AUDIO

MARCH, 1963
50¢

...the original magazine about high fidelity!

interior by Virzi, beverly hills

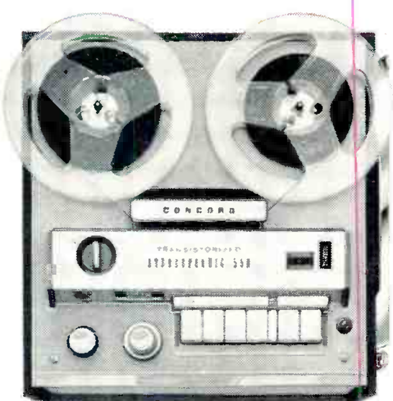
Captured by Concord: Sound Devotion.

Musical moments will live a lifetime with the Concord 550. Designed for the connoisseur of sound, it incorporates all the quality features so vital to professional tape recording and play back.

TRANSISTORIZED... Transistorized pre-amplifiers of the Concord 550 assure greatest operation reliability together with freedom from heat, noise and hum.

It offers all push button controls, three speeds, sound-on-sound recording, two VU meters, and 6″ speakers which can be separated for full stereo effect.

The Concord 550 is the ideal recorder for operation thru the amplifier and speakers of a high fidelity music system, or as a completely self-contained stereo system.



for Connoisseurs of Sound

Recording from multiplex tuners is perfect with the transistor Model 550.

Priced less than $320*

Concord 550 tape deck version of Model 550 especially fitted for easy custom installation.

Priced less than $230*

CONCORD 220—Hi fidelity monaural recorder with push button controls, 3 speeds, varisync flutter-free drive motor, dynamic microphones, cue and edit button and audio sync accessory for home movie sound.

Priced less than $150*

CONCORD 880—Finest 4-track stereo recording and play back. Professional 3-head design, sound-on-sound recording, 10 watt amplifier, computerized channel indicator, dual cathode follower, low impedance outputs. Two VU meters, three speeds, push button operation. Priced less than $400*

* *See your dealer for his price today*

CONCORD 550

CONCORD ELECTRONICS CORPORATION
® 809 North Cahuenga Boulevard, Dept. L, Los Angeles 38, Calif.

AUDIO

MARCH, 1963 Vol. 47, No. 3

Successor to RADIO, Est. 1917

C. G. McPROUD · *Publisher*

DAVID SASLAW · *Editor*

JANET M. DURGIN
Production Manager

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 Hamamatsu-cho,
Minato-ku, Tokyo, Japan

Contributing Editors

EDWARD TATNALL CANBY
JOSEPH GIOVANELLI
HAROLD LAWRENCE
CHARLES A. ROBERTSON
CHESTER SANTON

AUDIO Articles

AUDIO Reviews

AUDIO Profiles

AUDIO in General

•MEMBER• INSTITUTE OF HIGH FIDELITY MANUFACTURERS • INC •

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, $4.00 for one year, $7.00 for two years; all other countries $5.00 per year. Single copies 50¢. 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.

AUDIO CLINIC

Joseph Giovanelli

Send questions to:
Joseph Giovanelli
3420 Newkirk Ave.
Brooklyn 3, N. Y.
Include stamped, self-addressed envelope.

Meter Protection

Q. Referring to the matter of overload protection for a VTVM, to what extent will two silicon diodes placed across the meter (0–1 ma, 100 k)—one diode with its positive end at the positive terminal of the meter, and the other diode with its negative end at the positive terminal—affect instrument accuracy? The accuracy of the VTVM is about one per cent, and I do not want to sacrifice this in any way.

What d.c. voltage will the diodes safely withstand when measuring direct current? The current portion of the instrument is similar to that found in a VOM, and is separate from the rest of the circuit, except at the function and range switches. Name Withheld, Wellington, New Zealand.

A. There is little problem with overload on those ranges of a VTVM which make use of the tube circuits. The tubes will saturate before any damage to the meter can result. In those instances, however, where the meter movement is removed from the tube circuits and is placed on multiplier circuits, you do face the possibility of damaging the instrument when the range switch is set in such a manner that the pointer tries to deflect beyond full scale. Perhaps the diodes placed across the meter as you have suggested will offer some protection, provided that they do not conduct too soon. If they do, full-scale readings may not be possible because of the shunting action of the diode. I assume that the purpose of the diode with its cathode to the positive terminal of the meter is designed to protect against overloading when a negative voltage appears across the meter and the selector switch is not set to accommodate this negative voltage. The diode whose anode is connected to the plus terminal of the meter is intended, I assume, to be used when the meter voltage is correctly applied.

The type of diodes which are needed are types which will start conducting in their forward direction at a voltage slightly higher than 0.1 volt, the voltage which is likely to appear across the meter movement at full scale. I suspect this can be readily accomplished with germanium diodes rather silicon diodes because the silicon diodes might not start conducting until damage has already been done to the meter movement. Only experimentation will tell you just what will happen to the accuracy of the meter with diodes whose properties you do not know. It all depends upon the conductivity and the conductivity curve of the diodes. The reverse-biased diode would not enter the picture. At least this way you can consider that there is only one diode connected across the meter. It will simplify your experimentation.

Record Wear

Q. I often read that a stylus in bad shape can ruin a new record in one playing. What about the reverse? Can a record in very bad condition ruin a good stylus? If not, will it wear the stylus more than a record in good condition? Roy H. Tollfeldt, Aberdeen, Washington.

A. For this discussion, it is assumed that a diamond stylus is utilized because it is the most commonly used stylus material in high fidelity equipment. The diamond is one of the hardest substances know to man. Hard though it is, it can be chipped. For this reason, then, it is wise to check the performance and physical condition of a stylus if it has been dropped, especially when it lands on a metal surface.

The extent of the damage which can be done to a stylus is dependent upon the conditions to which it is subjected. If the tracking force is very heavy, this will increase the amount of wear. It is obvious that a rough-surfaced record will wear a stylus faster than a record with a smooth surface. A worn record will not necessarily abrade a diamond stylus more than a new one, possibly less, because it has been burnished smooth by repeated playings. Even under the worst of conditions the diamond stylus will last a long time. Therefore, do not throw away those irreplaceable, worn recordings.

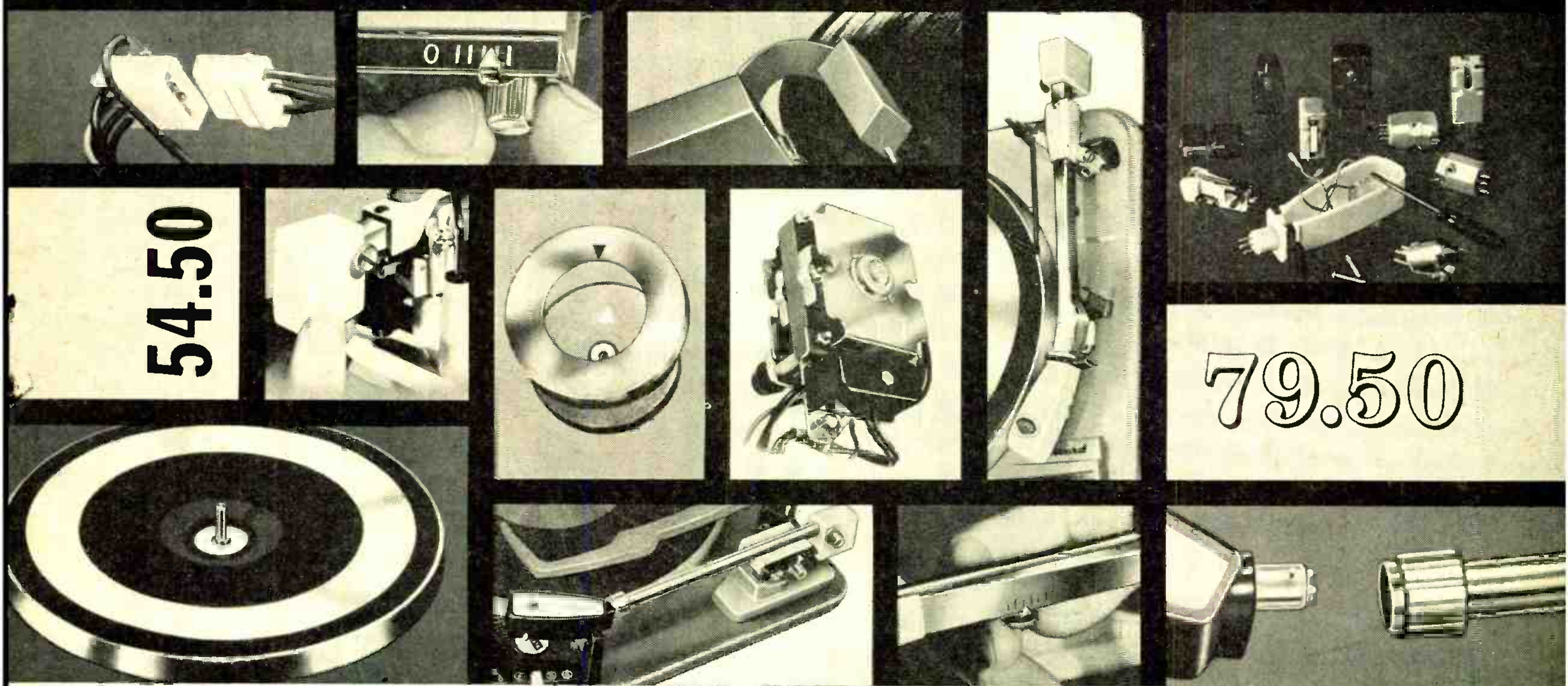
I have one diamond stylus which has played hundreds of severely worn discs and I can see no evidence of wear. In the nature of my work, I am certain that I shall play many badly damaged discs with this stylus and still not need to worry about the destruction of the diamond.

Tracking Error

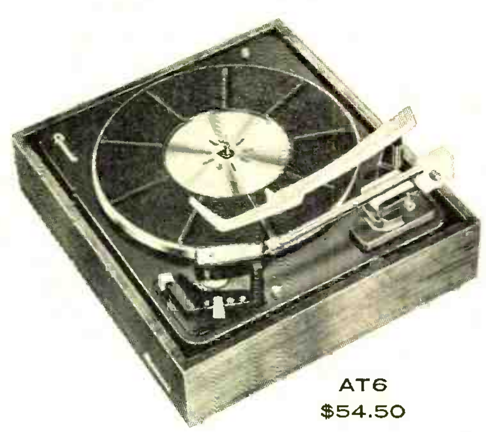
Q. Please tell me if these assumptions concerning tracking error are correct: 1. The stylus overhang is the important measurement—not the distance from turntable spindle to arm pivot; 2. tracking error is more critical in terms of distortion at the inner grooves than at the outer; 3. proper arm design aims at keeping the stylus riding tangential to the groove which means that the cartridge should aim more or less perfectly along the tangent of the groove. Name Withheld, Wichita Falls, Texas.

A. Your assumptions about tracking error are correct. The distance between the pivot and the turntable spindle is of no importance as you already have guessed, except that a greater distance or arm length will minimize tracking error. Once this has been

WHAT'S THE BEST THING ABOUT A GARRARD AUTOMATIC TURNTABLE?



TYPE A
$79.50



AT6
$54.50

It could be the tone arm—dynamically balanced ... counterweight adjusted ... tracking even professional cartridges flawlessly for flawless reproduction. It could be the turntable ... over sized, heavy, and balanced. It could be the motor ... Laboratory Series® ... on speed ... double-shielded against hum, and free from rumble. It could be the automatic feature ... at your service when you want it ... foolproof, incomparably gentle to records. It could be *any* of these ... precision components that you would previously have expected to select individually and have mounted together. Now, in the Automatic Turntable, Garrard has combined and integrated them for you. But we don't think any of these are the best thing about a Garrard Automatic Turntable. Most people realize after they own a Garrard, that the most important advantage it offers stems from a 50 year fund of engineering experience and a glorious tradition of craftsmanship ... supported by superior manufacturing and quality-control techniques, and the industry's most comprehensive spare parts and authorized nationwide service network. These practical factors result in the enduring satisfaction which Garrard owners enjoy. Every time you play your Garrard, the pleasure and the pride you will derive from owning this magnificent mechanism will increase. We think *this* is the best thing about a Garrard Automatic Turntable!

There is a Garrard for every high fidelity system. Type A $79.50, AT6 $54.50, Autoslim $39.50.
For Comparator Guide, write: Dept. GC-13, Garrard Sales Corp., Port Washington, New York.

Garrard
World's Finest

CANADIAN INQUIRIES TO CHAS. W. POINTON LTD., 66 RACINE ROAD, REXDALE, ONT. TERRITORIES OTHER THAN U.S.A. AND CANADA TO GARRARD ENGINEERING AND MFG. CO., LTD., SWINDON, WILTS., ENG.

taken care of in the original design, what you need to know is the amount of overhang.

Actually, if a manufacturer wishes to do so, he can provide a template with his arm which will show you a particular distance from the spindle's center; this distance which will be needed for mounting the arm base. Usually such measurements are given from the center of the spindle and presumed to extend to the center of the base of the arm.

The cartridge must always be tangent to the record grooves as you have said, otherwise some parts of the side-to-side undulations in the groove will impinge upon portions of the stylus in such a manner that the stylus can not transmit the information it receives to the generator element of the cartridge. To make this clear, consider what would happen if the cartridge were rotated 90 deg. from tangency. The side-to-side undulations of the groove would force the generator to try at least to move forward and backward rather than in the direction for which it was designed. Of course, the 45-deg. groove modulations would also be affected, but for simplicity their action need not be described.

Tracking is more critical toward the center of the disc than on the outside of the disc. Considering this, it is advisable to have tracking error at a minimum toward the center of the disc rather than at the outer edge, assuming that some compromise must be made.

Radio Interference in Amplifiers

Q. When playing my phonograph system, I hear a strong, local radio station even though I have no radio turned on.

I thought at first that my amplifiers were at fault. I checked the system and found the signal to be originating in the leads to the speakers.

My speakers are situated across the room (about 25 feet) from the amplifier. I use 40 feet of No. 18 zip cord through the attic to get to these speakers.

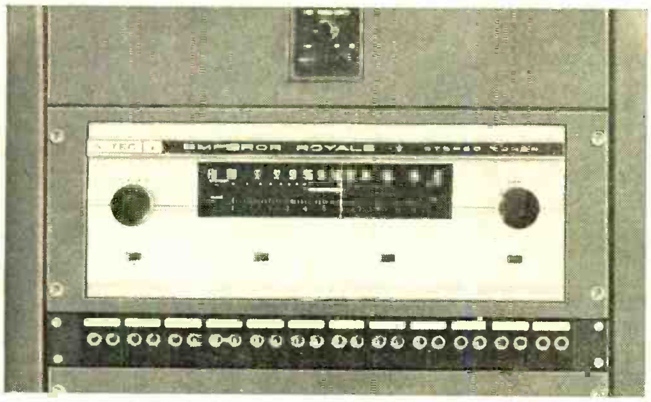
What would be the best approach to the elimination of this problem? I am also curious to learn how this type of distortion is developed because the signal is picked up at a point where amplification has been completed. James J. Allain, Jr., Port Allen, Louisiana.

A. The speaker leads of an amplifier are often the source of radio interference, especially when such leads are of considerable length, as in your case. This great length allows a considerable amount of pickup, much as the signal pickup of an antenna increases with increasing length.

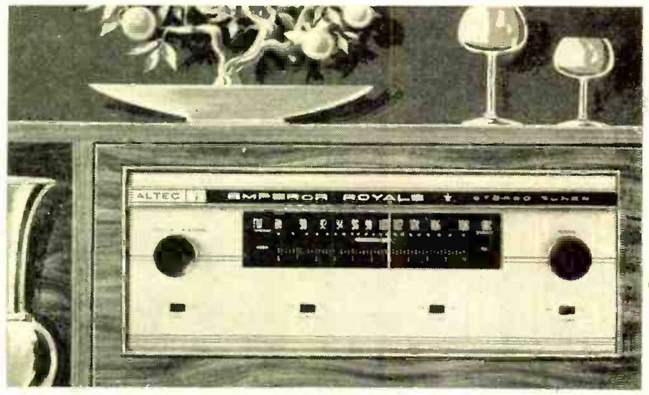
At first, one would have reason to wonder how the speaker could cause detection and amplification to the extent that the signal is clearly audible. This action, however, is not so surprising when you consider in detail the circuitry of most power amplifiers. The signal passes to the "hot" speaker terminal and proceeds through the feedback loop to the cathode of some earlier stage. It is from this point that the signal is amplified and appears as detected audio.

Fortunately your problem is easily solved. All you need to do is bypass the speaker terminal with a small capacitor, 0.05 μf or thereabouts. This capacitor should be connected directly to the output terminals of the amplifier. The value of this capacitor is not sufficiently large to cause degradation of amplifier performance but is still large enough to act as a bypass for the r.f. around the feedback circuitry. Æ

IDENTICAL TWINS



This is the new 314A "Emperor Royale" FM Stereo Tuner. It was designed by Altec to meet requirements for professional use as a monitor and network relay in FM stations. It is shown above in an Altec 13811 Rack Assembly, installed in standard studio relay rack.



This is the new 314A "Emperor Royale" FM Stereo Tuner. It is identical in every respect to its studio twin on the left. Without the rack mounting assembly, the 314A is the aristocrat of home stereo components offering studio quality reception for the discriminating listener.

Conceived as a broadcast studio unit in a home use cabinet, the "Emperor Royale" is a product of the advanced engineering skills of the world's largest manufacturer of professional sound equipment. For this reason, the new 314A provides the sensitivity, selectivity and total freedom from distortion required by the broadcast and recording studios, the theatres and concert halls for which Altec has been manufacturing professional audio equipment for more than a quarter of a century.

Specifically, the "Emperor Royale" provides these features:

- fully automatic, all-electronic switching circuitry for multiplex tuning. This facility includes a dial-mounted indicator light which automatically illuminates when program selected is transmitted in stereophonic sound.
- monophonic audio output jack which permits all program material to be supplied to a separate monophonic amplifier for listening to speakers throughout the house or at any remote location such as pool, patio, or workshop. Simultaneous stereo performance is totally unaffected by the use of this facility.
- wide-band characteristics are required in the IF stages to provide maximum channel separation for good FM multiplex reception. Altec IF filters are critically coupled using stabilized elements to provide the desired band width and long-term adjustment.

The 314A is priced at $359.00 including cabinet and excise tax.

For those who want to enjoy exceptionally good stereophonic sound at a savings, Altec provides the 315A "Empress Royale" FM tuner at only $256.00 including cabinet and excise tax. Both the 314A and 315A come with decorative control panels in satin gold.

Companion piece to the 314A or 315A tuners is the new 353B "Royale" Stereo Amplifier. The resulting system will reward you with a quality of sound possible to achieve only with such perfectly matched and balanced components. The 353 is a dual channel—50 watt (RMS) continuous—power and control amplifier with 14 stereo or mono inputs for all known sources, even microphones and TV. Recorder outputs are independent of tone controls for professional quality home recording. A matricing network is provided for center stereo speaker and for driving auxiliary speakers anywhere in the home. Price: $225.00

For complete information and specifications, see the Professional Altec High Fidelity Consultant in your area, or write Dept. A3.

ALTEC LANSING CORPORATION

ALTEC LANSING CORPORATION

LTV A subsidiary of Ling-Temco-Vought, Inc.

ANAHEIM, CALIFORNIA

LETTERS

SIR:

I was thumbing through my back issues of AUDIO a few days ago—they are an excellent source of reference data, you know—when I came across Mr. Canby's report, "More About Stereo" in his column of March 1957.

I was intrigued at the conclusion he drew that there is a big difference between people's reaction to a live musical performance and a reproduction of that same performance.

His views, as expressed then, substantiate an opinion I have long held but have never been able to demonstrate as Mr. Canby did, that people DO react differently to recorded music than to live performances. And, because I believe this, I wonder why so much effort is put to bear by the recording industry to recreate the concert hall in the living room. I do not think it can ever be done. Therefore, I think we should be content to let recorded music stand as an art in its own right. As such, it is already eminently successful. As an attempt to recreate the full impact of live performances, it is not quite so successful and, if we persist in regarding it in this light, we shall always be apologizing for that lack of success.

Don't misunderstand me. I do not imply that we should relax our efforts to achieve perfection in the recording and reproduction of music. But let our efforts be directed at doing just that. As Mr. Canby pointed out, a performance, once recorded, is no longer a performance but a recording. No matter how realistically or how perfectly the original sound was captured, there are certain factors, exclusive of the performance itself, that are an integral part of the live-listening experience but which cannot be recorded. Nor can the circumstances that gave rise be recorded. They will always be absent from the reproduced version of the performance.

For example, the excitement of being in the audience will not be there. Missing is the fact that you, the listener, made the effort to go to the concert hall in the first place, and missing is the warmth of fellowship at being among others who made the same effort for the same reason. Compare this to home-listening where the urge to hear a given selection can be instantly gratified simply by putting a disc on the turntable. In home listening, what can replace the suspense of waiting for the concert to begin or the anticipation created by the orchestra tune-up? What can replace the satisfaction of taking part in the respect the audience shows to the maestro or the guest artist when they make their appearances? How many of us have ever accorded a standing ovation or a 15-minute round of applause to a recorded performance, however great? What will replace the thrill that sweeps the audience at an almost impossible display of virtuosity? These are the facets of live-listening that will never be committed to tape because, as Mr. Canby implies, they exist only at the original performance.

I do not mean to minimize the importance of recorded music. It's values are so well known that they needn't be enumerated here. I wish only to show it to you for what it is—an experience apart from live-listening. Any attempt to create the one in terms of the other shall always fail. Let us, therefore, experience concert-hall realism in the concert hall and be not chagrined when it is not duplicated in our living rooms. Let us exult in the NEW art that has been born—an art fully capable of standing on its own merits. Let us go to the concert hall as often as we can and listen to recorded music as often as we wish but let us not think of one as a substitute for the other. Rather, let us think of each as being unique and take, at face value, any pleasure that it has to offer.

J. E. HANCEY
51 So. 400 East St.
Clearfield, Utah

(*Hear! Hear!!* ED.)

Tape Synchronization

SIR:

There has been serious need for discussion of tape synchronization methods for quite some time. Therefore, praise and expressions of appreciation are in order for both AUDIO and Mr. Hal Magargle for his efforts in preparing a clear description of the various systems, with their deficiencies, currently in use in motion-picture work.

We would like to point out that the situation is further complicated by differences in choice of system and the consequent flexibility, once the signal has been recorded. For example, a producer will generally prefer to have a choice of facilities capable of making his transfer to optical track. The cost of the "black boxes" necessary to play back a control signal generally far exceed the cost of "boxes" necessary to record such a signal.

One distinct advantage of the systems employing a biased 60-cps signal (Pilottone, Ryder-Sync) is that such a signal may be amplified and used to drive a sync motor for re-recording to sprocket tape or double-system projection. Our experience in consulting on motion picture problems has been that such flexibilities often are the determining factors in equipment choice.

DONALD STUART BERMAN
Industrial Sales Representative
Sixteen Eliot Street
Cambridge 30, Mass.

We've Succeeded—His Wife Hates Us!!

SIR:

My wife hates AUDIO magazine. I simply refuse to speak to her or any other member of the family until I have literally read each issue from cover to cover, including the advertising. Lately, she has taken to hiding it, but my sixth sense almost invariably leads me to it. You'd think she'd be resigned by this time since I have been an AUDIO fan since 1949 and an audiofan since 1945.

Now, having paid you the compliment you richly deserve, let me proceed to a few suggestions. As an inveterate do-it-yourselfer, I would like to see even more articles on construction projects. What about an article on a low-cost, reasonably-good, stereo power amplifier; small and light for portable use with a tape deck and record playback amplifier and designed primarily for monitoring purposes? Or more articles on the fine art of microphono placement for live stereo recording? How about a really first-rate transistor mike preamp designed for balanced-output low-impedance mikes.

One final word: Keep my wife mad at you.

EDGAR R. EMERY
23 Canterbury Road
Winchester, Mass.

(*We'll have to see your wife first!* ED.)

LOWER THE COST OF FUN
WITH VERSATILE TARZIAN TAPE

Make a Priceless Family Heirloom—*The Easy Tarzian Way*

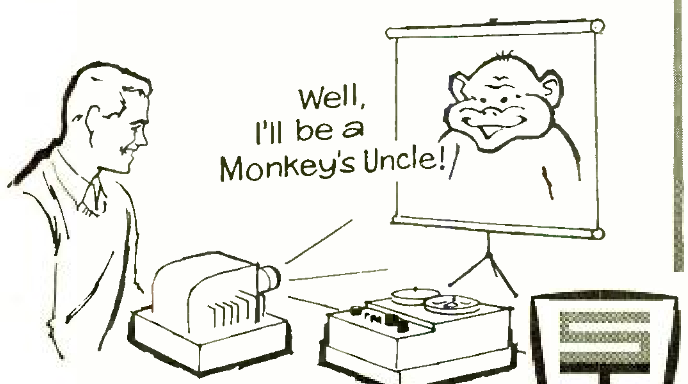
Next time the family gets together for a special occasion... and everytime a high point comes along in the lives of the children and grandchildren... be sure to record the events on long-lasting Mylar*-base Tarzian Tape. The tape will last indefinitely—and so will your pleasure—with a priceless heritage of voices and events unique to your family. Such moments can seldom be repeated, but thanks to Tarzian Tape they can always be remembered.

Double Your Pleasure With an Extra ¼ Inch

Here's good news for owners of battery-operated tape recorders. If you feel restricted by the standard 3-inch reel capacity, try the new Tarzian 3¼ inch reel for ½-mil "tensilized" Mylar* tape. Tape footage and available recording time are doubled. You get 600 feet of Tarzian Tape and one full hour of recording at 3¾ i.p.s.—compared to 300 feet and 30 minutes with the old-fashioned 3-inch reel.

Video Plus Audio

Tape recorders and Tarzian Tape pep up your movie and slide shows just as Rodgers worked with Hammerstein—good separately, outstanding together. In addition to straight commentary and music, other voices and sounds can be taped from radio and TV for use as needed—applause, traffic, etc. Speaking of taping from radio and TV, if you use a microphone try wrapping it lightly in a handkerchief to cut down on unwanted outside noise. You're even better off to eliminate the microphone. Obtain a recorder accessory cord with input plug on one end, and alligator clips on the other. The clips can be attached directly to the speaker voice coil.



This Is Tarzian's New Tape Booklet

"Lower the Cost of Fun." It is free, useful, and distills a wealth of information on recorder and tape use and care—into 32 interesting pages. Send for your copy today, or ask for one from your local camera, high fidelity, or tape recorder dealer. Meanwhile, depend on Tarzian Tape to capture every sound with professional fidelity. Available in 1½ and 1-mil acetate, 1-mil and ½-mil Mylar—on 3, 3¼, 5, and 7-inch reels to meet every recording requirement. The price is competitive... the quality is unchallenged.

SARKES TARZIAN, Inc.

World's Leading Manufacturers of TV and FM Tuners • Closed Circuit TV Systems • Broadcast Equipment • Air Trimmers • FM Radios • Magnetic Recording Tape • Semiconductor Devices

MAGNETIC TAPE DIVISION • BLOOMINGTON, INDIANA

Export: Ad Auriema, Inc., N.Y. • Canada: E. J. Piggott Enterprises Ltd., Toronto, Ont.

A

LIGHT LISTENING

Chester Santon

Melachrino: Our Man in London
RCA Victor LSP 2608

If the first shipment of the new year is any indication, RCA Victor really means business in 1963. Among the releases for the month of January are to be found several recordings that can do justice to the most expensive sound system. As the record business goes into a new year, the chasm that separates the engineering theories of the top labels becomes even more pronounced. We seem to be approaching the day when RCA and Columbia are going to be found occupying entirely different camps in the matter of engineering practice as it relates to their recordings of popular music. For some months now, the evidence has been mounting that the two firms no longer see eye to eye on what constitutes accurate sound reproduction in the pop field. When the stereo disc was born, both labels were in there pitching to produce a record that would emulate, where possible, the well-developed audio qualities of the mono LP disc. In this latest Melachrino release, RCA continues to demonstrate that its only aim is to turn out the best possible stereo disc that today's technology can manage. Compare the recent pop releases of the Columbia label on a wide-range playback system and you'll probably come away with the feeling I've been trying to voice in recent months. It seems to me that Columbia is turning its back on the very real advances made by the industry during all these years of the stereo record. It shows every sign of abandoning the hard earned attributes of impressive frequency response and dynamic range that are now part of RCA's products. In their place, Columbia is fooling around with gimmicks that appear valuable to them when their records are played on a portable stereo unit. The extent of their success in this regard becomes fully evident whenever I try to equalize one of their recent releases immediately after I've played a well-nigh flawless item such as RCA's latest Melachrino disc. Unlike the Columbia jobs, artificiality is no problem on LSP-2608. As miked by seasoned "panelists," each section of the familiar Melachrino orchestra makes its entrance just as though the listener were standing in the same studio. Because there is no pinching of the frequency range in order to gain an unusually high signal level on the disc, the location of the Melachrino instruments is ridiculously easy to spot. The relaxed highs captured by RCA are the highs of the instruments instead of something created by a bend in the recording curve. Victor's replica of the bass instrument's sound energy is the same stuff that courses along the hard studio floor to the sensitive mikes now part of any good studio's arsenal.

About one half of this album is given over to tunes associated with the English scene ("Foggy Day," "Nightingale Sang in Berkeley Square" etc.) while the rest is thoroughly American in content—Stephen Foster rubbing shoulders with Richard Rodgers' "Sweetest Sounds." Other outstanding releases in this latest series from RCA include LSP 2599 "Arthur Fiedler—Our Man in Boston" and "Ray Ellis—Our Man on Broadway," LSP 1615. Each offers exemplary treatment of sound but this Melachrino disc just about sums up the current thinking of the Victor staff.

Little Me (Original Broadway Cast)
RCA Victor LSO 1078

The sizable army of readers who enjoyed the hilarious story of Belle Poitrine on the printed page may be surprised at the change in emphasis now that the book has been made into a Broadway musical. Originally, *Little Me* was an elaborate spoof of the life stories of would-be actresses whose notoriety exceeds their talents by a handsome margin. As a satire on the modern biography that is "told" rather than written, the saga of Belle Poitrine was more than dotted with a long procession of men who figured prominently in each phase of her theatrical career. In this new Broadway musical from the venerable production team of Feuer and Martin (any producer with more than two hits to his credit is a Main Stem institution these days) the story of *Little Me* still digs through the recollections of a fabulous female but the show has become a starring vehicle for the incomparable talents of Sid Caesar. Fourteen years after his Broadway debut in a production called *Make Mine Manhattan*, one of television's truly gifted comedy stars is back in the main stream of show business with a procession of virtuoso impersonations. However incidental the succession of Belle's men may have been in the Patrick Dennis novel, the assortment of characters now takes on new importance as Sid Caesar leaps from costume to costume. Much of the success this original cast record may enjoy will depend on Sid's ability to bring these kooks to life by means of vocal talents alone. As Belle Poitrine (played by Virginia Martin during the first part of her career and Nancy Andrews in the later years) climbs the social ladder that is to carry her from the wrong side of the tracks in Venezuela, Illinois to a mansion in Southampton, Sid Caesar provides most of the entertainment playing the long list of Belle's husbands and lovers. You'll find equally diverting Caesar's portrayals of Noble Eggleston, the pride of Venezuela's elite; eighty-eight year old Pinchley, the miserly banker; Val du Val, the great French entertainer and heartbreaker; Fred, the timid doughboy of World War I and Prince Cherney, the declining regent of the mythical kingdom of Rosensweig. Virginia Martin, who established her position on Broadway playing the secretary in Feuer and Martin's "How To Succeed in Business Without Really Trying," carries off most of the remaining honors in the album as the younger Belle Poitrine. Her most touching moment in the score is the account of moviedom tribulations that runs through "Poor Little Hollywood Star." In this poignant number, Miss Martin reveals a depth of feeling that goes beyond anything she's done on records in the past. A cute touch in the album is the duet, "Little Me," as sung by the two Belle Poitrines. Cy Coleman of Wildcat fame wrote this score. While much of the music rises only slightly above a category that could best be described as utilitarian, there are several items that stand out in the course of the show. In addition to Belle's Hollywood sojourn, her vaudeville days contribute "Be a Performer" as sung by a team of bookers. An engaging tune of World War One vintage is a specialty delivered by the male chorus, "Real Live Girl."

RCA's sound is typical of many of their recent albums featuring original casts from Broadway shows. To the already live acoustics of Webster Hall in New York, several ingredients have been added in the processing of the stereo disc. These are undoubtedly calculated to lend more "oomph" to the sound of a middling-response console. I find that the extra processing tends to thicken the quality of the sound if I play the disc with the preamp in the RIAA setting. At the risk of offering a suggestion that cannot be carried out on some stereo control centers, I prefer the sound on this record when the turnover point is 400 instead of 500 cycles. If this seems a drastic measure, I know of cases where owners of a system rich in honest woofers have been using a 300 cycle turnover when playing some of today's really reverberant pop discs. No matter how many woofers you have working for you these days, all RCA Victor stereo discs, with the exception of most of their original cast show albums, sound fine at normal 500 turnover. The offending items requiring 300 cycle turnover in playback are found on other labels.

Gypsy (Original Sound Track)
Warner Bros. Tape WSTC 1480

Only a diehard tape fan with a very modest investment in four-track playback facilities is apt to derive much satisfaction from the sound quality of this reel. It's true that, in many instances, the well-equipped listener with access to both tape and disc playback will prefer to acquire a basic show in its tape format if he intends to live with it for many years to come. The disc version of the sound track seems the better buy in this case.

The original Broadway cast of "Gypsy" has been available for some time in the Columbia four-track stereo tape library (OQ 434, starring Ethel Merman, Jack Klugman, Sandra Church etc.) and is well entrenched in any comprehensive collection of show music. Made expressly for home instead of movie theatre listening, the Columbia recording enjoys advantages usually not shared by sound track albums. There is far less opportunity for distortion to creep in when only one recording characteristic is employed instead of the two that have to be juggled whenever a movie track is adapted for a home release. The "Gypsy" sound track produced by Warner Bros. does not translate too comfortably into a four-track reel for the home. The brassy quality of the Jule Styne score is not easy to record under any circumstance. The greater the gusto of the film cast, reaching some pretty wild peaks in this latest version of the play based on the memoirs of Gypsy Rose Lee, the higher the distortion content of this reel. With the exception of a few minor items at the very beginning of the show, the film version heard here follows the Broadway sequence of songs. Rosalind Russell drives hard in order to approximate Ethel Merman's naturally assertive portrayal of the domineering stage mother. Natalie Wood, for all her undeniable visual appeal, just about meets minimum requirements in the singing department during her big number, *Let Me Entertain You*. The important element of show business flavor that Paul Wallace supplied in the Broadway production is present in this album as he socks home *All I Need is the Girl*. The takeoff of the child acts of vaudeville is as biting as ever in the performance of Baby June and her News-boys. Aficionados of the esoteric talent that once was part of the famous Minsky runway will be pleased to learn that the film does not forgo the ornate contributions of the play's trio of strippers—Electra, Mazeppa and Tessie Tura. The dynamic range of this tape is more than enough to permit them to bring down the house with their routines at the windup of the album. Anyone who insists on acquiring the sound track of "Gypsy," as opposed to the Broadway cast recording, would be well advised to sample the stereo disc version on Warner BS-1480.

Sunday Only — Mobile Fidelity MF 9

Here is further evidence that Burbank, California, is one of the more active sources of steam railroad releases today. Riding the hard Polymax grooves of this latest Mobile Fidelity stereo disc are two star performers of the Burlington Route that stretches west out of Chicago. Midwesterners acquainted only with the Burlington's modern Zephyrs plying between Chicago and Denver may find it hard to believe that the line still maintains such an active interest in steam. This recording begins with a festive excursion from Chicago to Galesburg, Ill., held on Labor Day in 1959 Under the sponsorship of the Illini Railroad Club, perhaps the nation's most active railroad travel group, two famous locomotives were linked for a doubleheader—coal burner #6315, a Texas type 2-10-4 and the oil burning #5632, a 4-8-4. Carefully documented by

"Our measurements show the Fisher FM-100-B to be the most sensitive FM tuner we have tested to date."

—JULIAN D. HIRSCH and GLADDEN HOUCK, JR.

In "Laboratory Test of Stereo FM Tuners: Part Two"
HiFi/Stereo Review, February, 1963.

And it's not even the most sensitive FM tuner we make!

There are several higher-priced Fisher tuners even *more* sensitive than the FM-100-B. Add that fact to the Hirsch-Houck report and the conclusion is inescapable: Fisher FM tuners totally outclass all other makes in sensitivity — which is the most positive criterion of distortion-free reception in typical home installations.

To quote Hirsch-Houck: ". . . IHFM usable sensitivity (was) 1.95 microvolts. Its limiting action was near-perfect, with minimum distortion and full output being reached at about 3 microvolts and remaining unchanged up to 100,000 microvolts. Distortion at 100 per cent modulation was 0.65 per cent . . . capture ratio was 3 db.

"The Fisher FM-100-B performed as well as it measured. Tuning was exceptionally noncritical; when the tuning meter was peaked, distortion was always at a minimum and separation very near its maximum . . . Its interchannel muting circuit is very effective, producing a dead silent background between stations and operating without thumps or clicks."

A laboratory report by the United States Testing Company, Inc., published in the August, 1962, issue of High Fidelity, includes the following remarks about the FM-100-B: ". . . extremely sensitive, low-distortion instrument . . . designed to provide top quality monophonic or stereo FM reception for the finest of home music systems . . . IM distortion was measured to be 0.04%, which is extremely low . . . Calibration across the tuning dial was excellent . . . On stereo operation, both channels had uniform response characteristics within a small fraction of a decibel." Enough said.

The Fisher FM-100-B is priced at $249.50.* Walnut or mahogany cabinet, $24.95.* Metal cabinet, $15.95.*

FREE! $1.00 VALUE! The new 1963 edition of The Fisher Handbook, a lavishly illustrated 40-page reference guide, idea book and component catalogue for custom stereo.

FISHER RADIO CORP.
21-29 44th Drive, Long Island City 1, N. Y.
Please send free 40-page Handbook, complete with detailed specifications on the FM-100-B.

Name__________
Address__________
City______ Zone___ State______

03302

The Fisher

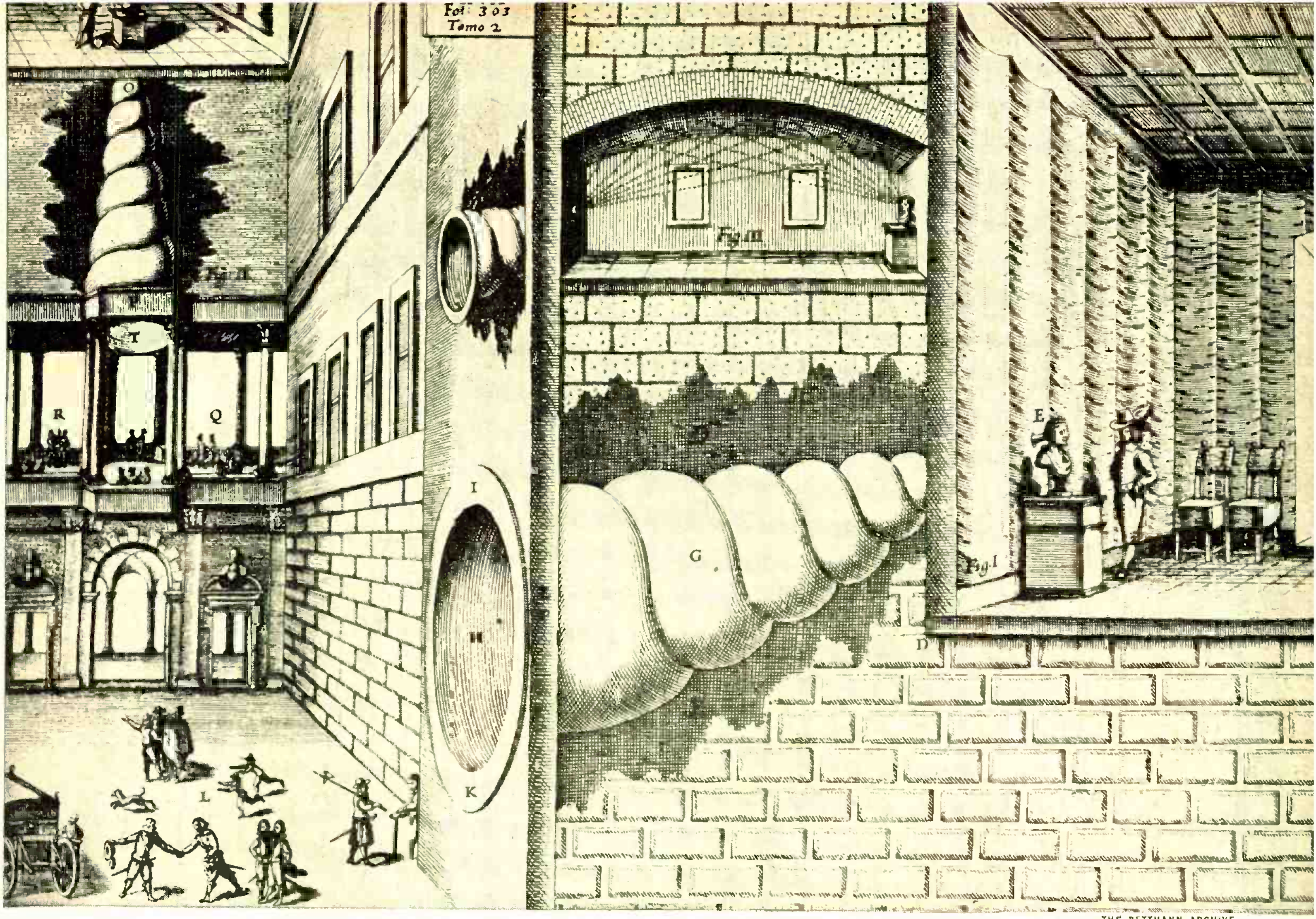
recording engineers Brad Miller, Leo Kulka and Ben Jordan are the dispatcher's voice and the ritual in the roundhouse as the tracks are cleared for the run of the special. The trackside scenes include a sound pickup alongside the powerful 4-8-4 at speeds up to 70 MPH as the mikes pace along at equal speed. A propitious vantage point is provided rail fans on Side Two of Sunday Only with the mikes placed on the tender of #5632 as she negotiates the grade of Burlington Hill, Iowa, past overheads, rows of factory buildings and warehouses. One of the most effective touches in the album occurs in the way the recording crew uses an echoing mountain at Armour, Missouri. In one sequence, a railside position lets us hear the bounce of the passenger whistle as it collides with the side of the mountain. Then the mikes are placed atop the same mountain during another run—this time to probe the full panorama of sound in the valley below as the train wheels past at a distance of three-quarters of a mile. Thanks to the harder groove surface of this Polymax pressing, the important transients of railroad sounds come through with reassuring crispness. Æ

THIS MONTH'S COVER

This month we see a stereo system in the home of George F. Varkonyi in New York City, N. Y. The equipment and cabinetry were designed and built by Mr. Varkonyi over a period of two years. Under normal operating conditions the entire system is controlled by a master unit consisting only of an input selector control, a volume control, and a stereo-mono switch, making it possible for the most non-technical person to operate the system. At the same time, complete flexibility of tone control and equalization are available to the technically-minded user at the flick of a switch. The loudspeaker system, not shown in the photograph, consists of a wall-to-wall ceiling-mounted infinite baffle enclosure containing 17 drivers. Both channels are triamplified. The loudspeaker system is a 36-cubic-foot infinite baffle mounted against the ceiling and spreading across the full width of the listening room. Each major channel utilizes an Audax 18-in. driver and three Goodmans Axiom 80 speakers (modified) for the low frequencies; two Bozak B-209 units for the mid-range; and two Wharfdale 3-in. tweeters. The center-channel speaker is an 8-in. Electro-Voice unit fed by a band-pass network restricting the bass and treble frequencies.

