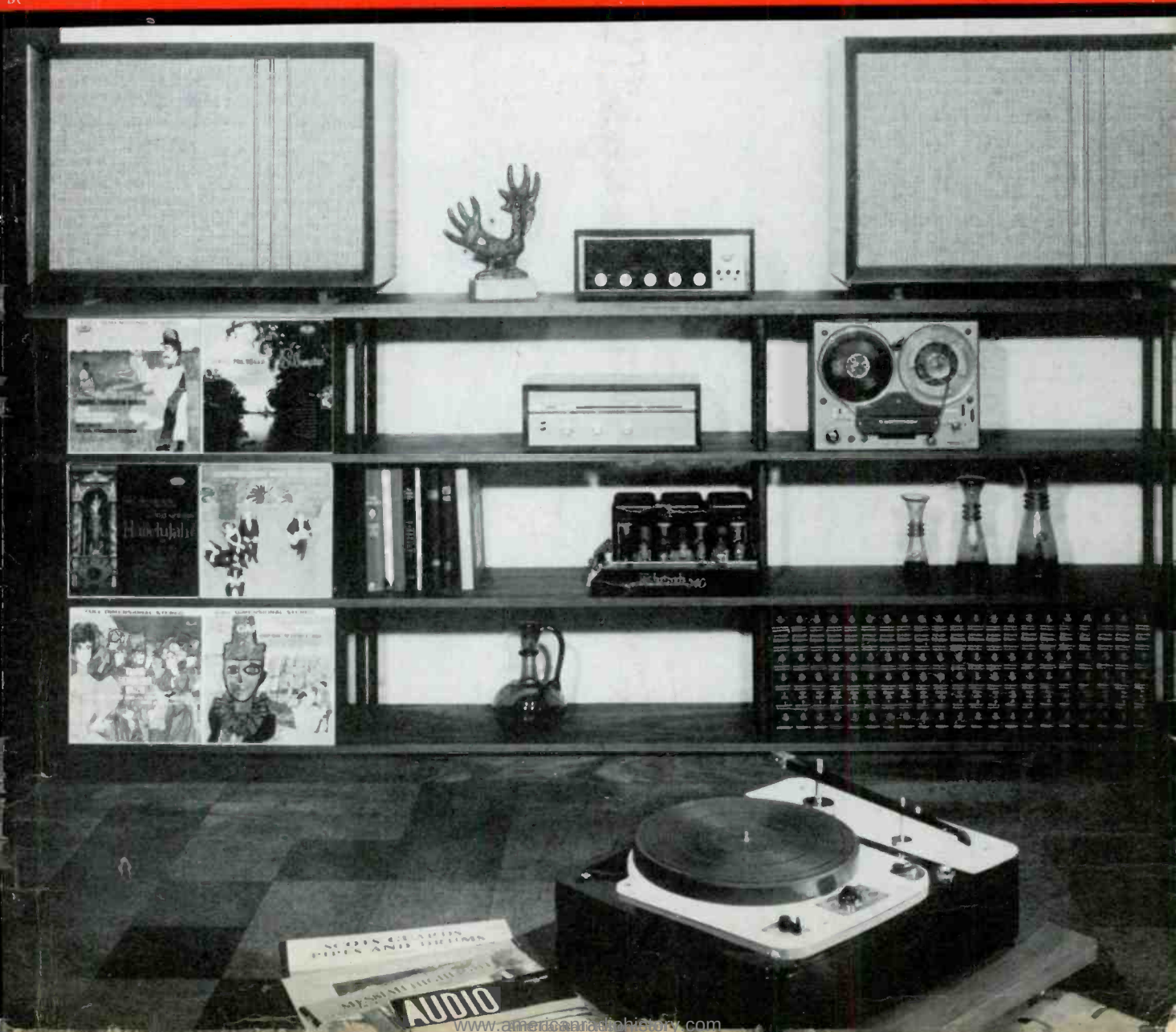
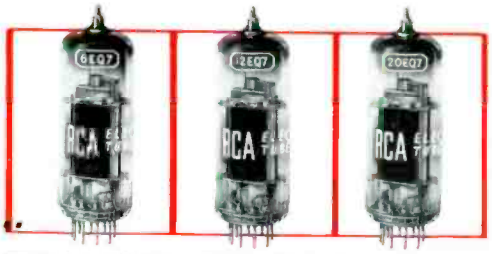
AUDIO

NOVEMBER, 1960
50¢

...the original magazine about high fidelity!



FROM RCA...



A NEW FAMILY OF DIODE-PENTODES

6EQ7-12EQ7-20EQ7

specially designed for improved low-cost radios!

AM-DETECTOR DIODE AND IF-AMPLIFIER PENTODE IN ONE ENVELOPE

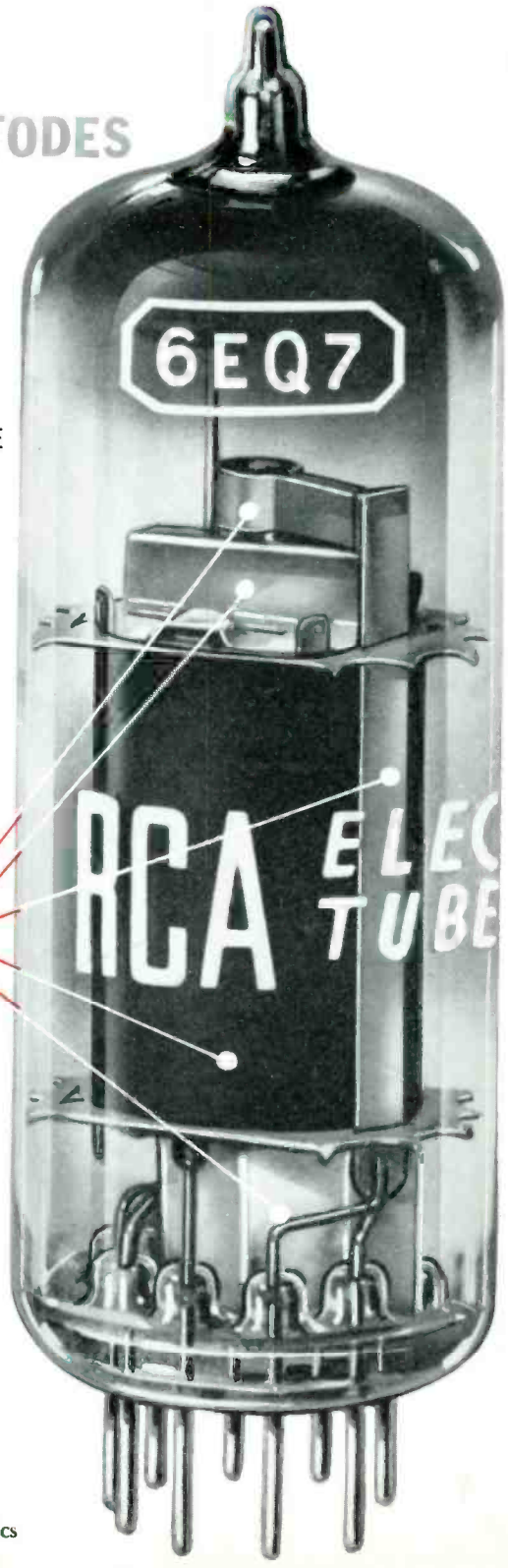
Each tube of this remarkable new family of broadcast receiver types represents a new arrangement of a diode and remote-cutoff pentode in a single envelope. *One tube* can serve as both *AM-detector* (diode unit) and *if-amplifier* (pentode unit) thus replacing a 6BA6 and a semiconductor diode at well under the cost of the two. In other applications, the pentode unit may be used as an rf amplifier; the diode may be used for avc.

APPLICATIONS:

RCA-6EQ7 and 12EQ7: in AM tuners of AM/FM radios.

RCA-20EQ7: Makes possible a new "All-American Economy Four!" A 100-ma-heater AC-DC AM receiver using only one 18FX6 converter, one 20EQ7 if-amplifier and detector, one 50FK5 power pentode and one 36AM3-A rectifier, actually approaches the performance of a 5-tube set!

Improved internal shielding and wide lead spacing provided by the 9-pin base assure low interelectrode capacitance, minimizing the possibility of instability.



ADVANTAGES OF THIS NEW RCA DEVELOPMENT:

- *Receiver cost reduction* due to this successful combination of a diode and a remote-cutoff pentode.
- *Relatively high transconductance* with low values of grid-to-plate capacitance.
- *Low interelectrode capacitance* provided by ingenious shielding (see photo) and by 9-pin design. Grid-No. 1-to-diode-plate capacitance is .0015 $\mu\mu f$ maximum.
- *High gain and stable operation* with no need for a cathode resistor to provide degeneration.
- *AVC output from the diode* may be applied to pentode.
- *Special basing arrangement* provides separate pin connection for each electrode and for internal shield.

Get the full story on this dramatic new development, and how it can benefit your receiver circuits. Check with your RCA field representative, or write to RCA Electron Tube Division, Commercial Engineering, Harrison, N. J.

RCA ELECTRON TUBE DIVISION—Designers Entertainment Field Offices

EAST: 744 Broad Street, Newark 2, New Jersey, HUmboldt 5-3900 · **MIDWEST:** Suite 1154, Merchandise Mart Plaza, Chicago 54, Illinois, WHitehall 4-2900 · **WEST:** 6355 E. Washington Blvd., Los Angeles 22, Calif., RAymond 3-8361

RCA The Most Trusted Name in Electronics
RADIO CORPORATION OF AMERICA

NOVEMBER, 1960 VOL. 44, No. 11

Successor to RADIO, Est. 1917.

AUDIO

ENGINEERING MUSIC SOUND REPRODUCTION

CONTENTS

COVER PHOTO—Arranged in the Chauncey, New York, home of NBC Special Projects Director Robert K. Sharpe prior to being connected into a stereo system are the following items: Garrard 301 turntable, Shure M-216 Studio Dynetic arm and pickup, Karg Futura FM tuner, McIntosh C-20 stereo preamp and MC-240 stereo amplifier, and two Electro-Voice Royal 400 speaker systems. Photograph by Mort Weldon.

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. 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.

