response I have ever observed\*\* ...”

These are examples of the acclaim accorded the Acoustech I Solid State Stereo Power Amplifier since its introduction at the 1962 New York High Fidelity Show. Now the first “all-out” solid state amplifying system is made possible with the new Acoustech II Stereo Decade Control Center. These two units afford the listener a new standard in music reproduction and reliability possible only with solid state circuitry throughout.

For full information on these remarkable instruments, send coupon below.

Acoustech I \$395, Acoustech II \$348 (slightly higher west of Rockies)

\*High Fidelity Magazine, August, 1962  
\*\*HiFi/Stereo Review, February, 1963



ACOUSTECH, Inc., 139 Main St.  
Cambridge, Mass. 02142 Dept. A-12.

Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_

CIRCLE 60

## SOUND SYSTEMS

(from page 23)

system must obviously provide an excellent match between the sound system and the auditorium. However, if such a system is to be used properly, a near perfect match is also required between the sound system and the operator. Touring shows will come into an auditorium such as the Fisher Theatre in Detroit, the Bushnell Auditorium in Hartford, or the Jacksonville Municipal Auditorium and remain for varying periods, from one day to several weeks. There will hardly ever be a rehearsal before opening night, and the sound-system operator must solve any “problems” on the spot. Also the reviews obtained by the show will be entirely on the basis of the first night performance, and everything must be right that first night.

When shows appear at theaters or auditoriums which have sound systems relatively well matched to their acoustical properties, the management of these theaters usually require, as a minimum, that the house reinforcement loudspeakers be used, and *not* the touring sound system loudspeakers. The output of the touring show’s control “rack” is then patched via microphone lines to the sound-system’s power amplifiers, and the results can be quite satisfactory.

Even better, and with increasing frequency, shows appearing at houses with really fine sound systems use the complete house sound-reinforcement system, sometimes even for sound-effects reproduction.

A control console for a well designed house reinforcement system should follow the guides in this article. Either a standard broadcast-type console or one employing slide-type attenuators would be applicable. Æ

## THIS MONTH'S COVER

This month we have a cover installation which was supplied to us by Dick Levy of Seneca Audio-Visual in Buffalo, N. Y. This installation is in the home of A. Frank Cowen, Jr., 83 Woodbury Drive, Eggertsville, N. Y.

The equipment installed in Mr. Cowen’s system includes a Fisher 40-watt stereo amplifier and AM-FM tuner. The speakers include a pair of Electro-Voice SP-12 low-frequency reproducers plus a pair of electrostatics for the high frequencies. The turntable and arm are Weathers. The cabinetry was custom-made by a local firm, Auburn-Watson, Co.

## STARTLING PERFORMANCE

Hit of the  
New York  
Hi-Fi Show

## The New KSC Speaker System



“The KSC-1 is easily the finest speaker in its price class I have heard”... Larry Zide, American Record Guide, Sept. 1963.

Hundreds of music lovers who already own these remarkable speaker systems are unanimous in their comment... “Simply Overwhelming!” They’re referring to the startling realistic reproduction — smooth from 30 to 20,000 cps, absence of distortion, superb quality, and the surprising low price ■ Compares with the best you’ve ever heard anywhere ■ Three magnificent speaker units from SEAS of Norway, skillfully blended, plus ingenious cabinet design produce extraordinary sound quality that is a delight to hear ■ Perfect for use in finest monaural or stereo installations. We invite your comparison ■ Size: 12”Wx12½”Dx20”H — fit any standard cabinet. Oiled walnut, many other finishes ■ Listen at these fine studios or write for literature and name of nearest distributor.

AIREX, N.Y.C. • HARVEY RADIO, N.Y.C. • SAM GOODY, all stores • INT’L. HOME FURNISHINGS, N.Y.C. RESCO, Phila. • HI-FI SHOP, Balt.

Also Compare Our Sensational New  
KSC-55 Low Cost Hi-Fi System

**KSC SYSTEMS, INC.**  
P.O. Box 303A, Knickerbocker Sta., N. Y. 2, N. Y.  
CIRCLE 72

## PURCHASING A HI-FI SYSTEM?

TRADE-INS OK—TIME PAYMENTS  
Up to 2 years to pay!

Send Us  
Your List Of  
Components  
For A  
Package  
Quotation

**AIREX  
WON'T BE  
UNDERSOLD**

All merchandise is  
brand new, factory  
fresh & guaranteed.

Visit our N. Y. Showroom  
Free cabinet brochure  
& hi fi catalog

**AIREX  
RADIO  
CORPORATION**

85-AM Cortlandt St., N. Y. 7, WO 4-1820

CIRCLE 73

Jim Lansing\*  
Altec Lansing  
Electrovoice  
Jensen  
Harley\*  
University  
Acoustic Research  
Janszen • Leak\*  
Wharfedale  
USL Citizen Band  
Gonset • Hallcrafters  
Texas Crystals  
Concertone • Viking  
Bell • G.E.  
Weathers  
Harman-Kardon  
Eico • Pilot  
Sherwood\*  
ESL • Frazier  
Superscope  
Dual Changer  
Bogen • Leak  
Dynakit • Fisher  
H. H. Scott  
Finco • ECI  
DeWald • Roberts  
Sony • KSC Sp Sys\*  
Challenger  
Browning  
Garrard • Norelco  
Miracord  
General Radio  
Rak-O-Kut  
Components  
Tandberg\*  
Fairchild  
Pickering • Gray  
Audio Tape  
Magnecord\*  
Rockford Cabinets  
Artizan Cabinets  
\* Fair Traded



## AUDIO ETC

(from page 14)

either. But with the best will in the world you can't start tossing off atom-smashers like that with impunity. Somebody's likely to get confused. Millions of people.

There's a sure fire term for this sort of thing, invented long ago. Half-truths. As somebody said, too, a little bit of knowledge is a dangerous thing, or words to that effect. Nonsense is just fine—but half truths are worse than nonsense any day. Half truths, addled semi-sense, the sort of writing that Thimble's uses multiplied everywhere every day, is the bane of hi fi sense and the instigator of really dangerous confusion concerning the true values of our noble stereo.

Look back at Thimble's genial ad. So we all hear differently? Of course (and electronics did discover how to measure the same). From person to person, our response to sound waves varies within the normal spectrum, quite aside from the more extreme kinds of hearing losses and distortions that rank as abnormal. But does this imply that, like glasses and hearing aids, our stereo machines should be tailored to fit our individual pairs of ears, matched to our hearing characteristics?

Well, that's what Thimble's has practically said. It's right there, in so many unintended words.

Don't laugh too hard. It could be serious. What about the great Dynagroove controversy (and many an earlier one of similar purport)? Do we tailor our phonograph records for maximum effect on cheap machines? Or do we shoot for the one-and-only standard, true high fidelity? Do we match varying ears—or reproduce sound faithfully?

Thimble's has an idea there, if perhaps by sheer accident. Let's all take audition tests and then go out and build equalizers to match our personal hi fi equipment to our ears. Better than tone controls and much more expensive.

But what of Thimble's own stereos? There's more. Thimble's observes that some of us have \$149 ears and others have such "sensitive" members protruding from the

sides of our heads that no less than a \$1200 stereo can possibly fill our bill. Now just what is Thimble's saying here?