The control center of the entire system is of particular interest. Only two major controls, the selector switch for the inputs and a volume control, are in full command. A combination on-off mono-stereo switch completes this unit, making it possible for a novice to operate the system. If anything other than standard R.I.A.A. equalization or additional tone control is needed, these networks are patched in by means of recycling relays. The following components are used in this system: A Shure MD-216 dynetic arm and cartridge plus a Fairchild SA-12; a Fairchild turntable with modified electronic control; a Citation III FM-tuner with Heath AC-11 multiplex adapter; a Fisher FM-AM 101-R tuner; an Ampex 350 tape playback transport; and an Ampex 351 recording transport and head assembly.

All the electronics in the system, including the record electronics mixer, all playback preamps, control center, electronic crossover and seven power amplifiers, were designed and built by Mr. Varkonyi as were the cabinets. All components are mounted in drawers or on slides and may be removed from the front for servicing. Tape transports are on pivoted panels for ease of access. Æ



THE BETTMANN ARCHIVE

It took 300 years to make Athanasius Kircher's dream come true.

Athanasius Kircher was a man of vision. Among his many accomplishments, this 17th Century scholar perfected the Aeolian Harp and invented a Tin Pan Alley dream—a composing machine. But his outstanding achievement... the Kircher Broadcasting System shown above, actually called for outsized cornucopias of sound built into walls. This system pioneered principles in use today.

The boldness, the vision of such a man, is truly epitomized today in the remarkable new instruments for high fidelity developed by University. In University's modern sound laboratories (what a treat they would be for Kircher) engineers devoted to the perfection of sound reproduction are creating extraordinary musical instruments. Consider the Classic Mark II. In according it top-notch rating, Julian Hirsch of Hirsch Houck Laboratories wrote: "In listening tests, it sounded very clean... there was an undercurrent of bass more often felt than heard that was completely lacking in some other quite good speaker systems that I compared to the Classic Mark II. Overall, the sound was beautifully balanced." The low frequencies up to 150 cps are handled through a 15-inch high compliance woofer in the tuned ducted port. An 8-inch midrange speaker covers from 150 to 3,000 cps, and above this, the superb Sphericon Super Tweeter takes over. Impeccable cabinetry, in oiled walnut. 35"w x 28¼"h x 17"d. $295. Hear it at your hi-fi dealer's or write for complete specifications and free Guide to Stereo High Fidelity. **University Loudspeakers**, Desk R-3, 80 South Kensico Ave., White Plains, New York.


The Classic Mark II.

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

AUDIO ETC.

Edward Tatnall Canby

1. BACK TO THE FACTORY

It seems to me that one of the greatest remaining problems in the "component" scene is that of adequate repair and maintenance.

I do not mean that our component units fall apart and need more repair than they get—not at all. Indeed, the very fact that components are generally reliable over a long period of years is one reason why repair services aren't too readily available. There's not enough business to warrant regular component service in most areas of our country.

Component hi-fi units are built to last and to remain non-obsolescent for a long time, too, thanks to typically component-style versatility. Add new components and bring the old ones up to date, rather than trading-in a complete one-piece console for another one very much like it merely because the changer doesn't work right. Components have bugs, like most equipment, especially in the early stages of production on a new model. But if you get hold of a component that behaves as the maker intended it to, minus bugs, it is likely to keep on behaving that way for a long period of time with a minimum of care.

Electronic instruments do tend to drift out of adjustment in one way or another, even though actual faults do not exist. Minor parts age and change values; the tubes go through a normal age-ripening, perhaps affecting other aspects of the circuitry even though they have not actually failed themselves. Who is to service our equipment for this normal and inevitable process? It is clearly the big problem, and a much bigger one than the servicing of obvious and gross failures or accidents, where the remedy is often simple—if expensive.

Fix It Yourself

There are four ways in which components are repaired and maintained today. The first is, of course, by the buyer himself. If he has the common sense he was born with, he can do a great deal of simple "repairing" on his own. If one speaker of a stereo system goes dead, he can deduce, perhaps, that the most likely thing wrong is a loose wire. (How many people do?) Hook up the wire again—it's usually at the speaker terminals—and he's back in business. Or maybe he'll discover that a stray strand of metal from one of the connecting cables has shorted across an amplifier output terminal. Takes two seconds to fix it.

A very large percentage of component "failures" turn out to be of this anticlimactic sort and a corresponding proportion of all component troubles, not including those where clouds of smoke suddenly appear, are home-soluble in instant fashion.

So the first answer to component repair and maintenance is home-style common sense. We could do with a lot more of it. But I once wrote a book on this, so I'll continue onwards.

Local TV Man

Second, in component repair, is the local serviceman, the neighborhood radio and TV man. The less said the better about him. My advice still to all who ask is to *stay away*.

A few years ago, when components were less widely sold and not many people knew about them, the local service people simply refused to touch such repair jobs. Now—alas—they have heard all about component hi-fi. They are well aware that many of their customers are likely to own the stuff. And so they have changed their ways, radically.

Nowadays, your local serviceman will take on any old job you want, with greedy anticipation. The more complex the hi-fi, the better he likes it. After all, these things all work mostly alike. An amplifier is an amplifier, isn't it, whether it's a Philvox or a Zenico. They all work the same. And the same goes for radios—uh, er—tuners, I should say. Tuner doesn't work? Simple. Just pull out that diagram for last year's Magnificent Magnarola. Tells you how to align the Magnarola super-combined FM-AM-Multiplex-TV circuit. Just do the same thing on the component tuner—it can't do any harm. Might come out OK. And so the component tuner goes merrily off to the repair shop and comes back a few days later; unaccountably, it still doesn't receive that local good music station, though the bill for repair was $28.50. When it was brand new, you got the station loud and clear.

The repairman, if questioned, goes into the classic song and dance. That tuner is *old*. It's out of date. Would cost you more to fix up than it's worth. We did the best we could—but. . . . Now, we sell a nice little number that maybe you'd like to try. . . .

The same, alas, with amplifiers, preamps, cartridges, phono turntables, tape recorders. It's a dismally familiar routine. Most people don't really question it, because, after all, most American equipment does get old, and quickly. Most new equipment is better, newer, fuller of the latest features. If you're going to trade in a $2000 car after a year or two, how can you expect a $150 radio tuner to keep on going?

IHFS?

A third way to solve the maintenance and repair problem is of somewhat limited interest merely because there aren't too many of the repair shops in this category: the custom hi-fi component shop, specializing in component installations, complete. Most of these outfits (sometimes an individual, sometimes a larger firm) will take on repair jobs and/or maintenance (the distinction is very slim when it comes to billing) perhaps with the hope that new sales potentials will be built thereby. The reputable people in this area do a good repair job, because they know the equipment.

Unfortunately, there's nothing to keep a TV man from putting out his shingle as a component expert, if he thinks maybe it's worth the trouble.

My own feeling about this area is that the good people ought to figure out a way to band together, set up standards and *make them known*. Like the "realtors"—real estate agents. Build public confidence in a service "label," a badge of quality. Say the CSA, the Components Service Association, to make up a name on the spot. Make it clear that these standards of repair and maintenance refer specifically to *components*—any and all reputable brands. Might even call it the IHFS—Institute of High Fidelity Servicers. They could seek affiliation with our own IHF, the Institute of High Fidelity. If they were any good, they'd get it I'm sure. Indeed, the manufacturers and the servicers could work together with immense profit and good will. The proposed IHFS, for example, could acquire circuit diagrams and alignment instructions, and so forth, for all new component equipment and make them available in a package or subscription format to all its members, along with service tips and quirks, and so on. . . .

As things stand now, I hesitate to recommend to my friends any "hi-fi repair dealer" or the like without knowing a lot about him ahead of time. The chances are more than good, I'd suggest, that the component customer will get the royal runaround, big repair bills, and little satisfaction. As I say, anybody can be a hi-fi repairman, and often is.

Back to the Factory

There remains that court-of-last-resort, the manufacturer himself. Box up your tuner, ship it back to the maker. *He* ought to know how to fix it.

Well, he does. Moreover, a number of the component manufacturers do maintain their own repair service, for their own brand of equipment. (But the manufacturer is NOT going to appreciate being asked to "repair" a tuner that didn't work because the owner forgot to turn the switch on, or maybe tripped on the power cord and pulled the plug out of the wall.)

For reasons that seem to me excellent, the manufacturers who do repair work charge a solid price for it. Also often a minimum "cover charge," perhaps $12 or more. Plus parts.

People send in equipment for silly reasons. People tend too often to grouse about fancied distortions that don't show up in testing, or are due perhaps to another component—the one that didn't get sent in. All of which takes time and patience. It might require a couple of hours to check all the way through a tuner merely to find that it is perfectly OK. The trouble was elsewhere. That'd be maybe $14, plus shipping charges, and it might take a week or a month.

Nevertheless, the hypothetical owner of such a tuner is lucky. Very lucky. For his hunk of cash, he's got his machine back *in working order*. Take it to the local repairman and the same hunk of cash will likely re-outfit it with a long list of unnecessary replacements, most of them the wrong ones, plus a fine job of de-aligning!

If I sound sour, I intend to. Personal experience and many a disgruntled letter from our component fans.

Last fall, I discovered a perfect opportunity to dwell on this problem in terms of one component, an FM-AM tuner, a real old one. Don't know the exact model-year, but it was a Fisher Model 50-R, roughly ten years old, which I had ordered for my parents 'way back, part of an inexpensive

"hi-fi system" that they had installed in their house in Connecticut, after my suggestions but via a local custom builder.

For many years this tuner had been in intermittent service some 125 miles out of New York, and I had nothing to do with its maintenance or use. I tried a couple of times on visits to get my New York program on it. But we were unfavorably situated; their roof-top antenna wasn't any good, and so I couldn't hear myself at all.

A short while ago, after my father's death, my mother moved from Connecticut to Ossining, N.Y., only 30 miles out of the big city. At last, thought I, my own relatives will be able to hear my weekly radio stint, after so long! So the first time I got to visit, I hopefully turned on the old tuner, which had been brought down from its former distant location and set up again along with the Bogen amplifier and Miracord changer that went with it.

Umph. The tuner turned on all right. It emitted noises, very loud ones. On AM, you could get dozens of stations mostly superimposed on each other in a roar of static and background noise. Unintelligible. The FM section just hissed very noisily. No reception at all. When we hooked up the TV antenna on the roof to it, the thing managed to produce just two faint stations, barely audible. Not the faintest trace of my own station, 30 miles away in the city. On the a.f.c. position, I noticed, a loud hum came through. It stopped when the a.f.c. was "defeated." Defeated the hum, but didn't bring in any better signal. The faint sounds I could hear seemed distorted—but I really couldn't tell for sure, thanks to the hideous hiss of background noise, right across the dial.

A mess. Well, I thought, it's an old, old tuner and it's worked plenty hard. Maybe it really is done for. And so I began to turn my thoughts to the idea of lending a newer tuner that would work better. This one had had too much servicing.

The custom builder who originally installed the system put his nose in the air when he found we didn't want any of his expensive hi-fi furniture, and we never could get him to come back to service it. Then he died. So my parents had called in the local radio man when things periodically got to be impossible. He had managed to keep the set in what might optimistically be called "working" condition, year after year.

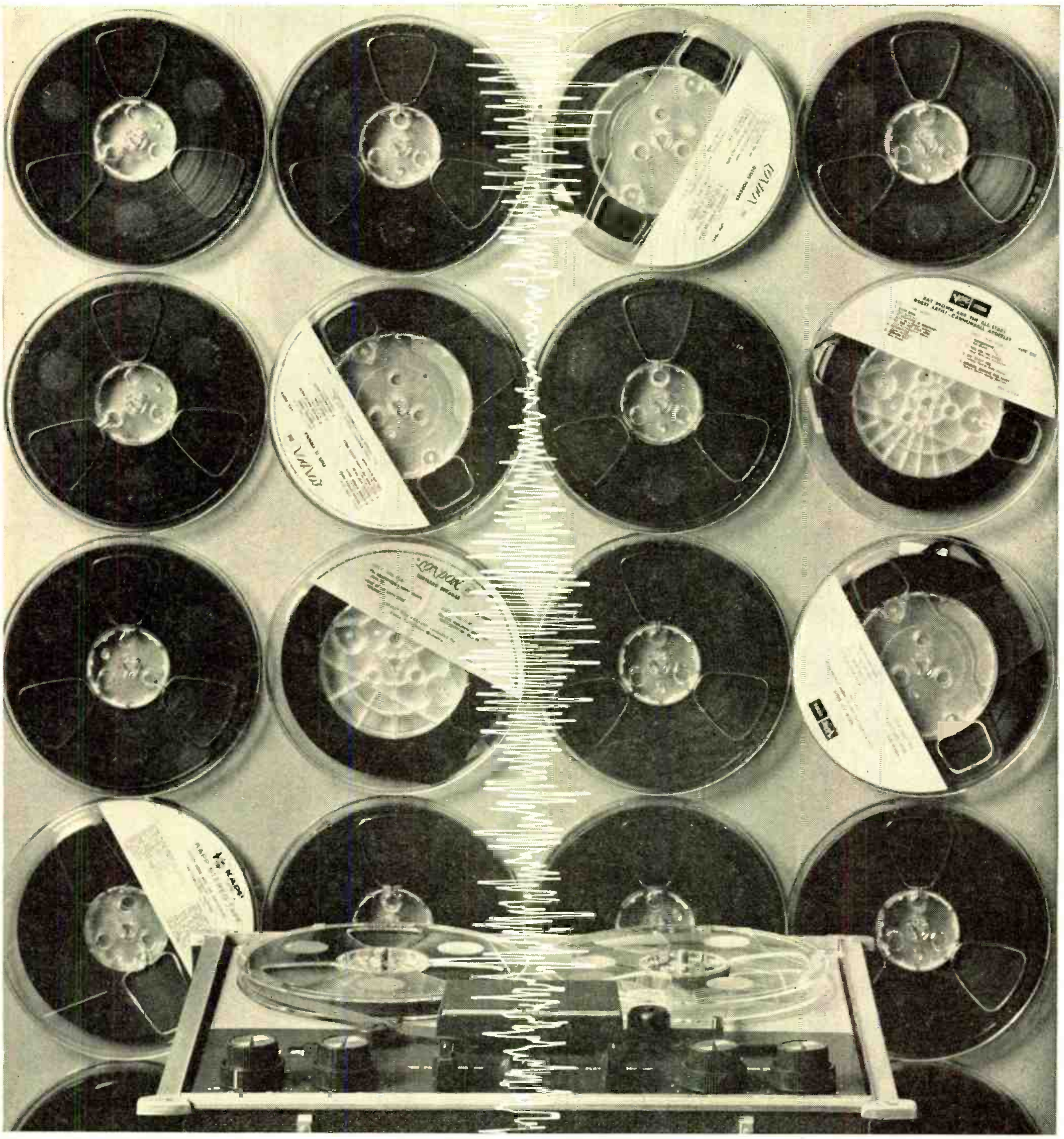
"Working Condition"

"Working condition" for my father meant two things. One, he had to get his morning news-of-the-world on the radio, along with his coffee. Two, there was the seven o'clock dinner commentary by his favorite news analyst. If these two were audible, more or less, he was happy. He didn't mind the extraneous noise, the distorted voice quality, that persistent blues singer who always overrode the commentator at just about seven-ten, no matter how carefully you tuned the dial. (Someone was always jumping up and re-tuning.)

After all, we had moved into the country. What more could you expect? My father was quite used to these sounds.

His first news radio had been a Kolster, back around 1925. Then we had a Philco mantlepiece model, the very first, followed by innumerable small portable Emersons and Admirals and what-not. The old 1940 Stromberg Carlson AM-FM radio console was his first flyer into "hi-fi" old-band FM and it sounded nice and boomy, minus any highs at all. The Fisher 50-R was wonderful, when we got it, and it still seemed wonderful when the repairman finished

(Continued on page 58)



For a limited time: what tape recorder comes with $116 worth of free tape? **AMPEX 1200**

Now, Ampex will give you $116 worth of tape when you buy any of the Ampex Fine Line 1200 recorder/player series. You get twelve reels of Premium Ampex Tape worth $66 — enough tape to record up to 38 hours of stereophonic or 76 hours of monophonic sound. Plus you get your choice of $50 worth of pre-recorded stereo tapes from 13 recording companies. And above all, you get the finest tape recorder in the world: the Ampex Fine Line 1200, the only 4-track home recorder built to professional standards. It features three new precision heads, a die-cast frame and a tracking technique and tape guidance system previously available only in professional recorders. No cross-talk. Just high fidelity sound. You also get the new Ampex "Four Star" One-Year warranty: Ampex will replace any defective part for a full year. Three models: 1250 unmounted, 1260 portable and 1270 portable with built-in amplifier speakers. This offer good only at participating dealers for a limited time only. See your Ampex dealer now. Ampex Corporation, 934 Charter Street, Redwood City, California. The only company providing recorders, tapes and core memory devices for every application. Worldwide sales and service.

AMPEX

EDITOR'S REVIEW

SOUND AND LIGHT

Some time ago, as we were putting this issue "to bed," some of the staff members were discussing the type of effects possible with a light organ such as the one described by Mr. Dollens in this issue. Those of us who have seen this type of display, in one form or another, can testify to the spectacular visual potential of this type of instrument. Some even had seen a light organ "played" on a keyboard in accompaniment to music where the result was quite beautiful. One of our staff then asked, "Why can't an organ be modified so that it will play light as well as sound?"

Why not indeed!

Perhaps it has been done before, but it certainly is not common. In any case it seems to us that it would be the simplest thing in the world to have the impulse of a pressed key translated into a signal to a light-organ circuit. This would be especially simple with an electronic organ. In fact it might be a good idea for the electronic organ manufacturer to provide taps especially for this purpose, perhaps in the form of barrier strips at the rear of the console.

It has been pointed out to us that a device exists to convert a piano keyboard into an electronic organ keyboard. Apparently it consists of plungers which contact the rear part of the key and make or break depending upon the position of the key. It would seem a mere hop, skip, and jump to convert this to a light-signal source for *any* existing keyboard instrument.

In case it sounds as if we are pressing to have all such instruments modified for use as simultaneous sound and light instruments, please be reassured; we aren't. We are mainly pointing out the relative ease with which such a conversion *could* be affected.

VERTICAL ANGLE 15 DEGREES?

In the past few months we have presented two articles addressed to the problem of vertical tracking angle distortion. In both articles, reference has been made to 15 deg. as the suggested optimum angle. In addition, the RIAA engineering bulletin which bears on this topic recommends the same angle. From all this, it has been assumed that we support the adoption of this particular angle as the standard. Frankly, nothing could be further from the truth. We support standardizing the angle, and nothing more (or less).

As we understand it, it is a rather complex problem to determine the exact angle which is most desirable from the distortion reduction standpoint, as well as from the manufacturing feasibility standpoint. Also we understand that the presently recommended 15-deg. angle was arrived at in Europe. It seems to us that the wisest course at this time would be for American manufacturers to consult with each other and arrive at the particular angle most suitable for *their* requirements. If this happens to be different than 15 deg., then it would be possible to present valid and persuasive reasons to their European counterparts for changing to whatever angle they found most suitable.

Our point, then, is that there should be a standard vertical cutting and playback angle agreed to by *all* record and cartridge manufacturers so that a needless, and known, source of distortion can be eliminated. We do not presume to tell the engineers in the field what the best angle is; let them tell us, *and soon.*

HIGH FIDELITY DEFINITION—PROGRESS REPORT

We wish to thank all of our readers who responded to the call to write to the Federal Trade Commission. Recently, we had a conversation with one of their staff members and he indicated the response was overwhelming. As a result of that response, the FTC is now aware that an inadequate definition of high fidelity will not protect the consumer. In all fairness to them, perhaps they were aware all the time. In any case, they are interested in the proposal we made in both our letter to them and in our editorial—that there should be standards of measurement adopted rather than standards of quality. For example (and here we borrow from the excellent proposal made by Mr. Ray Pepe, President of the Institute of High Fidelity), if a manufacturer wished to use the term "High Fidelity" to describe a product he manufactured, he would then be required to publish certain significant specifications measured in a standard and prescribed way. This would give the consumer a yardstick, if he wanted it, while at the same time avoiding the difficulty of trying to define a term which has subjective overtones. Certainly, it is the type of solution which can be put into effect in a reasonable period of time. As to whether it could work or not, in our opinion it would work very quickly; it wouldn't take long for a consumer to realize that 15 per cent distortion is not as good as 2 per cent or less. Can you imagine a manufacturer letting himself in for the ridicule attendant to the publication of embarrassing specifications? Frankly, we think that merely requiring standard measurements, and publication of them, would be all that is necessary to stop the misuse of the term "high fidelity."

By the way, in our conversation with the gentleman from the FTC, he pointed out to us that we had erred, by implication, in our statement that they had invited the EIA to come up with the definition. In reality, he said, all trade groups were invited. There was no intention to make it exclusively an EIA affair. We are glad to stand corrected.

THE WASHINGTON SHOW

As a last minute bulletin we are noting some of our impressions about the recently concluded show at the Shoreham Hotel in Washington, D. C. Frankly, we enjoyed the show. It was placed in an attractive setting, it was relatively free from the frenzied pace of some other shows we have seen, it was dignified in presentation, and it featured a live-*versus*-recorded demonstration. Perhaps there is some different quality about the resident of Washington of which we are unaware, but it seemed to us that the audience was truly interested in music-reproducing components, rather than technological developments. All too often, when we attend shows, we leave disappointed in the setting and manner of presentation, which doesn't agree with the quality of the equipment being shown. Perhaps the secret lay in the fact that they weren't trying to interest the entire populace, but rather only those who could profit from seeing this type of equipment; perhaps it was because of the manner of presentation; in any case we would recommend that other regional shows make an attempt to learn the secret.

Only Sherwood could combine the two most wanted components to bring you the new S-8000 II FM Multiplex Stereo Receiver

The advanced design, highly sensitive and selective stereo FM tuner is essentially the same as that employed in the pace-setting S-2100 Sherwood tuner (below). Stereo music power circuitry is similar to Sherwood's high-rated S-5500 II stereo amplifier (at right).

These extra quality features are standard with the Sherwood S-8000 II.

- Instant FM stereo broadcast identification — Sherwood's new **Stereo Indicator Light.**
- **Novar Output Tubes** — have higher voltage ratings, more dependable.
- Noise suppressing FM circuitry 3 Mc. Gated-Beam Limiter and Balanced Ratio Detector — **2.4 db. capture effect.**
- **Flywheel tuning** — for faster, smoother dial tuning.
- Elimination of "rushing" sound when tuning — **FM Interchannel Hush.**
- **Dial spread** — communications-type, 20%-longer professional scales.

64 Watts Superb Music Power

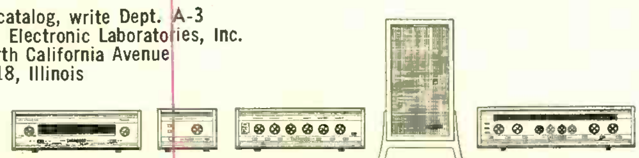
Price of the S-8000 II with attractive Walnut Leatherette Case $317.00 (Fair-Trade). Without case $309.50. Full-year warranty.

If you prefer a receiver which also includes AM reception and has even greater music power (80 watts), Sherwood now offers the new S-7700. Price with case $377.00. Without case $369.50. Full-year warranty.

S-8000 II Specifications

FM Sensitivity: 1.8 μv. for —30 db. noise and distortion (IHFM). **FM Selectivity:** 200 kc. @ —3 db. **FM Detector:** 1.0 Mc. peak to peak **FM Distortion:** ⅓% @ 100% mod. **Power output:** each channel 32 watts music power or 30 watts continuous @ 1½% IM distortion. **Stereo low-noise** phono or tape head play-back preamps. **Tubes:** 21 plus 2 silicon rectifiers, 9 diodes. Size: 16¼ x 4 x 14 in. deep.

For new catalog, write Dept. A-3
Sherwood Electronic Laboratories, Inc.
4300 North California Avenue
Chicago 18, Illinois



Sherwood
HIGH FIDELITY

Stereo Receivers • Tuners • Amplifiers • Multiplex Adapters • Stereo Indicator Lights • High Fidelity Speaker Systems • Contemporary Cabinetry

A Wall-Projection Color Organ

MORRIS DOLLENS*

Projecting its kaleidoscopic color pattern on a wall, or any convenient surface, this thyratron-operated instrument, limited only by the imagination of the operator, provides visual accompaniment to music.

The color organ has enjoyed much less publicity and literature than the other branches of electronic gadgetry, possibly because of the limited interest the average public has had in abstract images, whether it be the so-called modern art or the visual interpretation of music.

However, with the rapidly expanding field of component high fidelity making possible vastly improved quality of music reproduction, plus the spoken word and sound effects, there comes a time when many people search for a step beyond that of the commercially almost-perfect sound. Aside from playing with three-way stereo sound, there isn't much else that can be done at present. Subject to criticism from many music lovers, here is where the color organ can offer an additional dimension to the reproduction of music in a form which can be anywhere in the range from a flickering, humorous novelty to an elaborate visual presentation approaching the hand-drawn abstract animated Bach section of Disney's "Fantasia" film of some years back.

History

The idea of interpreting music in color dates back as far as music was played with any conscious effort, for the emotional effects of music suggest to many people the changing colors of nature, including the obvious sunsets; the moods which we attribute to various colors are often evoked by certain tones or rhythms, thus relating the aural and visual senses, and of course popular songs rely heavily upon the spoken words which habitually include color suggestions.

* *4372 Coolidge Avenue, Los Angeles 66, Calif.*

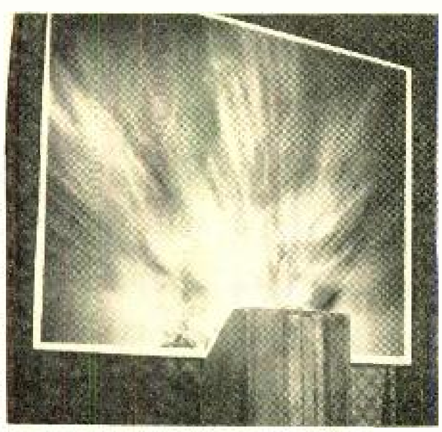


Fig. 1. The original unit.

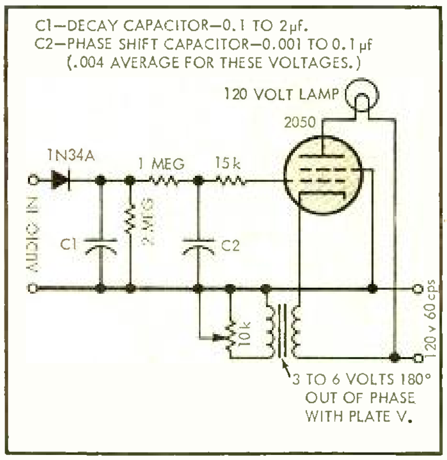


Fig. 2. Basic circuit of thyratron color organ.

Late in the last century the classical composer Scriabin wrote one piece of music calling for the use of a color organ of sorts, but the machine was not successful, no doubt due to the limited technology of the day. I have made only a modest study of the history of these devices, saving all printed information which came my way for a number of years, but I am told that a university student in Los Angeles recently wrote a 100-page thesis on this subject, so undoubtedly there is interest, but little information of a practical nature has been printed. My first introduction to the color organ was in a science-fiction story about 1928 which described such a machine, played by hand on a keyboard, as I recall, with disastrous results. The future development of the color organ seems to crop up fairly often in the recent stories of this nature, and the authors' imaginatively inspired effects are elaborately described as the art-form of the future.

Of interest to those of a more technical and cultural mind was the showing of the portable model at the Solacon during the World Science Fiction Convention at Los Angeles in 1958; up to twenty people at a time were entranced with the effects on the little screen, for eight hours each of the four days.

Sometimes referred to among the viewers of my instruments as modern art in motion, the effects achieved in even a fairly simple model can project imaginative shapes and forms on the screen; even the most superficially interested person finds it a pleasant novelty for a few minutes, and admittedly it can become boring if the pattern variety is limited, as it has been with the published plans of electronic color organs which I have clipped from magazines the past few years.

Ideally the true color organ would be played by hand with an elaborate keyboard, and I am told by a friend who has had me build him a number of these amplifiers and associated pattern-producing devices, that there have been limited successful runs of such hand-played color organ performances in large cities over the past half-century. But as with its distant relative, the Theremin, the appeal and application seem to be quite limited, at least up to date. It is possible that the hi-fi fan who has (almost) everything will find the pattern-projectors described herein will add a visual dimension to his musical presentations for occasional demonstrations to the novelty-minded, and with more elaborate patterns, can afford the more serious student of art, music, and culture something new to study and perhaps appreciate. I might get into an argument here with the music-lover, for there are those who wish to listen in complete darkness to music and nothing else—which I do sometimes—but certainly the color interpretation is worth a look. Obviously, the degree of effort expended on imaginative use of the color and pattern-forming reflectors and lens-wheels will determine whether the final result resembles a garish, drunken jukebox or becomes a poetic visual symphony. Some will still prefer darkness every time.

One practical use of the instrument, which I have never tried, would seem to be in presenting music to the deaf—supplying small speakers for them to feel while viewing the visual music patterns. A development of this idea has been in experimental use for some time in teaching the deaf to speak—the frequencies

Fig. 3. The present model projects varied patterns in color on a flat white screen in a window alcove.

are broken into about seven channels, which light up bands of color throughout the spectrum, enabling the deaf (but not mute) person to match his voice patterns visually to those of a standard voice, enabling him to speak in a more natural tone. Along this line might be mentioned the effect discovered by C. M. Brainard that discarded fluorescent lamps connected across the output of a standard audio amplifier will glow and flash at different frequencies; the principle has been applied in his "Light Organ," patented in 1948, consisting of a number of these lamps mounted in a row behind a ground-glass screen. Although limited in its appeal other than a novelty, the Light Organ has been installed commercially.

The ultimate in variety of patterns and elegance of engineering would seem to be a development of the Abstract Oscillography[1] produced on a 'scope by beating different wave forms together. A series of still photographs of the more interesting patterns achieved by Ben Laposky were exhibited at art galleries and museums throughout the country a number of years ago. Anyone who has played with this instrument has probably been fascinated by the unusual shapes to be seen when various waveforms are mixed, and a set of projection-type tubes with lenses or Schmidt-type mirror systems combining the basic colors on a screen would constitute an all-electronic color organ capable of a great variety of patterns, including an occasional glimpse of the actual waveforms of the music being played. However, such a color organ would be expensive to build, unless the experimenter has access to quite a bit of surplus or discarded oscillographic and television equipment to supply parts. Probably simple lenses could be used instead of the more elaborate projection lenses mentioned above, since the abstract patterns would not have to be quite as sharp over the whole projection screen as a regular TV image. This system would use only the three band-pass filters described herein, and would require a number of signal generators governed by some sort of random-pattern selector, and could get quite complex—a computer expert should have a wild time experimenting with this idea.

Early Home Color Organs

My own interest in the color organ, home-style, came about in finding an article in a back issue of *Popular Science,* I believe, of the mid-30's describing a three-way electrical filter similar to those used with present three-way speaker systems, and displaying a small ground-glass screen in a discarded table-model radio cabinet, presenting the colors in a uniform glow, but pulsing in time with the music: red for lows, green for medium frequencies, and blue for highs. To this day, I have kept this relationship, but others may prefer to reverse the order; but to me, the drums seem to suggest the low beat of a red heart, while the highs, such as violins' sustained notes, suggest the ethereal blues of the sky.

Theoretically, the three basic colors, red, green, and blue, add together to form all the colors of the rainbow, and during the sustained passages, other shades than the three colors can be seen, but not so much during the faster action. Especially pure basic colors can be seen when the pattern from one falls within the dark area of another pattern. Additional variations are achieved by using slightly different shades of the basic colors on different lamps, such as pure spectral red on one lamp, and orange-reds and violet-reds on others.

More than three channels can be worked out but the filters become more elaborate and much more expensive; it would seem that the expense might not justify the effort unless a very elaborate system is planned.

Departing from the small cabinet, I originally placed my three 6-volt colored lamps on stiff wire stems in the approximate focus of a faceted photo-flash reflector mounted on the shaft of a 1-rpm clock motor, the whole mounted in a sort of podium, a tall box situated at the lower center of a white screen, giving revolving and radiating lines which pulsated with the music (*Fig.* 1).

Later, more bulbs were added in parallel when a larger 25-watt amplifier was built, allowing nine pilot lamps to be reflected by three reflectors revolving at differing rates, from one to five rpm. This unit was placed about two feet behind the lower third of a ground-glass screen with a lamp of a different color in each reflector, with much more varied results than the one reflector in front. Translucent plastic sheeting can replace the ground glass, which was achieved by slowly working another piece of glass about 6-in. square around the larger sheet, with carborundum and water between. Unfortunately, with this arrangement, the brightness diminishes greatly off the axis of the lamps, even more

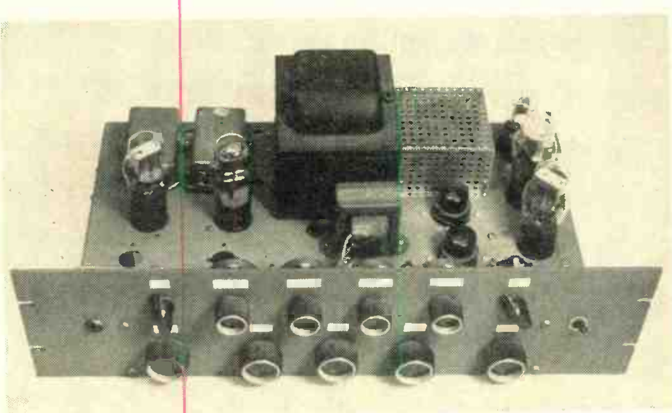


Fig. 4. Close-up view of thyratron amplifier chassis and control panel.

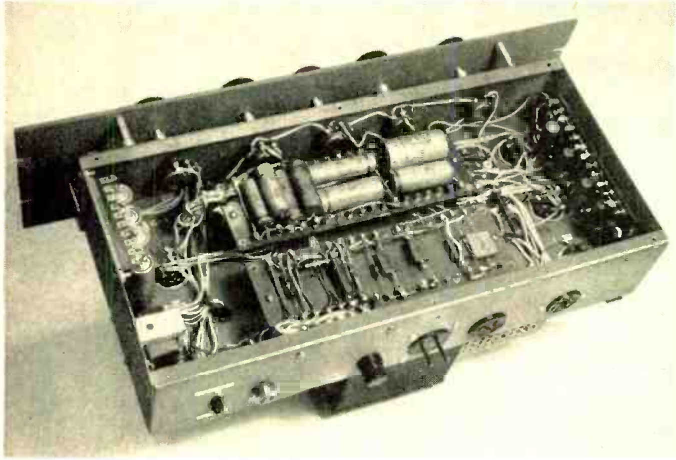


Fig. 5. Bottom view of chassis.

abruptly than with a front-viewed beaded screen. Some plastic sheeting is much better for the purpose, although the better diffusors naturally transmit less light. Matte acetate, obtainable at art supply stores is also practical to use.

The three reflectors could of course be situated in front if desired, but mounting them behind a translucent screen enables them to be raised up a bit, distributing the light better; however, there is a certain theatrical quality to the footlight effect of the low lamps, and I have gone back to this in the model shown.

Needless to say, the early versions of this gadget were not very bright, and necessitated a very dark room for viewing. One advantage in using the 6-volt pilot lamps is the almost point-source quality of their small filaments, producing very sharp images of the faceted and wrinkled reflectors; this sharpness is almost completely lost when using larger lamps unless much larger reflectors are used. A serious disadvantage, other than the high audio power required, is that the light-producing response of the lamps is extremely non-linear with respect to voltage. Reflected upon the screen, the lamps give almost no illumination until about half the rated voltage is applied; then they become fantastically bright (and extremely short-lived) at even 50 per cent above rated voltage, and eventually on sharp peaks of music they burn out, interrupting the performance. This was minimized in my earlier amplifier by loading up the system with enough bulbs so that when the bulbs had reached their rated voltages, the amplifier was overloaded, and ceased to increase in volume. Of course, the extreme distortion necessitated an additional amplifier for the speaker system. Another disappointment was that the softer parts of most music, in fact all but the crashing crescendos, were unable to achieve the half-voltage point and thus weren't visible; with the gain pumped up, the softer sections responded well, but the bulbs saturated on the peaks, and still occasionally burned out bulbs—a difficulty partly overcome by using a volume compressor in the light-amplifier circuit. Because of the non-linear response, however, the bulbs appeared to flicker, rendering the eyeballs numb after perhaps a half hour. But it was a great novelty.

The Thyratron Color Organ

The present model (electronically) evolved from a number of sources, among them an article describing a thyratron circuit for detecting, via photocell, the flickering of candlelight and gaslights on a movie set,[2] so that the wall behind the little flames would likewise flicker (though lighted by bright photo-floods); and a pair of articles describing thyratron power supplies,[3,4] both of which were controlled by small grid voltages. Using 60-cps a.c. on the plate, rather than filtered d.c., a small out-of-phase, 60-cps voltage is applied to the grid of a thyratron, a gas-filled electronic tube capable of handling fairly large currents in even the smallest sizes, and available in sizes which can handle many amperes. After a number of experimental hookups had been tried, the present basic circuit (*Fig.* 2) was settled upon, using a relatively inexpensive 2050 tube, costing less than two dollars, and seemingly capable of being overloaded, for a moderate time, to a considerable degree. Rated at 100 milliamperes average current, with a peak of one ampere, the color organ model shown here has been in use for hundreds of hours at 250 to 500 milliamperes drain with no tube replacements yet. During the experiments, a 500-watt bulb was used in series with one 2050 for several hours, draining about 4.4 amperes, with apparently little detrimental effect. It is doubtful whether this much overloading would be practical. If you prefer to stay strictly within the manufacturer's ratings, it is suggested that you use one of the more powerful (and expensive) thyratrons described in the article on a "Medium Power Color Organ" by Glen Southworth.[5] In fact, those experimenters who have previously built the color organ amplifier described in that article can easily extend its utility by adding some of the pattern projectors to be described here. The amplifiers differ from the Southworth model in exact circuitry, but basically are similar—our version is somewhat more versatile and hence more complicated in wiring and adjustment, but the added features will repay the user in more delicate control over the effects attainable. Some of the features, such as the variable time-decay selector switches, can be added to the medium-power amplifier if desired.

The Pattern Projectors

The most distinctive feature in the color organ installation shown here (*Fig.* 3) is the method of producing the varied patterns, at once simple and yet capable of producing a great variety of shapes, although the mechanisms shown are by no means the only way—but they are fairly easy to build, and are a starting point for the imaginative experimenter to take off from. It is these patterns which make this color organ far more interesting to view than any other I have seen written up, and the lamps may be switched manually, as in this model, selecting alternate lamps in different reflectors. A plan is being formed to have the selecting done automatically during the dark moments, so that more varied combinations of lamp positions may give greater diversity in the effects.