AUDIOclinic

JOSEPH GIOVANELLI*

Measurement of Feedback

Q. How does one measure the amount of feedback that an amplifier possesses? S. Mogieleff, New York, New York.

A. It is very easy to find out how much feedback you are using. All you need to do is to connect an a.c. voltmeter to the output of the amplifier and connect an oscillator to the input. The amplifier's output should be loaded with a resistor whose value is equal to the impedance of the output transformer tap to which it is connected. Proceed as follows:

1. Disconnect the feedback circuit at the output transformer.
2. Temporarily return this feedback circuit to ground.
3. Set the oscillator to 1000 cps and gradually feed the tone into the amplifier until the meter reads full scale. In so doing, be sure that the amplifier is not producing more power under these conditions than can safely be handled by the tubes, output transformer, and external load resistor.
4. Without changing any knob setting, introduce feedback and read the voltage indicated on the a.c. meter.

The ratio of the voltage obtained without feedback to that of the voltage with feedback can be expressed in db when you remember that db equals 20 times the log of that ratio. Of course, if your a.c. meter has a db scale, all you need to do is to read that ratio directly in db.

If you wish to know whether the feedback is uniform at all frequencies, you may apply the above procedure to any frequency desired and note the different ratios.

Even though this information is interesting to know, it is not important in evaluating the overall performance of the amplifier. What's really important is that the amplifier should have a wide and flat frequency response, should be free from ringing, and should exhibit low distortion

What you must do to obtain maximum feedback without amplifier instability is to proceed as follows:

1. Adjust the value of the feedback resistor to produce feedback which is 6 db below the point at which the amplifier oscillates.
2. Then choose a value of capacitance large enough to eliminate high frequency ringing, but small enough to leave the upper frequency response unrestricted to as great a degree as possible.
3. At this point, it may be possible to increase the amount of feedback and still be 6 db below the point of instability.
4. Then further experimentation with the feedback capacitor is possible.

Drift in FM Tuners

Q. After purchase of my tuner I noted that there was considerable drift for the first 30 to 45 minutes of operation. Does this suggest that this tuner has defective circuitry? If so, which circuit would most likely be involved? What suggestions can you offer to ascertain the cause of such drift in a new tuner that should have no drift according to the advertisements relating to it? What steps are necessary to improve the situation?

I was led to believe that with this tuner there would be no drift even from a cold start. The tuner has operated perfectly in all other respects.

I know that I should have notified the manufacturer of this defect during the warranty period, but I failed to do this and it is too late now. Edgar E. Hamer, M.D., Downey, California.

A. The drift of which you wrote is caused by improper temperature compensation—at least that is the most likely possibility. When a tuner warms up, the gradual buildup of heat causes expansion of the elements of the oscillator tuned circuit. This leads, in turn, to a change in circuit capacitance. The amount of this change will determine the drift of the particular circuit. To add to this, heating of the tubes (particularly the oscillator tube) will cause a change in interelectrode capacitance. This capacitance forms a part of the tuned circuit of the oscillator and, therefore, is contributory to the drift.

To offset these effects, we usually add a temperature-compensating capacitor either across the oscillator section of the variable capacitor or as the grid leak capacitor, or both. The capacitor placed across the variable capacitor should have a value of 1 or 2 mmf and should be negatively or positively compensated according to the direction of the drift.

If the oscillator frequency increases with temperature increase, it is an indication that the overall circuit capacitance decreases with an increase in temperature. To compensate for this a capacitor must be added whose value increases with increasing temperature. A capacitor designed for this purpose is said to have a positive tem-

* *3420 Newkirk Ave., Brooklyn 3, N. Y.*

PRESENTING THE WHARFEDALE ACHROMATIC SPEAKER SYSTEMS

The basic definition of "Achromatic" is: Pure. Non-colored by extraneous modulations.

During this past season Wharfedale, the name most highly regarded by music lovers and technicians in the field of high fidelity speakers, introduced the Wharfedale 60.

The Wharfedale 60 was the first shelf-sized speaker to employ the exclusive sand-filled principle which achieves rich, non-strident high notes and glowing bass without electronic, mechanical or acoustical tone coloration or false resonance.

The Wharfedale 60 was the first compact speaker system truly to meet the uncompromising standard of high fidelity performance which identifies all Wharfedale speakers.

The W60, unmatched in its field for quality of sound, has won amazing acceptance almost overnight. This success, in great measure, has been spurred by the unprecedented endorsement of qualified high fidelity dealers, everywhere.

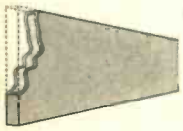
But, above all, this adds to our pride and pleasure . . . in the sweeping triumph of the W60, 74% of the new owners who returned the cards which register the Wharfedale guarantee, said that they had purchased their W60 upon the enthusiastic recommendation of a friend who had experience and knowledge of fine audio equipment.

Now, in addition to the W60, Wharfedale brings you two other achromatic speaker systems, the W50 and the W70.

In every one of the achromatic systems, the speakers and the superb, handsome cabinet perform truly as a single unit. The reproduction is a perfect image of the music as it was recorded . . . and, certainly as you wish to hear it.

Today, with the advent of the new Wharfedale Achromatic Speaker Systems, we have taken a giant step toward the goal of the perfect reproduction of the sound of music.

May we suggest that you ask your dealer to demonstrate their remarkable qualities.



The Wharfedale Achromatic Series' sand-filled panel consists of two layers of wood with a completely inert filler of dry sand between them for truer bass down to 20 cycles.

Wharfedale Achromatic W60

The original Achromatic unit, which set a new standard for complete speaker systems regardless of size or price.

True wood veneers:
Utility Model: $109.50
Unfinished $94.50

Wharfedale Achromatic W50

The lowest-priced Achromatic system. This fine speaker system is to be compared only with the others in this series.

True wood veneers:
Utility Model: $94.50
Unfinished $79.00

Wharfedale Achromatic W70

This great system is, in truth, a fine musical instrument. Its reproduction can be compared only to a live performance.

True wood veneers:
Utility Model: $149.50
Unfinished $139.50

Mail this coupon to dept. WS10
British Industries Corp.,
Port Washington, New York

Please send Wharfedale Achromatic Series literature.

*name*_____

*address*_____

*city*_____ *state*_____

Wharfedale

WHARFEDALE, A DIVISION OF BRITISH INDUSTRIES CORPORATION, PORT WASHINGTON, N.Y.

perature coefficient. Conversely, if the oscillator drifts downward with increasing temperature, it indicates that the overall circuit capacitance increases as temperature increases. This effect can be offset by the incorporation of a capacitor whose value decreases as temperature increases. Such a capacitor is said to have a negative temperature coefficient.

These temperature-compensating capacitors are available in a variety of different capacitance values and in various degrees of compensation. To illustrate, a 1-mmf capacitor would be designed to drift 0.001 mmf per degree centigrade; another might be designed to drift 0.0004 mmf per degree centigrade. The reference temperature is 20 degrees centigrade.

It is unlikely that this manufacturer failed to take this drift into account when designing your tuner. Probably one of the temperature-compensating devices in your tuner is defective.

Curing the difficulty consists of trying capacitors having various amounts of compensation until you hit upon the one which stabilizes your tuner. Realignment of the oscillator will probably be needed with the introduction of each new capacitor.

This, however, is not the only source of drift in an FM tuner. It is possible that the emission of the oscillator tube is falling off—changing as the tuner is warming up. This will cause a change in the effective interelectrode capacitance and hence lead to drift. The cure for this is to replace the oscillator tube.

Another possible source of drift stems from a weak rectifier tube. Changes in plate voltage applied to the oscillator will cause drift. Bear in mind that any thing done to an oscillator circuit will alter the frequency to some extent.

Noisy Power Transformers

Q. The power transformer on my power amplifier produces a loud and annoying buzzing sound that I assume is due to a loose lamination or winding. I cannot detect any vibration of the laminations by touching the outside of the transformer. My attempts to tighten the lamination and mounting nuts have had no effect on the sound.

I have never taken a power transformer apart and I wonder if by so doing I can locate the source of the trouble without ruining the transformer. This transformer has been in this condition since I bought my amplifier. H. H. Rosen, Montreal, Canada.

A. Some transformers are extremely noisy when they are mounted on a steel chassis because of their high magnetic fields. These fields induce voltages into the chassis which cause an attraction and repulsion between the transformer and the chassis. This condition can be cured by mounting the transformer on spacers to raise the transformer above the chassis, thereby cutting down on the attractive force between the two.

Sometimes transformers are loose because the core is not solidly held inside the coil. Frequently this condition can be cured by removing the outer shell and inserting fine wedges between the core material and

(Continued on page 100)

LETTERS

Silicon Diodes

SIR:

In his letter of comment on my Silicon Diode article, Mr. Bruce R. Kaufman brings out an interesting point.

The idea of matching rectifier diodes for use in series strings was considered, but omitted from the article for practicable reasons. Today the manufacturers of silicon diodes rate their products most conservatively, and I feel that the 1N2071 is an outstanding example. I have yet to find one of these that will not handle a 600-volt P.I.V. In fact, In was recently informed of a case where a series pair handled an 1800-volt P.I.V. for a couple of hours before one of the units failed. Perhaps a matched pair would have gone on much longer before both failed.

I still hold that the P.I.V. ratings of multiple-unit strings are additive, but I must agree that conservative operation with an ample safety margin makes good sense. It would seem to me that the integrity of the manufacturer is important, although a 100 per cent guarantee would not make sense. Given a proper design that includes a margin for safety, diodes purchased "across the counter" should display an extremely high survival rate without the need for selection.

L. B. DALZELL,
1162 Fleetridge Drive,
San Diego 6, Calif.

Cabinet Credit

SIR:

Our cabinet appeared on your July cover and also was used as an illustration for an article by C. F. Barton in August.

We are glad to see you thought enough of our work to use the pictures in each case; we would have been much happier if we had been given credit for the cabinetry.

FRANK RUSKAY, JR., President,
The Rus Lang Corporation,
123 Hurd Avenue, Bridgeport, Conn.
127 Old Dyke Road, Trumbull, Conn.

(*So would we.* ED.)