Is a \$149 pair of ears, maybe, immune to distorted highs and bumpy pseudo-bass? Well, maybe so. And do those \$1200 ears possess Extended Range and superior distortion-analyzers, built right in? Seems that way. Of course there's no mention whatever of musical taste, background, experience, preference, nor of our education or lack of the same in respect to good reproduced sound. These things do count—they count enormously. But let it pass: I fear that what Thimble's really meant by all this was a bit less inspiring. Some people have \$149 wallets, and to heck with their ears. Others, Thimble's optimistically hopes (and with reason), go around bulging with \$1200 bundles of green stuff, or equivalent in credit cards.

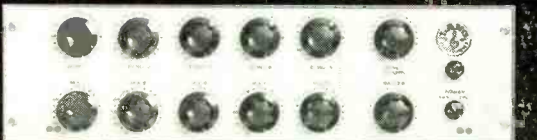
In which case, what Thimble's is really saying is that the poorer your wallet, the dopier are your ears, and the guy who carries all that lettuce is obviously equipped with "sensitive" listeners to match. After all, don't sensitive people buy Cadillacs? (Or Lincolns or Imperials—let's be fair, now.) Thus do we move from the preposterous to the ridiculous. And so, I say, come on now, Thimble's, are you trying to confuse the great American public? You sure are helping to.

What about that happy little 2 per cent figure? I'm wondering where that came from, and how Thimble's really might have pushed it around to make some better sense. If I'm right, the sleaziest \$19.95 hi fi can be made to measure "as low as" 2 per cent distortion, somewhere in its innards, if you turn down the volume to minimum perceptible power output and discount the loudspeaker and the phono cartridge. "As low as," my eye (and ear)! Nor is there any word from Thimble's man about the other and equally interesting extreme—"as high as." As high as 10 per cent? Very possible, at \$149.

And yet, you know, what I'm thinking is

(Continued on page 63)

## NEW! LANG COMPACT MIXER WITH EXCLUSIVE ECHO FEED AND RETURN



THE economical approach to most portable and console requirements, the new Lang Compact Mixer is ideal for use in any recording or broadcasting facility. The high gain, low noise Lang Compact Mixer has four low-level inputs and one high-level input with echo feed on each. In addition the Lang Compact Mixer has exclusive master gain control and echo

return. More and more the new Lang Compact Mixer is becoming the standard of quality for quality-conscious studios. Use one, two, or more units for multi-channel application.

Price less accessories: \$395.00

ACCESSORIES: Matching meter panel. 1, 2 or 3 Weston meters. Plug-in microphone and line transformer. Hammon reverb unit.

For complete details write

**LANG ELECTRONICS** INC. 507 FIFTH AVENUE  
New York 17, N. Y.

CIRCLE 74

# portable perfection for hi-fi fans



From Denmark comes this aristocrat of portables. Superb AM-FM-Shortwave performance with all the features you can imagine in a high quality portable: one full watt push-pull output and a 5" x 7" speaker, flywheel tuning with slide-rule dial, full range independent tone controls, pushbutton band selection, tuning meter and battery indicator, loudspeaker-earphone output and separate tuner output, plus plug-in connection for an auto antenna and accessory mounting bracket for over-the-road hi-fi.

Write for detailed specifications and test reports.

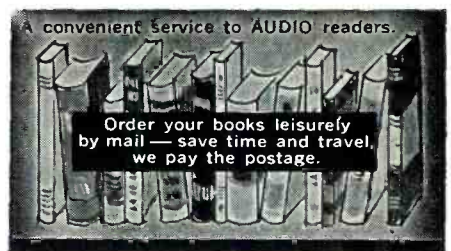
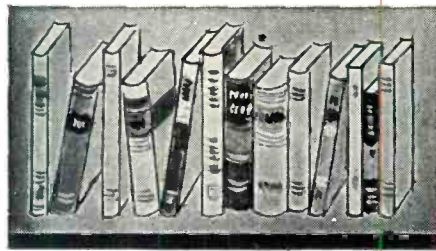


By appointment  
to the Royal Danish Court

# DYNACO

DYNACO, INC.  
3912 Powelton Ave., Phila. 4, Pa.


CIRCLE 61



**Maintaining Hi-Fi Equipment**  
Joseph Marshall

A valuable reference for anyone whose living or hobby is servicing hi-fi equipment. Outlines the professional approach for servicing all types of hi-fi components. Covers trouble-shooting of electronic, mechanical and acoustic problems. 224 pages.

**No. 58 Paperback \$2.90\***



**Designing and Building Hi-Fi Furniture**  
Jeff Markel

Written by a professional hi-fi furniture designer who has taught furniture design at leading colleges, this book is an authentic reference of value to the hi-fi fan and professional custom builder. Covers everything from types of woods to furniture finishing for the mechanically adept; design principles, styles and arrangements for the decor minded. 224 pages.

**No. 79 Paperback \$2.90\***




**"The AUDIO Cyclopedia"**  
Howard M. Tremaine

- 1280 pages
- 3400 topics
- 1600 illustrations

Here is one single volume with the most comprehensive coverage of every phase of audio. Concise, accurate explanations of all audio and hi-fi subjects. More than 7 years in preparation—the most authoritative encyclopedic work with a unique quick reference system for instant answers to any question. A vital complete reference book for every audio engineer, technician, and serious audiophile.


**No. 123 \$19.95\***



**McProud High Fidelity Omnibook**

Prepared and edited by C. G. McProud, publisher of Audio and noted authority and pioneer in the field of high fidelity. Contains a wealth of ideas, how to's, what to's, and when to's, written so plainly that both engineer and layman can appreciate its valuable content. Covers planning, problems with decoration, cabinets and building hi-fi furniture. A perfect guide.


**No. 115 \$2.50\***



**Handbook of Sound Reproduction**  
Edgar M. Villchur

Right up to date, a complete course on sound reproduction. Covers everything from the basic elements to individual chapters of each of the important components of a high fidelity system.

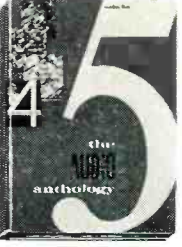
**No. 110 \$3.75\***



**The 5th AUDIO Anthology**

Edited by C. G. McProud, publisher of AUDIO. An anthology of the most significant articles covering: stereo recording and reproduction; stereo multiplex; measurements; stereo technology, construction and theory — which appeared in AUDIO during 1958 and 1959. The 5th is truly a collectors' item and a valuable reference for the professional engineer, teacher, student, hobbyist and hi-fi fan. 144 pages.


**No. 125 \$3.50**



**Tape Recorders and Tape Recording**  
Harold D. Weiler

A complete book on home recording by the author of *High Fidelity Simplified*. Easy to read and learn the techniques required for professional results with home recorders. Covers room acoustics, microphone techniques, sound effects, editing and splicing, etc. Invaluable to recording enthusiasts.


**No. 112 Paper Cover \$2.95\***



**"the best of AUDIO" —**  
edited by C. G. McProud

A new compendium of AUDIO knowledge. Here is a collection of the best of AUDIO — The AUDIO Clinic by Joseph Giovanelli . . . noted audio engineer and the original high fidelity answer-man — EQUIPMENT PROFILES edited by C. G. McProud . . . Editor of AUDIO. Here is a wealth of hi-fi and audio information. Answers to the most important issues in high fidelity and a valuable reference.