The reflectors are made of chrome-plated metal, cut from old photo ferrotype plates, although for the number of reflectors needed, a new plate can be purchased for a couple of dollars in a sheet about 14 × 20 in. Old faceted photo-flash reflectors are ideal, but their regularity of pattern might dictate a little distorting of shape to vary the effects as they revolve. Chrome-plated acetate can be bent or melted into shape (in boiling water), but might have to be tacked or glued to a wooden base disc, and bits of broken or cut mirror can be glued onto supports or to the center of the metal reflector for variety. Odd silvered or chrome-plated objects can be found in variety stores, offering other possibilities for unusual shapes of reflected images. In this color organ transparent rippled glass with lens-like bumps project other types of patterns and these will be described in that section.

Color Organ Refinements

One different feature in this color organ is the background circuit which stays lit during the quiet parts of the music, fading out as the music volume rises, presenting a magenta-violet pattern slowly moving over the screen, although the reflector for this channel could be eliminated and a soft glow all over the screen substituted. This background channel was dictated somewhat

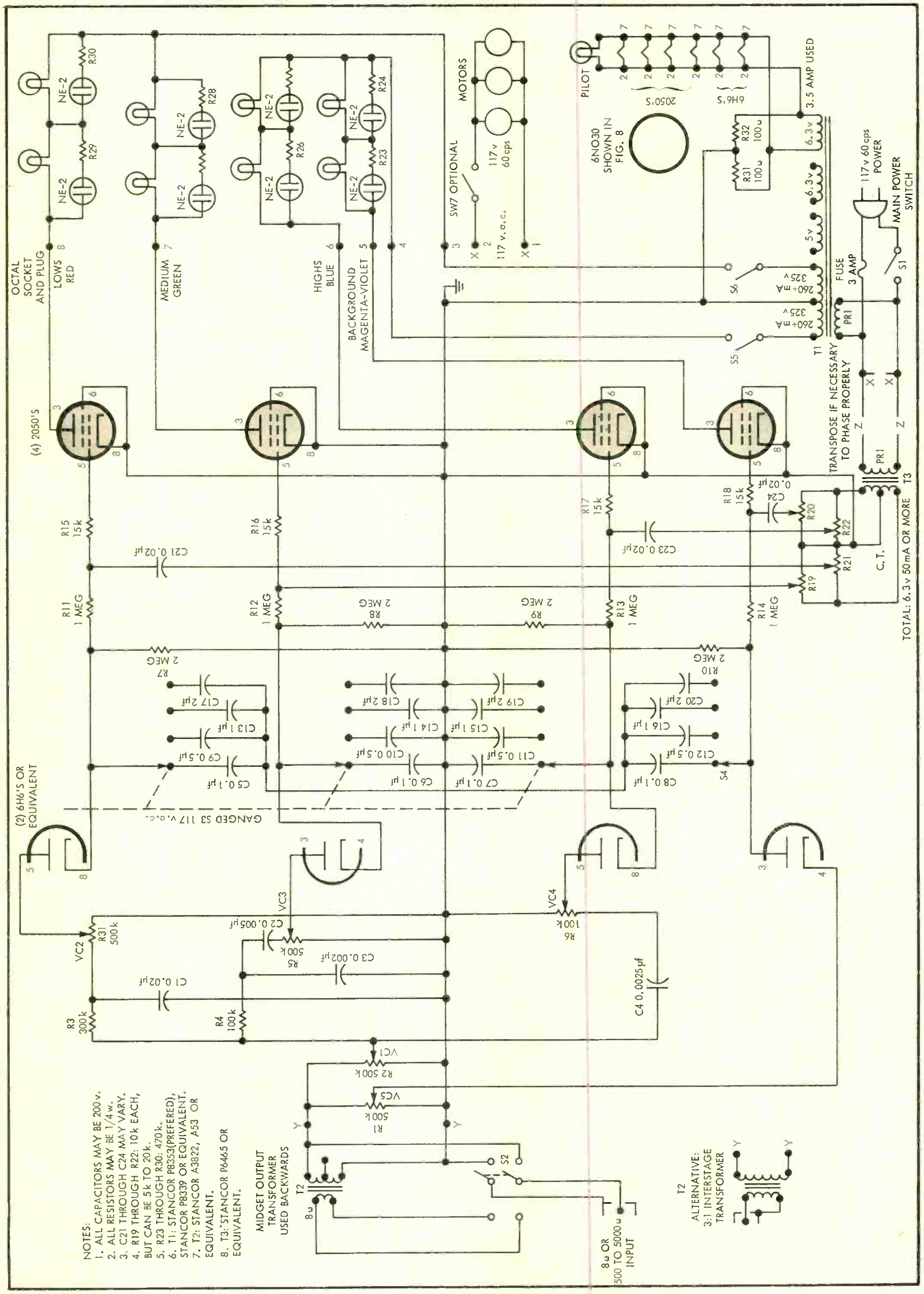


Fig. 6. Schematic of thyratron amplifier.

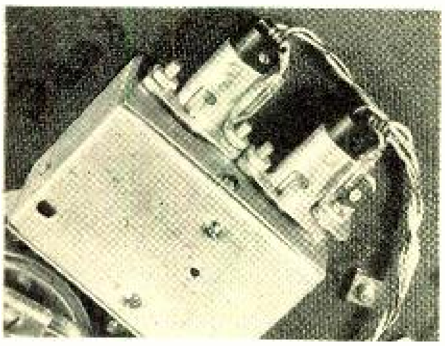


Fig. 7. Close-up showing optional neon indicators and series resistors on each lamp socket.

by the modest brightness of the screen patterns, and the preference for looking at the images in a very dim or darkened room, so that is necessary to prevent the screen from becoming completely black to minimize eyestrain. The darkened room prevents stray white light from diluting the colors, otherwise very delicate shades will be lost. The background lamp can be extinguished or set at any level desired by its basic intensity control; and with its volume control, the point in the volume at which the lamp begins to dim out can be set. Actually two lamps are used in the background channel, in different reflectors, so that a pattern of some kind is always on the screen.

Another refinement is the pair of switches which control the decay time in the rectifier circuits just after the band-pass filters. The decay time is controlled by the size of the capacitor across the 2-megohm load resistor in each rectifier circuit, and allows selecting the speed at which the lamps fade out after an increase in their brightness. The capacitor will vary depending upon the size of the projected image, the speed at which the patterns move, the darkness of the room, and the type and rhythm of the music being played; the sizes indicated will cover most of the effects in timing desired, with the smallest giving almost as fast a response as the 25-watt filaments can respond to, up to a fade-out time (after a heavy crescendo) of as much as four seconds when using the 2-μf capacitors. Unfortunately, the circuits fail to respond completely to the small variations in the faster rhythms when set for the slowest response, although the capacitors do charge up quickly on loud peaks, giving some sort of quick action, but present almost no rhythmic response to softer fast music. On a large screen, the slower response is easier on the eyes, and is especially good for slower organ music and sustained notes in classical music, smoothing out some of the fluctuations due to vibrato and tremolo.

Sometimes the slow timing on the three color channels keeps the main colors flowing more smoothly, while a faster setting on the background channel, set to stay lighted until the very loudest peaks dim them, offers a suggestion of rhythm without straining the eyes.

General Construction

This installation consists of a box $9 \times 12 \times 48$ in. in size, containing the thyratron amplifier chassis and the color wheels, designed to project patterns on a nearby wall. The amplifier is designed to work with an existing sound system.

The projected pattern is planned for viewing from a sitting position, with the top of the cabinet at eye level. If different viewing levels must be accommodated, such as standing plus sitting, the reflectors must be set lower in the cabinet, which might have to be deeper. Drawing a scale diagram of the room, the cabinet, and eye levels will help here.

Panel and chassis layouts are shown in *Fig.* 4 and 5, but are not critical. Band-pass filters are mounted on a terminal strip below the chassis; some of the decay capacitors are mounted on another, while the bulky dual 2-μf capacitors are mounted above the chassis.

Since weight was not considered a problem in this model, a TV transformer was used to secure a higher operating voltage for the thyratrons, allowing the possibility of using more lamps at a later date, and lowering the plate current, as the two lamps in each color channel are wired in series. Since the transformer supplies 325 volts on each side of the center tap, the voltage drop within each 2050 tube can be overcome by selecting a supply voltage high enough still to put a full 120 volts or slightly higher across each of the lamps at full brightness. This will increase the efficiency of the lamps and brighten the visual effect of the cooler greens and blues, for these are much dimmer when seen by the yellower light from "under-voltaged" lamps.

Actually the circuit shown (*Fig.* 6), with no series resistors, puts 150 volts on each lamp on loud peaks, a permissible overload if shorter lamp life is not too discouraging (estimated here at 200 hours or more) although some lamps have burned out within a couple of hours, due probably to the jolts received during the switching of the manual selector during peak brightness. To prevent excessive burnouts until automatic switching is installed, a 250-ohm 15-watt resistor has been added in series with each channel.

To lower voltage on lamps, and 5 ohms per volt of drop desired, if using 25-watt lamps in series. For example, to lower the 150 volts to 120 volts, a 30-volt drop per lamp, or 60 volts total $\times 5$ ohms $= 300$ ohms; dissipation is 12 watts (60 volts $\times 0.21$ ampere).

If a transformer supplying 265 volts on each side of the center tap is available, the 25-volt drop in each 2050 tube would put a normal 120 volts on each of the series-connected lamps.

A refinement is an indicator at the base of each socket (*Fig.* 7) consisting of a tiny NE-2 neon lamp with its limiting resistor (470,000-ohms, ¼-watt) across the terminals to aid in finding burnouts. Though these sometimes tend to light dimly when the incandescent lamp is operating, the one across a burned out lamp will burn more brightly as in an indicator-type household fuse. This aid in replacing lamps is helpful if many lamps are used, or if a delay in the performance is embarrassing with a larger audience.

Since the 2050 tubes act as efficient rectifiers, each tube uses only one half of the power cycle, so that the tubes are connected in pairs, each pair using half of the transformer winding, and passing current for only half of the time. Although the drain upon each side of the winding is around 500 milliamperes, this peak current is not drawn continuously, so that the transformer used has not heated up to any extent during normal two-hour performances. The original rating was about 260 mils for continuous duty, which is probably about what the average drain is in this application. The heater windings are not drawn upon to supply their full rated amperage, so this too helps to keep the transformer cool. Of course, in any installation expected to run for longer periods, such as all day in exhibits, a separate transformer winding would be advisable for each 2050 tube, requiring two transformers. Odd lots of discontinued units of this type are often for sale at about four dollars each so this might be worth considering if only to allow for future expansion of color circuitry.

Miniature thyratrons such as a 2D21 might be substituted, as they are elec-

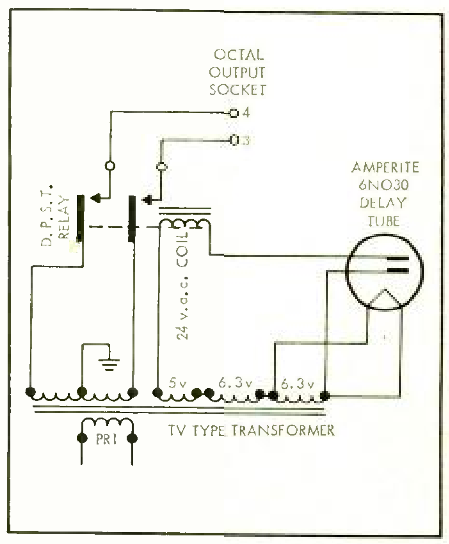


Fig. 8. Thermal-tube method of applying delayed plate voltages.

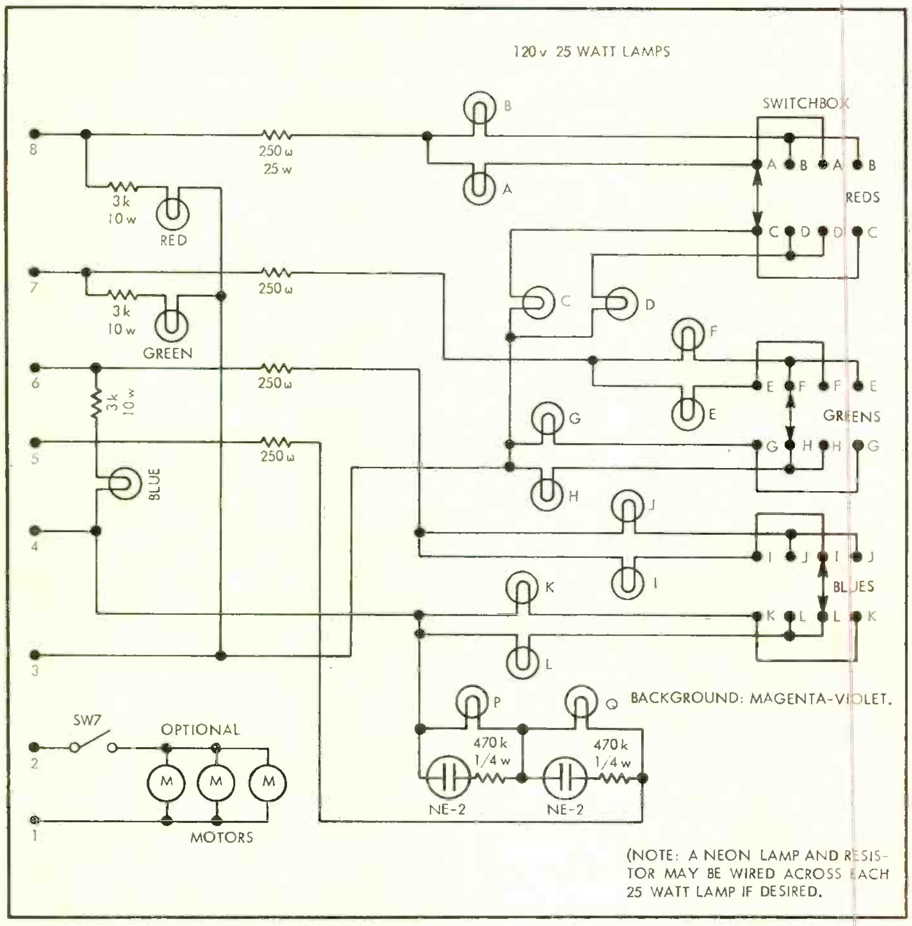


Fig. 9. Alternate lamp circuit used in this model.

trically equivalent, but would possibly require changes in the phase-shift capacitor. Wiring up a test circuit of one channel first would give the answer on this.

Although the out-of-phase "bias" voltage can be obtained from the main power transformer, it was found that the slight lowering of supply voltage due to the internal resistance of the transformer when the lamps brighten and draw full current sometimes caused a lamp to jump or flicker in the action, as this voltage-supply change is of course reflected in the grid control circuit. In the model shown an extra filament transformer was used to supply a.c. on the grids. If a center-tapped unit is not available, connect two small resistors, 100 ohms or so, in series across the winding, and ground the junction, to divide the voltage in two. Of course, if all four of the basic intensity controls are of the same value, this is not strictly necessary.

Testing one of the thyratron circuits is advised to get the feel of the action, and to phase the power transformer properly with the grid voltage. A slight added complication is the opposite "polarity" of the two pairs of circuits, which can cause some confusion if wires are crossed. This can become even more bewildering if two power transformers are used. If a common grid transformer is used, then the best place to switch the wires when phasing is in the high-voltage leads, since all four leads from the two transformers will have to be adjusted.

A slight interaction between the circuits can be noted when adjusting the basic intensity controls, due to the load placed upon the transformer when one of the tubes is drawing more current, but this is not noticed during the normal operation, since the music is constantly changing, masking any slight loading effects. However, in the case of a 2050 which seemed to test good, it still flickered badly, jumping up to full brightness when an adjacent circuit was brightened, calling for replacement with another tube.

The input to the color amplifier is through a small universal output transformer connected backwards, so that the audio signal can be taken directly from the sound system speaker terminals; this might leave something to be desired in proper engineering, but little effect was noticed in the quality of the sound in the installation here, probably because of the very small load reflected back from the high-impedance band-pass filters. A DPDT slide switch is shown connected to allow either the 8-ohm isolated input through the transformer or a 500-ohm input across the secondary winding to be used; if only a 500-ohm input is desired, the transformer can be eliminated, or if a higher voltage is needed to modulate the thyratrons fully, a 3:1 interstage transformer can be used, eliminating the switch.

In this model, the two volume controls act on the over-all sound to the three channels and the background modulation, while each channel has its own volume control to balance the light modulation. The band-pass filters divide at approximately 350 and 1000 cps. The mid-range filter is somewhat less efficient than the one described in the Southworth article, which used an iron-core choke, but is less expensive, and sufficiently sharp for this purpose. A plug-in box can be used for the filters if quick changes are anticipated.

In this amplifier two 6H6 tubes were used as rectifiers, since they were on hand at the time, but other types of rectifier tubes or germanium diodes can be used as well. Mounting space, heater supply, budget, or junk-box availability can help to decide which is used.

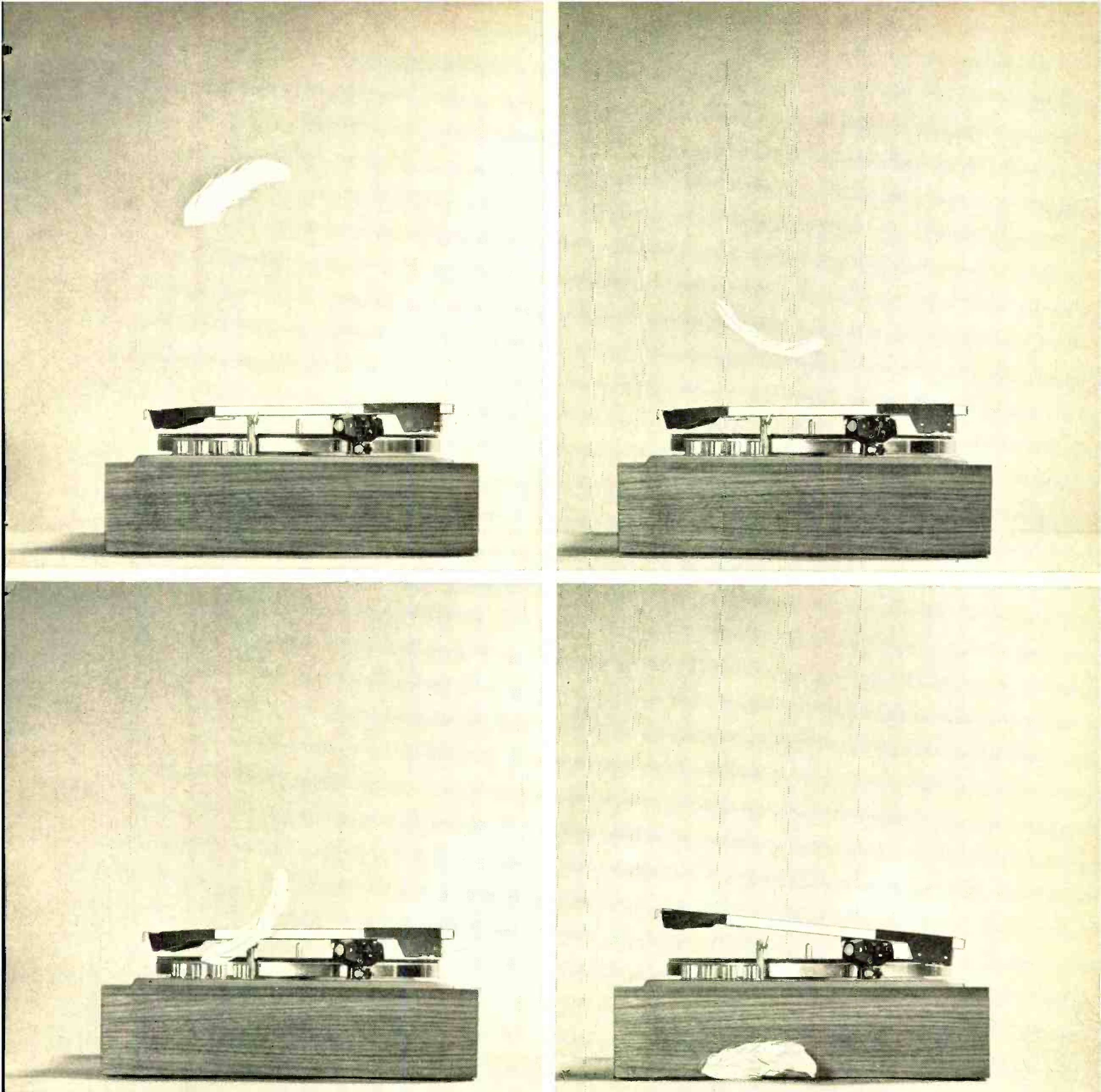
The 2-megohm resistor and selective capacitors form the decay circuits but the largest capacitor in each section has been increased to 2 μf to produce a very slow change in the larger projected image when desired. A five-step switch would be more desirable, as an additional 0.22-μf capacitor seems to be called for, since there is a large jump in steps of timing action between the first and second ranges shown. The selector arms for the three color channels are ganged but could be separated for more flexibility—especially if an awesome array of knobs is impressive.

The volume level determines the capacitor charge on louder peaks of the music, so at a given setting of the decay capacitors, the apparent timing will be longer at the higher volume setting.

The capacitors needed in the phase-shift circuits here are 0.02 μf each probably because of the higher plate voltage; they may differ in other cases from 0.001 to 0.1 μf to achieve smooth operation. A capacitor substitution box can aid in selecting the proper value quickly. The four controls used in setting the basic intensity of the lamps are connected in pairs, each pair 180 deg. out of phase with the respective plate voltage. Use care in getting this operating properly; with no signal applied, the control potentiometers should dim the lamps smoothly, but if connected in-phase, the lamps cannot be dimmed.

If too abrupt in dimming, either the wrong sized capacitor has been used in the grid circuit, or there is too much a.c. voltage applied to the grid. In the latter case a fixed resistor equal to that of the pot can be wired in series at the high side to cut the range of voltage on

(*Continued on page 72*)



the light, gentle touch

Nothing, short of experiencing it yourself, can better describe the feather-touch ease with which the Miracord responds—the way it operates and performs to bring out and preserve the best in your records.

For with the Miracord, you needn't handle the arm, and therefore, it can't be dropped. In fact, most Miracord owners rarely use it manually. They prefer to play even their single records automatically.

They put a record on the turntable, and simply push the button. Automatically, the arm rises from its rest, moves inward over the record and then gently lowers the stylus into the starting groove. When the record is finished, the arm automatically lifts off, and returns to its rest, or you can do this in the middle of play by simply pressing the 'stop' button. The Miracord performs these functions more gently and more precisely than by hand.

The Miracord also plays stacks of up to 10 records in automatic sequence But, unlike other automatic units, the Miracord is a demonstrably high quality instrument, with design features and performance characteristics you usually associate with quality turntables that can only be played manually.

The Benjamin-Miracord is equipped with a solid, one-piece, 12 inch, dynamically balanced turntable, a mass-balanced transcription arm, and a choice of two motors: model 10H with Papst hysteresis motor is priced at $99.50, and model 10 with 4-pole induction motor is priced at $89.50. Cartridge and base are priced extra.

Make it a point to see the Benjamin-Miracord at your hi-fi dealer soon. Write for free descriptive literature.

BENJAMIN MIRACORD

BENJAMIN ELECTRONIC SOUND CORP., 80 SWALM STREET, WESTBURY, L. I. SOLE U. S. DISTRIBUTOR FOR ELECTROACUSTIC (ELAC)® RECORD PLAYING COMPONENTS

This Business of Heat Sinks

RONALD L. IVES*

For the transistor experimenter a practical guide to the use of heat sinks is more important than thermodynamic theory. Here is a practical guide!

Fig. 2. Cooling discs and insulation for a zener diode.

MOST OF US, when selecting a transistor or solid-state rectifier, run across a little footnote in the data sheet, which reads something like this "(1) when used with adequate heat sink." This is all very clear and explicit except for one thing; few manufacturers define an adequate heat sink in terms that us ordinary mortals can understand.

Some handbooks give abstract formulas for the computation of heat sink dimensions which seem suitable for a doctoral examination in mathematics. The formulas use so many symbols that they run completely through the Roman and Greek alphabets, including some squiggles that I suspect are called *Aleph, Beth,* and *Gonoph.*

For most practical problems, an empirical design approach is most economical and successful. Something that worked well once will probably work well again, and logically-derived minor changes therein will probably work also. We don't need the differential equations of stability to tell us that a cone stood on its point will probably not be standing that way next week and that one stood on its base will probably stay put *ad infinitum.*

The purpose of a heat sink is to remove heat from a place where it is not wanted, as a junction, and to dissipate it where it will do no harm, as into the atmosphere. To accomplish this purpose, it must have a conductive path from the area to be cooled to the dissipating area; and an adequate dissipating area. Most good thermal conductors are good electrical conductors also so that the problem of electrical insulation immediately arises. Particularly with power transistors wherein the collector is electrically connected to the case.

* *2075 Harvard St., Palo Alto, Calif.*

Fig. 1. "Direct coupled" heat sink.

No matter what the formula may say, a heat sink is ineffective if the junction to be cooled runs too hot. This will occur: 1. if the contact between the junction and the heat sink is inadequate; 2. if the thermal resistance of the conductive path from the contact to the dissipating area is too high; 3. if the dissipating area is too small; or 4. if it cannot dissipate enough heat because of a hot environment.

With most devices, best cooling is obtained if the case is bolted directly to the heat sink. Thermal conduction can be increased, in some instances only, by use of various conductive compounds, but these are usually an unnecessary nuisance. A heat sink "direct coupled" to a transistor is shown in *Fig.* 1.

Here, the transistor is bolted directly to the heat sink, which is a sheet of 1/16 in. copper. Electrical insulation is provided by mounting the transistor-heat sink assembly on ceramic spacers. Air circulation about the heat sink is enhanced by a large chassis hole beneath it. This hole is also used for the electrical leads.

A second mounting system, which is more convenient in some instances, but thermally slightly inferior, is to use the chassis as the heat sink, and to insulate the transistor with mica sheets, which are commercially available for the purpose.

A similar cooling method is most effective with medium power zener diodes, a number of copper discs being mounted on the stud, separated by thermally conductive spacers, and the whole mounted on a porcelain stand-off insulator. Cooling discs which are too close together don't work very well because air is trapped between them and convective cooling is restricted. Two discs, too closely spaced, behave as one. A heat sink assembly for a zener diode is shown in *Fig.* 2.

Medium and high-power silicon rectifiers are also effectively cooled by disc and spacer techniques, as shown in *Fig.* 3. Considerable amounts of power must be dissipated in some rectifier assemblies, therefore it is important that the cooling discs be "out in the air" to allow the convection currents to remove the heated

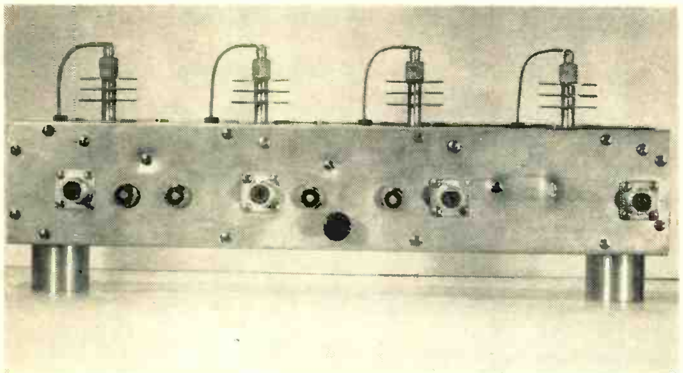


Fig. 3. Battery of silicon rectifiers and their heat sinks. Note use of screen grid caps as anode connectors.

air from the vicinity. Trapped air around a heat sink insulates it thermally, and makes it ineffective.

Experiments with heat sinks give some useful figures about size and shape of effective cooling devices and arrangements. Assuming that a temperature rise of 50 deg. F at the junction is permissible, a minimum of 1½ square inches of 1/16 in. copper is needed to dissipate each watt. Both sides of this copper must be exposed to the air, and it must be free to circulate out of the equipment, not "boxed in" in a corner of the chassis. If aluminum is used, about 2 square inches

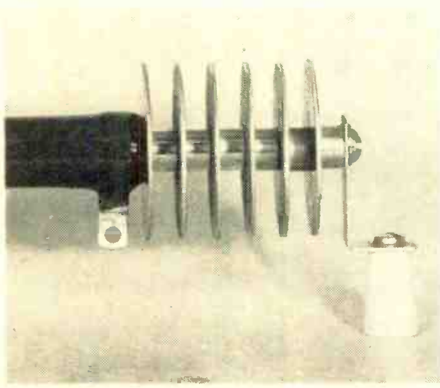


Fig. 4. Experimental cooling assembly.

of 1/16 in. stock is needed to dissipate each watt.

The effective radius of a single heat sink element is approximately fifty times its thickness. The outer section of a large heat sink will usually run "stone cold" and might as well not be there. To get more effective cooling from a large heat sink, its thickness must be increased to provide a more efficient conductive path from the heat source to its periphery.

When a series of disc heat sinks is used, the individual discs should not be closer together than about 1/20th of their diameter, or cooling will be inefficient. The spacers, which must be heat conductive, should not be smaller than about 1/5 the diameter of the discs. Closer spacing will inhibit convective cooling, as previously mentioned. Spacers that are too small in diameter will not conduct heat efficiently between discs.

There is a practical limit to the effectiveness of a string of discs as a heat sink. Experiments show that four are ordinarily as many as are useful. When more cooling is required, larger discs plus larger diameter spacers will work better than more discs. An example of this is shown in *Fig.* 4, a cooling assembly for a power resistor. Here, the 6-disc cooling assembly was operated with an overload until solder would melt on the inner (left hand) disc. The outermost (right hand) disc, at this time, was faintly warm to the touch, indicating that it was doing very little cooling. Discs here were 1½-in. in diameter and 1/16-in. thick. Spacers were ¼-in. long and ⅜-in. in diameter. Better cooling was obtained with ⅛-in. thick discs, 2-in. in diameter, separated by copper spacers ¾-in. in diameter and ⅜-in. long. Tests showed that the first three discs did all the work, the fourth was retained as a "safety factor," and the remaining two, which provided no useful cooling, were eliminated.

Although some handbooks state that the elements of a heat sink should be soldered together, the thermal justification for this is not at all clear. My experiments show that parts in *firm* mechanical contact cool very effectively.

According to most physics books, a black body is a better radiator than a polished body. This is true, and many commercially manufactured heat sinks are *chemically* blackened to increase radiative cooling. Painting a heat sink black, however, will not improve its performance because most paints are good insulators (i.e. poor conductors of heat), regardless of color. A copper heat sink will improve in performance as its surface oxidizes; additional treatment of the surface will not be worth the cost and effort.

Heat sinks are much more effective when there is good circulation of relatively cool air around them. A small fan will do the job; however small fans tend to be noisy, consume current, and generate some heat of their own; or we can "let nature do it," and arrange things so that the heat sink produces its own air circulation.

When air is heated it expands, becomes less dense than the surrounding air, and rises. Cooler air moves in to replace it which in turn is heated and the process continues as long as heat is produced. This, in brief, is what makes a chimney draw; a process called convection.

With small heat sinks, operated at medium to low temperatures, convection is not too important and they will work equally well in any position. Larger heat sinks, with plates larger than about

(*Continued on page 78*)

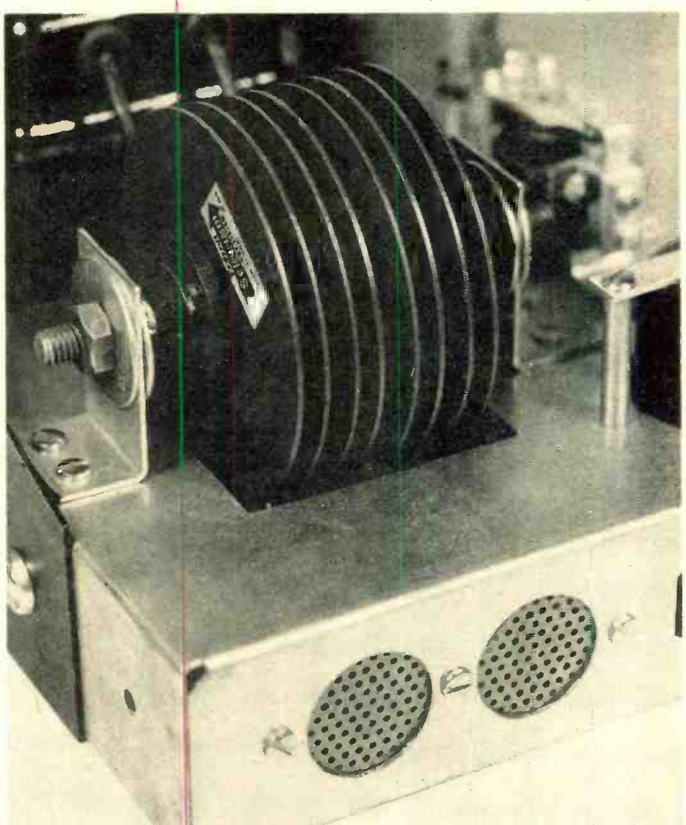


Fig. 5. Ventilation for a large selenium rectifier.

+0 -¼ db from 1 to 1,000,000 cps. That's the bandwidth of the new Harman-Kardon Citation A—the world's first professional Solid State (transistorized) Stereo Control Center. It is totally new in concept, design and performance. When you hear it, you will share the experience of its creators—the experience of genuine breakthrough and discovery; the experience of hearing music as you've never heard it before. Citation A represents a towering achievement for Stewart Hegeman and the Citation Engineering Group. It will change all of your ideas about the reproduction of sound. Visit your Citation dealer now for an exciting premiere demonstration.

For more complete technical information on Citation A write to the Citation Division, Dept. A-3, Harman-Kardon, Inc., Plainview, N.Y.

harman kardon

A Fresh Approach to Compact Speakers

WILLIAM HECHT*

An unusual woofer cone, voice-coil former, and elimination of the traditional basket add up to better bass from a little box.

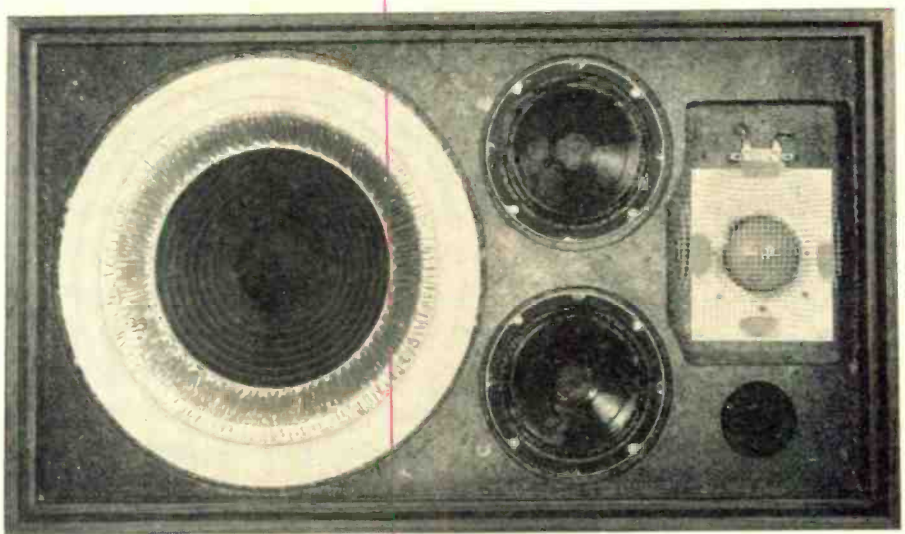


Fig. 1. The Fisher XP-4A with its grille cloth removed.

Without doubt, the stereo era is the compact speaker system era. Few houses can accommodate *two* of the "big box" speaker systems so popular before stereo. Some of us will remember it often took some "tall talking" to fit one big box into the decor! But it was necessary—big bass meant big box! Fortunately for the audiofan (and for stereo), the modern compact speaker does not sacrifice bass for space! It *is* possible to "growl" 30 cps from a bookshelf!

In general, all compact speakers have several common characteristics. The bass-producing woofer must have a low resonance since output falls off at 12 db per octave below resonance. (Remember, too, that the smaller box will raise the system resonance usually 25 to 100 cps above the free-air cone resonance.) The low resonance generally means extended cone travel and unless the voice coil is lengthened, it will move completely out of the magnetic gap causing high distortion. However, the longer voice-coil will result in lower efficiency—just how low depends on the exact design of the cone, voice-coil, and magnet assembly.

The mid-range and/or high-frequency speakers can be expected to have a low-to-medium efficiency to match the woofer. When conventional mid-range and high-mid-range reproducers are used, provisions are made in the crossover network to pad them down.

The enclosure will be rigidly constructed. The extended cone travel builds up tremendous air pressures inside. A flimsy box would buzz and rattle, either audibly or just enough to color the reproduction. The shape of the box is generally incidental so long as it does not form a "resonant pipe." Most compact systems have dimensions that are roughly 12 × 12 × 25 inches—hence the name "bookshelf" (even if they cannot fit in most bookshelves). The trend today is to a slim picture frame type size.

Since most compact speaker systems are built alike, a logical question is "why don't they sound alike?" Well, let's face it—they often do. Or to be more specific, many in the same quality (price) class have the same audible characteristics. This sound, when good, is acceptable; when poor, is too often attacked by simply altering the characteristics of the drivers and/or crossover network in the system until it seems to sound or measure better than the original. If this latter statement appears to be heresy to the purist, it must be pointed out that it is the author's firm belief that speaker system design is still as much an art as a science. Not that measurements are unnecessary. Indeed, a speaker must "measure good" to sound life-like. But there have been instances when the author has wanted to shout "Eureka" after measuring a speaker but before listening to it!

What is wrong with compact speakers? Considering the job most do, one shouldn't overly criticize them, particularly when the price and size are taken into account. Careful, critical listening, though, does show some imperfections.

High-frequency response is no longer the problem it used to be. Most modern tweeters respond well beyond the audible range and the better units are smooth and have good transient response. The major problem, a carry-over from the old days, is dispersion. The highs tend to "beam" and this can reduce the stereo illusion to just listening to two point sources and to losing "liveness" when off axis. Efficiency is no longer a problem, thanks to the low-efficiency woofer—except maybe in reverse, as previously mentioned.

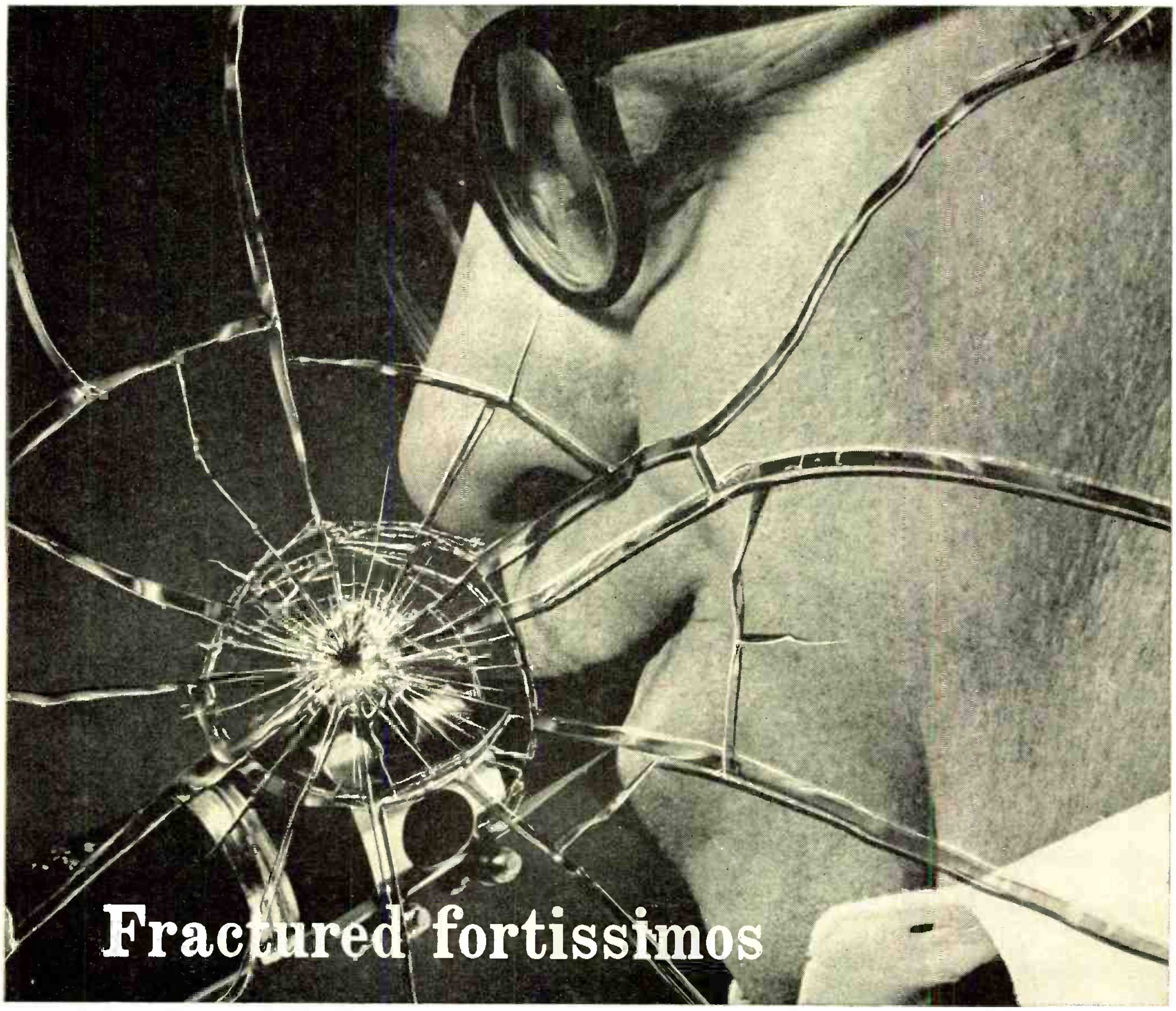
Mid-frequency reproduction offers no new problems. In fact, so far as the middle-frequency reproducers are concerned, there are fewer problems. This is due to the fact that most compact-speaker woofers work higher up into the mid-range region than the older big boxes. (This is particularly true in comparison to the old corner horns where the woofer seldom worked over 600 cps.) In addition, most modern tweeters go below 3000 cps whereas 5000 cps or above was not uncommon as the lower limit a few years ago. Thus the mid-range speaker may need only cover the 1000–3000 cps bandwidth. Important, yes—but not difficult.