Third Speaker

SIR:

I have been reading Mr. Canby's articles on the third speaker, and in spite of his good intentions to help people he has caused more confusion than we already have. To make matters worse, the amplifier manufacturers have introduced as a sales gimmick that "connection for a third speaker." And if we further add to this the innumerable ways that have appeared in magazines of how to connect the third speaker, the confusion becomes worse yet. People are going around in circles asking if they need the third speaker and how to connect it. The whole thing is preposterous and ridiculous.

Of all the people who have stereo equipment, 99 per cent do not need a third speaker; on the contrary, what we need are phonograph records with more separation. How often does it happen that the speakers are placed 20 feet apart and the listening point is ten feet away from the speakers? That will be almost the only case where the third speaker will be necessary. This condition is very rare indeed. All the package phonographs that I have heard with a third speaker have no stereophonic effect. What little separation and spread of sound that they have had has been killed by the third speaker.

DAVID FONSECA,
High Fidelity Advisory Service
555 Notre Dame Ave.,
Chattanooga 11, Tenn.

Distant FM Reception

SIR:

In AUDIOCLINIC for January, 1960, under the label "Pulling in the Weak Ones," John J. Haner of Galesburg, Illinois, brought up a very familiar problem. His problem was that in trying to receive WFMT (Chicago), 98.7 mc, and about 150 miles to the east-northeast, he was interfered with by WHBF-FM (Rock Island), 98.9 mc, 40 miles north. During the last year, I was chief engineer at WRSB, a closed-circuit AM station at Shimer College in Mount Carroll, Illinois. We received permission to rebroadcast WFMT. Since our location is similar to that of Mr. Haner, (WFMT is 130 miles east and WHBF-FM is 50 miles southwest) we also had interference from WHBF-FM. We solved the problem quite simply, with no special equipment. We used a Sherwood tuner, a Taco 12-element broadband FM Yagi about 50 feet high and standard 300-ohm twin lead. We get interference-free reception about 95 per cent of the time; the only time we get interference is when WFMT fades out completely. Our Physics instructor got the same results with the same equipment and his antenna is about 20 feet lower. One of the other students who lives in Sterling, Illinois, (in about a straight line between Chicago and Rock Island, though a little closer to Chicago) used two six-element Yagis stacked, at about the same height as our single 12-element Yagi with substantially poorer results.

MICHAEL T. VAUGHAN,
3443 Stettinius Ave.,
Cincinnati 8, Ohio.

Tape Demonstration

SIR:

I have solved the problem encountered by J. Emmett Cade in his tape purchases, namely the reluctance of sales personnel to demonstrate stereo tapes.

My customers are welcome and encouraged to audition stereo tapes prior to purchase.

As soon as they leave the store I quickly rewrap the tapes they did not purchase in Saran Wrap. This way, everyone purchases "factory sealed tapes."

WM. DRAEGER, JR.,
RECORDING, by Draeger,
2712 16th St.,
Racine, Wisconsin

there are mixers . . . then, there are the fabulous

new CustoMixers

designed and built by OLIVER BERLINER, internationally known sound systems authority

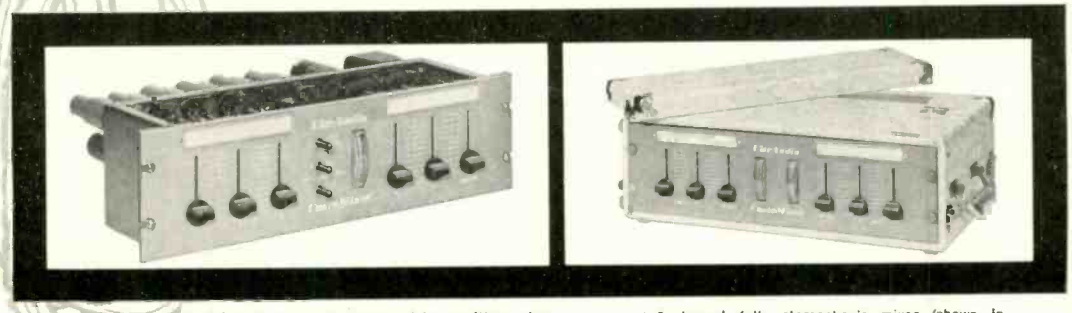
At last professional MONOPHONIC and STEREOPHONIC mixer amplifiers for Motion Picture and Public Address Systems, Broadcasters and Recordists . . . the CustoMixers incorporate features not found in any other mixers, regardless of size or cost; with quality equal or superior to anything in their price range.

The incredible UltrAudio CustoMixers,* customized because you select only the facilities needed to meet your personal requirements, are styled to compliment the most discriminating home or studio decor, and are perfect for portable* or permanent installation. All CustoMixers incorporate the amazing professional LINE-ATEN° Straight-Line volume controls and Plug-In amplifiers and transformers.

*handsome carrying case optional at extra cost.
°patent pending. * trade marks of Oberline, Inc.

COMPARE THESE EXCLUSIVE CustoMixer FEATURES:

★ Every control and indicator is **Straight-Line** for easier operation of multiple mixers and easier viewing of settings and levels.
★ All input transformers and Shock-Mounted preamplifiers plug in. Buy only those items you need. Virtually failproof . . . no need to repair; just replace in seconds and you're back "on-the-air" with a spare.
★ Plug-in accessory TONE GENERATOR. (Remove any preamplifier; plug in Oscillator to put sustained tone on the output line for level setting. Remove Oscillator; replug preamplifier.)
★ Input impedances 50 to 600 ohms and hi-z; low or high level.
★ Output impedance 50 to 600 ohms and hi-z; illuminated standard vu meter on each output line.
★ 5¼x19 inch front control panel for standard rack, carrying case or console mounting. Fused silicon rectifier power supply.
★ Separate output connection for stereo or monophonic headphones, monitor amplifier and public-address system feed.
★ Extremely light weight with easy-on-the-eyes military specification rugged finish, beige with white lettering.
★ Unique replaceable designation strips indicate use of each mix position.



Model M-5: Five independent mixing positions plus master gain control. Phono **equalizing** and **cueing** switches on front panel for mixers 2 & 3. A 60db pad switch enables mixer-1 to accept a high level, low impedance source. Single channel output.

A 2-channel fully stereophonic mixer (shown in optional carrying case) with two mix positions and a master gain control per channel. Special "MIX" switch permits all mix positions to feed both channels simultaneously with sub-master on each channel. Model D-4:

For technical and factory-direct purchasing information, write to Oliver Berliner at Dept. 2-11

UltrAudio PRODUCTS

7471 Melrose Avenue / Los Angeles 46, California / U.S.A.

CHESTER SANTON*

The symbol ✪ indicates the United Stereo Tapes 4-track 7½ ips tape number. When Mr. Santon has listened to the tape only, the tape number is listed first. Otherwise, the corresponding tape number is furnished by United Stereo Tapes.

Enoch Light: Provocative Percussion Vol. 2
Command ✪ RS4T 810
Terry Snyder: Persuasive Percussion Vol. 2
Command ✪ RS4T 808

One year has elapsed since a brand new label came on the scene with an idea that is still having repercussions in the pop record field. Late in 1959, Command Records initiated a series of percussion recordings on stereo disc that added entertainment to what, up to that time, had been the rather bleak chore of channel balancing. The idea itself was not a completely new one. Other nontechnical devices had been tried in stereo test and demo records in an effort to help the listener attain balance in response but this one really caught on. Quite a number of people in the record industry (outdistanced competitors in particular) have since been trying to duplicate the Command formula.

The formula, as practiced in this reel, calls for instantaneous switching of an instrument or group of instruments from channel to channel under conditions of rigid control—acoustical as well as electronic. Usually heard at the beginning of a selection, this is an unadorned series of mono sequences. The same device when used later in the middle of a stereo interlude loses some of its stark characteristic because the ear is slow to relinquish its memory of the stereo illusion preceding it. I was not surprised to discover that the stereo segments have better center fill than they do on disc. Tape, in this instance, undoubtedly has another and more important advantage. It should be easier to preserve the accuracy of the channel balance in the production run of stereo tape than it was in the days when most of the stereo demo discs were put on the market. Both of these reels exhibit fine balance on a system capable of delivering two equal sound channels. Given normal maintenance of the tape playback mechanism, there is every reason to expect that the tape version will hold this balance for a long time.

The Enoch Light reel is very impressive on a large system with the Terry Snyder album just a shade behind. Light uses a more varied assortment of instruments—pitting bongos against piccolo in one of many studies in contrast while Snyder relies on grouping of three or four drummers.

United Stereo Tapes has put forth its finest effort to date in the duplication of these Command tapes. On the majority of systems, these four-track reels should deliver signal-to-noise ratio almost equal to that of a good two-track job. One of my favorite two-track percussion tapes is Tito Puente's "Top Percussion" on RCA reel APS 120. If we give the reference Puente reel a score of 100 in signal-to-noise, freedom from distortion, and frequency response, then the better of these Command tapes rates a score that averages out in the neighborhood of 90.

Stanley Black: All Time Top Tongos and Music of Lecuona
London ✪ LPK 70035

It's still surprising how sparsely settled are some of the outlying areas in the catalog of four-track open-reel tapes. This is only the second commendable album of tangos to make its appearance on tape. Up till now, Audio Fidelity has had the field pretty much to itself with a reel of tangos played by Pedro Garcia. That album should have little difficulty in continuing to hold top place with tango fanciers who insist on an authentic South American atmosphere and an exceptional degree of crispness both in performance and quality of sound. Stanley Black, in this newer tape, offers a good sampling of some of the very best-known tangos . . . *La Cumparsita, Adios Muchachos, El Choclo*, etc. These are titles that have always been in heaviest demand. Black has the experience to maintain an international flavor in his fairly straightforward arrangements. (Luckily, it's almost impossible to fool around with the tempo of a tango.) The other half of the reel contains ten Ernesto Lecuona selections that include just about everything popular he ever wrote. These form the equivalent of a second complete album and may well be a deciding factor when a tape fan finds himself at a dealer's counter weighing in each hand tape's current tango repertory.