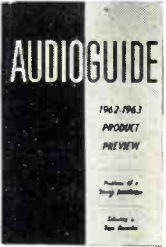
**No. 124 Volume I \$2.00\***



**AUDIOGUIDE**

By the editors of AUDIO, the original magazine about high fidelity. A 1962-1963 product review of stereo high fidelity components. Valuable reference for the high fidelity enthusiast and hobbyist. Part I contains a thorough discussion of the *Problems of a Stereo Installation*; Part II is a complete treatise on *Selecting a Tape Recorder*. Indispensable to the prospective buyer of stereo components and tape recorders. Includes a section on where to buy various stereo hi-fi components and accessories. 156 pages.

**No. 127 \$1.00**



**MONTHLY SPECIAL! SAVE \$5.25**

Save over 45% with this collection of AUDIO Books.  
Handbook of Sound Reproduction (\$3.75) "best of AUDIO" (\$2.00)  
McProud High Fidelity Omnibook (\$2.50)  
Tape Recorders & Tape Recording (\$2.95)

**TOTAL VALUE OF ALL FOUR BOOKS \$11.20**  
**Your cost ONLY \$5.95 POSTPAID**

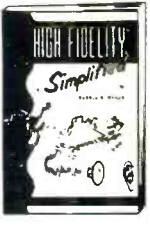
This offer expires December 31, 1963. Good only on direct order to Publisher  
**CIRCLE OS300**

**High Fidelity Simplified**  
Harold D. Weiler

**3rd Edition**

The complete hi-fi story — answers all questions about tuners, changers, amplifiers, tape recorders, speakers, record players, etc. Lots of ideas for custom installations. Tells how to achieve concert hall reception in your home. 216 pages.

**No. 142 \$3.30**



**AUDIO Bookshelf — RADIO MAGAZINES, INC.** \*All U.S.A. and CANADIAN orders shipped postpaid.  
P. O. Box 629, Mineola, New York 11502

Please send me the books I have circled below. I am enclosing the full remittance of \$..... (No C.O.D. or billing.)

58	79	110	112	115	123
124	125	127	142	251	OS300

NAME \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

**Getting The Most Out Of Your Tape Recorder**  
Herman Burstein

Written in "plain talk" for the man who has, or wishes to buy, a tape recorder. It answers the myriad questions raised by tape recording enthusiasts. Its chapters cover every phase of operation and maintenance—from adding a tape recorder to the hi-fi system, to a thorough dissertation on microphones. Lots of practical information on how to buy. 176 pages.

**No. 251 \$4.25**





## build your own bozak



URBAN OR EARLY AMERICAN  
INFINITE-BAFFLE SPEAKER CABINETS

Complete kits ready for assembly, and finishing to your taste. For the Bozak 2-way B-300 and 3-way B-302A Systems. See your Bozak Dealer, or write Bozak.

*Bozak*

DARIEN, CONN.  
06821

CIRCLE 75

**SEE  
YOUR  
COSTS  
SHRINK  
WITH KEY  
DISCOUNTS**

Prove it for yourself! Rush us your list of stereo hi-fi components for an immediate price-busting quotation.

- Enjoy these advantages:
- LOWEST PRICES
  - SPEEDY DELIVERY
  - FACTORY WARRANTY
  - EASY PAYMENT PLAN

For a real eye-opener, send for our valuable money-saving audio discount catalog A-17, featuring the latest in stereo equipment.



**KEY ELECTRONICS CO.**  
120 Liberty St., N. Y. 6, N. Y.

CIRCLE 76

(from page 61)

that Thimble's may actually be trying to say the right thing, honestly—for that \$1200 machine surely can measure up to some respectable distortion figures. Now why not give legitimate specs, and reap some legitimate credit?

Along with all this, Thimble's has tossed in some additional blockbusters about stereo itself—they had to tell what stereo is, after all. "The basic idea of stereo, of course," said the ad, "is to reproduce in your own home the kind of sound you hear in a concert hall." OK, OK—that's a safe-and-sound observation that we have heard before, even if I do, myself, happen to disagree heartily with it. (See above.)

"That full, rounded living sound is created because sound comes to you from left and right—and what your left ear hears is different from what your right ear hears. Stereo separates these left and right sounds for you in your own home."

Half-truth again! Stop! Sound comes to you from left and right, all right, and also from above and behind and sometimes down below, not to mention from straight ahead. And what your right ear hears is, indeed, different from what the other one hears. BUT please, Thimble's, stereo reproduction doesn't separate these sounds in your home—it brings them together. Look, Mr. Thimble's man, do you realize what you're getting us into here?

"Concert hall sounds" are partially, and significantly, separated by the mikes and recording machines at the sound-source. Yes. And this partial separation is, indeed, maintained all the way into the home living room, if with some degradation in the two-way stereo record groove and probably some more in the stereo cartridge. But there, I remind you, the separation ends. The home loudspeakers bring together the separated sounds for us, to create the over-all and single stereo sound.

Dear me, if a few more people (including Thimble's) could get that idea through their heads, we might have less of all this preposterous ping-pong stuff.

Things like this are insidious. Multiply Thimble's inoffensive little explanation by the inevitable million and you get a sea of confusion, among people who ought by this time to have learned at least the simple sense about stereo's values. Instead, they get more devastatingly confused every day. It's bad, and I mean it. A few million more half-truths, innocent or no, and we'll reach such an impasse that stereo—and hi fi too—will be talked straight out of existence. If you're going to make any dollars at all in this business, you'll have to make ~~ten~~ first.

### Stereo, or Hi-Fi?

Wanta see what I mean? Well, now that I've quoted you a sample of the output, one source out of millions for public confusion, let me toss at you a piece of the end-product, right from a befuddled consumer.

This is a genuine, unrehearsed letter, and don't think it isn't typical of many more that all of us supposed "experts" get, not to mention phone calls and amiable conversations at dinner parties, hi fi shows and all over the place.

This correspondent has been reading all sorts of publicity, that's for sure. Especially, the optimistic publicity that, because advertising can never say a negative thing, has avoided the objectionable yet reasonably accurate "mono" in favor of a happy but dangerously meaningless superlative, "hi fi." Oh no—of course, nobody meant to suggest that a stereo disc isn't a hi fi disc, though it has to be admitted that a hi fi disc isn't always stereo. But because of the implied confusion in these two overlapping terms, the general consumer is now so utterly mixed up about the difference "be-

# the most noise-free recordings you have ever heard



will be made on the new all-transistorized Norelco Continental '401' Stereo Tape Recorder, the only recorder using the newly developed AC107 transistors in its two preamplifiers. The AC107 is the only transistor specifically designed for magnetic tape head preamplifiers utilizing specially purified germanium to achieve the extraordinary low noise figure of 3 db, measured over the entire audio band (rather than the usual single frequency). This noise figure remains stable over large collector-emitter voltage swings and despite large variations in source resistance.

Hear the new transistorized Norelco Continental '401' • 4-track stereo/mono record and playback • 4 speeds: 7½, 3¾, 1½ and the new 4th speed of ¼ ips which provides 32 hours of recording on a single 7" reel • fully self-contained with dynamic stereo microphone, two speakers (one in the removable cover for stereo separation), dual preamps and dual recording and playback amplifiers • self-contained PA system • mixing facilities • can also play through external hi-fi system • multiplay facilities.