The low-frequency reproducer seems to cause most of the trouble in compact systems. It has many faults and probably no single one is more important than another.

Two often-overlooked gremlins are basket reflections and parasitic vibrations. As the cone moves back into the cabinet on negative peaks[1] of the signal

* *Fisher Radio Corp., Speaker Division, 124 Greylock Ave., Belleville, N. J.*

[1] Assuming a polarity where positive peaks move it forward.



in your concerto?

. . . then "bargain" recording tape's no bargain!

No doubt about it! Something's wrong with recording tape that carries a bargain-basement price, an unknown name. They're sure signs the tape would flunk some *or many* of the more than 100 quality tests that "SCOTCH" BRAND Recording Tapes are required to pass to assure flawless sound.

Coating and backing thicknesses of "SCOTCH" Recording Tapes, for example, are held to microscopic tolerances—especially important in today's 4-track stereo. This uniformity not only guards against crack-ups in sound, it assures wide dynamic range, identical full fidelity recording properties throughout every reel, reel after reel.

High potency oxides used in "SCOTCH" Tapes permit thinner, more flexible coatings that make intimate head-to-tape contact a certainty for maximum frequency response. Exclusive Silicone lubrication, impregnated throughout the oxide coating, ensures smooth tape travel. This completely dry lubricant protects recorder against head wear and actually extends tape life. For your recording and listening pleasure, step up to the tape professionals prefer: "SCOTCH" BRAND.

On SCOTCH® BRAND Recording Tape, you hear it crystal clear!

Magnetic Products Division 3M COMPANY

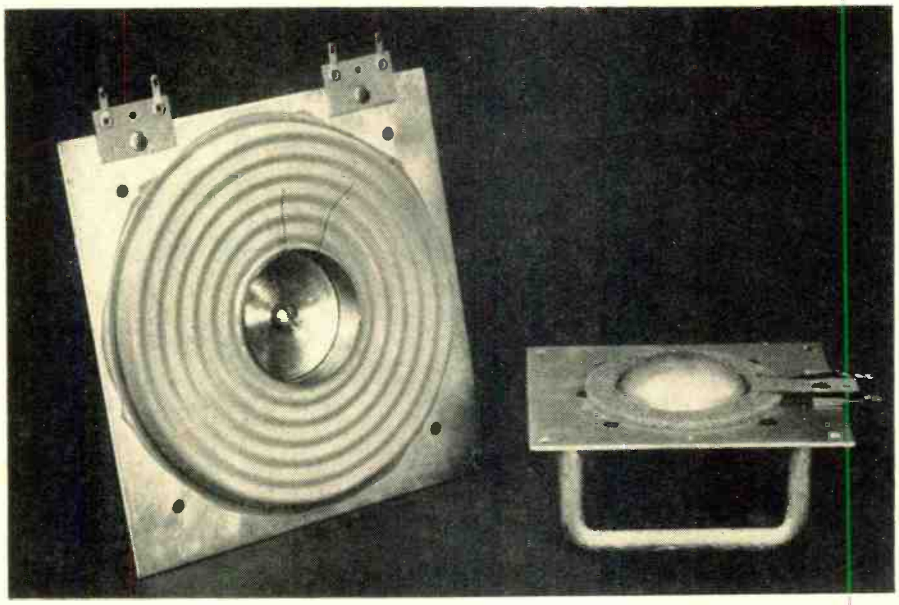


Fig. 2. The hemispherical-dome tweeter (on the right) and the spider and voice-coil assembly of the woofer. Note the metal former.

waveform, the compressed air can erratically reflect back from the speaker basket to the cone. This usually occurs on succeeding waveforms and will, depending on frequency, either re-inforce or resist the cone movement, thereby coloring the sound. Further, unless the woofer frame is extremely rigid, the frame will vibrate, usually from 300 cps down, causing muddy bass.

Erratic cone movement—breakup and resonance—is always a problem with dynamic loudspeakers. It is even more of a problem with compact speaker reproducers! Because of its long and violent excursions the cone *must* be as rigid a piston as possible to prevent breakup.

Low-frequency free-air cone resonance must be kept in the sub-audible region in order to get usable output at the low bass frequencies as previously pointed out. This low resonance is usually accomplished by a heavy cone and particularly by a resilient suspension system. Unfortunately, the latter usually causes a high-frequency rim resonance, again coloring the sound.

If any one characteristic causes speakers to sound different from each other it is transient response, despite the fact that there are no standardized measurements or specifications. Unfortunately, too, transient distortion can be due to any number of causes; a small magnet, a voice coil of insufficient length, a cone assembly which is too heavy, and so on.

The above "state of the art," particularly the critique thereof, was carefully examined as a prerequisite to the design of the Fisher XP-4A speaker system. It was firmly resolved that a fresh approach would be undertaken—not just a rehash of an old attack; a new method to *solve* rather than *minimize* the problem.

The high-frequency end evidently requires a low-efficiency extended-range unit exhibiting smooth response and wide dispersion. A horn can have good (but far from perfect) dispersion and be made fairly smooth. The high efficiency, however, is not required. A single-cone tweeter has limited dispersion. Multiple cones can minimize this but at the expense of increased efficiency and lack of smoothness due to phase cancellations.

The hemispherical type of reproducer appears to be near optimum for compact speakers. The 2-in. diameter unit (*Fig.* 2) designed for the XP-4A has better than 120-deg. dispersion, a smooth extended range beyond audibility and is just slightly more efficient than the woofer. This efficiency (along with a level control) permits optimum balance in any acoustic environment. A huge 5-lb. magnet structure with an air gap flux density of 14,500 gauss is used.

It is interesting to note that the hemispherical type of reproducer is far from new. It is essentially a modified driver section of a high-frequency horn.

For the mid-range, two separate 5-in. speakers were used, to reproduce frequencies from 1400 to 2500 cps. The reader will note that this is a rather narrow range for mid-range speakers. This range was restricted quite deliberately to take advantage of the unusually wide ranges of the woofer and tweeter made possible by their unique design.

The Woofer

By far the most radical departure from standard practice appears in the woofer. It has been systematically engineered to overcome each of the drawbacks and problems mentioned earlier in this article, and the result is a highly unorthodox speaker but with most gratifying results.

The woofer's resonance is kept low by the use of an extremely compliant surround, made of cotton and impregnated with a rubber compound. This is neither a difficult problem nor a radical solution; but now the tougher headache of what to do about the basket reflections was tackled. Eliminate the basket? Why not? This was done simply by making the woofer an integral part of the enclosure as shown in *Fig.* 3. The back of the woofer cone is completely unobstructed, and there can be no unwanted reflections.

Cone breakup has plagued speaker engineers for years, and still continues to do so. Ideally, of course, the answer is simple: make the cone out of some rigid material, so that it can do nothing but move all the same way at the same time, under the complete control of the voice coil. But rigid materials are usually heavy, with unacceptably low efficiency, and can cause poor transient response. The answer here was a two-piece cone formed from corrugated aluminum, pressed from 0.006-in. foil, bonded to a fibrous molded inner cone. The random "wrinkles" of the aluminum section are fabricated in such a way that the major piston surface moves as a unit, almost completely eliminating the twisting and erratic modes of vibration that account for so much speaker distortion.

Finally the problem of damping was faced—a serious one, since several of the factors (size of room, for example, or amplifier damping factor) are completely beyond the engineer's control. A serious effort was made to find a method of damping that was as nearly as possible independent of outside influences. Some useful damping is of course provided by ducting and by filling an enclosure with glass wool material. But these, and most

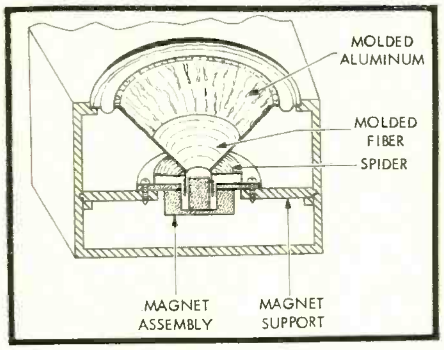
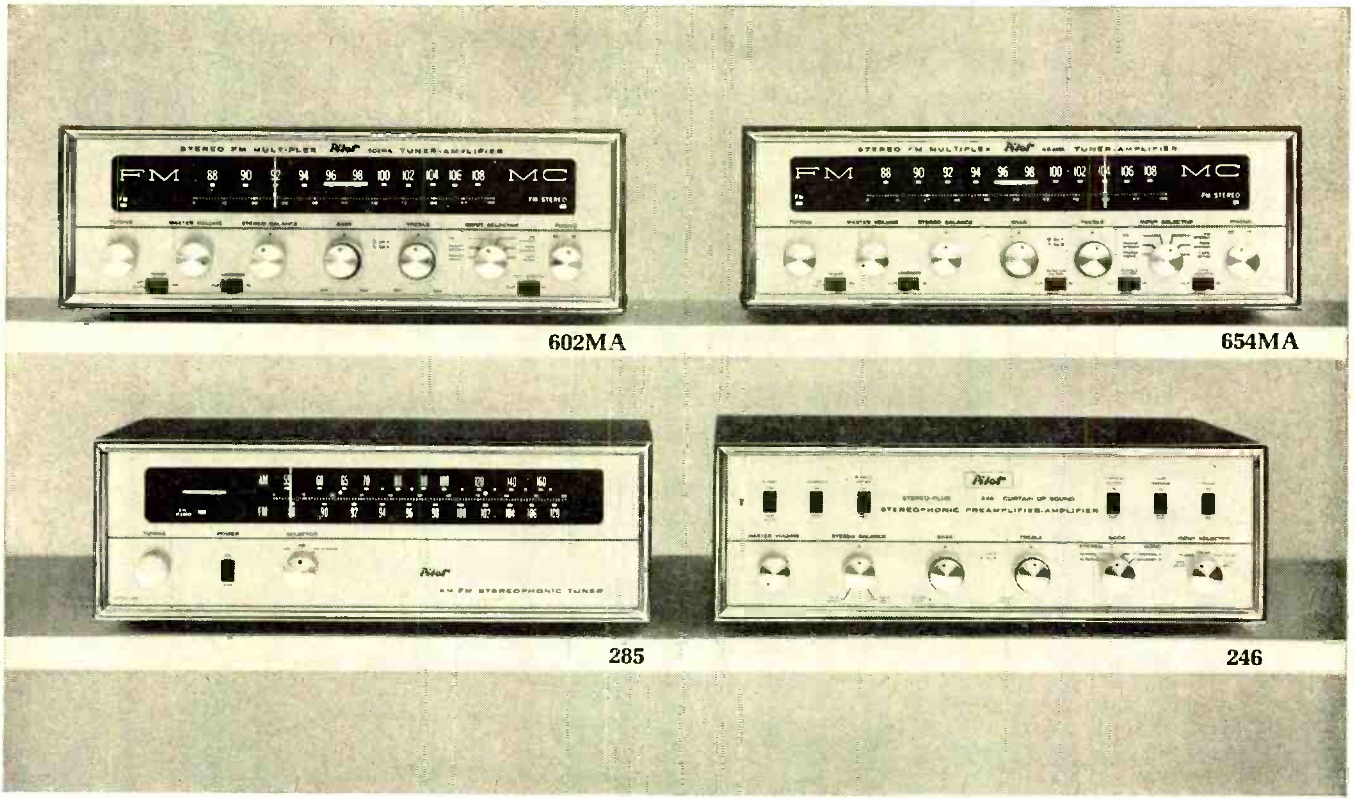


Fig. 3. Mounting of the woofer cone and magnet assembly in the enclosure.

other damping methods, are non-linear —the degree of damping tends to be affected by frequency.

Ultimately, eddy current damping was turned to and a method was evolved that is the subject of a second patent application (the "no-basket" woofer being the first). In this solution, the voice coil is wound on very pure, low-resistivity copper offering damping that is linear over

(*Continued on page 74*)



Hear here.

Hear the astonishing new sound... the clean, rich, surrounding sound... the pure, simple, ear-catching sound ...of PILOT. Hear it reproduced with all the dimension and depth that characterize the very best in modern stereophonic high fidelity.

Hear your favorite music with the 30-watt **602MA FM Stereo Receiver,** which includes PILOT's unique Multiplex circuit (better than 30 db separation); automatic FM Stereo indicator; record changer, turntable, tape transport and recorder connections; and complete control versatility, including a tape monitor switch—only 249.50 with cover. (The 602SA, with added AM, is just 299.50.)

Hear your music favorites with the 60-watt **654MA FM Stereo Receiver** (top-rated by HIFI/STEREO REVIEW), including FM Multiplex, automatic FM Stereo indicator light and 14 controls... for only 329.50 with cover.

Hear your favorite broadcasts with the **285 FM Multiplex-AM Tuner,** only 159.50... combined with the 60-watt **246 Integrated Stereo Amplifier,** top-rated by an independent consumers' laboratory—with 12 stereo inputs and 14 controls, 199.50.

Whichever PILOT component you happen to select, you're assured of a quality instrument that is second-to-none. And you're also assured of incomparable sound enjoyment that must be heard to be believed. Where? At your PILOT dealer, of course.

PILOT offers you a wide range of stereophonic components as well as a variety of three-way speaker systems. For complete literature, write:

PILOT RADIO CORPORATION, 37–40 36TH STREET, LONG ISLAND CITY 1, N. Y.

A High-Quality Transistorized Stereo Preamplifier

ERHARD ASCHINGER

CONCLUSION

The voltage gain of a feedback amplifier has been derived to be

$$g_v = \frac{\mu}{1+\mu\beta}.$$

Instability only occurs if for at least one positive frequency the denominator becomes zero. In this case the gain will be infinity.

$$g_v = \frac{v_2}{v_1} = \infty,$$

which means that a finite output voltage will be produced even with zero input voltage. The feedback amplifier will serve as an oscillator at that particular frequency. For $1+\mu\beta = 0$ we get $\mu\beta = -1$, the phase of the amplifier μ plus the phase of the feedback network β being ± 180 deg. and $|\mu\beta| = 1$.

Therefore, in order to obtain stability at all positive frequencies the condition $\mu\beta \neq -1$ must hold for all frequencies. Due to its barrier capacitance and base region transit time a transistor can develop considerable phase shift, up to 180 deg. and more. While the phase of the gain, arc μ, increases with frequency, the amount $|\mu|$ decreases, and generally $|\mu|$ will already be very small where the phase reaches 90 deg.

Thus, with two-stage, directly coupled feedback amplifiers the phase arc $(\mu\beta)$ may well assume the critical value of 180 deg. at certain, rather high frequencies, but at these frequencies the voltage gain of the transistor amplifier $|\mu|$ will already be so small that $|\mu\beta|$ will be safely below unity. At frequencies where arc $(\mu\beta) = \pm 180$ deg. feedback becomes positive, but no oscillation will occur since $|\mu\beta|$ less than 1.

As indicated by these considerations, no special steps need be taken to guarantee stability of a two-stage transistor feedback amplifier.

Stage Three: RCA 2N109. Since the RCA 2N109 transistor used in this stage is of the large-signal type, no h_{ike} parameter values are supplied by the manufacturer. For relatively small signals, however, the characteristic curves of the transistor may be replaced by their tangents in the operating point. As shown in *Fig.* 4, the error introduced by this approximation is negligible, the maximum signal handled by the stage being sufficiently small. From the slope of the tangents the small-signal h parameters can easily be determined.

For the selected operating point we have

$$h_{11e} = \tan\gamma \approx 1000 \text{ ohms}$$
$$h_{12e} = \tan\delta \approx 7.8 \times 10^{-4}$$
$$h_{21e} = \tan\alpha \approx 100$$
$$h_{22e} = \tan\beta \approx 125 \times 10^{-6} \text{ mhos}$$

With these parameters the audio-frequency characteristics of the stage may now be calculated using the formulas for small-signal amplification derived before.

The collector resistor of stage three is $R_4 = 620$ ohms, the external load resistance $R_L = 600$ ohms. The a.c. load of the stage is therefore

$$r_L = \frac{R_4 R_L}{R_4 + R_L} = \frac{620 \times 600}{620 + 600} \approx 305 \text{ ohms.}$$

To achieve flat frequency response and low distortion as well as the required voltage gain of $g_v = 4$ db, negative series feedback is applied by means of an unbypassed emitter resistor R_E. By solving *Eq.* (3) for R_E we get

$$R_E = \frac{h_{21e} r_L - h_{11e}|g_v|}{h_{21e}|g_v|};\quad |g_v| = 1.585$$

and

$$R_E = \frac{100 \times 305 - 1000 \times 1.585}{100 \times 1.585} \approx 185 \text{ ohms.}$$

The total d.c. resistance required in the emitter lead is $R_3 = 1480$ ohms. This value can be made up by the series connection of a standard 1200-ohm resistor and a 250-ohm potentiometer. The amount of unbypassed emitter resistance and consequently the voltage gain is made variable within a small range by connecting one lead of the emitter bypass capacitor to the arm of the potentiometer, which then serves as a gain control.

The input resistance of the stage is, from *Eq.* (1),

$$r_i = \frac{1000 + 100 \times 185}{1 + 125 \times 10^{-6} \times 305} \approx 18{,}700 \text{ ohms.}$$

The output resistance of stage three is virtually equal to the collector resistor R_4. The exact value will be calculated later since it is somewhat dependent on the still unknown output resistance of the preceding stage.

Stage Two: RCA 2N175. The small-signal h parameters of the RCA 2N175 transistor specified for an operating point of $-V_{CE} = 4.0$ v and $-I_C = 0.5$ mA are $h_{11e} = 3570$ ohms, $h_{12e} = 9.44 \times 10^{-4}$ $h_{21e} = 65$, $h_{22e} = 25 \times 10^{-6}$ mhos.

The operating point selected for stage two, however, is $-V_{CE} = 4.8$ v and $-I_C = 1.0$ mA.

Whereas the small difference in $-V_{CE}$ has no significant influence upon the h_{ike} parameters, the h_{11e} and h_{22e} parameters are strongly dependent upon the collector current $-I_C$. Using the formulas

$$h_{11e} = r_{bb'} - \frac{h_{21e}}{39 I_C}$$

and

$$h_{22e} = \frac{1}{r_{ce}} - 39 h_{12e} I_C$$

we get the h_{ike} parameters for the selected operating point: $h_{11e} = 1670$ ohms, $h_{12e} = 9.44 \times 10^{-4}$, $h_{21e} = 65$, $h_{22e} = 43.4 \times 10^{-6}$ mhos.

The load resistance of stage two consists of the parallel combination of the input resistance, r_{iIII}, of stage three, the collector resistor, R_{4II}, of stage two, and the frequency-dependent input resistance of the feedback network, r_{if}.

According to the RIAA playback curve, r_{if} decreases with increasing frequency, thereby loading stage two and decreasing second-stage voltage gain. However, this only changes the distribution of voltage gain between the first two stages. Over-all gain of the two-stage feedback amplifier is not affected, since it is entirely dependent on β of the feedback network only.

To achieve the required signal-to-noise ratio the correct voltage-gain distribution between the first two stages has to be maintained especially at low frequencies. Voltage gain and input resistance of stage two will therefore have to be calculated for that frequency range, where feedback is weak and the input resistance of the feedback network is very high compared to R_{4II} and r_{iIII}; r_{if} may therefore be neglected in the parallel connection.

With $R_{4II} = 6800$ ohms, $r_{iIII} = 18{,}700$ ohms and r_{if} much greater than R_{4II},

r_{iIII}, with f small, we have

$$r_L = \frac{R_{4II} \times r_{iIII}}{R_{4II} + r_{iIII}} =$$

$$\frac{6.8 \times 18.7}{6.8 + 18.7} r_L \approx 4{,}970 \text{ ohms.}$$

The required voltage gain of 23 db is achieved by the application of a suitable amount of series feedback. The emitter resistor value required is

$$R_E = \frac{h_{21e} r_L - h_{11e}|g_v|}{h_{21e}|g_v|}; \; |g_v| = 14.1$$

$$R_E = \frac{65 \times 4.97 \times 10^3 - 1670 \times 14.1}{65 \times 14.1}$$

$$R_E \approx 326 \text{ ohms.}$$

Using the nearest EIA standard value, we get $R_E = 330$ ohms.

The d.c. resistance required in the emitter lead $R_s \approx 7{,}340$ ohms can be made up by the series combination of $R_E = 330$ ohms and a 6800-ohm resistor bypassed by a large-value capacitor.

For low frequencies the input resistance of the stage is, from *Eq.* (1),

$$r_i = \frac{1670 + 65 \times 330}{1 + 43.4 \times 10^{-6} \times 4.97 \times 10^3} \text{ [ohms]}$$

$r_i \approx 19{,}000$ ohms. For obvious reasons the output resistance has to be calculated later.

Stage One: RCA 2N175. Selected for minimum noise, the operating point of this stage is $-V_{CE} = 4.5$ v and $-I_C = 0.5$ mA. The corresponding h parameters are $h_{11e} = 3570$ ohms, $h_{12e} = 9.44 \times 10^{-4}$, $h_{21e} = 65$, $h_{22e} = 25 \times 10^{-6}$ mhos. At low frequencies the a.c. load resistance of stage one is

$$r_L = \frac{R_{4I} \times r_{iII}}{R_{4I} + r_{iII}} \qquad R_{4I} = 22{,}000 \text{ ohms} \qquad r_{iII} = 19{,}000 \text{ ohms}$$

$$r_L = \frac{22.0 \times 19.0}{22.0 + 19.0} \times 10^3$$

$r_L \approx 10{,}200$ ohms (f small).

The required voltage gain being 33 db, $|g_v| = 44.7$, the necessary emitter feedback resistor is

$$R_E = \frac{h_{21e} r_L - h_{11e}|g_v|}{h_{21e}|g_v|}$$

$$R_E = \frac{65 \times 10.2 \times 10^3 - 3570 \times 44.7}{65 \times 44.7} \text{ [ohms]}$$

$R_E \approx 174$ ohms or 180 ohms using an EIA standard value.

A bypassed 5600-ohm resistor has to be connected in series with R_E to give the required d.c. resistance of $R_s \approx 5900$ ohms.

The low-frequency input resistance of the stage is, from *Eq.* (1),

$$r_i = \frac{3570 + 65 \times 180}{1 + 25 \times 10^{-6} \times 10.2 \times 10^3} \text{ [ohms]}$$

$r_i \approx 12{,}150$ ohms (f small).

Due to the frequency-dependent loading effect of r_{if} upon the second stage the input resistance of stage one becomes slightly frequency dependent, too. With increasing frequency r_{iI} is somewhat decreased. However, when the over-all feedback loop is closed, the input resistance R_i of the equalizer is increased considerably, according to

$$r'_i = r_i(1 + \mu\beta) \qquad Eq. (6)$$

It is seen that the input resistance assumes its minimum value where $(\mu\beta)$ is at its minimum, 2.82, at frequencies below 50 cps. The minimum input resistance thus is

$$r'_{i\,min} = r_i[1 + (\mu\beta)_{min}] = 12.15 \times 10^3 (1 + 2.82) \quad \text{[ohms]}$$

$$r'_{i\,min} = 46{,}400 \text{ ohms} = R_{i\,min}$$

(f less than 50 cps)

At all other frequencies R_i will be larger than $R_{i\,min}$, thus meeting the requirements, stated previously, that R_i be equal or greater than 33,000 ohms at all frequencies.

Output Impedances. The output resistance of the first stage will be, from *Eq.* 2 and $R_G = 500$ ohms (ADC-1),

$$r_{oI} = \frac{3570 + 65 \times 180 + 500}{25 \times 10^{-6}(180 + 500)}$$

$$r_{oI} \approx 927{,}000 \text{ ohms.}$$

The output resistance seen by the second stage is

$$R_{oI} = \frac{R_{4I} \times r_{oI}}{R_{4I} + r_{oI}} = \frac{22 \times 927}{22 + 927} \times 10^3$$

$$R_{oI} \approx 21{,}500 \text{ ohms.}$$

Now the second-stage output resistance can be calculated according to *Eq.* (2). With $R_{GII} = R_{oI}$ we have

$$r_{oII} = \frac{1670 + 65 \times 330 + 21.5 \times 10^3}{43.4 \times 10^{-6}(330 + 21.5 \times 10^3)}$$

$r_{oII} \approx 47{,}400$ ohms and

$$R_{oII} = \frac{R_{4II} \times r_{oII}}{R_{4II} + r_{oII}} = \frac{6.8 \times 47.4}{6.8 + 47.4} \times 10^3 \text{ ohms}$$

$$R_{oII} \approx 5{,}950 \text{ ohms.}$$

When the feedback loop around the first two stages is closed, second-stage output resistance is decreased considerably, according to *Eq.* (7). With frequency-dependent feedback the maximum value of r'_o will occur at the frequency where $(\mu\beta)$ is at its minimum. At all other frequencies r'_o will be smaller than $r'_{o\,max}$. In addition to this, the effective output impedance of stage two is further decreased by the parallel connection of r_{if}, which also decreases with increasing frequency.

With $(\mu\beta)_{min} = 2.82$ at f less than 50 cps and neglecting the feedback network input impedance we get

$$r'_{oII\,max} = \frac{5.95 \times 10^3}{1 + 2.82} \qquad r_{xII} = R_{oII} \quad r_{if} \gg r_{xII}$$

$r'_{oII\,max} \approx 1560$ ohms (f less than 50 cps)

As required for linear frequency response of the third stage, the internal resistance of its driver stage is very low compared with its input resistance, r'_{oII} is much less than r_{iIII}.

The output resistance of stage three consists of the transistor output resistance, r_{oIII}, shunted by the collector resistor, R_{4III}, of the stage. Due to the influence of the frequency-dependent output resistance of the preceding stage, r_{oIII} will also be frequency dependent. It will be at its minimum value where r'_{oII} reaches its maximum, which is the case at frequencies below 50 cps.

$$r_{oIII\,min} = \frac{h_{11e} + h_{21e}R_E + r'_{oII\,max}}{h_{22e}(r'_{oII\,max} + R_E)}$$

$$r_{oIII\,min} = \frac{1000 + 100 \times 185 + 1560}{125 \times 10^{-6}(1560 + 185)}$$

$r_{oIII\,min} \approx 96{,}500$ ohms

(f less than 50 cps).

Because of the series feedback employed, r_{oIII} is very large compared with the 620 ohms of R_{4III}. At frequencies above 50 cps it will be considerably larger than $r_{oIII\,min}$ and may therefore be neglected in the parallel connection throughout the entire frequency range. The output resistance then is

$$R_{oIII} = R_{4III} = 620 \text{ ohms} = R_o.$$

The required output resistance, $R_o \approx 600$ ohms, of the preamplifier is thus achieved with sufficient accuracy and virtually independent of frequency.

Feedback and equalization. It has been shown previously that with very large amounts of feedback both voltage gain and frequency response of a feedback amplifier become entirely dependent upon the transmission characteristics of the feedback network. The required RIAA playback curve can, therefore, be achieved by suitable design of this network.

The required voltage gain of the two-stage feedback amplifier is 27 db at 1000 cps. With the feedback loop open, the voltage gain is 56 db throughout the entire frequency range. The voltage transmission factor, β of the feedback network necessary to produce the required amount of feedback can be determined from *Eq.* (4). Thus

$$\frac{1}{\beta} = \frac{\mu g_v}{\mu - g_v}$$

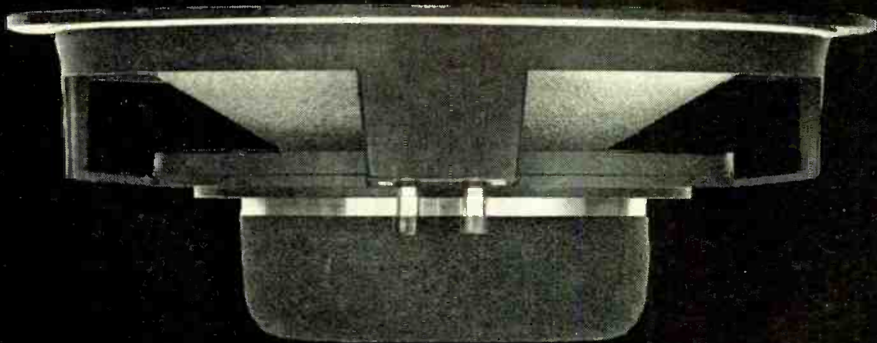
With $g_v = 27$ db, $|g_v| = 22.4$ at 1000 cps and $\mu = 56$ db, $|\mu| = 631$ at all frequencies we may write $|\mu| \gg |g_v|$

and therefore $\frac{1}{\beta} \approx g_v$ and $\left|\frac{1}{\beta}\right| \approx |g_v| =$ 22.4 at 1000 cps.

The feedback network will be designed as a passive linear network having the form of a voltage divider as shown in *Fig.* 22. The input voltage is dropped across the series connection of a large-value frequency-dependent impedance, Z_f, and a small-value ohmic resistance, R. The voltage transmission factor being

IT'S WHAT'S INSIDE THAT COUNTS

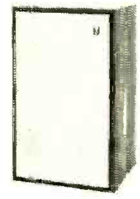
The quality of a loudspeaker is always heard, seldom seen. Once you've installed your transducer in the acoustical enclosure of your choice, it will probably be a long time before you examine it again. And yet, knowing that the voice of your high fidelity system is an exquisitely-wrought precision instrument will give you the same sense of fulfillment you get from any fine possession... camera, engine, watch, rifle. Let's take a close look at your LE14C, the JBL composite transducer. Notice the unusual design of the frame. It is a rigid aluminum casting with massive non-resonant struts. It is "stepped" so you may mount the unit from either the front or back of your baffle. Inspect the pot structure. It's heavy, made of soft iron, thick to confine all the magnetic energy within the dynamic assembly. Dangle an iron key near it... no attraction... indicating an absence of stray magnetic fields. The white material surrounding the cone is Lans-a-loy, selected from computer-determined specifications. It is inert, prevents reflections from the edge of the cone, permits extremely long cone excursion with a high degree of linearity. In the center of the cone is a grille. This protects another cone—that of an independent high frequency unit. It is possible to mount a complete unit in this position because the large, low frequency speaker has a voice coil four inches in diameter—a feature you will find only in JBL loudspeakers. With this arrangement it is possible to put both voice coils in the same plane, an immeasurable contribution to smoothness at crossover. This is effected at 1200 cycles by a dividing network which is part of the system. The sum of a thousand advanced design details and the extraordinary close tolerances held in the manufacture of the LE14C give you sound that is impeccably clean all the way from profound bass to brilliant treble. Complete sound. Accurate sound. Totally satisfying. Give the LE14C a long look and an even longer listen in the demonstration room of the Franchised JBL Audio Specialist in your community. Write for his name and address and your free copy of the complete JBL catalog.



JAMES B. LANSING SOUND, INC. LOS ANGELES 39, CALIF.

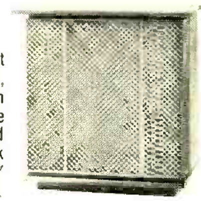
JBL

There Are Many Ways To Use Your LE14C



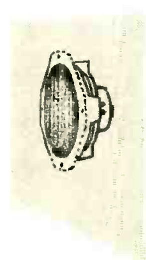
...in the JBL C53 enclosure, small enough for shelf, table top, or bench—23½" x 14" x 12" deep.

...in the JBL C38 compact reflex enclosure with turned aluminum legs—24⅜" high, 23¾" wide, 15⅞" deep.

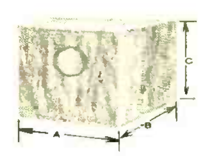


...in the elegant JBL Apollo, model C51, with its distinctive wrap-around wooden fretwork grille—26½" square, 18" deep.

...in the magnificent JBL Olympus—40" wide, 20" deep, 26⅜" high—large enough to permit all the performance of which the LE14C is capable.



...in a wall. Allow two to six cubic feet of air volume back of the speaker and pad the walls of this chamber with two-inch-thick fiberglass.



...in your own cabinet. Dimensions are not critical as long as A x B x C totals at least two cubic feet. Make the walls extremely rigid. If you have a unique problem, consult your JBL Audio Specialist or write to the JBL Customer Service Department.

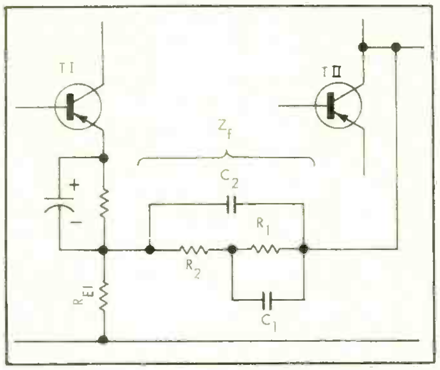


Fig. 24. RIAA feedback network.

$$\frac{v_2}{v_1} = \beta = \frac{R}{Z_f + R}, \text{ we get}$$

$$Z_f = R\left(\frac{1}{\beta} - 1\right)$$

and because of $\frac{1}{\beta} \gg 1$, $Z_f = R\frac{1}{\beta}$ and

$$|Z_f| = R\left|\frac{1}{\beta}\right|.$$

In our case the fixed divider resistor R is formed by the emitter resistor (R_{EI} = 180 ohms) of the first stage. The amount, Z_f necessary to achieve the required voltage gain of

$$|g_v| = \left|\frac{1}{\beta}\right| = 22.4 \text{ at 1000 cps}$$

is therefore $|Z_f| = 180 \times 22.4 = 4030$ ohms (1000 cps).

As shown in *Fig.* 23, the (ideal RIAA playback curve has a bass plateau of + 20 db at f less than 50 cps, followed by a 6 db per octave droop, starting at the first crossover frequency $f_1 = 50$ cps and ending at the second, $f_2 = 500$ cps. The subsequent mid-frequency 0-db plateau extends up to the treble crossover frequency $f_3 = 2120$ cps which again is followed by a 6 db per octave treble cut.

If the voltage gain of the feedback amplifier $|g_v| = \left|\frac{1}{\beta}\right|$ is supposed to follow the RIAA playback curve, the impedance $|Z_f| = R_E\left|\frac{1}{\beta}\right|$ has to follow a curve of similar shape. Since only 6-db-per-octave slopes are required, Z_f can be realized by a relatively simple R-C network, shown in *Fig.* 24. The time constants of the individual R-C networks are determined by the three crossover frequencies:

$$t_1 = \frac{1}{2\pi f_1} = 3180\ \mu s = R_1C_1$$

$$t_2 = \frac{1}{2\pi f_2} = 318\ \mu s = R_2C_1$$

$$t_3 = \frac{1}{2\pi f_3} = 75\ \mu s = R_2C_2.$$

Calculation of the individual network elements according to the above mentioned conditions is somewhat complicated. The same results can be obtained much easier by using the "hit and try" method. However, since only standard component values are to be used, the specified values for time constants and impedance can only be approximated. The values thus found are $R_1 = 47{,}000$ ohms, $R_2 = 4700$ ohms, $C_1 = 68$ nf, $C_2 = 15$ nf, resulting in a 1000-cps impedance of the feedback network of $|Z_f| \approx 4120$ ohms, and the time constants $t_1 = 3190\ \mu s$, $t_2 = 319\ \mu s$, $t_3 = 70.5\ \mu s$. The feedback network thus meets the requirements with sufficient accuracy without necessitating the use of odd-value, non-standard components.

If it is desired to provide equalization according to the DGG playback curve instead of the RIAA equalization, or as an additional feature, only one element of the feedback network has to be changed or added.

The DGG playback curve is described by the time constants $t_1 = 3180\ \mu s$, $t_2 = 318\ \mu v$, $t_3 = 50\ \mu s$ Since only t_2 differs from the respective RIAA time constant, only C_2 need be changed to $C_2 = \frac{t_3}{R_2} \approx 10.6$ nf, or, using the nearest EIA standard value, $C_2 = 10$ nf.

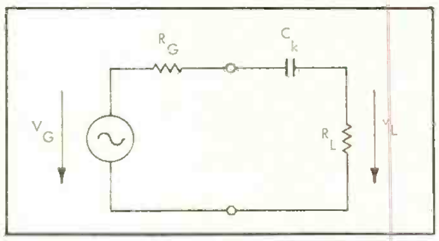


Fig. 25. Capacitive coupling.

Coupling Capacitors and Emitter Bypass Capacitors

The low-frequency response of the equalizer is limited by the finite values of coupling and emitter bypass capacitors. To ensure high quality of reproduction the lower cutoff frequency should be as low as possible. In our case, calculation of coupling and bypass capacitors will be based on a maximum tolerable value of f_o of 10 cps. The capacitance values thus gained are minimum values; in order to achieve a cutoff frequency below 10 cps, larger-value capacitors should be used.

The lower cutoff frequency, f_o, is defined as the frequency at which the voltage transmission factor of the system under consideration is 3 db down referred to its mid-frequency value (f = 1000 cps).

Coupling capacitors. The general equivalent-network representation of capacitive coupling between generator and load is shown in *Fig.* 25. The generator voltage, v_G, is divided vectorially across the resistance ($R_G + R_L$) and the reactance $1/j\omega C_k$. Thus the voltage v_L across the load R_L will be 3 db down (0 db at high frequencies) at the lower cutoff frequency f_o, which is determined by the condition $(R_G + R_L) = \frac{1}{\omega_o C_k}$ with $\omega_o = 2\pi f_o$. The required coupling-capacitor value expressed in terms of the desired cutoff frequency, therefore is

$$C_k = \frac{1}{\omega_o(R_G + R_L)}.$$

Input Capacitor.

The generator impedance is formed by the series connection of the internal resistance and inductance of the stereo cartridge. At very low frequencies, however the inductance may be neglected. With $f_o = 10$ cps, $\omega_o = 2\pi f_o \approx 62.8\ s^{-1}$, $R_G = 500$ ohms (ADC – 1), $R_L = R_{i\,min}$ = 46,000 ohms (f less than 50 cps), we get we get

$$C_i = \frac{1}{62.8\ (500 + 46.4 \times 10^3)}$$

$$C_i \approx 0.34\ \mu f.$$

Output Capacitor.

$R_G = R_o = 620$ ohms, $R_L = 600$ ohms

$$C_o = \frac{1}{62.8(620 + 600)}$$

$$C_o \approx 13.0\ \mu f.$$

Emitter bypass capacitors. If in a common-emitter stage d.c. stabilization is achieved by employing heavy d.c. series feedback by means of a large-value resistor in the emitter lead, this resistor has to be shunted by a capacitor of suitable value to avoid unwanted a.c. feedback.

Usually, both d.c. and a.c. series feedback are applied, as shown in *Fig.* 26. The voltage gain of the stage then is, from *Eq.* (3).

$$g_v = -\frac{h_{21e}r_L}{h_{11e} + h_{21e}(R_E + Z_3)}$$

where Z_3, is the impedance of the R-C parallel network

$$Z_3 = \frac{R_3}{1 + j\omega R_3C_3} = \frac{1}{\frac{1}{R_3} + j\omega C_3}.$$

(*Continued on page 72*)

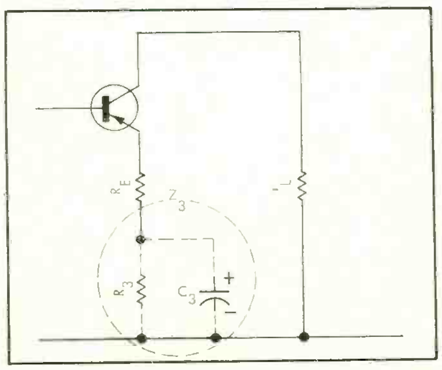


Fig. 26. Common-emitter stage with both a.c. and d.c. series feedback.

4 TRACK & 2 TRACK STEREOPHONIC RECORDER

Here, through your fingertips, you take complete control of sound, blending it to magnificent perfection.

A great symphony to record? With this superb instrument you are a professional. Touch your stereo level controls — feel that sensitive response. Dual V.U. Meters show precision readings as you augment the strings, diminish the brass. The richness of that low resonance is captured with your bass boost. The strength and delicacy of every sound — now yours to command.

On Sale only at authorized dealers, known for integrity.