Parade Field in Stereophonic Sound
ABC-Paramount ✪ ATC 806

This is an ambitious project that attempts to recreate the atmosphere of an army parade ground as it may have sounded back in the year 1776 and as we know it in the present. Although the reel boasts some interesting touches provided by a drill team from First Army Headquarters, Governor's Island, N. Y. and the quaintness of 18th Century fife and drum music is cleverly suggested. the overall effect of the tape is diminished by a recording studio that sounds cramped by today's standards. I could be sensitive on this score after spending some time this month with the outstanding sound of the Command tapes. This recording simply isn't in the same league with the best stuff being produced today. The rifle drill provides a good expanse of unbroken sound but the bugle calls and drum rolls would have been just as effective in mono. It's the old story—individual mikes feeding individual channels that do not always add up to a cohesive pattern of sound capable of transporting the listener to the scene of the event. The longer I lisen to stereo, the fussier I become when recreating a scene outside the concert hall.

Leroy Anderson Conducts His Music
Decca ✪ ST7 8954

Tape can be quite a help when a composer takes charge of his own music. Although Arthur Fiedler and Frederick Fennell have had their share of fun with most of the Anderson light classics featured in this recording, I've always entertained a slight preference for the composer's approach. I wouldn't attempt to dispute the fact that Mercury has placed at the disposal of Fennell's orchestra far more ebullient sound than Anderson has received from Decca on his disc recordings. With the appearance of this tape, the composer finally gets the break he has needed to put him out front on every count. The orchestra heard here is considerably smaller than Fiedler's Boston Pops. The engineers work in close for maximum detail. (Note the "boinngg" of the snapped spring at the end of *Syncopated Clock*.) There is no contest between disc and tape in this instance. If you like Anderson's music, don't settle for less than this reel.

The Best of (Peter) Sellers
Angel S 35884

Wackiness has had its share of supporters throughout the English-speaking world even before the word came into general use. The most recent explosion of same in the entertainment world has occurred in British comedy films. It centers on a one-man acting academy named Peter Sellers. Not too long ago, moviegoers in this country could take their choice among five Sellers pictures playing here simultaneously. His talent in mimicry is more than sufficient to put him in a class with the old master, Alec Guiness. Although a good deal of the material on this record is primarily aimed at the listener in the mother country, all of it will be seized by confirmed Sellers fans over here. The several spoofs of "rock-n-roll" are the most accessible items on the record. Lavish use of splicing enables Sellers to play a variety of roles in the same sketch. This, incidentally, is one of the rare humor records that requires stereo for optimum effect. At one occasion, Sellers is heard at three distinct locations in the studio as he impersonates an old-maidenly press interviewer, a somewhat shady Major who operates a school for would-be rock-n-rollers and finally one of the Major's less-than-poised pupils. Other good items include a wonderfully befuddled political speech and a truly deadly take-off on a British radio program offering a round-table discussion by critics of art, films, and books. The meticulous work of the staff engaged by Sellers shows up neatly in the job they do in a movie travelogue. The selection of background music and its editing reveal as many virtuoso touches as Seller's dead-pan delivery of the script. Highly recommended as a change of pace from our native nightclub-oriented comedians.

Stereo Dialogue For Brass
Columbia CS 8290

A stereo brass choir receives the key assignment in this novelty record. Columbia has gone to the trouble of evolving an idea that forms a plausible excuse for the severe separation demanded these days by the novelty-minded customer. Twelve tunes by Rodgers, Berlin, Porter, Loesser, Loewe and others, usually heard as male-female duets, were selected for performance by a bunch of trumpets in the right channel and a group of trombones in the left channel. The Lew Davies' arrangements call for extensive use of mutes and cups by the brasses in simulating the dialogue. To maintain an impartial element in the rhythm, each channel has its own guitar. Vibes, xylophone and bass share the center area. Drums and percussion, for a change, have been relegated to the background.

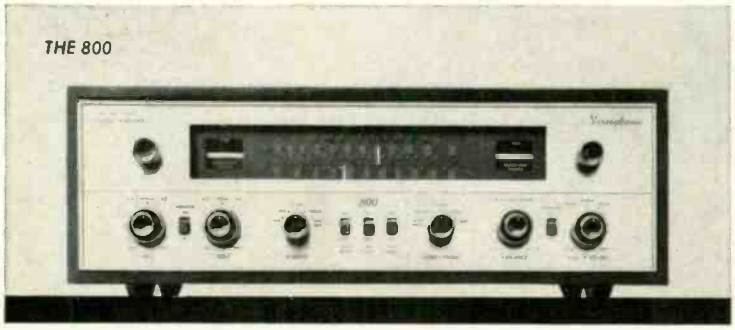
Finian's Rainbow: Original Cast of 1960 Broadway Production
RCA Victor LSO 1057

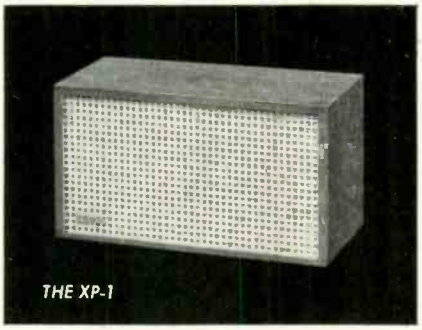
Finian is back on records with a new set of colors in his rainbow. Most, if not all, of the credit for whatever interest this new album will arouse goes to the added presence of stereo in a 1960 revival of a favorite of the 1947 Broadway season. The original cast recording of the earlier production (Columbia OL 4062) is still available in mono and will probably remain the choice of all serious fans of our musical theatre. The first cast of a fantasy as beguiling as Finian's Rainbow is bound to sound the only right one for the score. Since this holds true in the theatre, no one will be surprised to encounter the same situation on records. Listeners who don't have fixed ideas on the sound of songs by Irish leprechauns will take easily to this stereo produc-

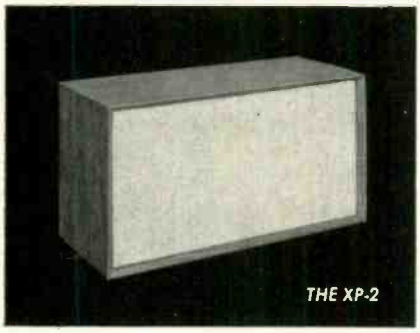
(Continued on page 94)

* *12 Forest Ave., Hastings-on-Hudson, N. Y.*

Now! You Can Choose the Stereo System That Meets Your Requirements EXACTLY!







THE FISHER

Stereo FM-AM Receivers and Speaker Systems

THE FISHER 800

■ *Twice as sensitive* as any competitive stereo receiver in the world—and easily the *most powerful!* Includes the identical Golden Cascode FM front-end used by broadcast stations. AM signal of FM calibre. 24 controls and switches for *unlimited flexibility!* 60 watts of distortion-free music power! **$429.50**

THE FISHER 600

■ The world's *best-selling* stereo receiver! *Says HF Reports:* "The performance of each portion of the 600 is of top calibre." Has extreme-sensitivity tuners. Music power: 40 watts, free of distortion. 22 controls and 15 connections for every application, including center channel! 22 tubes, two matched diodes. **$369.50**

THE FISHER XP-1

■ The revolutionary XP-1 offers big-speaker performance—high compliance *plus* high efficiency—in a bookshelf enclosure! The XP-1 is *92% more efficient* than the best conventional ring magnet speakers! Response: 30 to 18,000 cps. *In Unstained Birch,* **$124.50**
Mahogany, Walnut and Cherry, **$129.50**

THE FISHER XP-2

■ The new XP-2 utilizes the revolutionary design principles of the XP-1, but in an even *more* compact enclosure! Gives top-quality performance even with amplifiers rated as low as *10 watts!* Frequency response: 35 to 15,000 cps. *In Unstained Birch,* **$79.50**
Mahogany, Walnut and Cherry, **$84.50**

FISHER RADIO CORPORATION • 21-29 44th DRIVE • LONG ISLAND CITY 1, N. Y.

AUDIO ETC.

Edward Tatnall Canby

1. THE IN-BETWEEN AREA

The toughest sort of evaluation any of us must make, in this day of all-out superlatives and dangling comparatives, is that which passes some sort of judgment on the in-between equipment which—to use two negative-type phrases—is built to a price, designed for a market. When everything is better than ever, when nothing less than the finest is ever admitted in print, how are you going to talk about something that's good but maybe not best—good in its own terms?

Ah for the days when verbal padding was merely nominal! I remember with nostalgia when there was a "standard" Chevrolet and a "standard" Ford, actually so designated, that were indeed nothing worse than a slightly substandard, stripped-down and using last year's body shell. The actual standard models, in those days, were merely called de luxe, a very mild sort of exaggeration compared to ours.

So great is our current linguistic rate of inflation that the only kind of stabilization possible, in describing either top or bottom value categories, is strictly dynamic; you must upgrade the entire set-up each year by at least one category. Thus awhile back Ford introduced a fancy model in the top bracket called Fairlane. Couple of model-years later, Fairlane had slipped down and there was something new on top —Fairlane 500. That held for a while, then everything slipped again and we had Fairlane 500 Galaxie on top, the others demoted downwards, as befits their dynamic decline. Pretty soon, if it doesn't just disappear, the Ford Fairlane will hit the economy bottom of the line (*It has already, in the 1961 line.* ED.)

Now, my friends, we have a four-cylinder 1961 Pontiac, actually advertised as shorter and narrower than the wider-track, longer-look triumphs of recent eight-cylinder progress! One cylinder does the work of two—and we're right back to 1924 or so when, if I'm right, Buick still built a four-cylinder Buick, a highly desirable economy model with prestige and quality to go with it. *What* is going on?

And so, on to hi fi and my problem, which is to say useful things about a small group of products that are neither the best nor intended to be the best. Puts me on a dreadful linquistic spot, you see. How'm I going to describe the darned things? I'll be as dynamic as I can.

Granco FM Tuner

First a product I took on a dare—my own. The little Granco FM tuner is an item that to my mind falls into an extremely interesting and very important sales and consumer area, that which straddles our present mass-production (retail) and component (audio fan) spheres with all that this implies in manufacturing techniques, parts versus wholes, and, especially, sales and distribution. The item which follows below, the Pilot PSV-3 speaker, falls into a similar category and is similarly interesting, at a somewhat higher price level.