**Specifications:** Frequency response: 60-16,000 cps at 7½ ips. Head gap: 0.00012". Signal-to-noise ratio: better than -48 db. Wow and flutter: less than 0.14% at 7½ ips. Recording level indicator: one-meter type. Program indicator: built-in, 4-digit adjustable. Inputs: for stereo microphone (1 two-channel); for phono, radio or tuner (2). Foot pedal facilities (1). Outputs: for external speakers (2), for external amplifiers (1 two-channel); headphone (1). Recording standby. Transistor complement: AC 107 (4), OC75 (6), OC74 (2), OC44 (2), 2N1314 (2), OC79 (1). Line voltage: 117 volts AC at 60 cycles. Power consumption: 65 watts. Dimensions: 18½" x 15" x 10". Weight: 38 lbs. Accessories: Monitoring headset and dual microphone adapter.

For a pleasant demonstration, visit your favorite hi-fi dealer or camera shop. Write for Brochure A12. North American Philips Company, Inc., High Fidelity Products Division, 100 East 42nd Street, New York 17, New York.

*Norelco*

CIRCLE 63

# AR INC. books et al

## HIGH FIDELITY SYSTEMS—

A User's Guide by Roy F. Allison

AR Library Vol. 1 70 pp., illus., paper \$1.00

A layman's practical guide to high fidelity installation. We think that it will become a classic work for novices (and perhaps be consulted secretly by professionals). From the Bergen Evening Record: "completely basic . . . If this doesn't give you a roadmap into the field of hi-fi, nothing will." From The American Record Guide: "really expert guidance . . . I would strongly urge this book as prerequisite reading for anyone contemplating hi-fi purchases." From High Fidelity: "welcome addition to the small but growing body of serious literature on home music systems." From Electronics Illustrated: "To my mind, this is the best basic book now available on high fidelity."

## REPRODUCTION OF SOUND

by Edgar Villchur

AR Library Vol. 2 93 pp., illus., paper \$2.00

Vol. 2 explains how components work rather than how to use them, but it presupposes no technical or mathematical background. Martin Mayer writes in Esquire: "far and away the best introduction to the subject ever written—literate, intelligent and, of course, immensely knowledgeable." From HiFi/Stereo Review: "just the books to satisfy that intellectual itch for deeper understanding."

## RADIO MAGAZINES, INC.

P. O. Box 629, Mineola, N. Y.

Please send me the following:

Roy Allison's "High Fidelity Systems—A User's Guide" at \$1

Edgar Villchur's "Reproduction of Sound" at \$2

I enclose \$\_\_\_\_\_ in bills, money order, or check only. (All prices postpaid.)

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

tween" hi fi and stereo that it's going to take years—or the final abolition of the mono recording—to untangle the mess. Just look at it and weep. So silly.

Here's a perfectly sane, intelligent man, listening to a "highbrow" musical radio program (my own) and writing me to ask—

"In your opinion which is the better recording, high fidelity or stereo?"

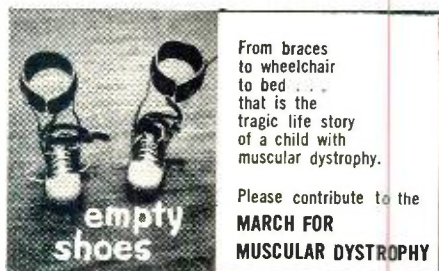
"I personally am not sold on stereo. It seems to me stereo gives off a squeaky sound, not a true sound, whereas high fidelity is more true. I may be wrong. I would like your opinion.

"My player is Stereo-High Fidelity so I can play both types, but for the life of me I can't reconcile myself to pay one dollar more for stereo records when I can get better sound—so it seems to me—in high fidelity.

"I would appreciate a reply. Thank you."

Now I ask you, how would you like to untangle this dismally confused customer?

Don't go telling me, well, he's just one of those nuts. He is not. He's just one of those guys that reads the advertisements. **Æ**



From braces to wheelchair to bed . . . that is the tragic life story of a child with muscular dystrophy.

Please contribute to the **MARCH FOR MUSCULAR DYSTROPHY**

## ADVANCE ORDERS

## BOUND VOLUMES

1963 Issues  
Audio Magazine

Order Now\*

LIMITED NUMBER  
AVAILABLE

\$10.00 EACH POSTPAID  
U. S. DELIVERY ONLY

Send Order  
and Remittance Today

Book Division  
Radio Magazines, Inc.

P.O. Box 629  
Mineola, N. Y.

\*Delivery January 15, 1964

## CLASSIFIED

Rates: 10¢ per word per insertion for noncommercial advertisements; 25¢ per word for commercial advertisements. Rates are net, and no discounts will be allowed. Copy must be accompanied by remittance in full, and must reach the New York office by the first of the month preceding the date of issue.

HIGH FIDELITY SPEAKERS REPAIRED  
AMPRITE SPEAKER SERVICE  
168 W. 23rd St. New York 11, N. Y.  
CH 3-4812

ENJOY PLEASANT SURPRISES? Then write us before you purchase any hi-fi. You'll be glad you did. Unusual savings. Key Electronics, 120 Liberty St., New York 6, N. Y. CLOverdale 8-4288.

SALE ITEMS—tapes—package quotes. Bayla, Box 1131-O, Wantagh, N. Y.

MILITARY DISCOUNT—name brands. Free recording tape and stereo handbook. Include rank, serial number. Electronics International, Inc., Box 3066, Charlottesville, Virginia.

WRITE FOR lowest quotations, components, recorders. No catalogs. HI-FIDELITY SUPPLY, 2817-BC Third, New York 55, N. Y.

HI-FI COMPONENTS, tape recorders at guaranteed "We Will Not Be Undersold" prices. All brands in stock. 15-day money-back guarantee. 2-year warranty. Write your requirements for quotation. No catalog. Hi-Fidelity Center, 1797-V 1st Ave., New York 28, N. Y.

## RENNWALD FULL-RANGE ELECTROSTATIC

Perforated electrode 45" by 5 3/4", \$5.68; Set of 8 spacers (one speaker), \$1.35; Special membrane for speaker, \$1.95 per yard; Complete speaker element ready to connect (less enclosure), \$37.85. Write for improved constructional data and hints. Rolf Rennwald, Anlage 11, Heidelberg, Germany.

MAY WE GIVE YOU our quote on your HI-FI requirements? You'll be pleasantly surprised that what you had in mind won't cost as much as you thought. We carry all brands in stock. Components are new and fully guaranteed. Ask to be put on our mailing list for special bargains. Crown Electronics Corp., 64 Cortlandt St., New York 7, N. Y. (212) WO 4-0790.

HARPSICHORD. Same as owned by Philadelphia Orchestra and RCA Victor. In kit form for home workshop assembly, \$150. Clavichord kit, \$100. Free brochure. Write: Zuckermann Harpsichords, Dept. R, 115 Christopher St., New York 14, N. Y.

WANTED: Blonder-Tongue Audio Baton, any condition. State price. Benjamin Hall, Box 934, Edgartown, Mass.

STEREO TAPES. 50% off. Send for free literature. P. O. Box 3603, Wichita, Kansas.

AUDIO CABLE. 3 ft. with phono plug each end. 2 for \$1. pp. Surplus Sy, 71 Corbin Pl., Brooklyn 35, N. Y.