SONY **SUPERSCOPE** *The tapeway to Stereo*

Four and two track, stereo and monophonic, recording and playback, the SONY STERECORDER 300 — with its hysteresis-synchronous motor, built-in stereo pre-amps and power amps. and a dozen more professional features — is truly *the ultimate* in tape recorder engineering. $399.50, complete with two dynamic microphones, two extended range stereo speakers all in one portable case. For custom mounting, $349.50.

Other *new* Recorders from world-famous SONY:

262-SL $199.50 — 4 and 2 track stereo playback. 4 track monophonic recorder. Sound-with-sound for language, voice and music students. Complete with F-7 dynamic microphone.

262-D $89.50 — A complete 4 and 2 track stereo recording and playback tape transport.

101 $99.50 — Bantam transistorized precision dual-track monophonic recorder. Complete with F-7 dynamic microphone.

For literature and name of nearest franchised dealer, write Superscope, Inc., Dept. 7, Sun Valley, California.

In New York Visit the Sony Fifth Avenue Salon, 585 Fifth Avenue

Blueprint for an Audio Club

CHARLES R. DOTY, SR.*

Here's how the Poughkeepsie Audio Society made the club idea work

THE SALES of high-fidelity equipment in the year 1950 amounted to but a small fraction of the estimated sales for 1963, nevertheless there was a definite indication at that time that the interest in audio was making rapid strides. This display of interest was not limited to those who were technically minded and who were interested in high fidelity for its hobby aspects. Included were many who knew nothing about the equipment and its installation but who were interested in securing the high degree of faithful reproduction of music which was available only through custom installation of the various components. A considerable number of people approached the writer and requested his advice. The time spent in discussing the considerations of finance, speaker placement, and equipment arrangement, plus demonstration of the writer's equipment, was beginning to seriously encroach on his free time for around-the-house chores and social engagements. The problem in 1950, which still exists in 1963, and probably will exist for many years to come, was how to offer guidance to people which would enable them to make a wise selection of components so that the over-all result would be satisfactory.

How We Got Started

The only possible way to handle this flood of interest seemed to be through gathering where people could discuss their problems with others and in this way receive the benefit of their experiences and conclusions. Also, by getting a number of people together, one demonstration would suffice where several individual demonstrations were formerly required. Accordingly, a meeting was held at the writer's home on the evening of June 5, 1950, at which it was decided to form such a group. There were twelve people present at this first meeting of the Poughkeepsie Audio Society. The fact that there are presently approximately 400 men and women in the Society is an indication of the large number of people who are interested in some phase of audio and who are anxious to learn more about the subject through demonstration and discussion sessions. More than 1000 men and women have been members of the Society through the years.

Our first regular monthly meetings began in the Fall of 1950. We started very modestly by meeting at the homes of the members and by covering such fundamental subjects as pickup stylus wear, the preamplifier-control unit and why it is required, power amplifier requirements, and so on. A portion of each meeting held at a member's home was devoted to listening to records on his equipment. After a few months we outgrew even the most pretentious home quarters and rented a room at the YMCA and later a room at a local High School. For the past several years our meetings have been held in the largest quarters of the local hotels because our attendance has averaged 140.

Selecting A Name

We purposely avoided the inclusion of the word "engineering" in deciding on a name for the Society as we did not want anyone to feel that our meetings would be so technical that they would be of little interest to lay people—after all, they are the ones who need assistance most. We decided that our organization was to be devoted to all phases of audio and that all of our programs would include some music for those who were only interested in listening. It is surprising how many of those who just came to listen at first have now become interested in the why's and wherefore's of the equipment. The exposure to the technical aspects of the subjects during the first portion of our meetings has created a desire in many members to know more about the basic principles because of their fundamental relationship to the over-all result. For example, the wife of one of our members, who attended our meetings fairly regularly, came up to me after one session and said "I am quite proud of myself, I understood everything the speaker said." The talk that evening was an explanation of the recording characteristics of LP records.

Meeting Notices

Meeting notices are mailed out about a week in advance of the meeting date. We endeavor to word our notices in such a manner that they will attract the attention and stimulate the interest of both the male and female members of the Society. Letters rather than postal cards are used because they are more personal and convey more information about the program, the speaker, and the equipment to be demonstrated and discussed. Our notices always conclude with an invitation to members to bring along a friend as anyone who is interested in any phase of audio is always welcome. Those who are not members and who do not receive the meeting notices learn of our meetings through word-of-mouth, two local radio stations, and the local newspaper.

We meet eight times a year on the second Tuesday during the months of October through May.

Because we are a non-profit organization we enjoy a special low mailing rate for our monthly meeting notices.

The Programs

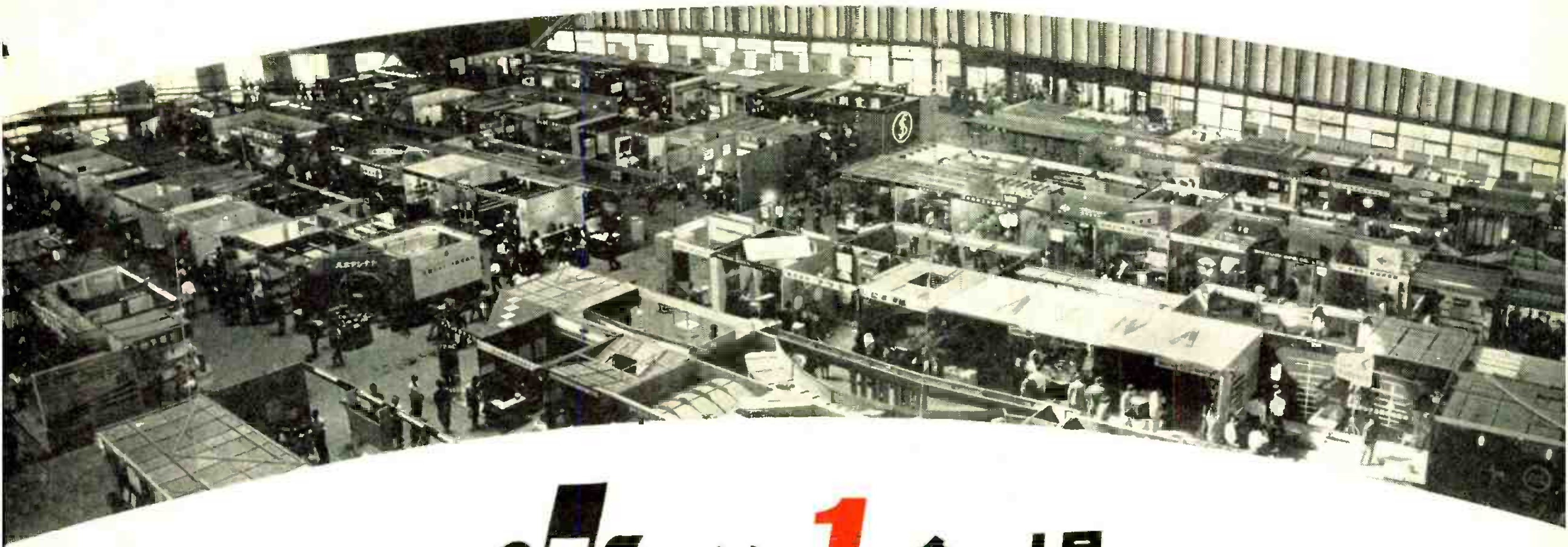
Letters to manufacturers inviting them to participate in our meetings contain sufficient basic information about the Society to permit them to rough out a program presentation. Further correspondence generally follows about the equipment to be demonstrated, who the speaker will be and the title of his talk, and the requirement for any special equipment such as a slide projector. Prior to the meeting, generally during dinner, the speaker is further briefed on the aims and purposes of the Society and the type of people he will talk to so that he can present a well-rounded program which will cover all facets of interest. Following the talk a question-and-answer period is held, following which the equipment is demonstrated.

Our guests are free to present their products in any manner that they desire. In many cases the talks are supplemented by projection slides or blackboard diagrams.

We make every effort to conduct our meetings as informally as possible and to restrict the business portion to absolute necessities such as the reading of the reports of the Secretary and Treasurer. The officers of the Society make final decision on all matters of policy or the expenditure of money, so that only very occasionally does anything develop which requires the attention of the mem-

(*Continued on page 60*)

* *International Business Machines Corp. Laboratory, Poughkeepsie, N. Y.*



JES 第1会場

Hi-Fi and Electronics in Japan

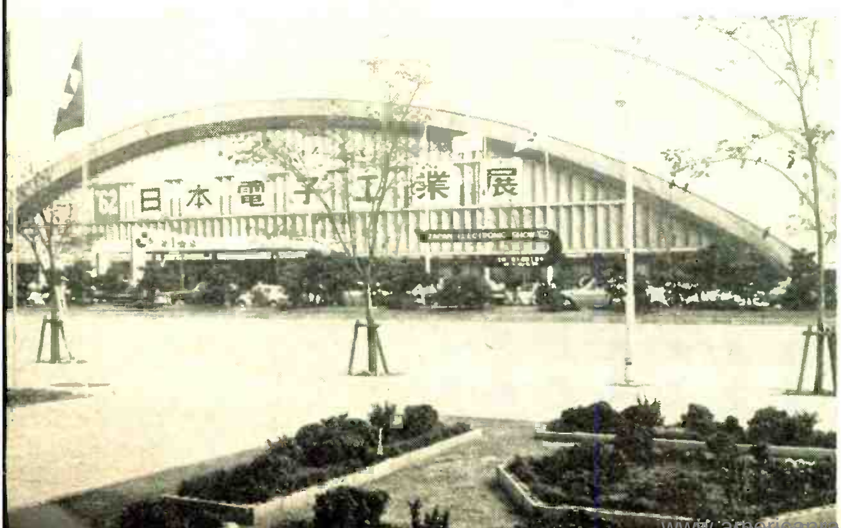
- How big is the electronics industry in Japan?
- How good is the equipment?
- Why does it cost less than comparable U.S.-made equipment?
- Is engineering up to that of the rest of the world?

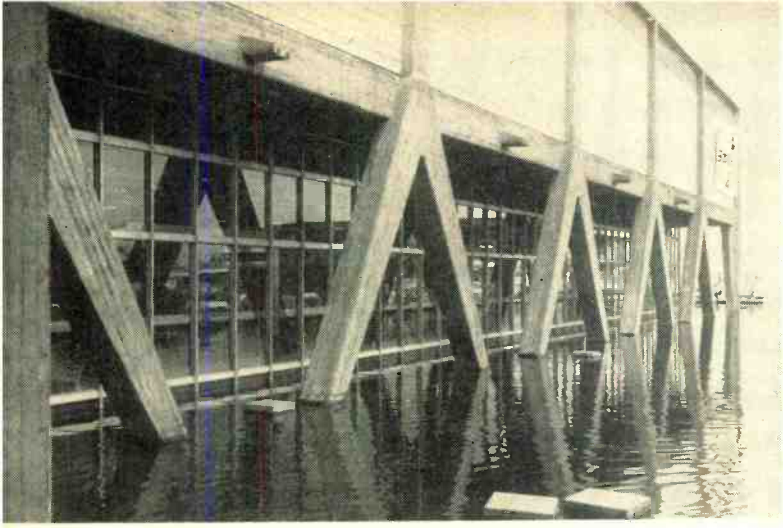
These are the questions that come to the mind of the average man-in-the-street, here are some of the answers.

C. G. McPROUD

Exhibition Hall at Harumi International Fair Grounds, 100 ft. high at the center, accommodates more than 300 booths.

Inside, the Japan Electronic Show resembled any other, except for the preponderance of Japanese signs and faces.





Exterior of attractive annex housing hi-fi exhibits.

EVERY ONE OF THE QUESTIONS listed at first was in the writer's mind when he boarded a Japan Air Lines plane last September on the way to the first Japan Electronics Show as a guest, with three other magazine representatives, of the Electronic Industries Association of Japan. And, like the average U.S. citizen, the writer wanted to know what the answers were to be.

Since the basic reason for the trip was to visit the Show, let us begin with it. Held in the Harumi International Fair Grounds not far from the center of Tokyo, it resembled any I.R.E. (now I.E.E.E.) show in the U.S., or the R.E.C.M.F. show in London, or the Components Exhibition in Paris. There were over 500 booths accommodating some 420 separate exhibitors, restricted to members of the EIA-J. The Show, the first under its new name, derives from the 1960 "Radio and TV Parts Show" and the 1961, "Electronic Parts Show." In addition to the enormous circular exhibit space with its amazing self-supporting roof, there was a second hall which more closely resembled a hi-fi show, and which was filled with hi-fi equipment only, both professional and consumer. It seemed to us that the show was intended to sell Japanese electronic parts to Japanese companies, since very few of the exhibits had any English in their signs. Later we learned, however, that a large amount of commercial activity is handled through Japanese trading organizations, and their personnel are fluent in English, naturally. It was easier to find English-speaking Japanese in Tokyo than it is to find English-speaking French in Paris, once away from the tourist hotels.

The Show itself was one in which anyone intensely interested in all phases of electronics could easily spend all of the exhibit hours, but otherwise not especially different from a similar exhibit elsewhere.

In the hi-fi area, there were many interesting items which have not yet appeared in the U.S. in any quantity. To accommodate the reverberation market—short-lived as it was—one company offered an 8-inch speaker which looked like any other except that the magnet housing was some 6 in. long. Within that housing was a spring-type delay mechanism providing a form of reverberation right in the loudspeaker itself. In use, a speaker of this type was mounted in a cabinet with a conventional 8-in. cone, or larger, with the two "hot" terminals being connected to opposite ends of a 50-ohm pot with the input signal fed to its arm. With such an arrangement, any desired balance between direct and reverberated sound could be had simply by the adjustment of a single control.

The largest possible variety of tape recorders was in evidence, ranging from tiny ones that could be operated in a pocket to large consoles. The Sony video tape recorder, since shown in the U.S., was on exhibit, providing a picture as good as any normally received in the home, and at a tape speed of 7½ ips. With this machine, speed of action can be slowed down to 1/60 of normal, providing an immediate slow-motion picture. One application of this feature was often seen during Sumo—a form of wrestling—matches. After each round, regularly telecast in color, the action was immediately repeated in slow motion, in black and white.

While many of the tape recorders shown were of the reel-drive type, there were also many which were completely professional in character. The reel-drive recorders, little more than toys actually, have no capstan, and depend for tape motion on the pull by the take-up reel. Thus speed is slower at the beginning of a reel, speeding up towards the end. For speech and for dictating use, however, this type of recorder seems perfectly satisfactory. All such models were transistorized, and depended on permanent magnets for erasure. But in the high-quality range, many of the machines appeared to be comparable with the best—most such models are already familiar in this market.

The widest possible variety of phono arms was on display, permitting perhaps a dozen manufacturers to buy as many different styles from the same supplier. Few phono pickups were shown, but those in the quality range were of watch-like precision in their construction.

Notable among the displays were a number of hi-fi "super-consoles," which in most instances were made up for display only without much expectation of their achieving a high degree of commercial success. In general, they appeared to show just what could be done in case anyone should want such a product.

The Electronics Industry

Like industry anywhere, there is a wide range between the largest and the smallest companies in the electronics industry in Japan. Of the 432 member companies in the EIA, 97 of them are capitalized at less than $10,000, while only four are capitalized at over $100 million. The real extremes are one company capitalized at $530, and then there is Sumitomo which stands at $250 million. Toshiba, capitalized at $193 million, employes 66,000 people; the smallest company employs only 7. But throughout the entire electronics industry, over half a million people are directly employed by the 432 companies, and countless others are engaged in selling, installing, and servicing the products of these companies.

Neat Onkyo Denki exhibit of turntables, arms, pickups.

All photographs by the author except those of JMI Labs, Sony plant, and Hitachi.

The largest companies in the association—Sumitomo, Nippon Onkyo, Hitachi, Toshiba, Mitsubishi, and Matsushita—are widely diversified. Some are in heavy industry; most all are in household appliances; Toshiba and Hitachi are strong in electric railroad and power equipment and Mitsubishi's activities in electronics are a minor part of their whole product line which includes shipbuilding, steel, and heavy construction.

Being essentially a small country—its entire population of some 93 million live in an area approximately equivalent to that of California—there is a tendency toward specialization in small items which use a minimum of raw material. This partially explains the stress on small products which are directly aimed toward mass markets, and the lack of expansion into industrial fields where each individual product may be more lucrative to produce but where the over-all market is limited. The immense success of the small 6- and 7-transistor pocket radio is a direct indication of this type of specialization. Nearly 15 million radio receivers (of all types) were produced in 1962; 4.5 million TV sets, 1.35 million tape recorders, 220 million transistors, and nearly 200 million receiving tubes round out this enormous market.

In spite of what everyone thinks, not all of the products of Japan are exported. Production figures of 1961 indicate a total of $1,414 million; of this, $251 million was exported—about 18 per cent—and only about $115 million to the U.S. market.

Three general criticisms have been leveled at over-all industry in Japan. The first—and one which is in part true—is that many of the products are shoddy and poorly constructed. But even in U.S. product lines, the same condition obtains—for example, did you ever try to buy a good screwdriver in the average neighborhood hardware store? This leads back to the general advertising pitch in many types of product which seems to be based on the bare fact that such and such an item is "and only $2.49." The fact that any item is of a certain price is not in itself an adequate reason for buying it. The fact that a product is "only $299.95" does not make it a bargain—it may be worth, actually, only $199.37. So if you want a 29¢ screwdriver, you'll probably get a 29¢ product—one that will work to attach a handle to a drawer once or twice, perhaps. Such a screwdriver would be discarded immediately by anyone who knew the value of tools—and a screwdriver is a particularly good example of a product in which quality shows up. As long as there is a market for cheap, shoddy goods, it is likely that there will be someone who will make them—and possibly at a lower price than the next manufacturer.

Pioneer's full line of speakers, tuners, and amplifiers.

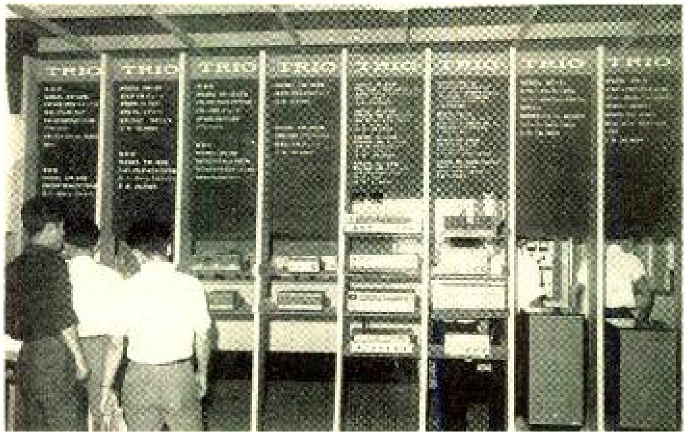
But one can not level such a charge against some of the higher quality tape recorders, for example, to enter a realm with which all readers of Audio are familiar. Nor could anyone ever call a Nikon or a Canon camera cheap or shoddy.

This brings us to the second charge against Japanese industry—that of copying others' products. This charge is certainly true in many areas—witness the Nikon and Canon cameras again. The original Nikon was a "Japanese" copy of the Contax and the original Canon was the same sort of copy of the Leica. But today's Nikon and Canon cameras are very little like their original "models"—both have been continually engineered until they are in themselves leaders in their field.

Hi-fi circuitry appears to have been derived from certain U.S. products—but then, who can honestly believe that every U.S. product is the result of original engineering and styling. If manufacturer X hits on a particularly successful amplifier or tuner, manufacturers Y and Z rush as nearly similar products on the market as fast as they can. Let us go back a short thirteen years to the introduction of the so-called Williamson amplifier to the U.S. market. How many commercial copies of the Williamson were placed on the market within the first year? And two years later, the Ultra-Linear amplifier? Or, in another field, how many infinite-baffle loudspeakers appeared on the market after the success of the first one?

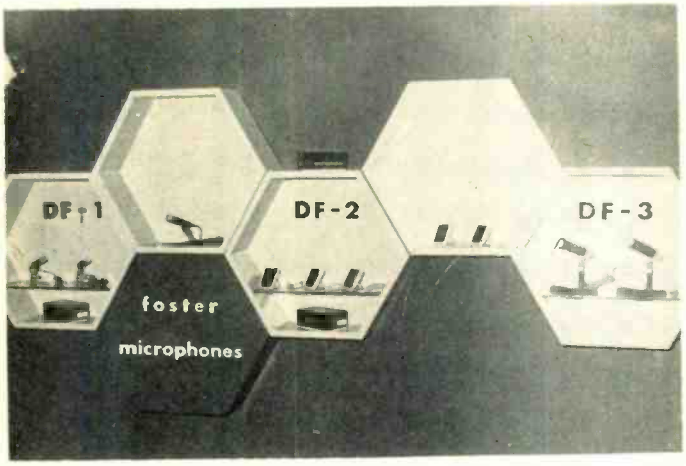
It is reasonably easy to copy another's product, since it goes on continuously in every field. If it is too obvious, someone raises violent objections, but there are very few completely original products on the market in any area of manufacture. We learn to speak by copying our parents—what we *say*, as time goes on, is the result of our own thinking, not that of our parents.

Now, in the case of a country which has had its economy disrupted seriously—regardless of the reasons—copying provides a little breathing space while independent engineering can catch up. After a year or so of "copying," any company should be able to branch off into its own engineering directions and—within the limits of its engineering ability—make its reputation on its own work. Some of the Japanese electronic companies are doing just that—a fact which is shown by the large percentage of engineers *vs.* production workers.



Full line of Trio products, sold in the U. S. as Kenwood.

The third charge against Japanese industry is that the products are made by "slave labor." This is really unfair, since the workers themselves do not feel that they are slave labor. They are obviously well fed, they are clean and neat, and they appear to be satisfied. They are, above all, friendly and courteous to a fault, if such is possible. But if their wages, in yen, are sufficient to buy their necessities, to feed them adequately, to

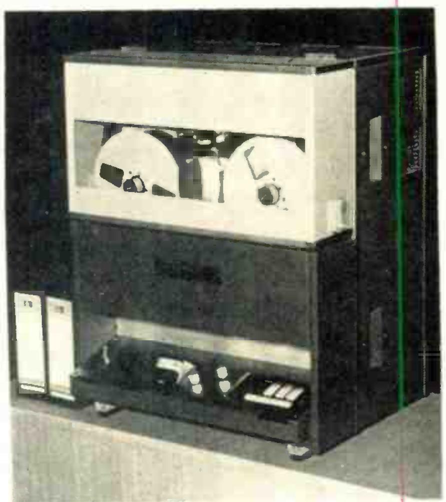


Foster showed a full line of microphones and loudspeakers.

permit them to dress as well as the average U.S. worker, who is to say they are paid "slave wages?" Does it really make any difference if one receives only 100 yen a month if he can live on 90? Or if he receives 10,000 and can live on 9000? A U.S. worker may make five times 10,000 yen—roughly about $139 —per week, but it may cost him in the vicinity of $125 to live. If we choose to price ourselves out of the world labor market, and cannot, for reasons of international politics, protect ourselves against imports, we have no one to blame but ourselves. We would have trouble, for example, in building 6-transistor pocket radios to export to Japan to compete with their price of around $6.50 wholesale, especially if we had to add on the import duty.

We realize that this is not a popular outlook these days, but these are the facts. As Japanese products are improved and as their own costs rise—as they do inevitably, for nothing ever goes *down* in price, well, hardly ever—prices will have to increase. It is a fundamental fact of economics that prices can not remain fixed when raw material, labor, and taxes all rise—not if the company expects to stay in business, anyhow.

This was not intended as a wholehearted defense of Japanese industry, but only as an attempt to present the other side, which is rarely heard here.



New Sony video recorder is not much larger than two audio tape recorders.

We know that some products from Japan are shoddy, but so are some U.S. products—and also British, German, French, and so on. We know that considerable copying has gone on—but in greater or lesser degree this charge could be made against practically every manufacturer, here or anywhere else. We know that one could not live in the U.S. on the wages of the average Japanese worker—but this average worker seems to live satisfactorily in Japan. Economies will change, gradually, perhaps, but there will be a continual readjustment. Already we have heard Japanese say that we—the U.S.—should be willing to pay as much for a Japanese product as for a domestic one, assuming equal quality. That one we can't agree with, since any country should favor its own products if all other factors are equal. And certainly a supplier 30 days away by sea is not as handy as one who may be only three days away by motor truck—or perhaps only three hours by plane.

A Close-up View

Any visit to a country solely to see an exhibit tends to foster a distorted view, since all the dust is likely to be swept under the rug, and only the best foot is put forward. And even on guided

Professional tape recorder shown by Denon Corporation

"Sharp" console with turntable and high-quality recorder.

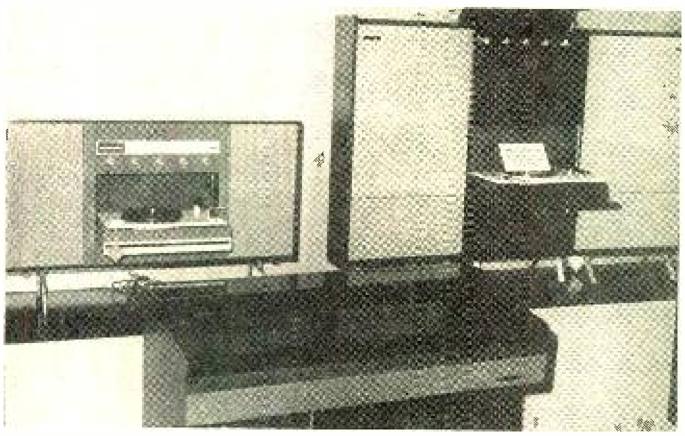
School console by OKI typical of professional equipment.

tours—all pre-planned—through a number of factories can be similarly staged. But during our visit, the group was taken through some eleven different plants, ranging from the largest to a few relatively small ones. To anyone familiar with manufacturing processes, these visits were most enlightening because of the effective combination of hand labor with highly mechanized equipment. Watching nimble-fingered girls putting what appeared to be grains of superfine bar sugar into holes in a jig—actually bits of indium which later became important parts of transistors—when it was next to impossible to see the grains with the naked eye, and then continuing to the automatic device which puts each individual transistor through a dozen different tests and sorts it into groups of different classifications rather surprises one. One machine, for example, separately gauges 1/16-in. square pieces of germanium for thickness and then deposits them in separate chutes in accordance with the thickness and indicates each thickness on a number light panel. Another takes a finished transistor header and fixes the can to it permanently without attention. Perhaps these are commonplace processes, but we have rarely seen such an effective combination of mechanization and hand work—each used where it was to the best advantage.

Tokuji Hayakawa, president of company bearing his name, and noted for his philanthropies and aid to the blind.

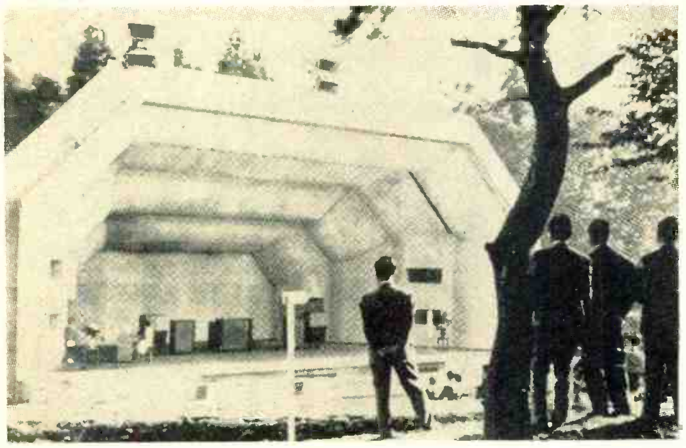
We were shown through two different transistor plants, both entirely air conditioned and lighted entirely by artificial light. Every visitor has to wear a jumper to keep dust from street clothes from contaminating the processes. Many of the plants were designed for visiting, with long galleries away from the work floor where groups were conducted at regular intervals. Throughout we noted extreme cleanliness—in every part of every factory. Female employees dress uniformly in long coat-like jumpers and simple cloths over their hair—with such "uniforms" furnished by the employers. Dressing rooms and lockers are provided so the girls remove their own clothing when they come to work and don the jumpers. Male employees wear shorter jackets for their work, also factory furnished. Most factories have lunch facilities, staggering their lunch hours so as to accommodate everyone without requiring a commissary of a size equal to the factory. And so quiet, too—100 girls at lunch make less noise than three non-Japanese women do here.

Since the young engineers in the average factory are generally unmarried (the usual age for a Japanese man to marry is around 32), and since the work force is likely to run in the range of 20 per cent engineers, many of the plants have dormitories on the factory grounds in which these young men live. This keeps them handy for additional training after hours, and is most effective.



Toshiba exhibit devoted to package consoles, organs.

One look at this and you can name the maker—it's Yaou.



Outdoor acoustic facility at Hitachi Central Research Lab.

Electronic plants in Japan seem to be centered around Tokyo and Osaka—two large cities about 350 miles apart. We visited Sanyo, Matsushita, Hayakawa, and Murata in the Osaka area, and in the vicinity of Tokyo we visited Hitachi, Toshiba, Sony, Mitsumi, Toko Coil, Tamura Transformer, and Pioneer.

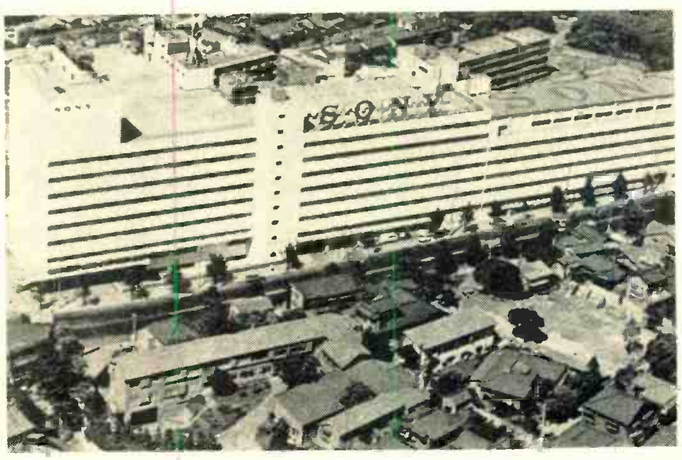
Sanyo, Matsushita, and Hayakawa all build TV sets, transistor radios, phonographs, household appliances, commercial sound equipment, and a generally large range of consumer products. Sanyo products are sold in the U.S. largely by Channel Master; Matsushita products are sold in the U.S. under the trade name of Panasonic, though throughout the rest of the world under the name National; Hayakawa's products are known as Sharp. Of those three companies, Matsushita is by far the largest, and with a larger range of products in commercial and industrial areas. It is, furthermore, one of the fastest growing companies in Japan. Hayakawa was building radio sets back in the 20's being one of the first radio manufacturers in the country. Its president, Tokuji Hayakawa, founded the company in 1912, and in the more recent years he has made considerable effort to provide employment and recreational facilities for handicapped members of his workers' families. For example, at the time of our visit, 51 totally blind workers were making small parts used in the company's products, and he had just completed a large recreational building especially equipped for blind and handicapped children. The company occupies five separate plants, two research institutes, and the head office facility, totaling some one and a half million square feet of floor space, and it employs over 8000 people.

Matsushita is considerably larger, with over 30,000 employees and fifty separate factories. The company started in 1918 with the manufacture of improved electric attachment plugs, an invention of Konosuke Matsushita, the company's founder and now chairman of the board. The next product of note was the dry-battery lamp for bicycles, which led to the manufacture of batteries, along with almost every other imaginable electric or electronic product—and adding bicycles in 1952, presumably to increase the market for dry-battery lamps. Along the way, Matsushita was awarded the Deming prize—Japan's highest prize for quality control.

Sanyo is also engaged in the manufacture of a wide range of electronic and electrical products, including household appliances of all types, together with a complete range of component parts used in electronic and radio products. This company is capitalized at around $25 million, and employs some 13,000 workers, and in addition to products marketed under its own name, many others are marketed with other trademarks on them.

Our fourth visit in the Osaka area was at the relatively small plant of Murata Mfg. Co., with only some 2200 employees. The principal product of Murata is the ceramic capacitor, although capacitors of all types are in the line, along with resistors and a wide variety of piezoelectric devices. The company is only eighteen years old, but has expanded to eight plants and has extensive research facilities in the realm of ceramics. In addition to the more mundane line of capacitor products, the company manufactures piezoelectric tuning forks, mechanical intermediate-frequency transformers using spherical ceramic balls as the resonators, thermistors, posistors—similar to thermistors, except that they have positive temperature characteristics—and various insulators of steatite. It was at Murata that each member of the party was presented with his own "hand stamp"—a signature stamp used by every Japanese as his personal seal. A reproduction of the writer's seal appears on the first page of this article. Osamu Saburi, director and manager of semiconductor development for the company, has contributed much to the art of piezoelectrics in the form of papers published in U.S. journals.

Hitachi was one of our stops back in the Tokyo area. This company—listed as eleventh in magnitude of all corporations outside of the United States—is engaged in every aspect of electronic and electrical machinery, and this means into the range of electric railroad locomotives, power plants, and power transmission equipment. With a capitalization of over $200 million and with 55,000 employees, it has a research budget of over $8 million annually. The Central Research Laboratory, located in the outskirts of Tokyo, occupies a 57-acre park which would do credit to a multi-million dollar resort hotel. Concentrated at this center are: the 8-story Odaira Memorial Laboratory, resembling the Los Angeles Ambassador Hotel in configuration, but with an additional 9-story tower on top for research in microwave communication; the Atomic Center, a discreet distance away; the Semi-Conductor Laboratory; and the Low-Temperature Laboratory. In addition, nu-



Main Sony plant; new addition is being built alongside.

Screen room in JMI laboratory for testing radio receivers.

merous small facilities dot the area—such as the outdoor acoustic lab—as well as dormitories for young engineers and scientists. Highly sophisticated equipment such as electron microscopes and elaborate computers are only a few of the end products of these Laboratories. The *Hitachi Review*—published bimonthly in English—is a superb "slick paper" publication designed to serve as interdepartmental liaison on technical problems, as well as a general electroscientific magazine.

Toshiba—a contraction of Tokyo Shibaura Electric Company, Ltd.—is nearly as large, and with its subsidiaries employs around 80,000 people. Here again is a company with the widest possible range of products from tiny transistors to electric locomotives and power generating equipment—with practically nothing left out in between.

Because of its high-grade tape recorders, Sony Corporation is better known in the U.S. than some of the larger companies. Small by comparison with the giants just mentioned, Sony employs over 4000 people, with about 600 of them being engineers. One of its latest products to attract attention is a video tape recorder which occupies just about the volume and the same general shape as two CS-300 audio recorders stacked one on top of the other. In addition to the main Tokyo factory—and some 29 additional buildings from which it has grown but which are still in use at the Tokyo site—a new building of similar size is just being completed, and there is a semi-conductor laboratory some 20 miles away in the outskirts of nearby Yokohama. Primarily devoted to consumer products, Sony scooped the market last year with the 5-in. "Micro TV" set which is to TV what the pocket transistor radio is to sound, making "personal viewing" as easy as the personal listening of the popular radio. Sony's line of tape recorders ranges from simple dictating-type models to three-channel studio recorder consoles of superb quality.

Headquarters building of Japan Machinery and Metals Inspection Institute.

Regardless of the brand name, everyone who has *any* transistor radio probably has some of the products of either Toko Coil or Mitsumi. Both make i.f. transformers and variable capacitors, and both also make resistors especially suited for transistor radio use. Mitsumi's Poly-Vari-Con is well known, employing a conventional variable-capacitor construction with fixed and movable plates, but with thin sheets of polyethylene film as the dielectric to reduce spacing and increase capacitance. Watching their production line in operation makes one wonder if a week's output wouldn't be adequate to provide a transistor radio for every person of the world. These capacitors are made in practically any form, with types for AM/FM receivers having four gangs. As in every factory we visited, we noted 100 per cent inspection of finished products, individual adjustment of tracking on the capacitors, and individual pre-setting of tuning slugs in the i.f. transformers.

Toko Coil's variable is constructed like a ceramic trimmer, with two fixed plates consisting of evaporated films on one side of the ceramic while the variable plate, at ground potential, is rotated against the other side. I.f. transformers of all types were wound on semi-automatic and fully automatic machines, the latter practically unattended. Toko Coil was just completing the setting up of an automatic machine for making resistors automatically in the range of half a million per day. These resistors, with both leads at one end, were made automatically, individually checked and adjusted to the specified value—all without attention.

Testing radio components at the Tokyo laboratory of JMI.

Since practically all electronic equipment uses transformers somewhere along the line, it was only natural that we should visit a transformer plant. Tamura Siesakusho, Ltd. has been producing audio transformers since the first radio station began broadcasting in Japan. The line includes practically any transformer used in audio, along with coils for relays and other applications wherein multi-layer coils are used. In addition to the transformers, the company has a chemical division which manufactures soldering fluxes, conductive paints, quality adhesives, and other products of this nature. It employs some 1500 people in its four plants.

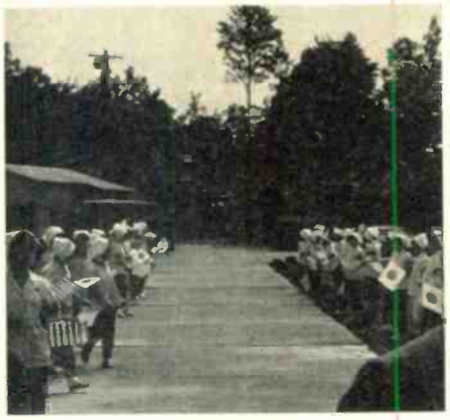
Our last visit was to the loudspeaker plant of Pioneer—another name familiar to readers of AUDIO. Speakers ranging from the small models used in pocket transistor radios to 12- and 15-inch models of hi-fi quality were assembled here, using as much automation as the processes would allow. Again we noted the 100 per cent inspection procedures, with even the inexpensive tiny models, and—in the case of the hi-fi models, 100 per cent curve-tracing for a complete check on performance. In addition to loudspeakers, Pioneer also makes tuners, amplifiers, receivers, and complete hi-fi systems.

Electronic Industries Association—Japan

This organization is a composite of various types of activities usually covered by a number of different organizations. It consists of a Board of Directors, nine divisions having differing spheres of operation, and an Engineering Department composed of five divisions.

The nine divisions are: general affairs, radio communication equipment, radio and TV, electron tubes, parts, electronics application devices, research and statistics, public relations, and foreign. Each division has a number of committees, and, in many cases, subcommittees. The Engineering Department divisions are: radio communication equipment, TV and radio, electron tubes, parts, and electronics application, corresponding roughly to the main equipment divisions, and handling all the engineering problems applicable to the individual main divisions. The organization is closely knit, well staffed, and efficient in over-all operation. It would appear to combine the functions of engineering and trade, thus providing an extremely close liaison between both aspects of the industry.

Anechoic chamber in JMI labs for complete acoustical tests of loudspeakers.



50 girls 50—count 'em—lined up at entrance of Toko Radio Coil factory to greet U.S. press group—typical of the reception accorded wherever we visited.

Inspection Standards

It will have been noted that inspcetion was strongly stressed at each of the factories which we visited. Backstopping the individual activity in factories is the Japan Machinery and Metals Inspection Institute, known as JMI, which was established in 1957 when Japan's export inspection system was revised and enacted as the Export Inspection Law, From the outset, JMI has been devoted toward preventing the export of goods of inferior quality by means of quality inspection in accordance with the Export Inspections Standards written under the law. These standards, however, were not originally established for the purpose of equally satisfying dealers and consumers abroad, nor were they written with full coverage in every technical field, but only for important products deemed to have a great quantitative export potential. JMI is a non-profit foundation with some 400 employees with its head office and laboratories in Tokyo. Its inspection and test services are available for any interested individual or party desiring to be benefited by their use. The engineering staffs are available for technical consultation and product development, interpretation and establishment of standards, and for many other projects. Services of JMI are available on a non-profit basis, and inspection fees, costs of tests, certification fees, and so on, are based on actual cost incurred in providing the services. Since the organization was established as a legal entity by government funds, and is supported basically from the national budget, it is actually a quasi-governmental agency and as such its actions are officially recognized. Because of this, machinery and electrical and electronic equipment for export is kept at a consistently high quality.

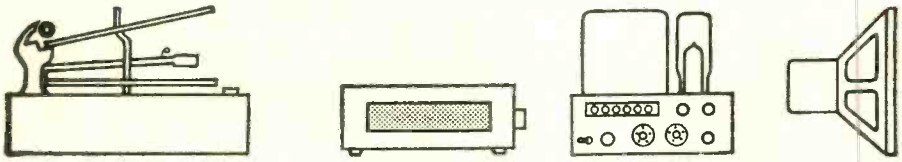
Conclusion

It is recognized that one cannot become thoroughly familiar with an industry as large as electronics in Japan in two weeks, but it is hoped that such a birds-eye view may serve to engender a high degree of respect for the initiative and ability of Japanese engineers and manufacturers. While we have not yet seen much evidence of a wide variety of hi-fi products, particularly with respect to appearance and styling, we believe that such native ingenuity and the traditional art-consciousness of the Japanese people will result in great improvements in this direction. Lack of familiarity with U.S. trends may be the partial cause, for here again a short visit to the U.S. can not possibly serve to provide a sufficiently wide knowledge of this market.

But we look forward confidently to progress in these directions within the next year or so, and we fully expect to see it. Æ

The old and the new—the Soroban on the table displaced by the slide rule, but still handy in case real speed is needed.