I took a look at the little Granco tuner because it sells for slightly under $20. Crazy! Impossible! Nobody can sell a workable tuner these days for that price, I thought to myself. If they do—and Granco does—then what is it like?

How far could such a gadget go towards meeting hi-fi minimum standards, since it is physically an actual component in its own right? It must, of course, play "into" something, an amplifier-speaker system; it could be a genuine hi-fi component rig. But then again, it could also play nicely into a table model AM radio, or a portable phono. How would it perform in this case, i.e., in comparison to mass-produced FM equipment as built into standard small radios? Two standards of comparison, you see, and they were miles apart.

I am always aware, in the back of my mind, of the violently different standards of acceptably "good" performance that exist from one household to another in our big country. I can go along with the differences myself, often enough. I understand the good points of much mere appliance-style home sound equipment. I can enjoy Beethoven on a transistor pocket radio, and so can any musician. It all depends.

For instance, my standard home AM radio, that sits in the kitchen or on the breakfast table, is a truly superb plastic job built by Admiral well before the war and bought new at that time by some vague member of my family. We've sort of passed it around ever since and its early history is lost in time's distant mists. It may have been repaired in the past, but not since I've been using it, which is maybe ten years. It has no AVC and when center-tuned on any station it produces no highs (off-tuning brings out a bit of crispness along with the static). But, long ago, my brother had a phono input installed, a plug with a switch. I could (but didn't) just plug my little Granco into that socket, and I'd have FM-AM by Admiral-Granco. Could Granco stand up to Admiral?

Well, yes as to performance. Admiral's AM set picks up all the New York city stations with its own flat-coil antenna (highly directional). It's a.c.-d.c., of course. In the city, I can't get any AM station further out than nearby New Jersey. Granco's FM tuner, in the city, similarly picks up all the local FM outlets, pretty much parallelling the AM lineup. It, too, is limited to city transmissions, via its unobtrusive single antenna wire, which need merely be pulled a bit away from the set for good results without even having to be stretched taut in a straight line. The Granco is a.c.-d.c., too.

Whether Granco's FM tuner will still be pulling them in around 1980 I'm not in a position to say. Admiral has the advantage of seniority here. But I must report that I'm running into mild FM tuning trouble already, undiagnosed but familiar. The tuning knob is rubbery; tune one direction and you get a station, tune the other way and it isn't there. The rubbery effect, I fear, is on the increase, but it may be a minor and correctible fault. (I'm out of an assistant, again. Will have to wait to check—but so would you, if you had run into this trouble as an "Average Home Buyer.")

In the country, my old Admiral gets the expected heady jumble of a million-and-one AM signals, overlapping and static-ridden. What else, when you are in the crowded East but nowhere near a strong outlet? In the same spot, my Granco got just one FM station, a local outlet in a small town a ways off. What more could you expect, with no station nearer than around forty miles? At least there was no static.

My Admiral is reasonably definite as to where on the dial a given strong AM station is best tuned in—sideband highs included, i.e., there's one peak tuning spot. My Granco wasn't so sure. It acted, indeed, like the earliest and pioneer low-cost FM tuner, the original Pilotuner of 1946 or so, tuning a succession of "humps" with no very clear indication (to the average and uninformed user) as to which "hump" would be best. This was, I gather, an effect associated with the ratio detector circuit used in the old Pilotuner. Maybe it's the same here—I am not investigating at the moment.

I tried a couple of diabolical tricks, on the other side of the fence, to put all this further into hi-fi perspective, too. At $20 or so this tuner clearly isn't intended to match up with a couple of hundred dollars' worth of component equipment (here we go, calling spades spades). And so, natch, I tried it immediately. Well, given a good FM signal, as in the city, the Granco tuner produces a fairly good sound via my system, entirely listenable though noticeably less perfect than the sound of the same FM stations via, say, a $150 tuner. I'm not analyzing, but remember that the basic FM advantage of low static and a steady interference-free signal applies here and is still a virtue, even at $20. The sound as I heard it was perhaps a bit distorted but not unpleasantly so; it seemed, rather, to lack response at the outer ends and it was a bit wavy in the linearity—there was a slightly hollow sound, as of a cavity resonance (but, I suppose, in electronic terms). Not bad at all—and of course a far better sound than emerges from my faithful AM set, out of its own little speaker and amplifier.

One more trick, that didn't work, I have my well-tried FM/Q antenna on my roof in the country, now complete with a blind rotator. (The meter went on the blink in a thunderstorm and I rotate by guess-and-deduce now. It works OK.) How about attaching Granco's other end to this fine bit of hi-fi equipment? But I needed a dipole connection and the tuner had only one antenna lead. Its a.c.-d.c. My then new assistant (who has had to give up, due to lack of time) took over and applied a second antenna lead, via a capacitor to protect me from fuse blowing and shock on the hot side of the set.

Well, it was a nice idea but so far it has got me nowhere. In fact at this point the little Granco produces nothing but a loud buzzing sound, whatever antenna I use. Something is wrong somewhere. I did, however, discover that the fancy FM/Q antenna would add two or three stations to the one-station maximum previously experienced. That was all.

The factors involved are too much for

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

- Exclusive advanced systematized engineering
- Latest and finest quality parts
- Exclusive "Beginner-Tested" easy step-by-step instructions
- Exclusive TRIPLE quality control
- Exclusive LIFETIME guarantee at nominal cost

IN STOCK — Compare, then take home any EICO equipment — right "off the shelf" — from 1500 neighborhood EICO dealers throughout the U. S. & Canada, most of whom offer budget terms.

HF81 Stereo Amplifier-Preamplifier selects, amplifies, controls any stereo source & feeds it thru self-contained dual 14W amplifiers to a pair of speakers. Provides 28W monophonically. Ganged level controls, separate balance control, independent bass and treble controls for each channel. Identical Williamson-type, push-pull EL84 power amplifiers. "Excellent" — SATURDAY REVIEW. "Outstanding . . . extremely versatile." — ELECTRONICS WORLD. Kit $69.95. Wired $109.95. Incl. cover.

HF85 Stereo Preamplifier: Complete master stereo preamplifier-control unit, self-powered. Distortion borders on unmeasurable. Level, bass & treble controls independent for each channe. or ganged for both channels. Inputs for phono, tape head, mike, AM, FM, & FM-multiplex. One each auxiliary A & B input in each channel. "Extreme flexibility . . . a bargain." — HI-FI REVIEW. Kit $39.95. Wired $64.95. Incl. cover.

New HF89 100-Watt Stereo Power Amplifier: Dual 50W highest quality power amplifiers. 200W peak power output. Uses superlative grain-oriented steel output transformers for undistorted response across the entire audio range at full power, assuring utmost clarity on full orchestra & organ. 60 db channel separation. IM distortion 0.5% at 100W; harmonic distortion less than 1% from 20-20,000 cps within 1 db of 100W. Kit $99.50. Wired $139.50.

HF87 70-Watt Stereo Power Amplifier. Dual 35W power amplifiers identical circuit-wise to the superb HF89, differing only in rating of the output transformers. IM distortion 1% at 70W; harmonic distortion less than 1% from 20-20,000 cps within 1 db of 70W. Kit $74.95. Wired $114.95.

HF86 28-Watt Stereo Power Amp. Flawless reproduction at modest price. Kit $43.95. Wired $74.95.

FM Tuner HFT90: Prewired, prealigned, temperature-compensated "front end" is drift-free. Prewired exclusive precision eye-tronic® traveling tuning indicator. Sensitivity: 1.5 uv for 20 db quieting; 2.5 uv for 30 db quieting, full limiting from 25 uv. IF bandwidth 260 kc at 6 db points. Both cathode follower & FM-multiplex stereo outputs, prevent obsolescence. Very low distortion. "One of the best buys in high fidelity kits." — AUDIOCRAFT. Kit $39.95*. Wired $65.95*. Cover $3.95. *Less cover, F.E.T. incl.

AM Tuner HFT94: Matches HFT 90. Selects "hi-fi" wide (20-9000 cps @ −3 db) or weak-station narrow (20-5000 cps @ −3 db) bandpass. Tuned RF stage for high selectivity & sensitivity. Precision eye-tronic® tuning. "One of the best available." —HI-FI SYSTEMS. Kit $39.95. Wired $65.95. Incl. cover & F.E.T.

FM/AM Tuner HFT92 combines renowned EICO HFT90 FM Tuner with excellent AM tuning facilities. Kit $59.95. Wired $94.95. Incl. cover & F.E.T.

AF4 Economy Stereo Integrated Amplifier provides clean 4W per channel or 8W total output. Kit $38.95. Wired $64.95. Incl. cover & F.E.T.

HF12 Mono Integrated Amplifier (not illus.): Complete "front end" facilities & true hi-fi performance. 12W continuous, 25W peak. Kit $34.95. Wired $57.95. Incl. cover.

HFS3 3-Way Speaker System Semi-Kit complete with factory-built ¾" veneered plywood (4 sides) cabinet. Bellows-suspension, full-inch excursion 12" woofer (22 cps res.) 8" mid-range speaker with high internal damping cone for smooth response, 3½" cone tweeter. 2¼ cu. ft. ducted-port enclosure. System Q of ½ for smoothest frequency & best transient response. 32-14,000 cps clean, useful response. 16 ohms impedance. HWD: 26⅜" x 13⅞" x 14⅝". Unfinished birch. Kit $72.50. Wired $84.50. Walnut or mahogany. Kit $87.50. Wired $99.50.

HFS5 2-Way Speaker System Semi-Kit complete with factory-built ¾" veneered plywood (4 sides) cabinet. Bellows-suspension, ⅝" excursion, 8" woofer (45 cps. res.), & 3½" cone tweeter. 1¼" cu. ft. ducted-port enclosure. System Q of ½ for smoothest freq. & best transient resp. 45-14,000 cps clean, useful resp. 16 ohms.

HWD: 24" x 12½" x 10½". Unfinished birch. Kit $47.50. Wired $56.50. Walnut or mahogany. Kit $59.50. Wired $69.50.