WANTED: Used condenser microphones in good condition. John J. McBride, 1204 Ipswich Dr., Wilmington, Delaware 19808.

QUAD FULL-RANGE ELECTROSTATIC. Excellent condition. \$175. G. W. Olsen, HS-11, FPO, New York, New York.

1961 Ampex 601-2 stereo recorder with accessories. Charles Goodman, 10 Woolson St., Mattapan, Mass. 02126.

NEW IN SOUND FOR "64": Full fidelity loudspeaker systems. Brochure. Island Associated Industries, 1261 Staley Rd., Grand Island, N. Y.

DELTA STUDIO MONITORS. Demonstration pair, \$130. Box 64, Laguna Beach, Calif.

WANTED: Marantz Model 3 electronic crossover. G. W. Riley, P. O. Box 775, DeBary, Fla.



## SAVE OVER 40% ON HI-FI

USE OUR EASY-PAY-PLAN UP TO 24 MONTHS TO PAY  
Don't Buy Hi-Fi-Components

- Tape Recorders or Electronic Equipment until you get return mail quotation from "your friend in the business."
- Trade-Ins—Highest Allowance—Send us your list.
  - 15 day money-back guarantee.
  - Full 2 year-warranty—parts & labor.
  - We are factory franchised all lines. We ship from stock.
  - 18th year of dependable & reliable service throughout the world.
  - We guarantee "We Will Not Be Undersold."
  - Call us at (212) EN-9-3700 from any part of USA. You may deduct 3 minute toll charge if your order is in excess of \$100.00.

BEST BUY HI-FI LIST FREE



Send 10¢ for stereo tape catalog—All labels. Save up to 33-1/3%.  
1797-U First Ave.  
N. Y. 28, N. Y.

CIRCLE 77

**AUDIO unlimited, inc.**

Specializes in **SAVING YOU MONEY**

- FACTORY FRESH COMPONENTS
- LOWEST POSSIBLE QUOTATIONS
- FAST DELIVERY
- TIME PAYMENTS UP TO 36 MOS.

We are FRANCHISED by OVER 50 NATIONALLY FAMOUS MANUFACTURERS. WRITE FOR BARGAIN LIST.

715A 2nd Ave., (Nr. 38th)  
New York 16, New York

Visit Our Warehouse

CIRCLE 78

**FAST SHIPMENTS**  
RECORDERS • TAPES

COMPONENTS • KITS

- BEST-BY-COMPARISON PRICES
- FACTORY SEALED CARTONS
- SEND FOR "QUOTE" ON PACKAGE DEALS AND SAVE MORE
- WRITE FOR MONTHLY SPECIALS

**CARSTON Studios**

125-A East 88 St., New York 28, N. Y.

CIRCLE 79

LONDON CALLING THE WORLD . . .  
KEEP HI-FI COSTS LOW — buy BRITISH EQUIPMENT from the United Kingdom Mail Order Specialists!

- AMPLIFIERS • MOTORS • TUNERS
- SPEAKERS • PICK-UPS

All goods Packed, Insured and Shipped promptly at minimum cost. Send \$1 bill for catalogue (refundable against first purchase)

C. C. GOODWIN (Sales) Ltd. (Dept. A)  
7, The Broadway, Wood Green, London N.22. ENG.

CIRCLE 80

CANADA  
High Fidelity Equipment

Complete Lines • Complete Service

Hi-Fi Records — Components and Accessories

**ELECTRO-VOICE SOUND SYSTEMS**

126 DUNDAS ST. WEST. TORONTO. CANADA

CIRCLE 81

## Industry Notes . . .

• **University's New One-Million Dollar Plant Dedicated.** Haskel A. Blair, president of University Loudspeakers, received the keys to University's new manufacturing plant in Oklahoma City. The dedication ceremonies culminated three years of planning and a 1500 mile move from White Plains, New York. Mayor Jack S. Wilkes, of Oklahoma City, presented the national and state colors to Mr. Robert McCulloch, Chairman of the Board of Ling-Temco-Vought, (University is a division of Ling-Temco-Vought). The keys were presented to Mr. Blair by Paul Strasbaugh, Secretary of the Oklahoma City Chamber of Commerce. After the ceremonies, over 150 guests were given tours of the new facility. Production was shut down in New York on June 30th and resumed on July 5th in Oklahoma City. The move was so well planned and executed, virtually no shipping delays were encountered. The precision of the move was made possible with the aid of the PERT computerized scheduling services, made available by University's parent company.

• **Roof Raised at Scott.** The recently announced addition to the H. H. Scott plant in Maynard, Mass. has reached the stage of construction wherein the roof has been placed over the steel structure. When last seen, the construction resembled a huge swimming pool with a roof. An important construction official (wheelbarrow foreman) opined that the structure would be complete within three months if it didn't get too cold, or rain, or snow. Mr. Scott noted that the new structure would more than double existing plant space.

SUPPORT YOUR MENTAL HEALTH ASSOCIATION

free information on the world's happiest hobby!

ASSEMBLE IT AT HOME

THE **Artisan**

ELECTRONIC ORGAN KITS  
for home, school, church, clubs.

The Original "Build-it-Yourself" Organ sounds like a glorious pipe organ

SAVE 70% up to

Anyone Can Do It! Here's What You Get

Manuals & Couplers, Tone Generator, Tone Changers, Pedal Keyboards, Consoles

Mail coupon below, and receive . . . absolutely FREE . . . complete information on Artisan's new 1963 Organ-Building Kit! Illustrated instructions lead you through every step of this happy hobby, as you assemble at-home a magnificent custom Artisan electronic organ — the best in tone and styling! No technical skill required, and you save up to 70% of comparable ready-built organ costs by skipping dealer profits and factory labor! You can play as you build and pay as you build. From \$1750 to \$7500. Write today!

ARTISAN ORGANS 2476 "A" N. Lake Ave., Altadena, Calif.

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_

CIRCLE 87



## MICROMINIATURE CONDENSER PML MICROPHONES

It is an accepted fact that practically every sound studio employs condenser microphones. Expensive? . . . definitely — but optimum results are important!

NOW THERE'S PML! . . . condenser microphones . . . studio quality . . . COST? . . . about 1/3 that of comparable condenser microphones.

If you are a professional or serious recordist, listen to the amazing difference a PML can make in your recordings. PML microminiature condenser microphones are precision engineered to give you smooth, sensitive, natural response — essentially linear from below 30 c/s to above 18 kc/s. They're available in cardioid or omni-directional patterns with AC or Battery Operated Power Supplies. Four impedances to selection is offered with both types.

A Leading Sound Studio states: "Even though they are miniature microphones they feature a frequency response from 20-20,000 c/s and have proven themselves as a valuable asset. They most definitely compare quite favorably with their "big brother" imports on the market today costing over 3x as much."

Professional Net Prices:

PML Microphone Model EK61 (omni-directional)	\$ 99.50
PML Microphone Model EC61 (cardioid)	109.50
PML Power Supply Model #4315 (AC only)	49.50
PML Power Supply Model #4316 (Battery operated)	39.50

STUDIO QUALITY SOUND? . . . YOU'RE CLOSER WITH



Sold Only at Selected Sound Specialist or from:  
**ERCONA CORPORATION**  
432 PARK AVE. SO., NEW YORK 16, N. Y.