EQUIPMENT



PROFILE

TANDBERG MODEL 64 TAPE RECORDER

During the past half dozen years or so, Tandberg (of Oslo, Norway) has sent this country a succession of tape recorders, each new model representing a high degree of craftsmanship and a step forward in the art of making a compact, high-quality, durable tape machine for home use. Despite the changeover to stereo, which calls for about twice as much tape electronics and introduces switching complications, and despite the addition of a separate playback head, which again nearly doubles the tape electronics, the Tandberg machine has remained unpretentiously small while improving in quality and versatility. Accordingly, Tandberg has won a position of special esteem in the home audio market.

The newest basic stereo tape recorder in the Tandberg line is the Model 64, which includes a number of new features plus subtle improvements in performance compared with the preceding Model 6. In briefest terms, the Tandberg 64 is a compact (15¼ × 11¾ × 6½ in.), light (25 lb.) stereo tape recorder of great versatility and of thoroughly professional design, construction, and performance. It lists for approximately $500.

Operating Features

As stated, the Model 64 is a basic machine, meaning that it must be fed into an external audio system for playback. Otherwise, it has just about everything that the audiofan might reasonably desire of a tape recorder. For maximum performance, and so that one can monitor the tape playback as the tape is being recorded, separate record and playback heads are used. The heads are quarter-track, and the machine permits four-way mono recording as well as two-way stereo recording. Tape speeds are 7.5, 3.75, and 1.875 ips, and the required changes in record and playback equalization are automatically made by the speed-control knob. A four-position digital counter is provided.

The record-level indicator for each channel is a magic-eye tube (EAM86), which presents a fluorescent pattern of two bars that come together at the center of the tube as signal increases. A damping circuit is employed to keep signals briefly at their peak level and thus enable the human eye to follow these peaks. The magic eye covers a range of about 20 db and is about equally sensitive to all frequencies between 30 and 20,000 cps. The persons may raise their eyebrows at the use of a magic eye instead of a VU meter in a tape machine of professional quality. But a good defense can be made for the magic eye. In a professional studio, the VU meter is generally needed to supply an absolute reading of playback level in order not to underdrive or overdrive other studio equipment. It is convenient to use the same meter to indicate recording level (and perhaps also to check bias current). In the home, however, the only need is to indicate recording level. Here the magic eye serves as well or better because, being an electronic device, it can follow transients with substantial accuracy and thus show peak levels, where distortion is greatest. The VU meter, being a mechanical device, may lag anywhere from 6 to 20 db behind transients; therefore the recordist must skillfully judge the actual level of transients and accordingly set the recording level low enough to avoid significant distortion.

Each channel has three inputs: 1. microphone input, presenting an impedance of about 5 megohms in order to preserve bass response fully when using a crystal or ceramic microphone; 2. high-level input, presenting an impedance of 1 megohm; 3. high-level multiplex input, which has a 28k-ohm impedance. The multiplex input is a new feature, replacing what used to be a second high-level input. It feeds the incoming signal through an LC filter sharply tuned to 19 kc, resulting in over 30 db attenuation at this frequency. Unavoidably, there is also some attenuation of audible frequencies below 19 kc, although not too serious. At 10 kc the filter produces about 2 db loss; at 15 kc, about 5 db. The regular and multiplex high-level inputs are effectively in parallel, thus providing a mixing facility. However, when a microphone is inserted into the microphone jack, this cuts out the high-level input signals. The high-level input jacks are at the back of the machine, while the microphone inputs are conveniently on top of the tape deck toward the front.

The output jacks are mounted at the back. The outputs are cathode follower, permitting a long run of cable to the external audio system.

Each channel has a separate gain control for recording level and playback level—four gain controls altogether. The record controls are concentrically mounted, as are the playback controls. In addition, there are 12 internal controls to enable the service technician or knowledgeable operator to adjust the machine for maximum performance. Two are record-level adjustments to assure proper correspondence between the input signal and tape distortion. Two are playback-level adjustments, to achieve equality between the input signal and the tape playback signal when making an A-B comparison. Two are record-level-indicator adjustments, so that the magic eye bars will just close when harmonic distortion on the tape reaches 3 per cent. Two are bias current adjustments. Two are to prevent bias current from reaching the record-level indicators, so that the indicators will not produce a false reading; these controls are variable inductors that form part of an LC bias trap. One control is to balance the pushpull oscillator, thereby minimizing bias-current distortion and resultant noise in recording. The last is a variable capacitor to keep the tape oscillator at constant frequency by compensating for the variation in load on the oscillator when two channels are recording rather than one. The purpose and number of these controls is indicative of the care lavished on the Tandberg 64 by its designers.

Electrical modes of operation are mainly governed by four pushbuttons (a fifth button, located amidst the others, starts and stops the transport in the record and playback modes): record Track A, record Track B, play Track A, and play Track B. Underlying this seemingly simple arrangement is a good deal of sophistication, because what any one button does depends upon the position of the other buttons.

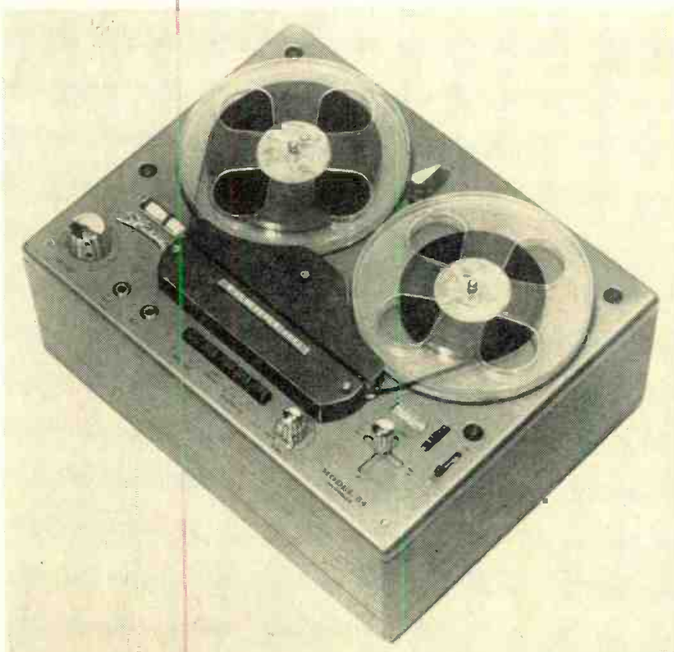
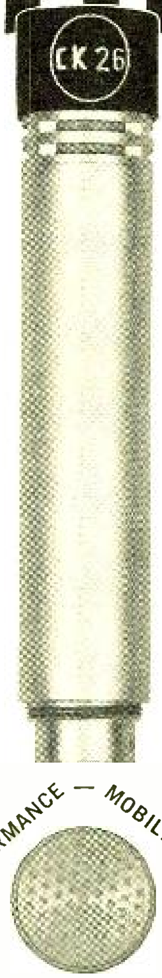


Fig. 1. The Tandberg Model 64.

THE BREAKTHROUGH CONTINUES:



C-60's are in use by Coast-to-Coast T.V. and Radio Networks, Personalities, Recording Stars and Studios, Acoustic Research Groups, Consultants, Ornithologists, Knowing Amateurs and Quality Sound Contractors

NEW PERFORMANCE — MOBILITY — ECONOMY

reversing the trend toward higher prices, and offering:

PERFORMANCE

No Peaks from 20 to 30,000 cycles. Like all AKG microphones, C 60 is smooth over its **full** range.

No Overload in today's close-miking techniques. C 60's circuitry and sturdy housing accept high levels cleanly without need of internal shunting.

No Instability with the field-proven omni and cardioid capsules, which perform consistently in recording environments.

MOBILITY

Transistorized B 60 Power Pack makes the C 60 independent of AC mains. Many hours of remote service without trailing power lines, from a single recharging at any 110/145VAC outlet. C 60 is four inches long, 2 ounces light including internal electronics. The DC Power Supply is miniaturized for use on shoulder strap or as a plug-in stand element.

ECONOMY

C 60 with choice of instantly-interchangeable capsules (**C 26** omnidirectional or **C 28** cardioid), with **B 60** Power Pack or **N 60 EA** AC Power Supply, and all necessary cables — only $259.50.

Field-Proven Accessories include: long-arm bamboo fishpole **FP 3** — efficient windscreen **W 60** — rack-mounting AC Power Supply **N 60 R4** to power four C 60's — a variety of stands and long cables — and a voltage-calibrating head.

CONDENSER MICROPHONE C 60

AKG

C 60 shown actual size

ELECTRONIC APPLICATIONS, Inc.
80 DANBURY ROAD, WILTON, CONN.
Phone: NYC, CYpress 5-1207, Wilton, POrter 2-5537

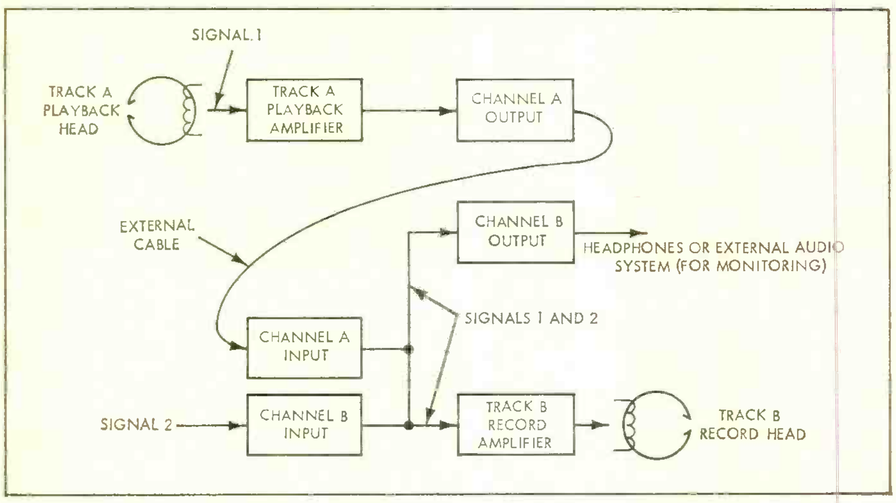


Fig. 2. Sound-on-sound recording with the Model 64.

With both record buttons down, Channel A input is recorded on Track A; Channel B input on Track B. But with only one record button down, both inputs are recorded on one track; thus if record button A is down, inputs A and B are mixed and recorded on Track A. This makes sound-on-sound recording feasible, on which we shall have more to say.

With both play buttons down, the Track A signal goes to the Channel A output; the Track B signal to the Channel B output. But with only one play button down, one signal goes to both outputs; thus if play button A is down, the Track A signal goes to both the Channel A and B outputs. Hence a mono signal can be fed to both outputs.

With both play buttons up, the outputs are connected to the incoming signal. With both play buttons down, the outputs are connected to the tape playback signal. This permits A-B comparison during recording. Or, with both play buttons up and both record buttons up, the Tandberg can be used simply as a voltage amplifier for whatever purpose one desires; for example, to preamplify a microphone signal.

Altogether, through suitable positioning of the record and play buttons, each output jack may be connected to any of four signals: input signal A or B; output signal A or B. The only thing the reviewer found the Tandberg unable to do was combine the Track A and Track B playback signals, which might be desired if feeding stereo signals into a mono playback system.

Electrical operation is further controlled by a three-position sound-on-sound switch concentrically mounted under the playback gain controls. In the "A-B" switch position, operation is as previously described. In the "Normal" position, the A-B test is obviated; that is, the outputs can no longer be connected to the input signals. This prevents the feedback and resultant howl that can occur in some audio systems where a continuous electrical path exists between the tape input jack and tape output jack. The third position is for sound-on-sound recording. This is illustrated in *Fig.* 2, which takes us to the moment when it is desired to transfer Signal 1 from Track A to Track B and simultaneously record Signal 2 on Track B. The switch is moved to the "S-on-S" position, the operator connects an external cable between the output and input of Channel A, and he depresses the Track B record button and Track A play button. Thus Signal 1 is played back from Track A and recorded on Track B; simultaneously, Signal 2 is also recorded on Track B. Signals 1 and 2 combined are monitored by the recordist via headphones or an external audio system connected to the Channel B output.

Mechanical operation is controlled by an operating lever—a joystick, as it is sometimes called—that moves in a "plus" figuration. Pushing the lever to the right or left rapidly winds or rewinds the tape. Pushing it up frees the turntables from their brakes to facilitate threading the reels (formerly the lever moved in a "T" rather than "plus" slot, and it was clumsy to thread the tape because the reels were difficult to turn by hand against the brakes). Moving the lever down completes a linkage between the drive motor and the capstan, preparatory to recording or playing the tape. Now the capstan turns, but the pressure roller is kept a fraction of an inch from the capstan. To bring the roller against the capstan and thereby drive the tape, it is necessary to depress the start-stop button. This is in the nature of a "pause" device because it enables the recordist to halt the tape temporarily without changing the operating mode.

There is a safety interlock between the record buttons and the operating lever to prevent accidentally setting the machine in the record mode and erasing a valued tape, or accidentally disengaging the machine from the record mode. The record buttons can be depressed only when the operating level is in neutral. To lock these buttons down, the lever must be moved down. The record buttons are released only when the lever is returned to neutral (the middle of the "plus"). The playback electronics are actuated only when the lever is down. This prevents ultrasonic frequencies that may be developed during rapid winding or rewinding from reaching the external audio system and possibly injuring the speaker; these frequencies can attain considerable magnitude.

One of the valuable new features is an automatic stop that halts the transport if the tape runs out or breaks. When the tape is inserted in the loading slot, the tape nudges aside a wire finger connected to a sensitive microswitch, which permits the transport to operate. In the absence of tape tension—that is, when the tape breaks or runs out—the finger returns to its original position and the microswitch halts the transport. The device is simple, effective, conducive to peace of mind if the machine is left alone, and much more convenient than the former method of automatically stopping the transport; the latter required metal foil to be spliced onto the tape ends, and was of no help if the tape broke rather than ran out.

Another innovation prevents the tape from creeping when the transport is in the pause mode. A rubber bumper presses the tape fast against the playback head. The bumper is released when the start-stop button is released.

Performance

At 7.5 ips the Tandberg 64 on the whole adheres very well to NAB equalization, as measured by playing Ampex test tape 31321–01. Only at 50 cps, where bass was slightly excessive, did playback equalization stray significantly from the NAB standard, which permits response relative to 1000 cps to be up 1 db between 50 and 15,000 cps; down 1 db between 100 and 7500 cps; down 2 db at 80 cps, 3 db at 60 cps; and 4 db at 50 cps; and down 2 db at 9500 cps, 3 db at 12,000 cps, and 4 db at 15,000 cps. Following is the measured playback response; although the Ampex tape uses 700 cps as a reference, the following data have been converted so that 1000 cps is the 0-db reference.

Frequency	*Left Channel*	*Right Channel*
15,000 cps	−2.25 db	−2.75 db
12,000	−1.75	−2.75
10,000	−0.75	−2.25
7500	0.25	−1.25
5000	0.75	−0.25
2500	0.25	0.00
1000	0.00	0.00
500	0.25	0.50
250	0.25	0.75
100	−0.25	1.00
50	2.75	4.25

Record-playback response at 7.5 ips was exceptionally smooth between 50 and 15,000 cycles, without significant emphasis at 50 cps:

Frequency	*Left Channel*	*Right Channel*
20,000 cps	−7.00 db	−8.00 db
15,000	−2.00	−2.00
12,000	−1.50	−1.50
10,000	−1.50	−1.50
7500	−1.50	−1.50
5000	−1.50	−1.25
2500	−1.50	−0.50
1000	0.00	0.00
500	1.00	0.75
250	1.00	0.50
100	−1.50	−1.00
70	−1.00	−0.50
50	0.00	1.00
30	−5.00	−3.00

Good record-playback response was maintained to 7500 cps at 3.75 ips, and to 4000 cps at 1.875 ips. Other tape recorders sometimes maintain response to considerably higher frequencies at these reduced speeds, but usually at the cost of a noticeable treble peak. In the case of the Tandberg, smoothness of response is apparently favored over extended response. Following are the measured results at 3.75 ips:

Frequency	*Left Channel*	*Right Channel*
10,000 cps	−6.50 db	−7.00 db
7500	−2.50	−1.50
5000	−0.50	0.50
2500	0.50	0.50
1000	0.00	0.00
500	0.50	0.25
250	1.00	0.50
100	0.50	−0.25
50	−3.50	−3.50

DYNACO B&O the mark of excellence

STEREODYNE II CARTRIDGE

Here is a cartridge which is easy on your ears and easy on your records. Uniform, wide-range, balanced response and high stylus compliance are coupled with exceptional tracking ability in the STEREODYNE. A triple-balanced push-pull magnetic circuit maintains accurate phase relationships at all frequencies, eliminates hum pickup, and cancels out distortion. The unique ISODYNE inertially balanced arm design equalizes the forces on both sides of the record groove without pulleys, springs, or weights; resists external jars; counteracts the natural tendency of the arm to pull to the center of the record. The result is the cleanest, clearest sound this side of the live performance: no "instrument wander"; smooth, sputter-free treble; solid, conscious bass.

SD-II cartridge $29.95 TA-12 arm and cartridge $49.95

AM-FM-SW PORTABLE RADIO

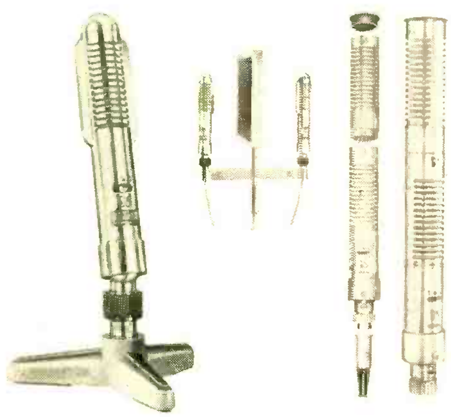
The perfectionist's portable: demonstrably superior engineering, construction, and performance. Longer life from its 6 standard flashlight batteries is assured by a clever, efficient circuit which gives greater sensitivity and higher power output with crystal-clear, natural, room-filling sound. Quality reproduction of the full FM and AM bands, plus shortwave coverage of 2.5 to 16 MC on a long slide-rule dial; flywheel tuning; one watt output; 5″ x 7″ speaker; separate tone controls; tuning meter and battery indicator; in a smartly styled black, grey and chrome case weighing less than 8 pounds. It can be used as a hi-fi component tuner; a folding auto mounting bracket is available, and a standard auto antenna fits the external aerial jack.

DYNACO-B&O portable transistor radio $149.95

BROADCAST QUALITY MICROPHONES

Professional microphones at a price to delight the serious amateur and the budget-minded studio. Wide, ultra-smooth response with a perfect figure 8 pattern and uniform polar pickup for precise source localization and true "curtain of sound" reproduction. The model 50 and 53 mono mikes, plus the SS-1, simplify stereo recording and give effective 10 foot separation. The uniquely flexible model 200 is suitable for MS or conventional stereo, with adjustable separation in a single in-line housing, or for mono. All include a switch for normal, close-talk and muting, a stand adaptor, 20 feet of cable and ball-swivel mounting. Matching transformers are available. Hear what a dramatic improvement a fine microphone makes in your own recordings. *SS-1, Stereo Spacer $14.95*

Model 200, $149.95 Model 50, $59.95 Model 53 $69.95



DYNACO 3912 POWELTON AVENUE PHILADELPHIA 4, PENNA.

BY APPOINTMENT TO THE ROYAL DANISH COURT

Following are the results at 1.875 ips:

Frequency	Left Channel	Right Channel
5000 cps	−7.00 db	−7.00 db
4000	−3.50	−4.00
2500	−1.00	−1.00
1000	0.00	0.00
500	1.00	0.75
250	2.00	1.00
100	1.00	0.00
50	−0.50	−1.00

Record-playback response was also checked by a listening test. A phono disc was simultaneously recorded and played back, and the tape playback was compared with the original signal. Participating in this A-B test was a musician who spends a good part of his time editing tape on professional equipment. At 7.5 ips neither he nor the reviewer could distinguish the tape from the original. At 3.75 ips, the two could be barely distinguished. The reviewer made his differentiation largely on the basis of slightly higher background noise when the tape was played. The musician noticed some "constriction" of the sound but described it as very slight. At 1.875 ips there was an obvious difference between the original and the tape, but still small enough to render this speed useful for such purposes as background music, dictation, party fun, and so on.

On each channel, the signal-to-noise ratio measured an exceptional 57 db at 7.5 ips, based on a 400-cps note recorded at maximum level (magic eye barely closed). At this level, harmonic distortion measured 2.2 per cent on the left channel and 2.4 per cent on the right channel. Inasmuch as S/N is usually based on 3 per cent harmonic distortion (for home tape machines), it is probably more correct to say that the Model 64's ratio is about 58 db. At 3.75 ips and 1.875 ips, the ratios were about 55 db and 53 db on each channel. These measurements conformed to the NAB standard so as to include all forms of noise: playback noise, noise produced in recording, and remanent signal due to inadequate erasure. The procedure was to record a 400-cps signal at maximum level, rewind, play back, and measure the signal; then rewind, record again but without signal input (thus erasing the tape), rewind, play back, and measure the noise. The highly effective erasure, it may be noted, is due to another new feature, which is the use of an erase head with a ferrite metal core. The manufacturer claims that this makes for 15 to 20 db stronger erasure than previously.

Motion was tested by recording and playing a 3000-cps tone. The musician participated in this test too. At 7.5 ips, motion was truly excellent, a very steady replica of the original. The musician described the motion fully as good as that of professional studio equipment operating at 15 ips. At 3.75 ips, some wavering or pusling was evident, but on a relative basis could still be described as quite good. Motion at 1.875 ips was fair.

Recording four tracks of mono can be satisfactory only if there is extremely little crosstalk between channels; that is, between the two sections of each head and between the two sets of electronics. The Tandberg 64 does very well in this respect. Its specifications claim at least 60 db separation at 400 cps, and 30 db at 50 cps. Crosstalk was unmeasurable at 400 cps, and at 50 cps it measured 45 db of separation rather than the 30 db claimed by the manufacturer. On listening to program material, no crosstalk was discernible.

Tape speed was very accurate. This appears due to use of a constant-speed hysteresis motor and to accurate machining of parts. Professional standards call for speed accuracy of 0.2 per cent. Playing Dubbings test tape D-110, which provides beeps covering a 10-minute interval, the Tandberg ran about 1 second slow during this period—an error slightly under 0.2 per cent.

Tape is handled well. A 1200-foot reel can be wound or rewound in slightly under 90 seconds, which is about par for home machines. When rapidly winding or rewinding, the mechanism can be stopped suddenly without throwing loops. One can shuttle immediately between rapid forward and reverse without breaking, stressing, or spilling the tape. The only danger of tape breakage is in case of power failure while the tape is in rapid motion.

Construction

The design is highly sophisticated in its attention to and execution of details. Nevertheless, like most well-made products, the Tandberg transport is relatively simple in its fundamental aspects. Attached to the motor shaft is a pulley with two grooves and three tracks of differing diameter. The grooves are for rubber belts that drive the supply and takeup turntables. Each turntable has a shaft on which a pulley disc revolves freely. The pulley is driven by one of the rubber belts that go to the motor pulley. When the pulley disc is pushed up the turntable shaft, friction between two felt surfaces causes the turntable to move with the pulley disc. A rubber idler wheel, riding against one of the three tracks of the motor pulley, engages a large weighted flywheel whose shaft is the capstan. To change speed, the idler wheel is shifted from one pulley track to another track of different diameter.

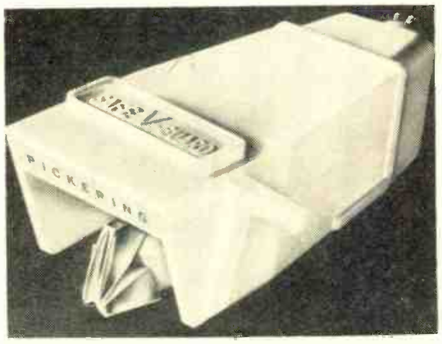
Considering the inevitable complexity of a unit incorporating a tape transport, stereo electronics, and elaborate switching facilities, the below-chassis area has a remarkably uncluttered and well-organized appearance. To one side, in a shielded compartment, is the majority of the tape electronics, kept compact with the aid of printed circuit boards. In a separate section outside the cage, to avoid interfering with the rest of the electronics, is the tape oscillator circuitry on a printed board. Off in a corner, to avoid hum problems, is the power transformer. There is plenty of open space. The careful layout should facilitate servicing.

All components are of excellent grade. It has already been mentioned that a hysteresis-synchronous motor is used; the unit bears the well-known Papst name. The power transformer appears very heavily shielded to minimize hum problems. Liberal use is made of high-quality capacitors and resistors, such as metalized capacitors, oil paper capacitors, deposited carbon resistors, carbon-film resistors, wire-wound resistors, and so on. Tubes and their shields are carefully shock-mounted. All tubes but the oscillator and magic eyes are d.c. operated. It is evident that nothing has been spared to make the Tandberg 64 a top notch performer. C-17

PICKERING U38-AT AND U38-ATG STEREO CARTRIDGES WITH "SAFE V-GUARD" STYLII

In recent months there has been a considerable amount of emphasis placed on anti-scratch devices for record changers. In general the idea seems to be that when the stylus force exceeds a certain maximum, the stylus is withdrawn from the record and a "scratch-free" surface contacts it instead. In essence, this is the type of product encompassed by the Pickering "Safe V-Guard." Of course, in the particular configuration shown in the photograph, these advanced model U38-AT cartridges are mounted in a plug-in head designed specifically for the Garrard Type A and AT6. We should make it clear, however, that the basic body configuration of the cartridge is the same as the standard U38-AT which fits any one of that new breed called automatic turntables.

Frankly, in considering this new safety feature, we are rather surprised at first that so much effort has been expended for a device to work with an automatic record changer. It seemed to us that changer mechanisms have been perfected to such a degree that the danger of an arm scooting across a record uncontrolled is nil. On the



Pickering U38-ATG in shell for Garrard automatic turntables.

other hand, on second thought, it is quite true that random and unexpected mechanical shocks are just as liable to happen to changers as anything else, and that some such circumstances might cause the stylus to scoot. In other words, this development is a safety device which is valuable—if we do not have to pay for it with loss of quality in performance. Happily, we can report that the new U38-AT offers improved performance as well as safety.

Performance

The new U38 cartridge comes in two versions, the AT and the ATG. The AT version is intended for use in changers which require a tracking force of better than three grams or so in order to function well in all aspects. The stylus is designed to retract into the soft-plastic V-Guard at slightly over six grams. The ATG, on the other hand, is designed to retract just slightly over three grams (the one we tested retreated in the neighborhood of four grams). Obviously, *and we emphasize this point*, your changer must be able to function well at lower tracking forces in order to use the ATG version.

We tested the ATG version and found performance optimum at just over two grams *in an automatic changer*. In general, the performance was essentially the same as the standard U38-AT cartridge which we reported on previously except at the bottom end. The new U38-ATG has a noticeably improved low-frequency response—smoother and richer. We were impressed. We do recommend this new Pickering cartridge for use with automatic turntables. As we noted before it is presently available only in the plug-in heads for Garrard Type A and AT6, but the cartridge should fit any automatic turntable. For Garrard owners it's easy; just get the premounted cartridge which operates best with your machine and plug it in. For owners of other brands of automatic turntables, ask your dealer when it will be available. C-18

Jensen "SPACE-PERSPECTIVE*"

FOR STEREO HEADPHONE LISTENING

Jensen's exclusive SPACE-PERSPECTIVE network makes it possible for the first time to eliminate the "closed ears" effect of ordinary stereo headphone listening, in which the sounds appear to come only from the left and right, and accurately presents the "open ears" sensations of normal stereo speaker listening in a room, in which the performance is out-in-front as intended with true directional effects. It accomplishes this by accurately shaping the frequency characteristics and time delay of the signals sent to the individual phones so that they correctly portray the sound "build-up" and "shadowing" at the ears due to the obstacle effect of the human head as acoustic waves from the source flow around it. This breakthrough is due to an ingenious circuit development by Bauer of CBS Laboratories, employing the analogue computer, and is based on the acoustic measurements on the human head by Wiener, then at the Psychoacoustic Laboratory, Harvard University.

1 Ordinary stereo headphone listening confines the left channel sound to the left ear, the right channel sound to the right ear. You have the impression you are in the midst of the musicians, who are partitioned to the left and right of you.

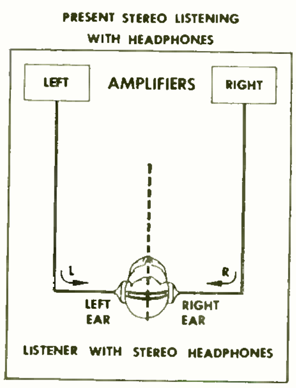
2 In "open ears" stereo speaker listening, sound from the left speaker reaches the left ear, *and also* the right ear a little later in time. The sound pressure at the left ear rises, while that at the right ear falls, due to acoustic "shadow" as the audio frequency is increased. The corresponding thing happens for sound from the right speaker.

3 Bauer at CBS Laboratories visualized an inspired answer to the problem—a left-right, right-left "cross-feed" *electrical* network that would accurately simulate the "open ears" *acoustical* situation. Note the resemblance of the electrical paths of 3 to the acoustic paths of 2.

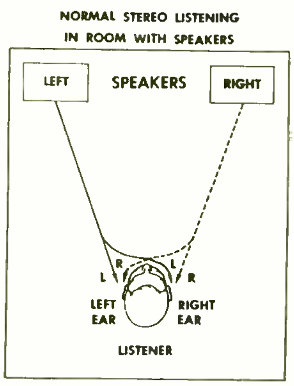
4 Bauer's circuit is complex, as would be expected since frequency characteristics and time delay must be precisely shaped. Resistance networks and potentiometer or volume control "blending" circuits cannot do this.

5 Here is the performance of the Jensen SPACE-PERSPECTIVE network compared with Wiener's acoustic data. Note how accurately the network produces the desired acoustic result at the ears. (The data is shown only over the frequency range important to stereophonic directional location; HS-1 'phones and network transmit the full frequency range.)

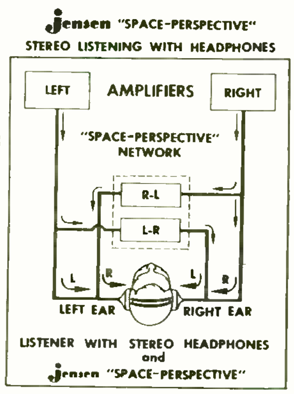
*T. M. Jensen Mfg. Co. CC-1 and CFN-1 Licensed by CBS Laboratories Div., Columbia Broadcasting System, Inc.



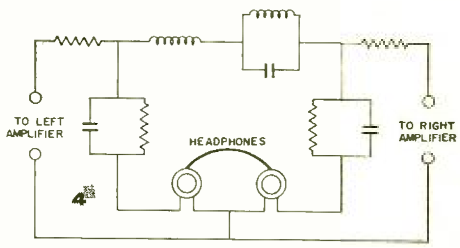
1

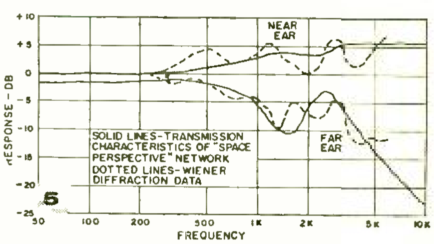


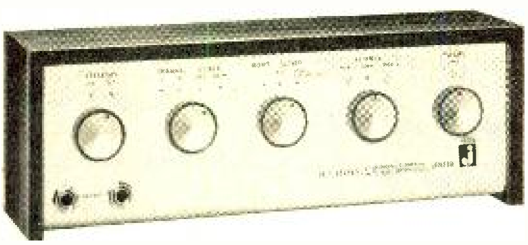
2



3







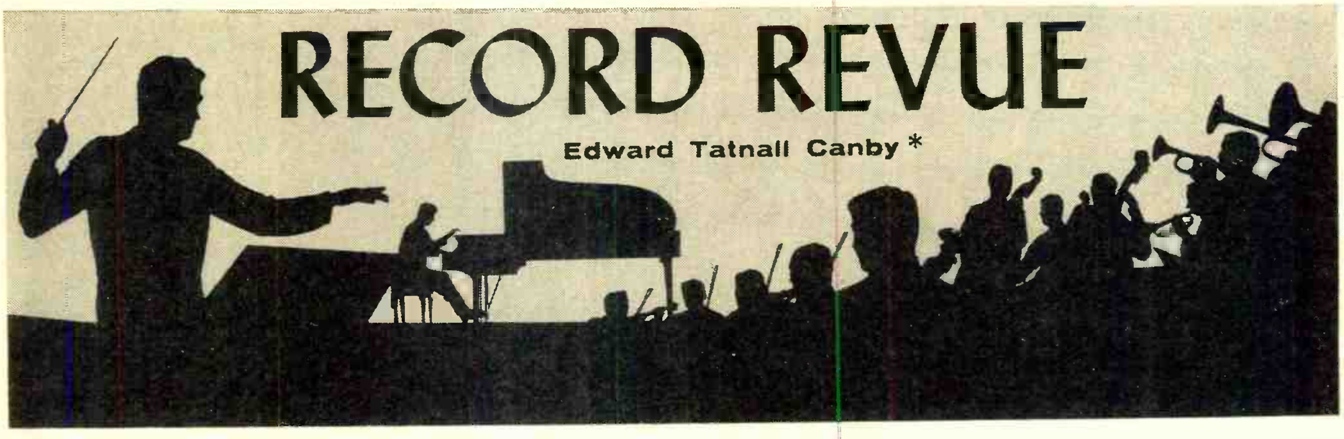
The JENSEN CC-1 STEREO HEADPHONE CONTROL CENTER places at your fingertips complete controls for personal or professional stereo headphone listening . . . plus the exclusive advantage of Jensen's new SPACE-PERSPECTIVE. Styled in an oiled walnut case, this attractive and compact unit can be conveniently located wherever you choose to listen; hang it on the wall if you wish. Controls allow you to adjust volume; adjust balance to suit the music and the best hearing conditions for you; select left or right channels or have stereo with choice of left-right reversal; switch from mono to stereo or stereo with SPACE-PERSPECTIVE; switch speaker system on or off. 'Phone jacks for two. Requires as little as 10 watts per channel (20 watt stereo rating) capacity. May be used with one or two 4 to 8-ohm nominal impedance dynamic headphones. Jensen HS-1 'phones are recommended for best results. $39.75

Model CFN-1 SPACE-PERSPECTIVE CROSS-FEED NETWORK only is available for incorporation into your system at lowest cost. It provides the full cross-feed characteristics to simulate speaker listening but without the controls of the CC-1. Consists of network, 'phone jack and terminals for extension phones. Small enclosure can be mounted wherever you choose. $19.50

JENSEN

Write for Catalog 165-H

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



RECORD REVUE

Edward Tatnall Canby *

STRINGS

Dvorak: Complete String Quartets. Vol. 1,
Kohon Quartet.
Vox Box SVBX 349 (3) stereo

There's more than meets the eye here. This is not only a new recording but the quartets are very largely "new" too—some of them have never been heard in the U. S. though Dvorak was a celebrated resident for awhile and his Quartet Opus 96, the "American," was composed here. There are altogether fourteen quartets, dating from 1862 through 1895, and all, including a number of unpublished works, will be heard in the three volumes of this series. In Volume 1 are five, from 1874 through 1881, the middle period, at least three of which have not ever been heard here, nor recorded before.

It is lovely stuff, this Dvorak, warmly Romantic, lyric, rich, emotional, the writing beautifully idiomatic for the quartet medium. Perhaps a bit long-winded in a thoroughly honest way—for Dvorak, near to the German school, was no German at all but a pure Bohemian—Czech—and there is not in his work (as in that of Brahms, his great model) the German urge towards epic structure and economy.

The Kohon Quartet, associated with New York University, shows itself immediately sympathetic to the music, which is ever so clearly this group's meat. The enthusiasm of a chamber music "first" shows, too, in the unusually expressive performance. These men are playing not only for the mikes (and a New York concert series) but for their quartet colleagues who have for so long neglected this mine of performing material.

A curious recording. The mikes place the two violins almost "in" the left speaker, close-up, the viola and cello near the right speaker, all in a good over-all liveness. The left channel seems louder and brighter; the cello and viola, on the right, are somewhat muffled and weak. Nevertheless, this close-up positioning allows for some interesting use of speaker placement. Following a picture in the booklet, I even tried placing myself between the two speakers, set towards each other about six feet apart. Sounded fine—I was "inside" the quartet. On wide-spaced speaker systems, the four instruments will tend to crowd to the sides, two at each speaker, but on most home stereo phonos with close-spaced speakers the effect should be excellent. (Maybe that was the idea.)

Mozart, The "Haydn" Quartets. Juillard Quartet.
Epic BSC 143(3) stereo
(mono: SC 6043)

Columbia-Epic has acquired another of RCA Victor's properties in the Juillard Quartet, here making a debut as a younger corporate alternative to Columbia's Budapest Quartet, covering similar musical ground. The Budapests for many years have made these superb Mozart quartets their specialty, along with the Beethoven works.

Yes, the Juillard, founded as recently as 1946 (the Budapest goes much further back), is one of the leading groups in the world. It is, moreover, a rather typical New York ensemble, with the characteristically intense, driving playing that seems to grow unconsciously upon those who live long in the fiercely competitive musical life of our big city. It has New York showmanship and drama, New York perfection of technique and New York versatility—it can, as so often must be the case, "play anything."

It can play Mozart, too, but not with profundity. Mozart, here, has splendid force, ensemble, expressiveness; but it is somehow a relatively superficial forcefulness, missing the limpid depths of simplicity, overlooking telling points that the Budapest discovered decades ago, playing with a too-Romantic fervor and a too-intensive vibrato. I can see why many audiences are deeply impressed. But for all the forcefulness, Mozart himself is not really well projected.

FORTY-FIVE

Tchaikovsky: Sleeping Beauty Ballet Suite: Swan Lake Ballet Suite.
Rome Opera Orch., Goehr.
Quarante-Cinq 45005 stereo 45

Take this as a sample of the new experiment in 45 rpm if you want a good one. It's a glittering, solid performance of Tchaikowsky, complete with immense bass drum and a one-two sort of huge liveness (some species of wall bounce) that would add up to impressiveness at any turntable speed. A very fair test of the virtues of 45.

First, I deliberately avoided timing these records, but simply played them like so many standard LPs. I decidedly did *not* notice any shortness of play. In fact, I found myself expecting the end a good deal sooner than it arrived. Though 33 rpm does allow a longer play at the extreme expansion of an LP side, the plain fact is that most LPs today are far shorter than the maximum, with grooves spread 'way out to look longer than they are. I'm not complaining on that score. One does not buy music by the minute and the second. Today's shorter LPs are much preferable to (and generally cheaper than) the very long LPs put out in the early years of long-play.

It is my distinct impression, then, that for the present *average* side-length, 45 is interchangeable with 33. Maybe not for long symphonies and the like. But for most other material—for most records—45 would do fine.

Second, the cutting advantages of 45 are negligible at the outside of the disc, but very considerable near the inside. I was astonished to see the needle travel almost up to the center label in "Swan Lake" without a noticeable trace of increased distortion. The problem of loud music in the inside grooves is clearly reduced, quality over-all is decidedly more uniform. Given the right musical "parcel," 45 can be a real help. Good quality is more evenly distributed than in a corresponding length of 33 playing time.

Third, there are minor disadvantages. These Quarante-Cinqs show a few examples of slight groove echo—though not as prominently as I've heard the same on some major LP labels at 33. This is presumably from cutting the grooves fairly close. A more practical disadvantage, for me, was the silliest one of all—invariably I start these discs at 33, then wonder why the sound so odd. And, also invariably, the next time I play a standard LP it comes out 45. Shouldn't really hold this against the system.

BIG STUFF

Sibelius: Symphony No. 1(1899).
Phila. Orch., Ormandy.
Columbia MS 6395 stereo

Eugene Ormandy is famed for his skill—and his orchestra's—at "playing anything," with finesse and polish, if not always with profundity. But here, though, is a composer for whom Ormandy clearly has a real personal affinity and affection. He was a friend of Sibelius over the years, even took the entire "Philly" orchestra to visit him shortly before his death. And so we have a superb performance of the first of the seven Sibelius symphonies, the one which is least heard.

I was really impressed by this work, after so long a Sibelius silence. (He's pretty *passé* these days.) The old man really was a commanding figure in the musical language of the orchestra. His fault, if it was that, seems merely to have written "Germanized" music in an essentially Latin manner, i.e. without the great architectural structure expected of all successors to Beethoven. Sibelius is episodic—but strongly so! A splendid record, this one. Listen and learn a lot about turn-of-the-century music.

Schubert: Piano Sonata in A Major, Op. Posth. Mozart: Rondo in A Minor K 511.
Charles Rosen, piano.
Epic BC 1255 stereo

Charles Rosen is no high-flying Horowitz nor yet a sensational Serkin. Not even a climactic Cliburn. (All Columbia artists, if I remember.) But Columbia's side-kick, Epic, nevertheless has one of the finest and most musical pianists in the business here. I'd say that his Schubert was near the ultimate top—but then, his other recordings might rate similarly.