HFS1 Bookshelf Speaker System complete with factory-built cabinet. Jensen 8" woofer, matching Jensen compression-driver exponential horn tweeter. Smooth clean bass; crisp extended highs. 70-12,000 cps range. 8 ohms. HWD: 23" x 11" x 9". Kit $39.95. Wired $47.95

HFS2 Omni-Directional Speaker System (not illus.) HWD: 36" x 15¼" x 11½". "Fine for stereo" — MODERN HI-FI. Completely factory-built. Mahogany or walnut $139.95. Blond $144.95.

New Stereo/Mono Automatic Changer/Player: Jam-proof 4-speed, all record sizes, automatic changer and auto/manual player. New extremely smooth, low distortion moisture-proof crystal cartridge designed integrally with tonearm to eliminate mid-range resonances. Constant 4½ grams stylus force is optimum to prevent groove flutter distortion. No hum, turntable attractions, acoustic feedback, center-hole enlargement. Only 10¾" x 13". 1007S: 0.7 mil, 3 mil sapphire, $49.75. Incl. F.E.T. and "Magnadaptor."

†Shown in optional Furniture Wood Cabinet WE71: Unfinished Birch, $9.95; Walnut or Mahogany, $13.95.

††Shown in optional Furniture Wood Cabinet WE70: Unfinished Birch, $8.95; Walnut or Mahogany, $12.50.

EICO, 33-00 N. Blvd., L.I.C. 1, N. Y. A-11

Show me how to SAVE 50% on easy-to-build top-quality HI-Fi. Send FREE catalog, Stereo Hi-Fi Guide plus name of neighborhood EICO dealer.

Name.....

Address.....

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

New! 36-page Guidebook to Stereo and Mono Hi Fi... Send 25¢ to cover handling and postage.

me to sort out at present—there may be something wrongly figured out. But my tentative conclusion is that a tuner of this simplicity, not more sensitive than is needed in most city areas where FM stations are close at hand, simply can't be expected to produce quantities of stations in the distant "fringe area" even with the help of a fancy antenna. This is strictly a big-city tuner.

Again—what more can you expect?

And yet—believe it or not—my general feeling is favorable towards the Granco, with reservations. It can do what it ought to do at the price. It is nice looking, compact (about four by six inches, neatly framed in gray plastic, with tuning and on-off knob, no pilot light, no volume control). It's lightweight and simple. It is an honest piece of component-type equipment in the non-component area, where such enterprise is rare and sorely needed, where a few more simple, low-cost, genuine components could do a world of good in educating the mass public to the component idea itself—in this specific case, a tuner instead of just "a radio."

My reservations on Granco, then, do not have to do with ideal performance as such. The unit can at best do as much as it might be expected to. But I do feel that any piece of equipment, at any price—well, anything over five bucks—should be designed to operate in a stable and reliable fashion, within its area. The AM set has been doing it for darned close to a quarter century. I think that with a bit more polishing and stabilizing, the Granco FM tuner might well turn out to be a highly useful piece of equipment, in its rather unusual niche in the total picture. Now if I can just find out why it's producing nothing but that loud buzzing sound. . . .

Pilot PSV-3

And so we turn to another product launched into the in-between zone, between the component, audiofan area and the "mass-produced" appliance market. Pilot, I must remark at once, has been very much interested in this area for some years and, indeed, has been busy launching an assortment of interesting products that split the difference between component hi-fi and straight home radio-phono equipment. In my book "High Fidelity and the Music Lover," as published in the summer of 1958, I went into detailed analysis of several Pilot music systems just on account of this very aspect—even then, they represented an interesting new move towards the one-piece appliance-type machine with separately described internal components. Since then, of course, the trend has continued, with much abuse (as with those misleadingly described "peak power" amplifier ratings in home equipment) but also with considerable useful progress.

Pilot's little PSV-3 speaker, of which I got (unknowingly) a hand-assembled prototype, fits squarely into this picture. It sells at a relatively solid price mainly through the so-called "music stores," the retail appliance dealers who purvey TV, radios, portables, and a very limited quantity of hi-fi componentry.

Limited, of course, because of harsh economic fact. These stores sell generally at a much higher mark-up than the component outlets. To sell through this distribution channel you must thus produce equipment at a remarkably low manufactured cost if it is to have any sort of home value at all. America still loves its music stores and the big companies still can mass-produce low-priced equipment via this time-honored arrangement, to sell on the local scene. But can a real hi-fi component honestly be designed to fit into the same sales system?

To put it more specifically, how about a separate component loudspeaker system that might bridge the frightfully large gap between the flimsy "detachable" hi-fi speakers nominally supplied with most home stereo sets and the relatively huge, heavy, high-quality bookshelf models selling in the hi-fi component area? A tough design problem, let me tell you, but this is Pilot's area of interest and this, I gather, was their intention, mark-up or no.

Now right away you'll want me to tell you how the PSV-3 compares with a KLH, or something. I can tell you, but in all honesty I think the comparison with any component-type speaker must be a qualified one in view of Pilot's intended distribution and sales. The comparison, if you wish, must be two-way, with quality hi-fi componentry and also with the appliance-type retail equipment that will be the main competition.

In any case I had to wait for my own evaluation. As you might guess, my prototype hand-assembled models turned out to be atypical. Pilot sent their expert over to fix them, in line with production standards, since set up. But even before this I had come to enjoy the speakers in other respects.

The PSV-3—most people will want a pair—are of a size and construction that should prove extremely handy in plenty of homes, quite aside from questions of marketing and comparative sound. The little speakers are in each dimension only about half the size of the now-conventional bookshelf speaker of similar shape. They are truly bookshelf, these, but they can also sit or stand neatly on a table or on the floor. They are correspondingly modest in weight, easy to move and carry, taking little room in your compact's trunk or back seat. A nicely finished cabinet, obviously well made, solidly sealed up in back with an open plastic grill material in front (part of the acoustic system) makes an immediate appeal to the eye—my eye, anyhow. These boxes are clearly worlds ahead of the semi-cardboard affairs that often enclose the usual "detachable" stereo speakers.

Don't forget, in this connection, that the great fight for legitimate stereo, *stereo from separated-and-equal sound sources*, is not yet half won. Keep in mind that the public is still dismally confused as to stereo's values, how it should be set up, where there can be compromise and where there cannot. It seems to me that even if Pilot's little speakers sounded no better than the cardboard "detachables," their size, convenience, good looks, and solid furniture construction should nevertheless be an immediate stimulus in the right direction for the buying general public. More speakers of this sort are needed if we are to woo the supposedly adamant lady of the home into allowing two *separated* sound outlets in her precious living room.

And how *do* they sound, these Pilot PSV-3s? My first try was disappointing. The highs were shrill and strident, overbalancing the bass end (which tends to make even clean highs sound distorted to the ear). Turning down the tone controls on my amplifier rolled off the highs, a moderate bass boost helped the balance further, and with this not-so-legitimate tinkering I managed to get a balanced sound, though I still could hear the unpleasant highs, muted by the tone control. Not so good.

But remember that these were the handmade, nonstandard prototypes. (Why do we evaluators always get sent nontypical

early models? Manufacturers' over-eagerness, quite legitimate on the part of any enthusiast for his brand new production.) The Pilot man duly arrived and went to work on the prototype speaker. There are three interrelated cone speakers in this unit, a woofer, a concentric mid-range and a small cone-type tweeter.* The hookup is elementary, using simple impedance values to shunt the proper frequency range to each. Somebody had goofed; there was a wrong capacitor or resistor (I forget just what) and the small cone-type tweeter, 3-inch if I remember, was eating up too much of the signal. Too loud. A replacement fixed it in a few moments, reducing the tweeter volume to par.

Now this, of course, nicely explained why I couldn't get the same results via amplifier roll-off. Simple—but who would think of it? If you'll envision the performance-level of the three cone speakers as like three steps, let's say escalator steps, level at the top of the escalator rise, you'll understand me. Flat. (To be sure, in practice the steps are rounded at the edges and overlap in their "curves."

If one of those steps, the tweeter, is set "flat" but a number of db *above* the other two in level, as my tweeter was, you'll get shrill sound. But if you roll off the whole high end via your amplifier tone control you will in effect merely tip the top step over, and the middle one too. The bump between them remains, though lopsided, and so does the unpleasant sound.

On the other hand, when the tweeter unit is brought into proper balance with the middle and bass speakers, the sound is quite different and properly so. That's what happened when the PSV-3 prototypes were re-balanced to normal. A very significant improvement.

Take note, while we're at it, that this problem of "step" volume balance between speaker units in a system is by no means confined to Pilot's, nor to small systems. In fact I have been rather thoroughly bothered by the so-called "balance controls" provided on many new speakers, because I have been aware all along that the adjustments are often of this same step variety, each speaker going up or down like my step, its response "flat" at all levels of volume.

Now we are all aware that tone controls, often elaborate and multipurpose on present stereo amplifiers, are mainly intended for adjusting speaker sound to taste and to acoustics. (Some say to pickup cartridges as well, though for me this is an inadmissible thought. Cartridges, at least, *must* be flat, period.) But these amplifier adjustments are of the "leaning" variety, tipping the curve up or down; whereas the speaker balance adjustments, provided for the self-same purpose, are of the step type, each segment flat.

Or are they? To tell the truth, I'm not sure in every case that I've been involved in. It takes quite critical listening to figure it out by ear on your own, tinkering with each speaker unit in turn. Some systems, moreover, give you "step" control of the mid-range but not the tweeter; others combine tweeter and mid-range in a single balance, not usually described with candor and clarity in the instruction sheets. ("Just adjust the balance control for the most pleasing sound.")