CIRCLE 65

# SUBJECT INDEX

## 1963

### AMPLIFIERS

Class D amplifiers; George Fletcher Cooper. **June 24**.  
Class D amplifiers—a closer look George Fletcher Cooper. **I, July 24 II, Aug 23**.  
Design of solid-state stereo power amplifier with silicon transistors; Marshall R. Myers, Jr. and Morley D. Kahn. **Jan 21**.  
High-quality transistorized stereo preamplifier; Erhard Aschinger. **III, Jan 35; IV, Feb 39; V, Mar 34**. (Began Nov. 1963)  
High-quality transistorized tape recorder amplifier; Lee Beeder. **May 17**.  
The matched load; George Fletcher Cooper. **Nov 30**.  
Remote control with light; William G. Dilley. **Nov 24**.  
This business of heat sinks; Ronald L. Ives. **Mar 26**.  
Transistorized stereo microphone mixer; Peter A. Stark. **Oct 19**.

### AUDIO CLUBS

Blueprint for an audio club; Charles R. Doty, Sr. **Mar 40**.

### BOOK REVIEW

Music, Acoustics, and Architecture; Leo L. Beranek. **Jan 4**.

### BROADCAST EQUIPMENT

The Auditioneer; John Whitacre. **Dec 24**.

### COLOR ORGANS

Wall-projection color organ; Morris Dolens. **I, Mar 19; II Apr 23**.

### CROSSOVERS

Crossover design; Norman H. Crowhurst. **I, Sept 26; II, Oct 26**.

### DISTORTION

Harmonic distortion—tests and measurements; Mannie Horowitz. **Oct 38**.

### EQUIPMENT PROFILES

Acoustic Research needle force gauge; **Jan 46**.  
Acoustic Research 2-speed turntable; **Apr 48**.  
Antronics electronic FM antenna, model MA-44; **Nov 56**.  
Audio Dynamics Model ADC-18 speaker system; **June 46**.  
Benjamin/Elac model 322 stereo cartridge; **July 42**.  
Dual automatic turntable, model 1009; **Nov 73**.  
Dynaco "Stereo 35" basic power amplifier; **Nov 52**.  
EICO Model ST97 FM-stereo tuner, ST70 stereo amplifier, ST84 stereo preamp; **Oct 48**.  
Empire record playing system, model 498; **Oct 46**.  
Fisher stereo receiver, model 500C; **Dec 44**.  
Fisher model SA1000 150-watt stereo power amplifier; **Sept 54**.  
Fisher model K1000 150-watt power amplifier kit; **Sept 54**.

Fisher XP4A loudspeaker system; **May 42**.

Freeman model 660 portable tape recorder; **Nov 52**.

Garrard automatic turntables—Model A, AT-6, Autoslim/P; **May 40**.

Harman-Kardon "Citation A" transistorized stereo preamp kit; **Apr 48**.

Heathkit transistorized stereo amplifier, model AA-21; **June 44**.

Heathkit transistor tester, model IM-30; **Dec 38**.

Heathkit (Thomas) transistorized electronic organ, model GD-232; **Oct 44**.

Kenwood AM, FM, and FM-stereo receiver, model KW-40; **Apr 46**.

Knight-Kit d.c. to 5-mc laboratory oscilloscope, model KG2000; **Sept 60**.

Knight-Kit stereo record/play tape recorder model KP-70; **May 38**.

Korting stereo tape recorder, model 3000; **Dec 38**.

Lafayette 200-watt transistorized stereo power amplifier, model LA-250; **Nov 54**.

Leak "Stereo 60" power amplifier; **Jan 42**.

Neat stereo tonearm model GA-17; **Jan 46**.

Neat stereo cartridge, model VS1000D; **Jan 44**.

Norelco "Continental 100" tape recorder; **Feb 50**.

Pickering stereo cartridges U38AT and U38ATG with "Safe V-Guard" styli; **Mar 54**.

Pilot FM-stereo tuner model 780; **May 42**.

Revere/3M stereo tape cartridge system, model M-2; **July 30**.

H. H. Scott FM-stereo tuner, model 350B; **July 30**.

H. H. Scott FM-stereo broadcast monitor tuner, model 4310; **Sept 55**.

Sennheiser condenser microphone, model MKH-104; **Oct 50**.

Sherwood FM-stereo tuner, model S3000V; **Dec 44**.

Shure Model M/99 series "Gard-A-Matic" stereo cartridges; **June 51**.

Shure Model M222 Studio Dynetic arm and cartridge; **Dec 59**.

Sony "Newscaster" tape recorder portable, model EM-1; **Feb 48**.

Tandberg tape recorder, model 64; **Mar 50; recheck, May 43**.

Tannoy 10" Dual Concentric "Monitor" loudspeaker; **Sept 56**.

Uher "8000 Royal" stereo tape recorder; **Sept 58**.

Weathers Universal tonearm, model MT-66; **June 45**.

### FANTASY

Knobs—the shame of it all; Don Nort. **Aug 24**.

### FM-STEREO

Alignment and adjustment of FM-stereo tuners and adapters; C. G. McProud. **Jan 26**.

FM-stereo reception; Jack Beaver. **Jan 19**.

FM-tuner characteristics and their relative importance; Daniel R. von Recklinghausen. **I, Aug 19; II, Sept 44**.

Mobile FM-stereo reception; North C. Ham. **Sept 21**.

Receivers with transistors plus tubes; William Cornell. **Feb 21**.

### GENERAL

The definition hassle—an approach to high fidelity standards; C. G. McProud. **Aug 25**.

Hi-Fi and Electronics in Japan; C. G. McProud. **Mar 41**.

### LAW

Knowledge and skills available upon re-employment; Albert Woodruff Gray. **May 34**.

### LOUDSPEAKERS

Crossover design; Norman H. Crowhurst. **I, Sept 26; II, Oct 26**.

Fresh approach to compact speakers; William Hecht. **Mar 30**.

Full-range electrostatic speaker; Rolf Rennwald. **June 17**.

Open baffle parallel-series array; R. S. Oakley, Jr. **Dec 30**.

### MEASUREMENTS

Checking frequency-compensating circuits; Mannie Horowitz. **May 26**.

Harmonic distortion—tests and measurements; Mannie Horowitz. **Oct 38**.

Testing amplifier response with an oscilloscope; Herbert Malamud. **June 34**.

### MICROPHONES

Professional condenser microphone; R. Williamson. **July 17**.

Transistorized stereo microphone mixer; Peter A. Stark. **Oct 19**.

### MUSICAL INSTRUMENTS

All-electronic method for tuning organs and pianos; A. M. Seybold. **I, Feb 28; II, May 20**.

Electronic simulation of organ sounds; Norman C. Pickering. **June 21**.

Organs and organ music; Winthrop S. Pike. **I, Oct 23; II, Nov 40**.

### NOISE

Suppressing noise in audio systems; Herman Burstein. **Nov 46**.

### PRODUCT PREVIEW SECTION

August issue.

### RECORDING, DISC

15-deg. vertical angle—a key to better stereo sound; B. B. Bauer. **Nov 21**.

78-rpm stereo test record; Allan R. Keskinen. **Apr 32**.

Vertical tracking distortion in practice; Duane H. Cooper. **Sept 40**.

Vertical tracking improvements in stereo recording; B. B. Bauer. **Feb 19**.