Schubert's long, complex last piano sonatas are the bane of most pianists' existence because of their toilsome finger demands—endless repeated accompaniment figures that quickly become monotonous in the wrong hands—and even more because of their enormous demands on the musical intelligence, their huge emotional sweep and size, on a close par with the music of the last great Symphony in C Major of the same period. Very few pianists really encompass these big works. Even fewer understand the extraordinary harmonies, easy enough to play but profoundly involved for the ear.

Rosen does all, to perfection. Not a nuance is missed. And not a bit of the big shape is lost, either. This record, with its poignant Mozart dividend, is a treasure-piece for anyone who has "discovered" Schubert. Æ

* *780 Greenwich St., New York 14, N. Y.*

AUDIO ETC

(*from page 14*)

with it. Wonderful to him, if not to me.

Thus it suddenly occurred to me, last fall, that here was a chance to find out what *could* be done with a hopelessly hissy, insensitive, tired old tuner, maltreated for nine or ten years and ready to be tossed on the junk pile—if the *manufacturer* would work on it, in his own repair shop.

My mother got ahead of me, though. She found her TV was out of order; so she called in that nice new TV man and told him, now that he was here, to fix the radio too, while he was at it.

He did, or so she tells me. Indeed, she had it "fixed" twice, if her account is right. I asked her how much it had cost—she didn't know. She wasn't sure. All *I* knew was that the thing sounded about the same as before, only maybe the a.c. hum was reduced a bit. Still impossible to get more than a shadow of a station on FM, and the usual noisy hash on AM.

I looked in her check book. There was the bill. $18. To the best of my knowledge, that was for the radio. Might have been the TV. I tried to press her for details; she merely got exasperated. She *told* the man to fix the radio—yes, he'd been there twice, at least. It *was* fixed. He'd taken it away, and brought it back. It *must* be fixed. In working condition.

It wasn't. It was just plain terrible. And nothing could be done about it. Except, of course, to get a new tuner.

So I had my chance. I contacted Fisher and found that they do have a factory repair service for their own equipment. I took the tuner into the city and sent my assistant with it to the Fisher shop on Madison Avenue, from whence it was whisked out to Long Island. A short time later—must have been a week—it was back and we retrieved it. Still later, I took it back to my Mother's, in Ossining, and hooked it back into its old place in the system, feeding the Bogen amplifier and the Kelton bookshelf speaker.

Now it happens that this old Fisher tuner used now non-standard antenna plugs, a four-prong affair, one for AM and one for FM. We'd lost the plugs in the moving and I had been sticking bare wires into the four holes of the socket, trying to figure which two of them to use for FM, or one of them for AM. So I started this business again with our TV antenna dipole leads (from the roof). Turned on the set, shifted to FM—and before I so much as approached the antenna leads, out boomed my own New York program loud and clear (this being a Sunday at one o'clock), minus any antenna connections at all!

To heck with TV dipoles. This set didn't need an antenna any more. It was as good as new.

Well, you can look up the circuit for yourself to see whether there is a built-in receptor. I didn't need to. From that moment on, the Fisher 50-R has picked up the entire gamut of New York FM stations across the dial with full limiting, plus plenty more at distance. It acts like a new tuner—and it seems to be as sensitive as most, too. Works like a charm.

Ostensibly this was a routine repair job at the Fisher factory; but I arranged with the Fisher people to give me a detailed special report on what was actually wrong with the tuner. Mr. Joseph Merolla, the service manager, wrote me soberly that the information he had was from the regular repair worksheet; he had not personally checked the set. There was a possibility, he said, that "the bench may not have approached this repair as a complete restoration project with an eye towards replacement of items which might be necessary to establish good as new condition."

Now you cynics may snort at that. Obviously, you'll say, Fisher got his people to do a bang-up job for me, knowing the thing might be written about in a magazine. Well—maybe. I'm not sure I care at this point. My impression is that this was a factual statement on Mr. Merolla's part, and that the job was done pretty much as it might be done for anybody with the same model 50-R. If not—then at least, I now know what *can* be done in the way of restoring an ancient and inoperative tuner to brand new condition, at the factory. Wonders can be done.

What was actually wrong with this tuner, in its inoperative state? The report tells me.

Four new tubes. A 6AU6 had very low emission. A 6BQ7 had a short, cathode to grid. A 5Y3 had low emission. A 6U5 was "very dim."

The only other replacement item was a broken a.c. receptacle, which had nothing to do with the performance. (I'd taped it in place myself with tire tape.)

What *was* wrong, aside from the four tubes (which, as far as I can figure, had gone to the TV man's shop and come back again, untouched) was, as you may guess, alignment. I quote. *"All of the i.f. transformers including the front end trimmers were quite badly detuned, accounting in a large measure for the poor performance of this unit."*

Well, there you have it. Tubes and alignment. The tubes are no problem—or should not have been. (But my mother should have used an old trick of mine. Take out all the tubes in the set, marking their places if necessary. Put a sofa cushion in a small suitcase and take the tubes—*not the set*—to a repair shop.)

The major problem, as most readers will have anticipated, was the alignment. Obviously, this tuner had been giving tenth rate performance for many years simply because a succession of repairmen had progressively misaligned it, worse and worse. It could not possibly have "drifted" that far out of alignment.

The cost of repair? For other owners of the Fisher 50-R, and for owners of similarly tired equipment which might benefit in the same way, here are Fisher's figures on the repair, which I suspect are rather on the modest side.

Labor: One and a half hours at $7.50 per hour. *Materials:* $11.25. That means $22.50, minus shipping. Total cost, with shipping, could be $30 or more.

Pay—With Pleasure

It's expensive. Is it worth it? Definitely. At the factory, you are likely to get genuine improvement for your money. Myself, I don't relish paying for mis-alignment of my tuner, nor for needless new parts, repairing where no repairs are required, missing the things that are wrong. I don't figure the charge was excessive. Not for solid, constructive servicing, out of the horse's mouth.

I gather that the factory service people get quite a bit of complaint about their stiff repair charges. It is surely worth pointing out that this sort of service is costly, and is worth good money to the home owner.

Repairs are by their very nature uneconomical, running straight head-on into everything that makes original production move smoothly and economically. You can't mass-produce repairs. Each piece of equipment is an individual problem that must be given skilled individual analysis if the malfunction is to be traced correctly and repaired properly.

A factory repair service isn't supposed to be a money-losing proposition. Good will counts for something, of course; but not on *that* scale! You could quickly repair yourself out of business, through sheer good will. To make such a service pay, or at least sustain itself, it must be costly because it is so very inefficient. It would be fine if all sets had exactly the same faults and an assembly line could be set up to correct them on a mass-production automated basis. It doesn't work out that way.

And so, I suggest, it is inevitable that we should pay a high repair rate, even up to $12 an hour for labor, at these factory service places. If your equipment works when it comes back, you should cough up the dough without a murmur of complaint.

I am not in a position to say how many manufacturers have regular factory repair services of the sort offered by Fisher. A good many, I think. Eico, for instance, is one. H. H. Scott has it. Also Pilot, Harman-Kardon, Marantz—the editor says most of the well-known component manufacturers.

My strong suggestion, in any case, is to investigate the possibilities of factory repair *before* you call in the TV man from around the corner. The only other man who is likely to take *authoritative* responsibility for your equipment is the custom builder who may have installed your system for you. In that case, he is surely responsible—though he in turn may call upon the factory's resources if he can't solve the problem himself.

Mail Order Repair?

There remain two complications that need a mere mention. The large hi-fi outlets generally do not do repair work on the products they sell, whether by mail or over the counter. Maybe they should; but the proposition, on the scale of their immense operations, is simply not feasible. Not today, anyhow. Repair is simply too individualized for any such large-scale business.

Anyhow, that's the way they feel. If you'd seen a few of the "crank" letters I have, and a lot of the perfectly well-intentioned ones that say they've sent their entire hi-fi system back to be fixed because the speaker made a funny noise or one of the tubes had a queer light in it—well, *you'd* want to get out of the repair business too. And anyway, there's always the guarantee.

That's the second point. The standard RMA guarantee is given by the manufacturer and it is his repair service that ordinarily makes good, or else an authorized service to which he refers you. It's just as well to have the guarantee repairs and the non-guarantee jobs in the same place. They often overlap anyhow, with a charge for some items, no charge on others. The manufacturer who has his own repair service will give you the best treatment under his own guarantee, you can be sure.

So—if your hi-fi doesn't work, and if the trouble is *serious*, send it to the manufacturer's shop, and be prepared to pay a legitimate price—with pleasure. Æ

AUDIO CLUBS

(*from page 40*)

bership. Announcements of sales of records or equipment by the local stores are made at the meetings. Also announcements are made of topics of interest to our members concerning concerts by the local philharmonic orchestra and meetings of other organizations, such as the IRE and AIEE. The matters seldom take more than a few minutes so that practically all of our time is devoted to the speaker of the evening, demonstration of equipment and the playing of music.

The list of those who have come to Poughkeepsie and presented programs during the past years reads like a "who's who" at the Audio Fairs.

We reserve two meetings a year for the playing of carefully selected records. We use the best equipment obtainable for these concerts and they are always well attended. People like to come to these meetings to hear the quality of reproduction possible with the best equipment and to make comparisons with their installations. The first half of these programs is drawn from the latest popular releases. The second half is devoted to selections from classical releases. Programs are issued to each person in attendance. They include the name of the manufacturer and the record number to facilitate the purchasing of any records which members desire to add to their libraries.

For the past several years one concert has been devoted to the playing of a Gilbert and Sullivan operetta. Libretti are purchased from the record manufacturer and are furnished to all in attendance free of charge.

At our meetings and concerts we make every effort, and in most cases succeed, in keeping the volume at living-room level. We believe that a modern high-fidelity installation is an instrument for reproducing music for pleasurable listening and not for testing the adequacy of the construction of the house or the patience of the family or neighbors.

In May we have our annual dinner meeting at which we have a guest speaker who talks on some phase of audio, such as how to build a record library, how to select components, how to listen to music, and so on.

Society Officers

At the annual dinner meeting the President appoints a nominating committee whose duty it is to select a set of officers for the next year. The selections are voted on at the first meeting in the Fall. We have a standing rule that elected officers can serve only one term in the same capacity.

The elected officers of the Society include the President, Vice President, and Treasurer. The Secretary is not an elected office because a follow-through from year to year by one person has proven to be highly desirable. He is paid $100.00 a year for his services.

The Program Director and all committees are chosen by the President at the time of his election. The President presides at all meetings, dictates the order of business, and introduces the speaker of the evening. The Program Director has complete charge of the selection of programs and makes all of the arrangements with the equipment manufacturers for the guest speakers.

Income and Expenses

For several years we solicited 50 cents per person per meeting when the membership charge was $1.00 a year. This was adequate to meet our monthy expenses of $30.00 for the meeting room plus the cost of entertaining our guest speakers at dinner, based on our average attendance of 140. Two years ago we increased our annual dues from $1.00 to $2.00 and admitted members free to the meetings. This resulted in a saving for members who attended the meetings regularly. A donation of 50 cents is solicited from non-members who attend.

Other major items of income are a

$5.00 membership fee and first year's dues for new members and the returns on speakers rented to members for trial in the home.

By paying his dues a person can retain his membership and be entitled to all of the privileges of the Society (except out-of-town speaker rentals) regardless of his geographical location. We have some members who live as far away as California.

Principal expenses include rental of the meeting room, rental of a slide projector when required, cost of printing meeting notices and mailing, dinner for the speaker of the evening, purchase of loudspeakers for rental use, postage, services of the Secretary, insurance, payment of fee to dinner-meeting speaker, printing cost of stationery and membership cards, and so on.

The Society is a non-profit organization and any money remaining in the treasury, with the exception of a relatively small amount reserved for current operating expenses, is given away as door prizes at the annual dinner meeting.

Incorporation and Insurance

The Society is incorporated under the laws of the State of New York. This was done primarily to protect the members of the Society against lawsuits which might arise out of bodily injury caused by handling rental speakers, from shocks while assembling, testing, or using amplifiers which the Society purchased for them, or any form of bodily injury to members or guests at meetings.

Insurance is also carried as additional protection. The cost is a little over $100 per year.

Equipment Purchases

At the close of each meeting members may place orders for equipment. Most of the prominent manufacturers are included. Purchases are made through a New York City store for the most part. A check must accompany each order. Checks and order forms are mailed to the store and the store in turn mails the items to the members' homes, postage collect.

The Society reserves the right to refuse to sell equipment to any member if in the opinion of its officers the member has already purchased what we consider to be his fair share. Our order forms contain the following stipulation: "In consideration of the discount prices available to me as a member of the Poughkeepsie Audio Society, I hereby certify that the unit(s) ordered above are for my personal use or for the use of a member of my immediate family."

(*Continued on page 64*)

JAZZ and all that

CHARLES A. ROBERTSON

STEREOPHONIC

Benny Golson: Pop Plus Jazz Equals Swing
Audio Fidelity 3P-AFSD5978

Just when it sounds as though all the avenues opened up by stereo have been thoroughly explored, along comes something called Triple Play Stereo to uncover a whole new area. The initial release offers a choice of jazz on one channel, popular dance music on the other, and then demonstrates how swing results from a combination of both styles in normal stereo playback. Setting the controls to far left or right entirely eliminates the opposite channel, but a gradual transition from one extreme to the other allows listeners a chance to try any number of different blends. The ease of operation stems from the simplicity of the basic idea, and more than one record producer must have toyed with plans for a similar project. Carrying it to successful completion is quite complex, however, and requires perfect coordination of programing, arranging skills and engineering facilities.

Triple Play may illuminate other musical styles in the future, but the combination of pop and jazz selected for the first venture will be hard to beat. Besides using tunes adaptable to either idiom, producer Tom Wilson includes several jazz originals to show how they evolved from songs with the same chord changes. *Moten Swing*, with the familiar Kansas City riffs, becomes novel and refreshing when heard against the background of *You're Driving Me Crazy*. Stepping down one side of the street comes Charlie Parker's *Donna Lee*, while the theme across the way is *Indiana*. Hushed strings play *Whispering*, contrasting with the wild exuberance of Dizzy Gillespie's *Groovin' High*. A melodic map of the mother lode, *Lover Come Back To Me*, reveals where Horace Silver staked out a claim to *Quicksilver*.

Every jazz lecturer should be grateful to Benny Golson, of Jazztet fame, for arrangements which make the task of explaining the difference between pop and jazz so much easier. As might be expected, the jazz scores are uniformly excellent and full of imaginative phrases. What will surprise Golson's admirers is the rightness of the pop orchestrations, plus the patience shown in matching the two styles. Contrary to the impression given by jazz purists, good examples of unadulterated jazz are easier to find today than pop music that is free of outside influences. When Lawrence Welk and Lester Lanin hire jazz musicians, and even Chet Atkins leads the Nashville crowd in jam sessions, old fashioned dance music is growing scarcer and scarcer. Moderate tempos and melodic strings recall the time when potted palms graced hotel ballrooms, yet Golson includes such unobtrusive modern touches as French horns and the paired flutes of Jerome Richardson and Danny Bank.

Experienced jazz buffs may feel little interest in the educational side of Triple Play, but they will undoubtedly be entertained at the way some favorite players handle the problem. It would be a shame to miss the only opportunity on record of hearing Bill Evans put down chords for a tea dansante. As the same rhythm section works all three styles, the pianist fills that unaccustomed role before running true to form on *Autumn Leaves*. The jazz solos must be able to stand alone and still fit snugly into the full ensemble. Not only do Eric Dolphy, Bill Hardman, Wayne Shorter and Grachan Moncur fill the requirements, but they perform all the better for being forced to deliver according to Golson's carefully plotted charts.

Instead of being another recording gimmick or something entirely original, Triple Play is simply the end result of all the stereo trickery and technical advances worked out since the new medium was introduced. Just as few ball clubs can perform a similar feat in spring training, so the present accomplishment takes practice and lots of late season know-how. As a starting point there is Olmsted Studios, with president Richard B. Olmsted at the controls, then the play goes to Audio Fidelity's William Hamilton for re-recording, finally ending up in the hands of Ray Hagerty for mastering. Stereo separation, in an amount claimed to be better than 35db, aids all along the line. Certainly, netiher side can protest to the umpire about an instance of interference on the base path. If anything, the strings appear to receive an extra boost when placed in close competition with the brass. Now that the way is clear, Triple Play should be quite effective in bringing about a Strauss waltz duel between a German band and Viennese strings, or in taking bossa nova apart and putting it together again.

The Temperance Seven: Those Popular Gentlemen
Kapp KTL41047 (4-track UST tape)

While the Trad bands of Great Britain indulge in broad comedy, it is all done with the serious mien of an archaeologist opening King Tut's tomb. The majority take the recording of New Orleans masters as a base and branch out from there, but Tin Pan Alley and early attempts at symphonic jazz are also exhumed. Leading lights in the study of ancient relics of syncopated dance music are The Temperance Seven, a group of Edwardian gentlemen who dress in the boiled shirts and tails of the period to perform in public. Banding together for organized research in 1955, they dug into dusty files of sheet music and hunted down caches of acoustic recordings. Like the Firehouse Five of California, whose members lend animation to cartoon at Walt Disney's studios, the septet is largely composed of artists and designers. This carefree existence, plus lack of experience with the Volstead Act, might be the reason for scholarly interest in prohibition and the effect it had on popular music in the United States. Their sober approach to the subject is the cause of much hilarity at home, where the demand has mounted in the last year or so for vintage bottlings of *Chili Bom Bom*, and *Black Bottom*.

On sampling the product, collectors in this country will be reminded of an afternoon spent looking for an undiscovered chorus by Bix Beiderbecke among stacks of records bearing names of the Broadway Bell Hops and other forgotten bands. Four-track stereo tape restores memories with greater clarity than the originals could ever boast, and the experience is thoroughly enjoyable. Youngsters who never danced to an orthophonic victrola can hear sounds emerging from a phonofiddle reinforced by the same system of amplification. Big bass notes blossom forth from the huge brass bell of a sousaphone, which once again sets steady tempos for dancers instead of columns of marching men. A megaphone assists in the delivery of "Whispering" Paul McDowell's vocals, without greatly increasing the decibel count or lessening the suffering on his part. Spoons, banjo and musical bells are also brought out of hiding, but the biggest surprise comes when some showy bit of arranged nonsense almost sounds logical. Among the treasures reclaimed are *That Certain Party, Home In Pasadena,* and *Vo-Do-Do-De-O Blues*. By employing a single microphone setup, George Main retains the feeling of the acoustic originals in the modern dimensions of stereo.

Horace Silver: The Tokyo Blues
Blue Note Stereo ST84110
Poon Sow Keng: Popular Songs In Mandarin Chinese
Capitol T10326

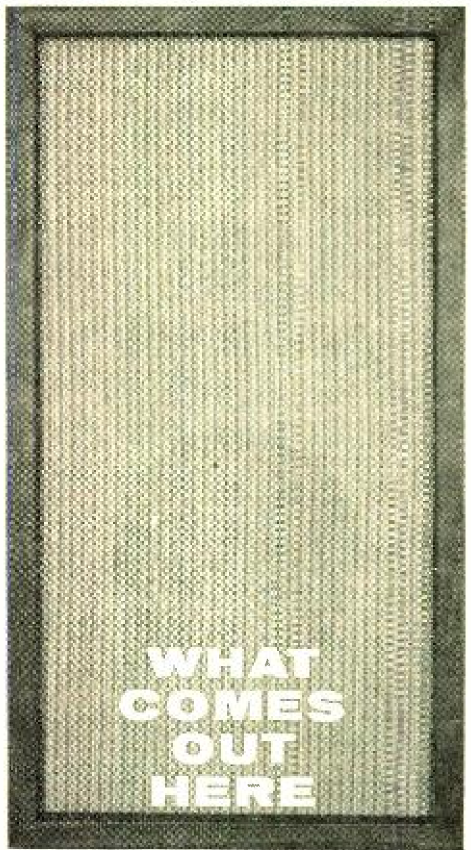
A successful concert tour of Japan early in 1962 provides the background for Horace Silver's half-yearly visit to the recording studios of Rudy Van Gelder, and the pianist commemorates both occasions with four new originals. While listed among the nations eligible to receive State Department cultural aid in the form of jazz exports, Japan has developed a capacity that official channels are unable to fill. Jazz troupes are finding it profitable to make the trip under their own steam, and Silver is just one of several leaders who intend to go back again soon. This album guarantees his Quintet an even warmer reception the next time, if only because of the sentiment attached to the titles. For all that is accomplished in the way of a fusion between Oriental music and jazz, Silver might just as well have remained at home and gathered a few impressions from pianist Toshiko Mariano, a talented representative of Japan now in residence in this country. It seems that Japanese audiences were most appreciative of his particular skill with a Latin beat, so he obliges by joining all three styles together in several instances. Someone should tell the State Department that sending Silver and crew to South America would be policy making of the highest order.

Ever since lyrics were added to *Senor Blues*, writers study each new Silver release and try to hit upon an equally happy combination of words and music. His works are carefully plotted, but creating the right story to go with his melodies often defies the best efforts of the experts. Trying to beat the professionals at their own game is always a challenge, and the chance comes as an extra attraction with every album. Although the Oriental atmosphere makes the task more difficult this time, the material is full of promise and firmly based on jazz tradition. Blues in the modern manner are represented by the title tune and *Sayanora Blues*, while good bets for adventurous vocal groups seem to be covered by *Too Much Sake*, and *Ah! So*. The services of a fellow pianist were sought to complete the set with a ballad, and Ronnel Bright responds with a slow, picturesque *Cherry Blossoms*.

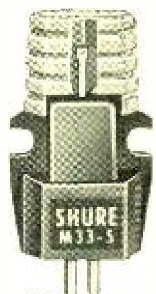
Poon Sow Keng is just the girl to put anyone in proper spirits to deal with mysteries of the Orient. She was born in Malaya, began a recording career at the age of seventeen, and is immensely popular in Singapore. All twelve numbers are in Mandarin Chinese, but with only a quaint touch of the characteristic high-pitched singsong cadence. Besides being at home on romantic ballads, including one which requires her to play two girls in love with the same man, she shows familiarity with Latin tempos and a dixieland beat. More native to the region are an exotic Malayan tale about a journey on elephant back, and an Indonesian legend about a white handkerchief. EMI's Asia division encases everything in silky sound.

Terry Gibbs: Explosion!
Mercury Stereo SR60704

Exciting is the way Terry Gibbs likes to describe his big band, regardless of how overworked that adjective has become, but a few calmer moments crop up among the explosive blasts. A psychiatrist might say something about split personality, point out that short men like to make a big noise, or even refer to Woody Herman as a father image. Instead of dominating the vibes as Lionel Hampton does so easily, the diminutive Gibbs often engages in a furious and seemingly unequal struggle before taming his adversary. When the sound of battle dies down, all his wiles are turned to coaxing forth tender ballads and creating a romantic mood. Which mode of expression represents the real Gibbs is anybody's guess, but both are embraced with a



DEPENDS ON WHAT GOES THROUGH HERE



"SKIMPING" ON THE CARTRIDGE JEOPARDIZES THE SOUND (AND SATISFACTION) OF THE WHOLE SYSTEM The hundreds, even thousands of dollars you put into speakers, pre-amps, amplifiers, turntables and recordings can be virtually nullified by an off-hand selection of the phono cartridge. For even though it is the lowest-cost single component in the typical system, it is charged with the frighteningly complex task of getting the music out of the grooves and translating it into precise electrical impulses . . . without addition, subtraction, or distortion. And without damaging the record grooves. Leading critics and noted audiophiles recognize this and (with due care and study) select a Shure Stereo Dynetic cartridge for their personal systems. It was, from its inception, and is today the finest stereo cartridge your money can buy. And not much money, at that. The $36.50 spent on a Shure M33-5 (if you have a fine tone arm that tracks between ¾ and 1.5 grams) or Shure M33-7 (for tracking pressures from 1.5 to 3 grams) will audibly improve even fine quality stereo systems. Compliance is an astounding 22×10^{-6} for the M33-5 (20×10^{-6} for the M33-7). Response is transparent and smooth not only at the top and bottom but in the critical middle range (where most music happens—and where most other cartridges garble the sound). No "peaks," no "shattering." Et cetera, et cetera. Better listen to it, and judge for yourself.

IF YOU INSIST ON A SHURE DYNETIC CARTRIDGE, YOU CAN EXPECT MORE FROM YOUR SYSTEM

SHURE

Stereo Dynetic

Patented and other patents pending

M33 SERIES HIGH FIDELITY PHONO CARTRIDGES
SHURE BROTHERS, INC. • 222 HARTREY AVE., EVANSTON, ILLINOIS

directness and enthusiasm that will draw foot-tapping enthusiasm from any therapist.

As on the last album Gibbs recorded for Verve, the band is the one he heads at The Summit and would like to take on the road. Studio jobs keep most members close to Hollywood, but they manage to rehearse long and hard despite other commitments. Prominent among the sixteen in attendance are Frank Rosolino, Bill Perkins, Conte Candoli, Pat Moran and Mel Lewis. Bill Holman and Al Cohn share arranging credits with the leader, who sets off two great blasts with *Big Bad Bob*, and *Pretty Blue Eyes*. In a more gentle lyric vein are Holman's *Soft Eyes*, and *Nature Boy*.

Gibbs again managed to have the recording session take place during a performance at the club, with Wally Heider at the controls to tape all the action. Both men work on the theory that big bands sound best in natural surroundings, and the stereo version fully justifies their views. Æ

AUDIO CLUBS

(from page 61)

People joining the Society are not eligible to purchase equipment until they have attended three meetings. For example, if a person joins the Society in October he will be eligible to purchase equipment at the December meeting, if he also attended the November meeting. If he did not attend the November meeting but did attend the December meeting he would be eligible to purchase equipment at the January meeting, and so forth. The only exception to this rule is that people who join at April meetings will be eligible to purchase equipment at the May dinner meeting the following month.

In order to keep track of the attendance of new members their cards are punched whenever they attend a meeting.

Because acoustics play such an important part in how an installation sounds, the writer conceived the idea several years ago of renting speakers so that it would be possible for a member to try them out in his own home before deciding on which speaker to purchase. Accordingly, we purchased two each of several models of two prominent speaker manufacturers and started renting them to members for $1.00 per week each. There was no thought of realizing a profit from this operation as it obviously would take several years of continuous rentals to pay for the initial investment.

When there is no further demand for the speakers, as has been the case with two models, they are sold to members at greatly reduced cost or given away as door prizes at our annual dinner meeting.

A member is required to sign the following statement before he can rent a speaker:

AGREEMENT

The undersigned, in consideration of the low rental being charged by the Poughkeepsie Audio Society concerning the use of a speaker owned by them, hereby agrees to hold harmless the Society from any and all claims for injury to person or property arising directly or indirectly out of the use of the aforesaid equipment; and the undersigned further agrees to be fully responsible for any damage to the equipment as the result of the use of same; and agrees to repair or replace the equipment if damaged while being used. The undersigned further agrees, and fully understands, that the Society is in no way making any warranties or representations concerning the equipment, and assumes no responsibility whatsoever in the rental of the equipment to the undersigned.

Signature ....

Record Reviews and Lending Library

Each month a committee of reviewers auditions many of the latest LP stereo records and writes reviews about them. These reviews are mailed to the membership once a month along with the meeting notices. Comments are included on the technical merits of the recordings as well as on the merits of the performance and performers.

After the records are reviewed (with the exception of those temporarily reserved for concerts) they are put in a lending library so that a member of the Society can have the opportunity of hearing before he buys—not in a store, not in someone else's home, but in his own home with his own equipment and in his own acoustical environment. This insures the greatest satisfaction per dollar for this popular entertainment medium. Records which members select to add to their libraries are, of course, procured through normal retail channels.

The Society owns the following equipment which is occasionally used at meetings when a manufacturer does not wish to bring one or more of the items with him. (We do not encourage this practice but it sometimes unavoidable. This same equipment is used at our two yearly concerts):

1. An 18-transistor custom designed and built preamplifier-control unit;
2. Two 70-watt custom designed and built power amplifiers;
3. Several loudspeakers;
4. A 33⅓ rpm turntable.

Free Services

The aim of the Poughkeepsie Audio Society is to render the best possible service to members and consequently no charge is made for any service with the exception of speaker rentals.

Whenever possible the officers circulate among the members at meetings to exchange pleasantries and to greet those attending a meeting for the first time. They also offer advice on problems presented to them before and after the meetings.

We wish every member, or interested non-member, to feel free to attend only those meetings which are of interest to him, or to attend the meetings only as long as necessary in order to secure the information or help he is looking for. In other words, we are interested in performing a service. The element of friendship and the opportunity to talk things over (and possibly to brag a little about one's accomplishments) is an ever-present force which brings many people out to every meeting. As members leave our rank, others step in to fill their places.

At times we distribute to the members blueprints of circuit diagrams, speaker enclosures, and such, so that those who wish to "do it themselves" can enjoy the added stimulation of individual accomplishment.

The Poughkeepsie Audio Society has been successful financially, its members have benefited through their acquisition of knowledge as to the system components, why they are necessary, and how to operate them to the best advantage. Last, but by no means least, every member has been able in turn to advise and assist in the education of newcomers to the high-fidelity fold.

(*Concluded on page 67*)

ABOUT MUSIC

Harold Lawrence

A Hard Look at Sound Reinforcement

You have just brought home a new disc by a certain French popular singer and are settling down in front of your loudspeaker system as the stylus tracks the lead-in grooves. The band plays a twenty-second introduction and the vocalist begins one of her love laments. . . . Oh, oh, there's something wrong: the solist appears to be too close to the microphone; in fact, her intakes of breath nearly blot out the accompaniment. However, you suppose that the producer of the record was trying for the *intime* effect. Let's concentrate on the drama of the song. But as it reaches its climax the total volume approaches the threshold of pain. You can visualize the needle of the V. U. meter laying on the pin as the band concludes in a sustained burst of electrical distortion.

Is your stylus worn? Has someone been fooling around with the pressure control on your tone arm? Has one of the pre-amplifier tubes gone over the hill?

Gnawed by these disturbing thoughts, you remove the offending disc and place an older, reliable "test" record on the turntable. No distortion here. The sound is clear and unruffled. So back into its envelope goes the new purchase to be returned to the dealer in the morning.

Like most record buyers, you would no sooner keep a badly distorted recording than you would a book of art reproductions in which the colors "bleed."

Distortion in the Concert Hall

Yet would you endure, without even a murmured protest, the same distorted sound reproduction at a 'live' performance? Take the case of one of Edith Piaf's last Carnegie Hall appearances. With her unerring dramatic sense, the diminutive singer in the black silk dress faced the audience alone, the orchestra being hidden behind the curtain. She cast a spell over the hall with the utmost economy of bodily movement, underlining her phrases with an expressive gesture or an upward tilt of the head.

For at least one spectator, the enchantment was less than total. Piaf was not entirely alone on the stage: directly in front of her a microphone. Into this she lay down a withering vocal barrage. At such close quarters, the puny electrical device collapsed ignominiously, and the proscenium loudspeakers transmitted its raucous, squealing protest. As Piaf piled climax upon climax, one cringed in anticipation of each wild aural peak.

The Double Standard in Sound Reproduction

The Piaf concert illustrates an important fact about our audio attitudes—while we flatly reject rampant distortion in a recording, we tolerate it blithely in a sound-reinforced 'live' performance. Distortion, however, is only one of the many illnesses that plague sound-reinforcement systems; it is also the least serious because presumably it can be diagnosed and cured with a minimum of time and effort. More insidious are the inherent difficulties of the medium itself.

Audio-visual Mismatch

Our electronic age makes it possible for the same artist to be heard performing several parts simultaneously; e.g., Jascha Heifetz in the Bach Double Concerto and Les Paul and Mary Ford in multiple voice-and-guitar commercials. But so far no one has devised a method of conducting and sitting in the audience at the same time, not even the versatile Leopold Stokowski. Had the white-maned maestro been able to do this during his first performance of Orff's *Carmina Burana* at the City Center in New York, he would have stopped the music.

There was no mistake about it. The concertmaster playing the solo passage was smack in the center of the orchestra, next to Stokowski. Nevertheless, apart from a handful of spectators in the first rows, the audience heard his amplified solo violin emerge distinctly from the extreme left of the hall. It was as disconcerting as watching a movie with faulty lip-synchronization.

Earlier that evening, the chamber ensemble playing Stravinsky's *Oedipus Rex* was stretched out aurally like some sort of orchestral taffy, producing a larger-than-life effect.

These sonic grotesqueries were caused by the fact that sound reinforcement at the City Center is stereophonic and highly directional, with loudspeakers placed at the sides of the large stage. Far from improving things, the stereo installation called attention to its own deficiencies.

Putting the Microphone in Its Place

Normally, the sound of a harpsichord is lost in the dry acoustical setting of London's Covent Garden Opera House. To remedy the situation, the directors placed a microphone next to this instrument during performances of Handel's *Samson*, thereby enabling everyone in the audience to hear the full sound of the *continuo*. The trouble was that it brought the harpsichord up to the level of half the orchestra, transforming what should have been a discrete rhythmic punctuation into an aggressive metallic clamor.

At the other end of the acoustical spectrum, excessive reverberation can pose even more difficult problems for the sound reinforcer. The systems utilized by St. Bartholomew's Church in New York and the Duomo in Florence, for example, seem to multiply the reflective surfaces of these cavernous interiors. This condition is aggravated in many churches and temples by faulty balance between choirs and intoning priests or cantors.

For the night club performer who habitually labors in crowded areas the size of a doctor's waiting room, reverberation is nonexistent. An Italian firm has come up with the answer—instant reverberation. Using an inexpensive portable unit, the entertainer can create his own acoustical setting, varying the amount of reverberation by means of a foot pedal or a push-botton panel.

Time-delay mechanisms, such as the one probably incorporated in the above device, frequently turn up in the most unlikely places. The manager of a small New York movie house (formerly a newsreel theatre), thinking he was plunging forward into a New Frontier of entertainment, installed sound reinforcement in his modest establishment. Behind the screen stood a standard theatre loudspeaker system The stage was flanked by subsidiary units carrying time-delayed audio. It was like hearing a stereo tape recorded on a staggered-head machine and played back on stacked-head equipment. Only by sitting in the first row center could one make any sense out of his sonic jumble.

Like taxes and traffic jams, sound reinforcement is here to stay. Most of us pay little or no attention to it, however, although we are constantly assaulted by distortion, faulty balance, over-reverberation, audio-visual confusion, and generally low fidelity. A notable exception is John S. Wilson, the jazz critic of *The New York Times*, who is a vivid and vigorous opponent of non-sound. Reviewing Diahann Carroll's concert debut at Philharmonic Hall in Lincoln Center, he noted that "Miss Carroll wore a hidden wireless microphone, which often amplified her voice to a harsh and hollow level and gave it ringing metallic overtones. . . . The unnatural qualities of the amplification took the edge off her best efforts."

When will the sound-reinforcement people catch up with the rest of the audio world? Æ

AUDIO CLUBS

(from page 65)

And this is only the beginning—remember that less than 40 years have passed since the electron tube and the microphone and loudspeaker have made possible the recording and playback of a full symphony orchestra.

High-fidelity in its true sense of faithful reproduction of sound, with wide range and low distortion, will continue to improve as the years pass and the best way for the increasing number of interested music lovers to keep pace with this progress would seem to be through adult education as sponsored by Audio Clubs or Societies. Æ

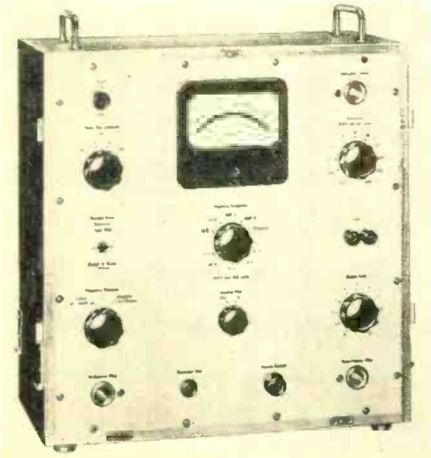
IF YOU ARE MOVING

Please notify our Circulation Department at least 5 weeks in advance. The Post Office does not forward magazines sent to wrong destinations unless you pay additional postage, and we can NOT duplicate copies sent to you once. To save yourself, us, and the Post Office a headache, won't you please cooperate? When notifying us, please give your old address and your new address.

Circulation Department
RADIO MAGAZINES, INC.
P. O. Box 629, Mineola, N. Y.

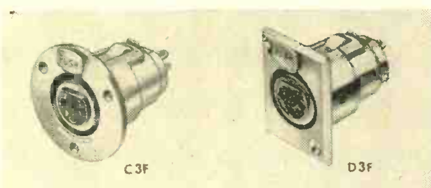
NEW PRODUCTS

• **Random-Noise Generator.** B & K Instruments, Inc. announces the new Model 1402 Random Noise Generator, designed to combine with complementary Bruel & Kjaer instrumentation to form complete integrated measuring systems for calibration, frequency response, environmental testing, reverberation and acoustic transmission measurements. A uniform spectrum density, ± 0.5 db, is supplied from 20 to 20,000 cps by the Model 1402 with a symmetrical Gaussian (normal) amplitude distribution to four times rms value (four sigma). A



special output circuit provides for matching impedances of 6, 60, 600, and 6000 ohms and supplying maximum peak voltages up to 170 volts with minimum distortion. The random-signal output-voltage level is indicated by a built-in true rms voltmeter. To accommodate the need for bands of random noise, jacks are provided to connect external filters between the input and output amplifiers, such as the B & K Model 1612 for 1/3-octave bands of noise. Stable output meter readings are insured for different bandwidths of noise by a Miller integrator circuit, which provides meter time constants of 0.5, 1.5, 5, and 15 seconds. Price is $1015 B & K Instruments, Inc., 2972 West 106th Street, Cleveland 11, Ohio. **C-1**

• **"Q-G" Audio Receptacles.** Switchcraft has designed new "Q-G" audio receptacles for electrical-electronic applications. "Q-G" (Quick-Ground) audio receptacles are 3-contact, female type for panel mounting. Part No. C3F and D3F feature "Captive Design" insert screws and "Ground Terminals." The "Ground Terminal" is an electrically integral part of the die cast housing. Upon engagement with the mating connector, the ground circuit is automatically engaged. Any circuit contact can be readily grounded to the housing simply by a jumper wire between the



selected contact and the "Ground Terminal." Switchcraft's "Q-G" audio receptacles have bronze, silver plated, chromate dipped pin contacts to give long electrical and mechanical life. Pins resist tarnishing. Part No. C3F is a round, flanged, panel mount female receptacle and mounts with 3 screws. Part No. D3F, rectangular shaped panel mount female connector, mounts with 2 screws. List Price for the C3F is $3.10; D3F is $3.20. Switchcraft, Inc., 5555 N. Elston Avenue, Chicago 30, Illinois. **C-2**

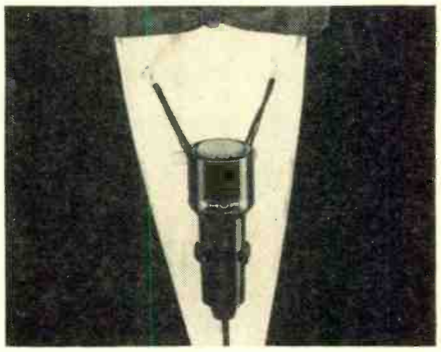
• **Baffle for Custom Installation.** Featuring the same components used in the EMI Model DLS 529 enclosure, the EMI "Baffle," Model 1, is intended for custom installation. It utilizes a 13½ × 8⅛-inch handmade elliptical woofer with patented aluminum cone and plastic suspension. The voice-coil is wound both inside and outside the coil layer. This unit is used for the range 40–4500 cps. Two 3½-inch high-frequency units with special curvature diaphragms are used for the range

4500–15,000 cps. A high-precision crossover network operates from 4500 cps upwards. It is mounted and completely wired on the baffle board which is 11⅜ × 22⅜ × ¾-inch thick. The over-all height of components mounted on baffle board is 7⅜ inch. The crossover unit may be removed and mounted elsewhere in the enclosure. Impedance is 4 ohms and the gross weight is 17 lb. Audio net retail is $115.00. Scope Electronics Corporation, 10 Columbus Circle, New York 19, N. Y. **C-3**

• **Large Speaker System.** Recognizing the continued demand for the large high-efficiency loudspeaker systems, Electro-Voice is featuring the new, redesigned Patrician 800. Completely restyled, the Patrician 800 is shown in a traditional furniture design but is also available with modern contemporary styling. The cabinetry is constructed of one-inch-thick wood throughout. The Patrician 800 uses a 30-inch woofer which gives it efficiency and extended bass response. Although designed for utmost operating efficiency in a corner,

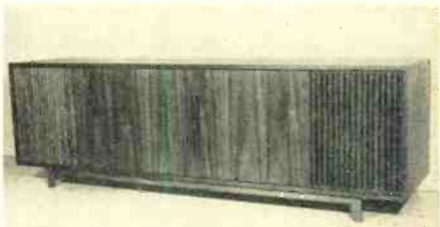
the Patrician 800 can be placed in almost any room location without seriously hampering its performance. It has a frequency response of 20 to 35,000 cps and a program power handling capacity of 100 watts. Above 100 cps a 12-inch mid-bass speaker is used and above 800 cps treble is handled by the new T250 treble driver. A T350 driver, operating from 3500 cps to beyond audibility, handles the "super-tweeter" frequencies. Electro-Voice, Inc., Buchanan, Mich. **C-4**

• **Lavalier Microphone.** A new dual-impedance dynamic microphone specifically designed for lavalier use has been announced by Shure Brothers. Called the Model 560, it is an entirely new microphone built to match a special response curve developed to solve two basic problems of lavalier microphones: 1. Their "bassy" sound characteristic produced by low-frequency energy transmitted through the speaker's chest cavity; and 2. their substantial loss of high-frequency portions of the speaker's voice due to voice projection across and away from the microphone. Investigation showed that a response curve with smooth roll-off below 200 cps and smooth rise above 1500 cps answered these problems,



and the Model 560 was designed to match such a curve. Physical characteristics of the Model 560 are also in keeping with its design as the ideal lavalier microphone. It weighs only five ounces and is less than four inches long. Finish is non-reflecting black. Cable is very flexible, small diameter, and two-conductor shielded. Each unit is equipped with a specially designed lavalier cord and clip assembly which permits the user freedom of movement and full use of both hands. The Model 60 may also be used as a handheld microphone or on a floor or desk stand with the Shure A25B Swivel Adapter. Impedance changes are conveniently made by a pinjack-terminal arrangement inside the microphone's case. List price of the Model 560, including lavalier cord and clip assembly, is $42.50. Further information is available from Shure Brothers, Inc., 222 Hartrey Avenue, Evanston, Illinois. **C-5**

• **Equipment Cabinet.** The Model 600 Low-Boy is a 6-ft. cabinet, featuring two acoustically-designed speaker enclosures for 8 or 12-in. speakers plus space to accommodate tuner, amplifier, turntable, and tape deck. Deflection of sound through louvers provides excellent stereo reproduction. It is solidly constructed entirely from ¾-in. stock except for control panel and component shelf. Blank control panel allows custom installation of components. Available



in walnut, mahogany, or cherry woods. Over-all dimensions are 74W × 24H × 19D; tuner space is 18W × 7½H × 17½D; amplifier space is 18W × 7½H × 17½D; turntable space is 18W × 10H × 17½D; tape deck space is 18W × 10H × 17½D. Price of model number 600 in kit form is $179.00 and completely assembled and finished it is $295.00. Drawers are available at extra cost. Kliewer Kabinetry, P. O. Box 2201, Boise, Idaho. **C-6**

The Quality . . . Features . . . Engineering Excellence You Expect from Scott at Unexpected Prices!