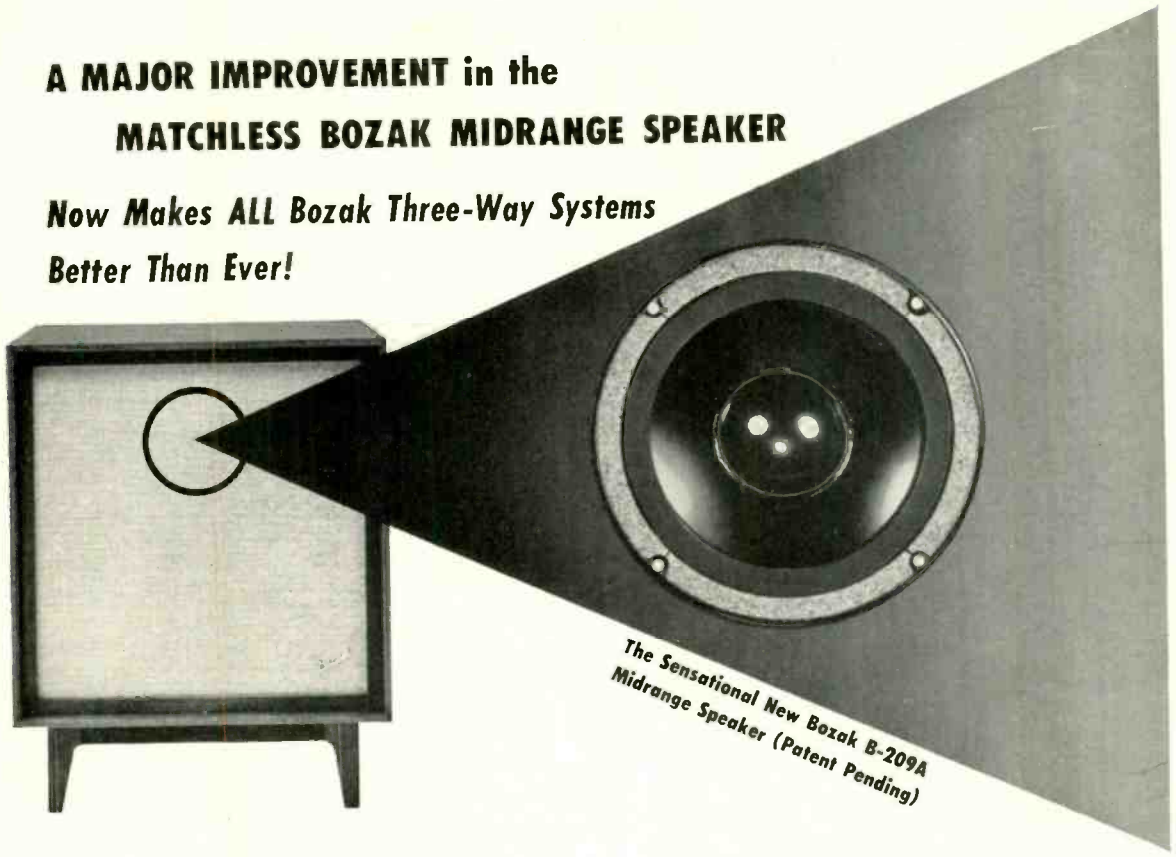
There are so many possible combinations of "step" and "leaning" (rolloff) circuitry in the speaker area that only a circuit-reader, who knows exactly what is involved, can be sure what is happening in

(*Continued on page 87*)

* See "1.02 cubic feet and 45 cps," AUDIO, August, 1960.

A MAJOR IMPROVEMENT in the MATCHLESS BOZAK MIDRANGE SPEAKER

Now Makes ALL Bozak Three-Way Systems Better Than Ever!



All Bozak Three-Way Speaker Systems now incorporate the new B-209A Midrange, featuring a revolutionary and altogether different diaphragm. The result is an overall excellence of musical performance beyond anything previously attained!

The new speaker is a radically improved version of the matchless B-209, hitherto generally accepted as the best midrange in musical reproduction. To its many exceptional qualities there has now been added an instantaneously precise transient response that is simply unequalled. The speaker retains every subtlety and nuance of all vocal and instrumental music, and must be heard to be appreciated. Ask a Bozak Franchised Dealer for a demonstration.

TO OWNERS OF BOZAK SPEAKER SYSTEMS:
Arrangements are being made with Bozak Franchised Dealers under which you can have your speakers brought up to the minute at nominal cost. See your dealer for information.

Bozak

DARIEN, CONN.

THE VERY BEST IN MUSIC

EDITOR'S REVIEW

AUDIO ENGINEERING SOCIETY CONVENTION

PROBABLY THE MOST SUCCESSFUL of all of the twelve Audio Engineering Society Conventions was held in Hotel New Yorker from October 11 to 14, with a total of almost 800 visitors registering for the combined technical sessions and the exhibits of professional equipment.

Dr. Harry F. Olson, incoming president, and for the past year, vice-president—who, traditionally is charged with the responsibility of securing the papers for the Convention—is to be congratulated for the array of 83 papers which were presented during the thirteen sessions occupying morning, afternoon, and evening of every day of the Convention except Thursday when the Annual Banquet was held.

The new officers and governors for the coming year are: president, Dr. Olson; executive vice-president, Hermon H. Scott; Central vice-president, L. R. Burroughs; Western vice-president, Pell Kruttschnitt; secretary, C. J. LeBel; treasurer, Ralph A. Schlegel; governors, Murray G. Crosby, John M. Hollywood, and Dr. M. R. Schroeder. Harry L. Bryant, the out-going president, continues as a governor of the Society, and the other governors are: William S. Bachman, Sherman M. Fairchild, Donald J. Plunkett, William B. Snow, and Edgar M. Villchur.

Frederick V. Hunt, Rumford Professor of Physics and Gordon McKay Professor of Applied Physics at Harvard University was the guest speaker with an address entitled "Needles—in the Groove or in a Rut." He referred to the "hare-brained fringe of respectability and prevailing ignorance" of its field that exists throughout the phonograph industry, and offered a cure which involves the launching, through an agency such as the RIAA, of "an industry-supported program of basic research into its livelihood" on the order of other large industries.

The John H. Potts Memorial Award, furnished annually since 1949 by AUDIO Magazine, was given to Dr. S. J. Begun "in recognition of more than thirty years of research and engineering in the science of electronics, magnetics, electrostatics, and mechanics, toward more perfect sound transmission and recording." The Emile Berliner Award was presented to Rene Snepvangers "in recognition of his contributions to fine-groove disc recording." The Audio Engineering Society Award went to Harvey Sampson, Jr., "in recognition of unstinting devotion of time and energy to the indispensable tasks of the Society."

Honorary Memberships in the Society were given to Miklos Rosza "as an outstanding composer-conductor, devoted to the new art of music especially for the medium of recording"; to Otto W. Kornei of IBM "in recognition of basic physical research in ferrite material . . . in the field of mechanical recording"; and to W. W. Wetzel for "fundamental contributions in mechanical and chemical technology toward the practical creation of magnetic recording media." Fellowships in the Society were awarded to: W. J. Moreland, Edgar Villchur, and John G. McKnight.

This is the first year that the Society has operated its Convention entirely separate from the hi-fi industry, but it has proved that the twelve-year-old organization is now thoroughly capable of standing by itself. The caliber of the exhibits was highly technical, with a wide variety of professional equipment for recording and reproduction being shown.

On the whole, the Society and those who made the Convention and Exhibit the successes they were deserve considerable credit for the fine showing throughout. We know how much work there is in such an enterprise, and everyone has apparently performed beyond the call of duty.

OPEN HOUSE IN BOSTON

In the absence of a hi-fi show in Boston this year, two New England manufacturers have announced their co-operation in providing some hi-fi "show" of their own in the form of an open house at their respective plants. These companies are H. H. Scott, Inc. and Acoustic Research, Inc. and the dates for their event are November 17–19. Both factories will be open to visitors, with plant tours and demonstrations, and engineers will be on hand to answer questions and to show how their products are constructed, tested, packed, and shipped.

To anyone who has never visited either type of plant this should be a very interesting experience. We have always been fascinated by the workings of these types of plants because the methods of making loudspeakers differ considerably from one plant to another and the testing of amplifiers and tuners in a modern high-quality electronic factory tends to demonstrate better than anything else can just how much care goes into the products we finally bring into our homes and lives. We believe that the open house idea should be followed often and by a wider segment of the industry, for most of the plants we have visited have increased our respect for the companies' products.

ERRATA

An eagle-eyed author, D. E. Johnson, has spotted two errors in his paper "The Musical Scale as an Engineering Tool," which appeared in the September issue. On page 23, the word "progress" appearing in the fifth line above *Fig.* 1 should have been "progressed," and on page 58 about half way down in the third column, the second formula should read, $\sqrt[6]{2} = 1.12246$ instead of 1.2246 as shown.

We were also advised by one reader about this same latter error. Congratulations to the eagle-eyed reader, and none at all to ourselves.

The Arm—Model 198 UNIPOISE Arm with integrated Stanton Stereo Fluxvalvet Pickup...identical to the **top-rated** Model 380A Collectors Series Cartridge. Balanced on a single pivot—friction-free for almost infinite compliance to trace the **more-difficult-to-track** groove of a stereo record—the Model 198 precisely reproduces music from mono and stereo recordings with full fidelity. **$54.00**

The Stereotable—Gyropoise 800 ... the only magnetically balanced high fidelity turntable...actually revolves on a **cushion-of-air**. Without a trace of rumble—horizontal or vertical—the Gyropoise 800 is the **perfect-mute** in a **Stereoplayer,** keeping the record in **quiet motion** at precisely 33⅓ rpm. **less base $66.00**

two...perfect for stereo

Perfect Stereo-mates for the best Stereoplayer ever!*

Silent partners...the 198 and 800 reproduce only the music in a record...perfectly...faithfully...without adding a whisper of sound. Here is responsible performance—for all who can hear the difference. From a gentle pianissimo to a resounding crescendo—every movement of the stylus reflects a quality touch possessed only by the Stanton Stereo Fluxvalvet.

LISTEN! Ask for a Pickering Stereoplayer demonstration at your Hi-Fi Dealer today!