### RECORDING, MAGNETIC

High-quality transistorized tape recorder amplifier; Lee Beeder. **May 17**.

### REMOTE CONTROL

Remote control with light; William G. Dilley. **Nov 24**.



## SOUND REINFORCEMENT

Controlling sound-reinforcement systems; David L. Klepper. **Dec 19.**  
Sound reinforcement at Philharmonic Hall; David Saslaw. **Apr 38.**  
Sound reinforcement at the Ziegfeld; George Schimmel. **July 21.**

## TEST EQUIPMENT

Alignment and adjustment of FM-stereo tuners and adapters; C. G. McProud. **Jan 26.**  
Transistorized audio voltmeter; Alex M. Schotz. **Apr 19.**

Another transistorized voltmeter—and how to use it. C. G. McProud. **Apr 42.**

## TRANSISTORS

Class D amplifiers; George Fletcher Cooper. **June 24.**  
Class D amplifiers—a closer look; George Fletcher Cooper. **I, July 24; II, Aug 23.**  
Design of solid-state stereo amplifier with silicon transistors; Marshall R. Myers, Jr. and Morley D. Kahn. **Jan 21.**  
This business of heat sinks; Ronald L. Ives. **Mar 26.**

High-quality transistorized stereo preamplifier; Erhard Aschinger. **III, Jan 35; IV, Feb 39; V, Mar 34.** (Began Nov. 1963)

High-quality transistorized tape recorder amplifier; Lee Beeder. **May 17.**  
Receiver with transistors plus tubes; William Cornell. **Feb 21.**  
Transistorized stereo microphone mixer; Peter A. Stark. **Oct 19.**  
Transistorized audio voltmeter; Alex M. Schotz. **Apr 19.**  
Another transistorized voltmeter—and how to use it. C. G. McProud. **Apr 42.**

# AUTHOR INDEX

## 1963

### Aschinger, Erhard

High-quality transistorized stereo preamplifier. **III, Jan 35; IV Feb 39; V, Mar 34.**

### Bauer, Benjamin B.

15-deg. vertical angle—a key to better stereo sound. **Nov. 21.**

Vertical tracking improvements in stereo recording. **Feb. 19.**

### Beeder, Lee

High-quality transistorized tape recorder amplifier. **May 17.**

### Beever, Jack

FM-stereo reception. **Jan 19.**

### Bursteln, Herman

Suppressing noise in audio systems. **Nov 46.**

### Cooper, Duane H.

Vertical tracking distortion in practice. **Sept 40.**

### Cooper, George Fletcher

Class D amplifiers. **June 24.**

Class D amplifiers—a closer look **I, July 24; II, Aug 23.**

The matched load. **Nov 30.**

### Cornell, William

Receiver with transistors plus tubes. **Feb 21.**

### Crowhurst, Norman H.

Crossover design. **I, Sept 26; II, Oct 26.**

### Dilley, William G.

Remote control with light. **Nov 24.**

### Dollens, Morris

Wall-projection color organ. **I, Mar 19; II, Apr 23.**

### Doty, Charles R., Sr.

Blueprint for an audio club. **Mar 40.**

### Gray, Albert Woodruff

Knowledge and skills available upon re-employment. **May 34.**

### Ham, North C.

Mobile FM-stereo reception. **Sept 21.**

### Hecht, William

Fresh approach to compact speakers. **Mar 30.**

### Horowitz, Mannie

Checking frequency-compensating circuits. **May 26.**

Harmonic distortion—tests and measurements. **Oct 38.**

### Ives, Ronald L.

This business of heat sinks. **Mar 26.**

Kahn, Morley D. and Marshall R. Myers, Jr.

Design of solid-state stereo power amplifier with silicon transistors. **Jan 21.**

### Keskinen, Allan R.

78-rpm stereo test record. **Apr 32.**

### Klepper, David L.

Controlling sound-reinforcement systems. **Dec 19.**

### Malamud, Herbert

Testing amplifier response with an oscilloscope. **June 34.**

### McProud, C. G.

Alignment and adjustment of FM-stereo tuners and adapters. **Jan 26.**

Another transistorized voltmeter—and how to use it. **Apr 42.**

Hi-Fi and Electronics in Japan. **Mar 41.**  
The definition hassle—an approach to high fidelity standards. **Aug 25.**

Myers, Marshall R., Jr. and Morley D. Kahn

Design of solid-state stereo power amplifier with silicon transistors. **Jan 21.**

### Nort, Don

Knobs—the shame of it all. **Aug 24.**

### Oakley, R. S., Jr.

Open baffle parallel-series array. **Dec 30.**

### Pickering, Norman C.

Electronic simulation of organ sounds. **June 21.**

### Pike, Winthrop

Organs and organ music. **I, Oct 23; II, Nov 40.**

### Rennwald, Rolf

Full-range electrostatic speaker. **June 17.**

### Saslaw, David

Sound reinforcement at Philharmonic Hall. **Apr 38.**

### Schimmel, George

Sound reinforcement at the Ziegfeld. **July 21.**

### Schotz, Alex M.

Transistorized audio voltmeter. **Apr 19.**

### Seybold, A. M.

All-electronic method for tuning organs and pianos. **I, Feb 28; II, May 20.**

### Stark, Peter A.

Transistorized stereo microphone mixer. **Oct 19.**

### von Recklinghausen, Daniel R.

FM tuner characteristics and their relative importance. **I, Aug 19; II, Sept 44.**

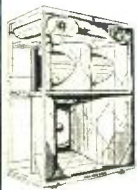
### Williamson, R.

Professional condenser microphone. **July 17.**

### Whitacre, John.

The Auditioner. **Dec 24.**

# True High Fidelity Speaker System



of the 4-way horn-loaded type. Gives clean, true sound reproduction unobtainable by any speaker of the cone type. Further information is available on request. U.S. and Canadian representatives (importers and distributors) are wanted. Apply directly to:



**YL ACOUSTIC CO., LTD.**

19 Shiba-Tamura-Cho, Minato-ku, Tokyo, JAPAN

CIRCLE 68

## LAFAYETTE

RK-140



Imported

Mikes and Case  
OPTIONAL

ONLY **9950**  
\$5 Monthly

### LAFAYETTE PROFESSIONAL 4-TRACK STEREO RECORD and PLAYBACK TAPE DECK

Complete with Built-in Transistorized Record/Playback Preamps

- Records Sound-with-Sound • 2 Recording Level Meters • Records 4-Track Stereo & Mono • Plays 4 & 2 Track Stereo, 4, 2 and Full Track Mono • With Connecting Cables and 7" Take-up Reel



**Free!** LAFAYETTE Radio ELECTRONICS  
Dept. AL-3, P.O. Box 10,  
Syosset, L.I., N.Y. 11791

Rush me FREE Giant 422 Page 1964 Cat. 640

RK-140 tape deck \$... Enclosed. Shipping Charges Collect

Name .....

Address .....

City .....

Zone .....

State .....