New Scott FM Stereo Tuner Kit

$109.95

From the famous Scott engineering laboratories . . . an amazing low priced FM Stereo tuner kit that performs like higher priced Scott units. All the exclusive Scott features you want and need are included: "Time-Switching" multiplex circuitry, Wide-Band design, Sonic Monitor stereo indicator, precision tuning indicator, and separate level controls for perfect channel balancing. Scott engineers used new Space-Age compactron circuitry to assure perfect performance at this remarkably low price.

Like all Scott kits the new Model LT-111 comes with an exclusive full-color instruction book to make construction absolutely foolproof. The high conductivity copper RF front end is pre-wired and aligned at the factory. All wires are precut and stripped. Scott's amazing new Align-A-Scope lets you align each section of the tuner perfectly without special instruments.

Specifications: Usable Sensitivity 4.0 µv; Signal to Noise Ratio 55 db; Harmonic Distortion 0.8%; Drift 0.02%; Capture Ratio 6 db; Selectivity 32 db; I.M. Distortion 0.3% (CCIF); Separation (1 kc) over 30 db. Dimensions in accessory case: 15½w x 5¼h x 13¼d.

Available early in April.

Prices slightly higher west of Rockies. Subject to change without notice.

New Scott 30-Watt Stereo Amplifier Kit

$99.95

Imagine! A stereo amplifier kit . . . from Scott, the quality leader . . . at less than $100! This superb 30-Watt stereo amplifier has all of the most needed Scott features: dual tone controls, tape monitor, front panel stereo headphone output, derived center channel output, all-aluminum chassis, scratch filter, stereo balancing, and loudness-volume control. Unique Scott output circuitry delivers full power down to the low frequencies where power is really needed and where most moderately priced amplifiers fail to meet their published specifications. That is why the new Model LK-30 will drive most inefficient speaker systems to full room volume.

Like Scott's new tuner kit, the LK-30 utilizes a full color instruction book, Kit-Pak container, and all the Scott kit features the experts recommend so highly. Its performance will astound you!

Specifications: Power Rating (IHFM) 30 watts; Power Band (IHFM) 25-19,000 cps; Distortion under 0.8%, Hum and Noise —70 db, Frequency Response (normal listening levels) 20-20,000 cps ±1 db, Dimensions in accessory case 15½w x 5¼h x 13¼d.

Available early in March.

SCOTT®

H. H. Scott Inc., Dept.35-3, 111 Powdermill Rd., Maynard, Mass.
Rush me complete details on your new budget priced FM Stereo Tuner and 30-Watt Stereo Amplifier kits.

Name..

Address..

City........................Zone......State...........

Include names of interested friends and we will send them details, too.

Export: Morhan Exporting Corp., 458 Broadway, N.Y.C.
Canada: Atlas Radio Corp., 50 Wingold Ave., Toronto

• **New Recorder Line.** Three new tape recorders, including two stereo models with "Dub-A-Track," have just been introduced by Gemark. Heading the line is a compact, versatile stereo recorder, Model 430W, that has a fine furniture walnut finish and is supplied with two external speakers in matching wood cabinets. Model 430W (shown) retails for $379.95, including auxiliary speakers. Identical to Model 430W, except in finish and the fact that external speakers are an optional item, is Model 430, which retails for $299.95. In addition to "Dub-A-Track," Model 430W and 430

also have "sound-on-sound," a feature that allows simultaneous electronic mixing of new material with previously recorded material already on the tape. "Sound-on-sound" produces the effect of multiple instruments and voices with only a single performer, while "Dub-A-Track" or "sound-with-sound" is useful for simulating stereo with monaural sources and in language teaching. Weighing only 25 pounds, Model 430W and 430 measure 20¾-in. by 11-in. by 7½-in. They fit standard bookshelves. Model 430 is finished in black vinyl. General Magnetics and Electronics Division, Estey Electronics, Inc., 59 Hempstead Gardens Drive, West Hempstead, New York. **C-7**

• **Professional FM Tuner.** Production of a new stereo FM tuner designed to meet the requirements for professiontl usage in FM radio broadcasting stations as both a monitor and network relay, as well as application for home mono or stereo music systems, has been announced by Altec Lansing Corporation. Sporting a satin-gold-finish panel, the new Altec 314A "Emperor Royale" tuner provides front panel switching controls for afc, interstation squelch, multiplex, noise filter, and a.c. power switch. Among other features, the 314A has an inertia-type flywheel and an edge-lighted dial that illuminates the

logging scale. It also incorporates a horizontal tuning indicator for "on frequency" tuning and signal strength indication. The 314A has a monophonic audio output jack which permits all program material to be supplied to a separate monophonic amplifier for remote locations. The "Emperor Royale" is identical in circuitry and performance to the FM and multiplex sections of Altec's 708A "Astro" stereo tuner-amplifier. It has an FM sensitivity of 1.2 microvolts for 20-db of quieting with 300-ohm antenna, built-in time division multiplex, and 30-db of separation from 50-15,000 cps. Complete with cabinet, it sells for $359, including tax. Altec Lansing Corp., 1515 S. Manchester Ave., Anaheim, Calif. **C-8**

NEW LITERATURE

• **Frame Grid Tubes Brochure.** A detailed description and analysis of how Amperex conceived and conducted reliability and life studies is available in the form of a free brochure, "Guaranteed Reliability with Amperex Premium Quality Frame Grid Tubes." Interested persons may procure copies by writing on company stationery to: Amperex Electronic Corporation, Special Purpose Tube Department, 230 Duffy Avenue, Hicksville, Long Island, New York. **C-9**

• **Discussion of Noise Figure.** An eight-page Application Note defining noise figure and how it may be measured is available from Hewlett-Packard Company. The Application Note No. 57, states that the ultimate sensitivity of a detection system is determined by the noise presented to the system with the signal. In addition, any system will contribute noise to the signal in detection and amplification processes. Since the input noise presented with the signal cannot usually be controlled, the approach is to study, measure, and attempt to minimize the noise contribution of the system. After discussing the basic considerations of noise figure, the Note proceeds to such topics as: Noise figure measurements with a signal generator; the noise source as a broadband signal generator; noise figure measurements with an excess noise source; networks in cascade; accuracy considerations. Application Note No. 57 can be obtained by writing Hewlett-Packard Company, 1501 Page Mill Road, Palo Alto, California. **C-10**

• **Transistors in the Home.** Publication of a new consumer selling guide book, "Transistor In Your Home," was announced this week by the Electronic Industries Association of Japan. The 16-page, two-color, illustrated booklet touches on the uses and advantages of the most popular transistorized electronic consumer products, including multi-band radios, radio-phonos, transceivers, TV sets, and tape recorders. Included in the illustrations are a radio frequency guide, showing uses of different frequencies in the radio spectrum; a tape recorder playing-time chart and a double-page transistor battery replacement guide. Japan Trade Center, Electronics; 389 Fifth Avenue, New York 16, N. Y. **C-11**

• **Transistor Manual.** The first "RCA Transistor Manual," featuring do-it-yourself circuits as well as basic theory and device data for technicians, students, and hobbyists, has just been published by RCA Commercial Engineering. Some of the typical circuits included in the manual are: a 3-watt stereo amplifier; a citizens-band transceiver; 6-volt and 12-volt auto radio receivers; an AM/FM auto radio tuner; an FM-stereo multiplex adapter; a 200-mw phonograph amplifier; a 600-volt power supply for amateur transmitters; a code practice oscillator; a grid-dip meter; as well as a photo relay circuit. Each circuit also includes a complete parts list. The publication, which will be available from RCA distributors, contains detailed technical information on 373 RCA semiconductor devices including transistors, silicon rectifiers, and tunnel diodes. The 304-page book is designed to assist engineers, technicians, educators, and radio amateurs in their work or experiments with semiconductor devices and circuits. The manual contains basic semiconductor theory, applications, and installation information. Detailed information on semiconductor devices in the RCA line is presented in the technical data section. Comprehensive selection charts classify RCA semiconductor devices by function and performance level. The new "RCA Transistor Manual" SC-10 may be obtained from RCA distributors or by sending $1.50 to RCA Commercial Engineering, Somerville, N. J. **C-12**

COLOR ORGAN

(*from page 24*)

the grid in half, spreading out the action over a larger rotation of the knob. If the light will not dim completely, or to the point desired, again the capacitor may be too large, or more voltage might be needed; in this case, a higher voltage grid transformer is required.

Since each pair of 2050 tubes has its own high-voltage winding, two "common" hot leads are supplied, to terminals 3 and 4 of the octal output socket. In this circuit, terminal 3 is common to the low and medium channels, which feed terminals 7 and 8; terminal 4 is common to the high channel and the background circuit, at intervals 5 and 6. Line voltage for the motors is supplied through terminals 1 and 2.

A more elegant method of delaying the application of the high voltage to the thyratron is shown in the circuit employing a 6NO30 Amperite thermostatic delay relay tube (*Fig.* 8), which in turn actuates a double-pole ceramic-insulated relay with a 24-volt a.c. coil. The delay chosen is 30 seconds, giving sufficient time for the heaters to warm up before the plate voltage is applied, and preventing heavy current from surging through the thyratrons, which usually occurs when the high voltage is applied at the same time as the heater voltage with insufficient grid "bias." A surplus relay was used. The insulation must withstand 800 volts if one of the higher voltage TV transformers is used. The coil is operated on 20 volts, using the three heater windings in series; other coils are available with 6-volt and 120-volt ratings.

If a separate heater transformer is used to supply the thyratrons, then the relay can be eliminated, and the plate transformer can be switched on directly through its primary winding with the Amperite delay tube if the current drawn is not over 3 amperes. If surplus relays are not available, and stock items too expensive, consideration might be given to using a separate Amperite tube in each plate lead, as they are rated at 1000 volts on the contacts. These tubes come with either 6- or 115-volt heaters, (the 115-volt models are numbered 115NO30), so they can be connected either across a heater supply or the power line. If the automatic delay seems expensive, toggle switches can be used; if switching in the high-voltage circuit, two toggle switches might be necessary, as some of the DPST switches may break down under the 500 to 700 volts between the arms, although high-voltage switches are available from stock or surplus.

TO BE CONTINUED

[1] "Abstract Oscillography," *Radio-Electronics;* April, 1955.
[2] "Electronic Fire and Gas Light Effect," J.S.M.P.T.E., April, 1947.
[3] Richard Graham: "A Variable-Voltage Power Supply," *Radio and Television News;* September, 1952.
[4] P. J. Vogelgesang: "Thyratron Power Supply," *Radio and Television News;* August, 1955.
[5] G. Southworth: "Medium Power Color Organ," *Radio and Television News;* October, 1957.

PREAMPLIFIER

(*from page 38*)

At frequencies well above the cutoff frequency, f_c, of the network ωC_s is much larger than 1, hence $Z_s \approx 0$ at f greater than f_c. The voltage gain at relatively high frequencies thus becomes exactly Eq. (3) at frequencies above the cutoff frequency. With decreasing frequency the reactance of C_s increases and Z_s may no longer be neglected. For relatively high values of R_s we have

$$\omega C_s \gg \frac{1}{R_s} \text{ and thus } Z_s = \frac{1}{j\omega C_s}.$$

The low-frequency voltage gain of the stage then is

$$g^*_v = -\frac{h_{21e} r_L}{h_{11e} + h_{21e}\left(R_E + \frac{1}{j\omega C_s}\right)}.$$

According to definition, the voltage gain $|g^*_{v\,o}|$ at the lower cutoff frequency, f_o is 3 db down referred to the mid-frequency gain $|g_v|$. By solving the equation

$$|g^*_{v\,o}| = \frac{1}{\sqrt{2}}|g_v|$$

the cutoff frequency of the amplifier stage may be determined.

$$\frac{h_{21e} r_L}{(h_{11e} + {}_{21e}R_E)^2 + \left(\frac{h_{21e}}{\omega_o C_s}\right)^2} = \frac{h_{21e} r_L}{\sqrt{2}\,(h_{11e} + h_{21e}R_E)}$$

$$\omega_o = \frac{h_{21e}}{C_s(h_{11e} + h_{21e}R_E)}.$$

This produces the emitter bypass capacitor value required for a lower cutoff frequency, f_o

$$C_s = \frac{h_{21e}}{\omega_o(h_{11e} + h_{21e}R_E)}.$$

Stage One.

$f_o = 10$ cps, $\omega_o \approx 2\pi f_o \approx 62.8\ s^{-1}$
$h_{11e} = 3570$ ohms, $h_{21e} = 65$, $R_E = 180$ ohms,

$$C_{s\,I} = \frac{65}{62.8(3570 + 65 \times 180)}$$

$C_{s\,I} \approx 67.7\ \mu f.$

Stage Two.

$h_{11e} = 1670$ ohms, $h_{21e} = 65$, $R_E = 330$ ohms

$$C_{s\,II} = \frac{65}{62.8(1670 + 65 \times 330)}$$

$C_{s\,II} \approx 44.7\ \mu f.$

Stage Three.

$h_{11e} = 1000$ ohms, $h_{21e} = 100$, $R_E = 185$ ohms,

$$C_{s\,III} = \frac{100}{62.8(1000 + 100 \times 185)}$$

$C_{s\,III} \approx 81.6\ \mu f.$

2

CONCLUSION

It has been shown that with careful circuit design, adequately exact calculations, and consideration of the special properties of transistors, it is relatively simple to develop a transistorized low-noise, low-distortion preamplifier of equal quality or better than amplifiers employing vacuum tubes. Low power consumption, low circuit-impedance level, low supply voltages, and compact size have been found to be the most outstanding additional advantages. Æ

SPEAKERS

(*from page 32*)

the entire operating range. This yields superb transient response without sacrificing "low lows," and without undue dependence on room acoustics or amplifier characteristics.

One indication of the quality of performance of a loudspeaker is its transient response—response to sudden (or rapidly varying) input excitation such as that produced by percussive sounds (cymbals, shots, and such similar noises). The speaker, of course, should faithfully follow the input signal transient—starting and stopping precisely with it. This, however, is difficult to achieve in practice, for the reasons noted earlier which alter resonant and velocity characteristics of the speaker. It follows, then, that any solution to the problem would involve some way of either neutralizing or compensating for these extraneous influences—at all frequencies of interest. It was our hope that this could be done in some way that would not turn out to be outrageously complex or expensive. Of the many approaches examined, even magnetic damping of the usual sort did not seem at first to offer much promise since proper damping achieved at one frequency will not do, generally, at some other; the voice-coil impedance varies happily up and down the graph from one frequency to another.

All things considered, however, some form of electromagnetic voice-coil damping seemed to be the most promising approach. It is certainly well known that a "shorted" copper ring will generate eddy currents when moved through a magnetic field, and that these currents will produce a force in a direction opposite to the motion of the ring. It is not feasible, however, to form a closed copper voice coil form and maintain the extremely tight diameter tolerances (± 0.0002-in.) necessary for close air gaps (i.e. high flux densities). Metal voice coil forms, therefore, must be "split" when placed over the extremely accurate mandrels used for voice-coil winding. It was found, however, that a metal form was shorted in fact if a portion of the form at least equal to the air gap height remained *out* of the air gap as shown in *Fig.* 4. The portion of the form out of the magnetic air gap provided the return path for any eddy currents that might be generated. With most metals used for coil forms, such as aluminum and copper alloys, eddy current generation is insignificant due to their high resistivities. However, it was found that pure copper and pure silver, and *only* these two metals, provide significant eddy current damping when used as a voice-coil form in a properly designed speaker magnet assembly. Furthermore, speakers constructed using silver and copper forms displayed a marked improvement in frequency response, especially at the upper end of the frequency range, where voice-coil damping action tapers off. The compensating action of the copper and silver forms almost completely eliminates the peak in the response curve associated with the behavior of the diaphragm at higher frequencies.

Here, then, is a speaker whose engineering oddities are not mere selling points or advertising hooks, but substantial improvements in the high fidelity speaker art. The Fisher XP-4A shows what can be done by stepping back, taking a long look, and tackling old problems with a fresh approach.

Appendix

The following equations were utilized in determining the choice and geometry of the voice-coil form material.

The forces acting on a damped vibrating system are given by the expression: $F = K_1x + K_2\dot{x} + M\ddot{x}$ where:

x, $\dot{x}$, and $\ddot{x}$, respectively represent the displacement of the system in meters, and the respective first and second derivatives thereof with respect to time;

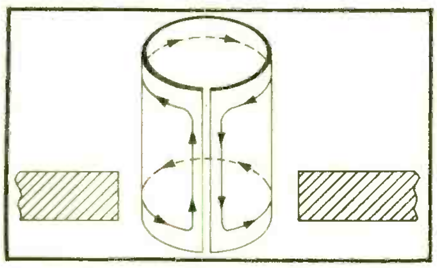


Fig. 4. Voice-coil former with the electrical circuit indicated.

K_1 represents the spring constant of the moving system, in newtons/meter;

K_2 represents the damping constant, in newtons-meters/sec.;

M is the mass of the moving system in kilograms; and

F is the total force acting on the system, in newtons.

Substituting $A \cdot \sin \omega t$ for x, where ω is the frequency of vibration, in radians/sec. (assuming sinusoidal excitation, i.e. $F = \sin \omega t$)

$$F = (K_1 - M\omega^2)A \cdot \sin \omega t + K_2\omega A \cdot \cos \omega t$$

At resonance, the "reactive" term $K_1 - M\omega^2$ vanishes. Thus:

$K_1 = M\omega_r^2$, where ω_r is the resonant frequency.

Thus, the basic differential equation may be written as follows:

$$F = M\omega_r^2x + K_2\dot{x} + M\ddot{x}$$

In a critically damped system, the radical of the corresponding quadratic expression is equal to zero, thus,

$$(K_2^2 - 4M^2\omega_r^2)^{1/2} = 0, \text{ or } K_2 = 2M\omega_r$$

Thus, the damping force F_{CD}, in a critically damped system, is given by:

$$F_{CD} = 2M\omega_r v, \text{ where } v = \dot{x}.$$

For the split cylinder coil form of *Fig.* 4, it may be shown that induced eddy currents follow the pattern indicated, in *Fig.* 4, by dotted lines on the hidden surfaces of the cylinder, and by solid lines on the visible surfaces. The damping forces, F_D, due to eddy currents induced in the form, are given by:

$$F_D = BL_cI, \text{ where}$$

B is the flux density in webers/square meter;

L_c is the circumferential length of the form cylinder, in meters;

I represents the induced current, in amperes, given by:

$$I = BL_gTv/k, \text{ where,}$$

L_g is the length of the gap 4, in meters;

T is the thickness of the form, in meters;

v is the velocity, as stated above; and

k is the resistivity of the form material, in ohm-meters.

Thus,

$$F_D = BL_cI = B^2L_cL_gTv/k$$

Hence, the damping ratio, R, defined as the ratio of the actual damping force, F_D, to the critical damping force, F_{CD}, is given by:

$$R = B^2L_cL_gT/2kM\omega_r$$

Solving for the resistivity k:

$$k = B^2L_cL_gT/2RM\omega_r \quad Eq.\ (1)$$

Substituting $d/2f_r$ for L_c/ω_r in Eq. (1), where d is the diameter of the form cylinder, as shown in *Fig.* 1, and where f_r is the resonant frequency in cps, we have:

$$k = B^2dL_gT/4RMf_r \quad Eq.\ (2)$$

The optimum system frequency response without overshoot is obtained when the actual system damping is approximately 0.7 of critical damping; i.e. $R = 0.7$. *Equation* (*2*) then becomes:

$$k = B^2dL_gT/2.8Mf_r \quad Eq.\ (3)$$

and Eq. (1) becomes:

$$k = B^2L_cL_gT/1.4M\omega_r \quad Eq.\ (4)$$

A typical set of values used in the construction of a speaker of this type when substituted in *Eq.* (*3*) would indicate a required resistivity of: (0.016) (10^{-6}) ohm-meters.

Referring to any table of resistivity values, for example that given on page 197 of "Acoustics," it is seen that there are two materials which approximately provide the above value of resistivity, and all the rest do not. These two materials are silver $(0.0163 \times 10^{-6}$ ohm-m), and copper $(0.0172 \times 10^{-6}$ ohm-m). Æ

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*

Stereo...How It Works
Herman Burstein

A well known authority writes on the exciting technology of stereo. Its theory and operating techniques including recording, playback, broadcasting, simulcasting, multiplexing. Covers stereo discs and tapes with a unique and practical approach. 224 pages.
No. 80 Paperback $2.90*

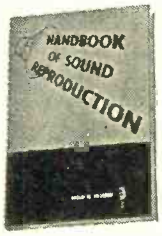
Introduction to Hi-Fi
Clement Brown

An original, refreshing approach to hi-fi theory and practice—a typically British thoroughness in the discussion of pickups, preamps, amplifiers, speakers, acoustics, etc. — with an interesting prognosis of hi-fi in the future. The author is a renowned British authority. His style contributes a fresh new look at hi-fi. 192 pages.
No. 88 Paperback $3.20*

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 context. Covers planning, problems with decoration, cabinets and building hi-fi furniture. A perfecr 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*

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*

"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*

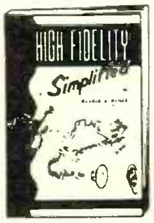
• MONTHLY SPECIAL! SAVE $5.25

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 June 30, 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.
P. O. Box 629, Mineola, New York
Please send me the books I have circled below. I am enclosing the full remittance of $.................. (No C.O.D. or billing.)

*All U.S.A. and CANADIAN orders shipped postpaid. Add 25¢ for Foreign orders (sent at buyer's risk).

58	79	80	88	110	112
115	123	124	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

The Tape Guide

HERMAN BURSTEIN*

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

Replacing a Tape Preamp

*Q. I have a **** tape deck and would like to replace the accompanying tape preamp with the xxxx tape preamp. According to the specifications for the xxxx preamp, the maximum record current it can supply is 0.1 ma. The only information I have on my record head is that it has an impedance of 10 ohms at 1000 cps. I would appreciate any information you can supply with respect to the following: 1. What record current is required to drive this type of head? 2. Is there a test method for determining the required record current for a record head? 3. Do you know whether the xxxx preamp would be able to drive my record head?*

A. From your description of the record head in your tape deck, I am dubious about the xxxx preamp working out satisfactorily. Although it might barely supply enough audio current, it is doubtful that it could supply enough oscillator current for the record head and, especially, for the erase head. I surmise that the erase head in your tape deck, as well as the record head, has low impedance.

Based on an impedance of 10 ohms at 1000 cps, your record head has an inductance of about 1.6 mh. This compares with an inductance of about 500 mh for the heads commonly used in home tape recorders. Accordingly, you will need a good deal more driving audio current than home machines ordinarily require. A machine of the latter kind may need as much as 0.08 ma. Your head probably needs between 0.2 and 1.0 ma, whereas 0.1 ma is the most that the xxxx preamp can supply. Similar reasoning applies to the erase head.

I cannot tell specifically how much record current is required for the record head in your machine. However, with suitable measuring equipment you can find out. Insert a 10-ohm resistor between the ground lead of the record head and ground. Feed into the tape recorder a 400-cps tone at maximum permissible recording level (producing 3 percent harmonic distortion). Disable the oscillator by removing the oscillator tube. Measure the voltage across the resistor and calculate current by Ohm's Law: $I = E \times R$. This requires a sensitive voltmeter. If your voltmeter isn't sensitive enough, use 100 ohms instead of 10.

In similar fashion, you can measure bias current, assuming that your present tape preamp is supplying the correct amount of bias. And in the same way, you can measure how much current is drawn by the erase head. Of course, you leave the oscillator tube in place when making the latter two measurements.

Hum Ho

Q. I have assembled a tape machine and the enclosed photographs show the results (Fig. 2 and 3); however I am experiencing hum in playback. I plan to change the input tube in the power amplifier (now a 6AN8). Which tube would improve performance? All units are grounded together. I can put shields over all tubes and transformers. Will a 250-ohm hum-bucking pot across the heater leads of the power amplifier help? Low-loss shielded cable is used on the playback head. Shielding material can be glued in front of the record-playback head. Could copper plate or other shielding material be used to shield the motor from the head leads? Could the a.c. wires be twisted or shielded some way to help? The chassis has a slight tendency to cause schocks. Would grounding it to a water pipe stop this?

A. Except for transformer hum possibly picked up by the playback head, I doubt very much that your power amplifier is a significant source of hum. Accordingly, I have no comments on a substitute for the 6AN8 or the advisability of installing a hum-bucking potentiometer. To check whether the power amplifier as such is a significant source of hum, put a shorted plug into its input jack, and listen. I doubt that you will hear a significant amount of hum. Make the same test with the preamplifier; that is, put a shorted plug into the tape-head input jack.

From your photos, showing the routing of the a.c. cords, it doesn't seem likely that these cords are a source of hum.

Your hum is probably picked up by the playback head. Part of this is the hum field present in any building equipped with a.c. Part is the hum field generated by motors and transformers in the vicinity of the head. The photos indicate that the head is inadequately shielded. In a high-quality tape machine, the head is surrounded by a heavy shield.

In the vicinity of the playback head are the motor of the tape deck and the transformers of the preamplifier and power amplifier. Using extension cables, you should see what improvement can be had by putting more distance between the tape deck and the other components. Obviously, you can't put the motor at a greater distance, but shielding might help—either shielding of this motor or substitution of a better shielded motor.

With respect to your shock problem, have you tried reversing the line plug in the wall socket? If this doesn't solve the problem, then ground the chassis to a water line or other object making a good connection to earth (but never a gas line).

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

High-Pitched Clicks

Q. My query is about commercially produced prerecorded tapes. I have encountered short high-pitched clicking noises in several of my prerecorded tapes. This noise occurs usually during moderate to high volume musical passages and may consist of many rapid-fire clicks floating around the room or only a few disturbances per performance. I do not even notice them at the first playing of the tape or think perhaps they are fingering noises or other mechanical sounds from the orchestra. The more I listen to the tape the more distracting these clicks become. As I have similar tapes which do not contain these clicks, I wonder if they are caused by a defective recording. I would appreciate any information you can give me.

A. The noises to which you refer may have been created either acoustically in the recording studio or electrically in the recording process. From your description, it seems more likely that they were created in recording. Possibly, they arose during the process of duplication, owing to the accumulation of electrostatic charges as the tape moved at high speed (usually 60 inches per second) through the duplicator. Æ

HEAT SINKS

(from page 28)

4-in. in diameter, cool much better if the plates are arranged vertically. Then the spaces between the plates are little chimneys, which is demonstrated by blowing cigarette smoke across them. Convection currents are useful only if heated air can escape and cooler air can enter.

The entry path is often a hole cut in the chassis beneath the heat sink. This works fine on the bench, but when the job is completed, and the bottom plate is added to the chassis, the air path is blocked; cool air cannot enter! Vent holes in the chassis skirt will solve this problem. Effective air circulation paths for a large selenium rectifier are shown in *Fig*. 5. Here, air heated in the rectifier stack rises by convection. A hole in the chassis permits cooler air to enter from below. Vent holes in the rear chassis skirt allow this cool air to be replenished as needed. Perforated metal over the vent holes keeps mice and meddling fingers out of the chassis interior.

These rather rough rules for heat sink design have proven very effective in the medium power range, from one watt to 25 watts, in a wide variety of devices, some of which have been in continuous service for as long as three years without a breakdown. Empirical rules are not guaranteed to be perfect, they have not been exercised against Maxwell's Demon, but they seem to work effectively in the situations I have run into. Æ

MORE CLASSIFIED

WANTED: Quality tape recorder, mono or stereo, such as Ampex or equal. Also, Altec Lansing 21D microphone only. R. E. Murphy, 7720 Greentree Road, Bethesda 14, Md., Phone (301) 365-0491.

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.

WRITE for quotation on components, recorders. FREE catalog. HI-FIDELITY SUPPLY, 2817-VC Third, New York 55, N. Y.

SALE ITEMS—tapes—package quotes. Bayla, Box 131-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.

LOWEST PRICES, factory fresh hi-fi components, all manufacturers. Write for quotations. Audio Accessories, P. O. Box 64, Franklin Park, N. J.

PIPE ORGAN REBUILDS advertising and nostalgia monthly magazine, $2, year. Alden Miller, 3212 34th Avenue South, Minneapolis 6, Minn.

WANTED: Altec Lansing 604-C or 604-D duplex speaker with network in perfect condition. Ready cash whatever the price. R. E. Bennett, 1460 W. 20th St., Long Beach 10, Calif.

SELLING OUT USED surplus equipment. Ampex, Concertone recorders. Altec speakers and microphones. RCA limiters. Cinema amplifiers and equalizers. Write for list. Boyd Recording Service. 2924 Bowser Ave., Dallas, Texas.

FOR SALE: 2 McIntosh amplifiers MC30. 1 Altec corner cabinet. 2 speaker cabinets. Mr. Oliver, TR 4-9871, TR 4-4283. 320 W. 89 St., New York 24, N. Y.

KARLSON speaker enclosures—basic kits $14.95 up—ceiling 12-watt flush-mounted asymmetric projectors, $29.95. Parasonic Laboratories, Orcutt, Calif. (Dealers wanted—Western States).

WANTED: Used: Neumann lathe AM131. Scully lathe. Gotham PFB 150-watt amplifier. Grampian feedback head. Mr. Oliver, TR 4-9871, TR 4-4283, 320 W. 89th St., New York 24, N. Y.

JBL D208 new, guarantee, $20. Sony 262-D, new, guarantee, $59. Rek-O-Kut K34H with arm and base, perfect, $49. J. M. Miller, 1006 N. Gardena Ave., Rialto, Calif.

FOR THE MUSIC LOVER and non-technical audiofan. Provides accurate, simple way to achieve professional standards in setting up and balancing stereo system. Provides tests to keep system in top operating condition. Samples of superbly engineered musical selections serve as reference standard of recorded music. Contents: Channel orientation, phasing, loudness and tone balance, tests for rumble, wow, flutter, tracking, etc. Send $3 to CONCERT-DISC, Box 88, Wilmette, Ill., for STX-12.

FOR SALE: Two Concertone #63 stereo tape recorder with cases. $350 each. One Fisher SA300 stereo amplifier, $100. One Fisher 400C preamplifier, $100 One RCA 77D mike, $125. Two Altec 660B mikes, $50 each. Two Altec 605A speakers in Karlson enclosures, $100 each. Franart Audio, 131 Mac Dade Blvd., Collingdale, Pa.

ALTEC 604C and EV-TRX15 in matching oiled walnut reflex enclosures. $295. Jaeger, 123 E. 37 St., New York, N. Y. MU 4-3139.

SALESMEN WANTED: Bi-lingual, preferably married. Career opportunity for men 25 and older. Three year training program. No ceiling on earnings. Starting salary up to 7200 plus bonuses for qualified men. Previous sales experience not necessary. (Phone 212 TN 7-1554 during business hours for appointment.)

Industry Notes . . .

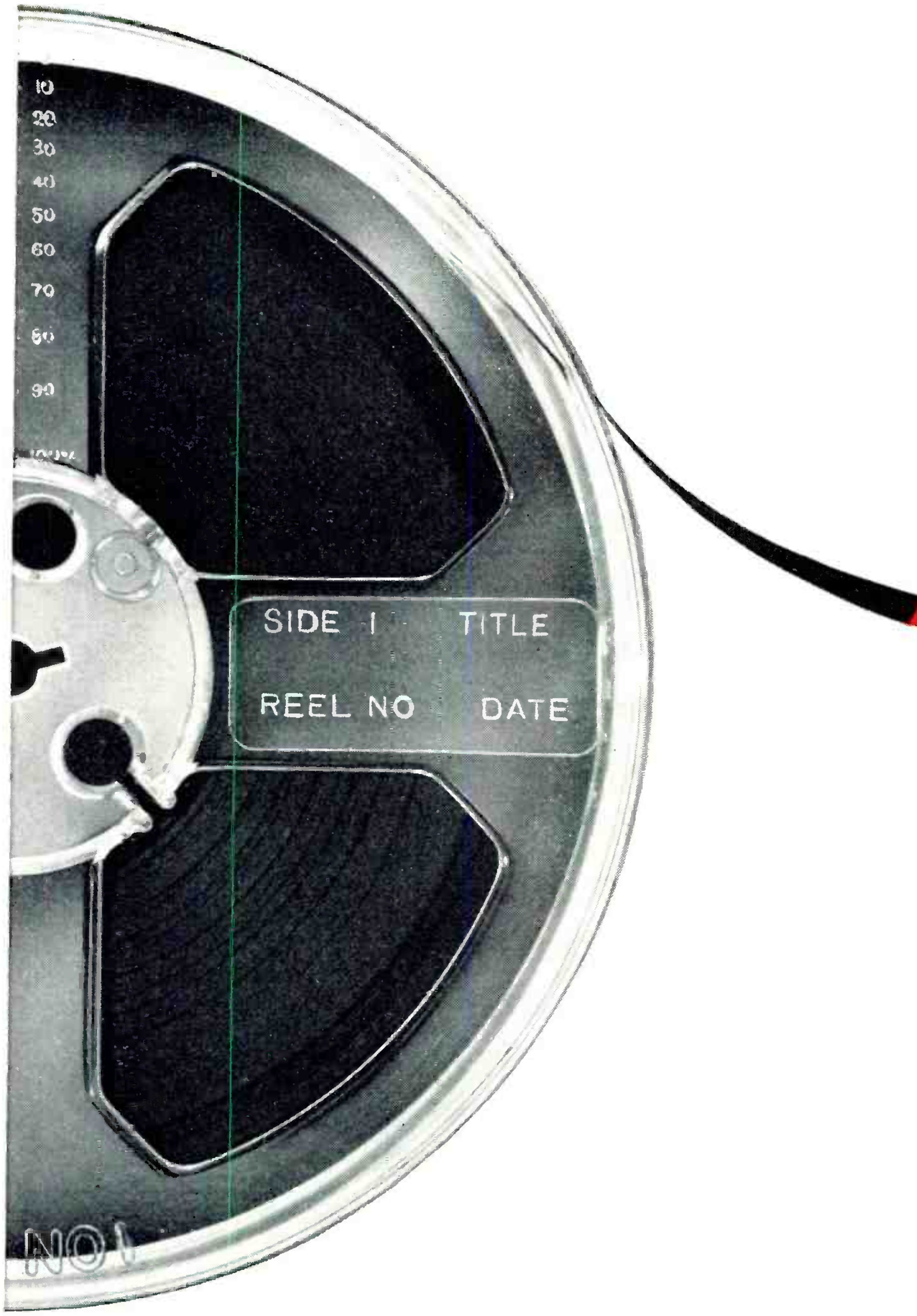
• **Jensen Promotes Three.** Ralph P. Glover, formerly vice president, has been promoted to the new post of executive vice president, according to Thomas A. White, Jensen's president and general manager. Walter R. Wolfgram, former factory superintendent was promoted also to the new position of vice president-manufacturing and Horace L. White, previously industrial sales manager, to vice president-industrial sales.

• **Harman-Kardon Appoints Ad Manager.** Fred Zeller has been appointed to the new position of Manager, Advertising and Promotion, at Harman-Kardon, Inc., it was announced by Murray Rosenberg, Vice President—Sales. He is a B. A. graduate of London University and also holds a Diploma of Electrical Engineering.

• **New Audio Concern for Southern California.** Arthur C. Davis heads a new research and manufacturing firm to be known as Electrical Research Products, Inc. With offices and laboratories at 1630 E. Maywood, Santa Ana, California. Initial manufacturing will be in the field of professional tape recorders and reproducing equipment. Research and development contracts will be sought by the new concern. Mr. Davis resigned the Presidency of the Sonotec Corporation and its Langevin Division, January 31st, 1963, to take this new post. As founder of Electrodyne Corporation, he remains on the Board of Directors of the Sonotec Corporation.

• **New Heath President.** Charles M. Kirkland has been appointed president of the Heath Company of St. Joseph, John B. Montgomery, president of Daystrom, Inc. announced. Mr. Kirkland was vice-president and director of the Okonite Company, Passaic, N. J. A native of Philadelphia, Pa., Mr. Kirkland graduated from Harvard in 1934. A veteran of World War II, he was a Major in the U. S. Army Air Force, rising to that rank from Private during his period of service from 1942 to 1945.

ADVERTISING INDEX



Your assurance of a flawless tape: **this Quality Control Number**

PLUS — 50 QCT-5-G

now on every reel of Soundcraft Tape!

Every reel of Soundcraft Tape must pass the toughest inspection standards in the industry. **For with modern 4-track recorders, you need this standard of perfection in the recording tape you buy.** Even the subtlest physical defects—surface irregularities, edge burrs, skew, feathered edges, cupping and curling—will prevent intimate contact between the narrow tracks and recording head, causing severe loss of high frequencies. The quality control number you now see on every reel of Soundcraft Tape is the final step in the painstaking manufacturing processes which make these recording tapes the very best that money can buy.

- Soundcraft's patented Micropolished® Process polishes the tape surface to a mirror smoothness. Surface irregularities are eliminated, the tape needs no breaking-in; you record perfectly right from the start.
- Soundcraft Tape is slit to incredibly close tolerances, insuring a tape entirely free of edge burrs and skew.
- Soundcraft Tape is wound extremely smooth to eliminate protruding edges which can be "feathered" or damaged during handling and use.
- Soundcraft's oxide coating and base material are balanced to prevent the cupping and curling caused by different rates of expansion and contraction between these materials.
- Soundcraft's exclusive FA-4 oxide formulation is frequency adjusted for 4-track stereo. It offers the most advanced magnetic properties in a tape today—more high frequency output, greater signal-to-noise ratio and dynamic range, and freedom from tape hiss, low-speed and editing squeal.

Always buy Soundcraft Tape, quality controlled to assure best performance on your tape recorder. Write for the "ABC's of Soundcraft Tape".

To our engineering-minded friends: mail us the tab showing the quality control number of your reel of Soundcraft Tape and we'll send you its rigid specifications.

REEVES **SOUNDCRAFT** CORP.

Main Office: Great Pasture Road, Danbury, Connecticut • New York: 10 E. 52nd Street • Chicago: 28 E. Jackson Blvd. • Los Angeles: 342 N. LaBrea • Canadian Reps.: Toronto, Vancouver

Traditional Patrician 800 illustrated with matching Contessa equipment console. In walnut, mahogany or cherry finishes.

...a complete new collection of high fidelity loudspeaker systems and matching equipment consoles

The Patrician 800, like its famous predecessors, is devoted to the reproduction of sound with absolute honesty. It speaks only when spoken to . . . with a voice that is no more spectacular—and no less so—than the music it is asked to duplicate.

As a result, the Patrician 800 is somewhat larger than most other speaker systems — even to its extraordinary 30-inch woofer—simply because a system of this magnitude is required to reproduce the deepest musical sounds accurately and without compromise.

In appearance, the Patrician 800 achieves a new standard of elegance in both Traditional and Contemporary designs . . . for this system was conceived as the ultimate reflection of your good taste in fine music and superb home furnishings.

We invite your critical appraisal of the entire new Patrician loudspeaker collection at your nearby Electro-Voice high fidelity demonstration center. Or we will be happy to send a catalog on request.

ELECTRO-VOICE, INC., *Consumer Products Division, Dept. 334A, Buchanan, Michigan*

Electro-Voice®
SETTING NEW STANDARDS IN SOUND