CIRCLE 82

## ADVERTISING INDEX

Acoustech, Inc. ....	60
Acoustic Research, Inc. ....	41, 51, 60
Airex Radio Corporation ....	54
Allan, Richard, Speakers ....	59
Altec Lansing Corporation ....	8
American Concertone, Inc. ....	42, 43
Ampex Corporation ....	49
Argos Products Company ....	65
Artisan Organs ....	62
Audio Bookshelf ....	47
Audio Fidelity Records ....	65
Audio Unlimited ....	3
Barker & Williamson, Inc. ....	55
Benjamin Electronic Sound Corp. ....	33
Bozak ....	39, 63
British industries Corporation ....	3
Carston Studios ....	65
Classified ....	64
Clark, David, Company ....	55
CTS Corporation ....	Cov. III
Dynaco, Inc. ....	61
Eastman Kodak Company, Inc. ....	27
EICO Electronic Instr. Co., Inc. ....	11
Electro-Voice, Inc. ....	Gov. IV, 1
Electro-Voice Sound Systems ....	65
Empire Scientific Corp. ....	5
Ercona Corporation ....	65
Fairchild Recording Equipment Corp. ....	54
Finney Company ....	12
Fisher Radio Corporation ....	7
Frazier, Inc. ....	58
Garrard Sales Corp. ....	3
Goodwin, C. C. (Sales) Ltd. ....	65
Gotham Audio Corporation ....	48
Harman-Kardon ....	29
Hi Fidelity Center ....	65
International Electroacoustics, Inc. ....	52
Jensen Manufacturing Company ....	9
Key Electronics Company ....	63
KSC Systems, Inc. ....	60
Lafayette Radio ....	68
Lang Electronics, Inc. ....	61
Lansing, James B., Sound, Inc. ....	45
Martel Electronics ....	53
McIntosh Laboratory, Inc. ....	57
Murray Carson Corporation ....	14
North American Philips Co., Inc. ....	63
Permoflux Corporation ....	68
Pickering & Company, Inc. ....	17
Pioneer ....	13
PML ....	65
Roberts Electronics, Inc. ....	4
Scott, H. H., Inc. ....	Cov. II
Sennheiser Electronic Corp. (N. Y.) ....	15
Sherwood Electronic Laboratories, Inc. ....	18
Shure Brothers, Inc. ....	25
Sonovox Co., Ltd. ....	68
Stanford International ....	59
Superscope, Inc. ....	35
Telex Acoustic Products ....	58
United Audio—Dual ....	37
University Loudspeakers ....	31
YL Acoustic Co., Ltd. ....	68



## Dynamic HEADPHONES



THE ONLY HEADPHONES WITH A LIFETIME GUARANTEE

Permoflux presents . . . Absolutely the finest sound in stereo high fidelity today. Professional quality sound with exciting features that add up to the greatest value in stereo listening.

- TONAL STABILITY
- COMPARATIVE FREEDOM FROM HARMONIC DISTORTION
- WIDEST FREQUENCY RESPONSE
- BEST POWER HANDLING
- LONGEST LIFE

Feature for feature your best headphone buy is Permoflux—with a lifetime warranty. Write for free details.

**PERMOFLUX CORPORATION**

P. O. Box 1945, Glendale, Calif.

CIRCLE 83

## IT'S NEW... SPHERICAL MAGNET STEREO CARTRIDGE



MODEL SX-1

TYPE: MOVING MAGNET  
RESPONSE: 20 TO 20,000CPS.  
OUTPUT BALANCE: ±0.5dB at 1000CPS.  
STYLUS: 0.7mm RADIUS DIAMOND



**SONOVOX CO., LTD.**

101 Tokiwamatsu-cho, Shibuya, Tokyo.

CIRCLE 84



# *For a particular type of customer...*

... one more interested in performance than price. Yet, in quantity, this new 15-inch loudspeaker is priced surprisingly low for what you get. In fact, half the price of equivalent models.

■ Power handling capacity is conservatively set at 60 watts and has been tested, without breakdown, at 90 watts. Cone resonance varies from 25 to beyond 100 cps, depending on your requirements. Electronic organ, electronic guitar, bass amplifier, deluxe stereo, and other prestige sound system manufacturers will find this new CTS loudspeaker a welcome component.

■ CTS devotes an entire automated manufacturing facility (106,000 sq. ft.) to volume loudspeaker production. All sizes. All types. Just specify or write for catalog P-102. **CTS of Paducah, Inc.**, 1500 North 8th Street, Paducah, Kentucky, a subsidiary of **CTS Corporation**, Elkhart, Indiana.


## *Carte Blanche*



New 15-inch speaker, 60 watt capacity, CTS model 15F35760

NEW  
ELECTRO-VOICE  
MODEL  
676  
CARDIOID  
MICROPHONE

Outperforms them all...or your money back!

 In the last 36 years, Electro-Voice engineers have developed many important microphone firsts\*, but their latest achievement, the new E-V Model 676, may well be their most significant contribution.

The goal of 676 design was to overcome some of the most basic problems in PA, hi-fi recording, and communications. The result of this engineering effort is a uniquely versatile dynamic cardioid microphone with the best field performance of any we have tested. In short, the 676 does *everything* a little better.

For instance, response is wide, uniform, and smooth in the E-V tradition of natural sound. But the 676 also allows you to *change* response. Now you can "neutralize" room reverberation and rumble (usually encountered in larger rooms). A built-in three-position switch allows selection of flat response (for small rooms or recording), or bass attenuation "tilted off" from about 800 cps, with response down either 5 db or 10 db at 100 cps.

This means you get higher average sound levels, better intelligibility, and less likelihood of feedback. Yet there is no "missing bass" effect, common with most tone controls or

filters, because of the flat-slope characteristic of the 676 bass tilt-off.

The cardioid pattern and response superiority of the 676 results from a creative variation of the famed E-V Variable-D® principle, called Continuously Variable-D (CV-D). It reduces size and weight without compromising quality, and it's responsible for reducing wind noise and shock noise pickup far below that of any other small cardioid. Bass-boosting "proximity effect" is gone, too, to give you well-balanced sound, even when performers work ultra-close.

Basis of the CV-D<sup>T</sup> design is a slotted tube, coupled to the back of the 676 diaphragm. The CV-D tube appears to vary in length—acoustically (and automatically)—so that low tones "see" a long tube, while high tones "see" a short tube. The apparent length of the tube is always just right to phase out sound arriving at the back—for maximum front-to-back cancellation.

Modern styling by noted designer Lute Wassman adds grace and beauty to 676 practicality. The one-inch case fits all present E-V slip-on stand mounts, and its balanced weight

distribution is just right for hand-held use.

But there's more to the 676 than just new features—built into it are the many characteristics that make E-V the choice of more professional sound engineers than any other brand: high output level, exclusive E-V Acoustalloy<sup>2</sup> diaphragm, dual impedance selection, efficient dust and magnetic filters, and the most important ingredients of all—fine materials and quality workmanship.

Accept our invitation to try the 676 soon—and the more difficult the job, the better. We guarantee you'll find the 676 will outperform any other PA cardioid microphone you are now using...or your money back!

Model 676—\$100.00 list (less normal trade discounts). Complete specifications available at your E-V sound specialist's or write to: ELECTRO-VOICE, INC., Dept. 1232A, Buchanan, Michigan.

\*Some of the E-V microphone firsts include: The Differential, Mechanophase, Variable-D®, Cardiline and Sound Spot®, plus slim dynamic and lavalier microphone designs, Acoustalloy<sup>2</sup> and Acoustifoam. And the E-V Model 642 has earned the first Academy Award microphone citation in 22 years, for its contribution to motion picture sound.