FOR THOSE WHO CAN HEAR THE DIFFERENCE

Pickering

PICKERING & CO., INC., PLAINVIEW, NEW YORK

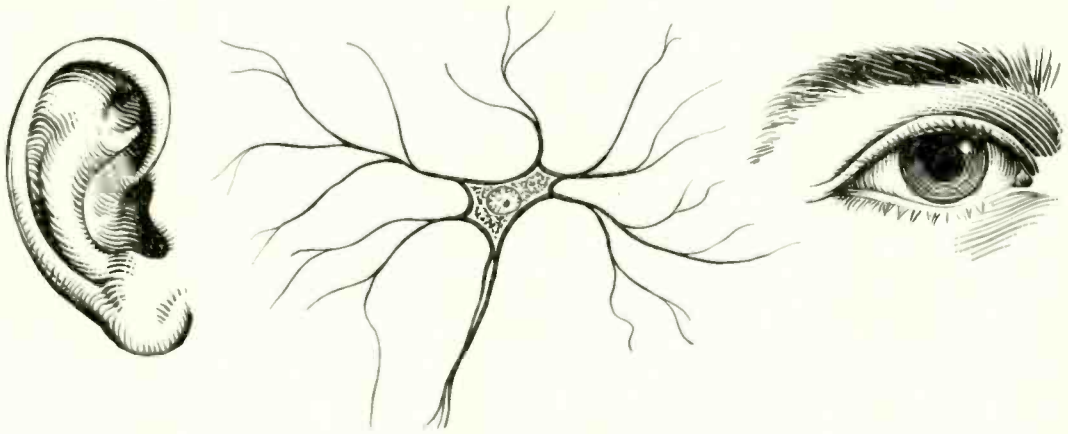
Send for Pickering Tech-Specs—a handy guide for planning a stereo high fidelity system...address Dept. B110

†U. S. Patent No. 2,917,590

*The Model 198 and Gyropoise 800 are sold separately

STEREO-MATES, STEREOPLAYER, UNIPOISE, GYROPOISE, STANTON STEREO FLUXVALVE ARE TRADEMARKS USED TO DENOTE THE QUALITY OF PICKERING & CO., INC. PRODUCTS

WHAT GOES ON HERE?



Bell Telephone Laboratories' new electronic "nerve cell" is a step toward finding out

One fascinating area of communications has long resisted exploration—what happens inside the nervous system when you see, or when you hear.

This area is of special interest to telephone science; knowledge of how the nervous system handles sound and picture signals can help determine what information is essential to perception. This in turn may lead to more efficient communication instruments and systems.

To probe the mystery of nerve activity, Bell Telephone Laboratories scientists have developed an electronic model of a living nerve cell or neuron. Consisting of transistors, resistors, capacitors and diodes, the "artificial neuron" exhibits many of the characteristics of a living neuron; for instance, "all-or-none" response and fatigue.

In one experiment at Bell Laboratories, a network of artificial neurons is subjected to a stimulus from light through a set of photocells. The network can distinguish specific patterns of light and dark, thus duplicating roughly some of the eye's basic reactions to light. Similar studies are underway to explore our hearing processes.

At present, too little is known about neural action to permit exact electronic duplication. But experiments with artificial neurons can provide suggestive clues, contributing to a stimulating interplay between electronics and neurophysiology which may help workers in both disciplines.

The human nervous system, including the brain, is the most efficient and versatile data processing system known; and data processing is an essential part of communications. The artificial neuron provides a new approach to investigating and understanding basic nerve network functions. It is a fresh example of how Bell Telephone Laboratories constantly explores new frontiers to improve America's communications system, now and in the years ahead.

Network of neurons is assembled by L. D. Harmon of Bell Laboratories, the initiator of this new research. Many kinds of assemblies are possible.

A single artificial neuron. It delivers electrical impulses when stimulated, like a living cell. Neurons are also being used for research into hearing.

BELL TELEPHONE LABORATORIES

WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT

Acoustic Matrixing—A Basis For New Loudspeaker Developments

NORMAN H. CROWHURST*

Through acoustic matrixing control is exercised over the direction of particle velocity as the sound wave leaves the speaker to achieve wide sound coverage. In application this concept provides a system with unusually fine stereo sound—from a single cabinet.

We've heard a lot about electrical, or electronic, matrixing recently, particularly in relation to stereo broadcasting. While there are some similarities in the acoustic variety we shall discuss in this article, it should be stated at the outset that it is *not* an acoustic way of doing the same thing.

In electrical matrixing, the quantities to be matrixed are scalar; voltages or currents specified completely by instantaneous magnitude and polarity. An algebraic sum and difference process will convert "left" and "right" channels into "mono" and "stereo" by this process, or vice versa.

In acoustic matrixing two additional features complicate matters: propagation and space. Not only does the original scalar quantity, converted into an acoustic wave, take *time* to reach any specific point, determined by propagation velocity and distance; the quantities themselves do not remain scalar. An acoustic wave is possessed of pressure and velocity components that are not simple counterparts of voltage and current in the electrical analog. While the instantaneous sound pressure at a point is a scalar quantity, particle velocity at a point is possessed of direction, which may *or may not* coincide with the direction in which the wave is propagating.

Spherical Waves

It seems as if, so far, most people concerned with applying loudspeakers to stereo have avoided any deliberate use of acoustic matrixing. They have utilized loudspeakers whose radiation is predominantly longitudinal and relatively nondirectional. Within certain limits, a loudspeaker with enclosed back (including bass reflexes, which are effectively closed back at most frequencies) radiates waves of a diverging spherical character.

* *216-18 40th Ave., Bayside 61, N. Y.*

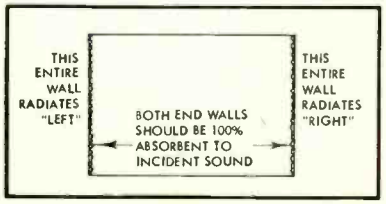


Fig. 1. A hypothetical way of achieving stereo by radiating plane waves from opposite walls of the room.

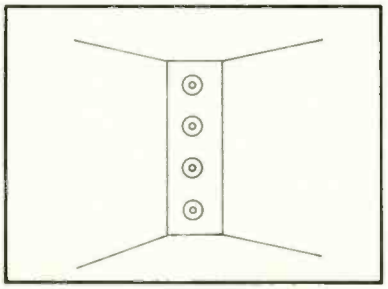


Fig. 2. A vertical line of loudspeaker units will approximate cylindrical radiation with a vertical axis.

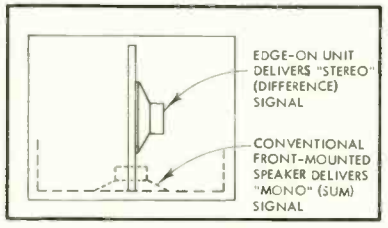


Fig. 3. Basic loudspeaker arrangement used in some of Lauridsen's experiments.

Two such loudspeakers, using a stereo (left and right) source will radiate two sets of spherical diverging waves. The stereo illusion, if it is achieved at all, is the result of the difference between the way these two sets of divergent spherical waves combine at the listener's two ears. There are certain disadvantages to this method, which account for many of the dissatisfactions experienced with stereo reproduction.

Ignoring at first the effect of reflections, the pressure and velocity due to a spherical wave decrease in proportion to distance from the source. If the listener is at a distance greater from each loudspeaker than the loudspeakers are from each other, the difference in intensity received from each will not be too great. Thus far, we might conclude that a scaled-down theater system would achieve equally good effect in a living room, throughout an area corresponding to the part of a theater occupied by the audience. But now we take into account the effect of reflections.

In an auditorium, the distances are such that the direct waves from the loudspeakers reach the listener with a perceptible lead time before any conflicting reverberant waves, wherever the listener is located. Also the difference in distance traveled by the two groups of waves is such that the direct wave maintains a substantial intensity difference above that of the reverberant ones.

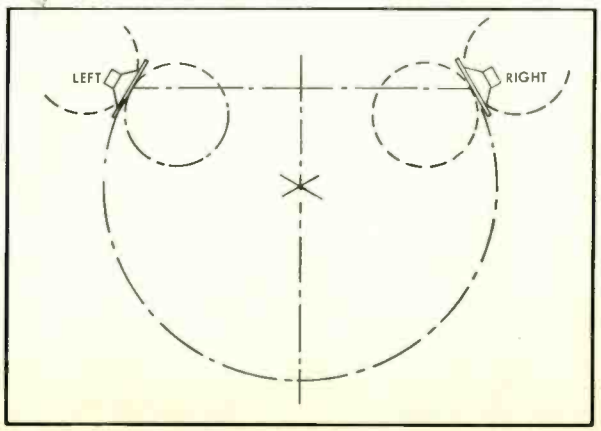


Fig. 4 Construction on which CBS "isophonic" demonstration was based: dashed lines represent polar patterns of individual isophonic units; dot-and-dash lines link points at which received intensity from the two units is equal, when they radiate equal power.

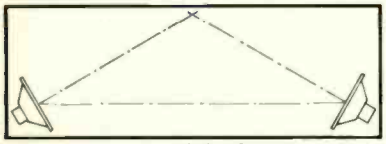


Fig. 5. Each unit will be free from transverse components only along the axis.

In a smaller room, such as more normally used for home listening, a different relationship obtains. The shorter distances serve to "catch" waves radiated in all directions from the loudspeakers, reflecting them inwards again, so the listener at almost any location hears the reflected sound with little time delay or intensity loss from the direct sound. Also the *relative* intensity difference between direct waves from each loudspeaker is apt to be more dependent on listener positioning than in the large auditorium.

This last statement is true for two reasons. To get separation, the loudspeakers need to be further apart in proportion to the major room dimensions. Consequently altering one's location can make the distance ratio from the two loudspeakers change to a greater extent.

The second reason is that spherical radiation reduces its intensity more rapidly than the direct inverse square law at first. At greater distances, both pressure and velocity diminish in inverse proportion to distance. In the shorter distance range, the velocity component of the wave decraeses in inverse proportion to the square of the distance. So deviation of effect with listening position may be even greater in small rooms.

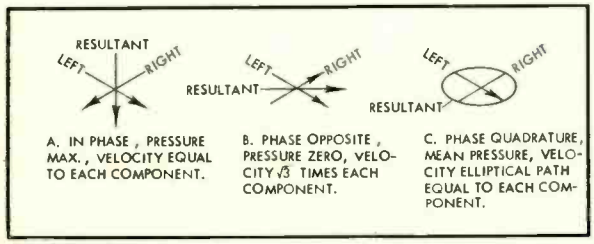


Fig. 6. At the intersection of axes (Fig. 5) the pressure and particle velocity (magnitude and direction) depend on the relative phase of signal from the two units.

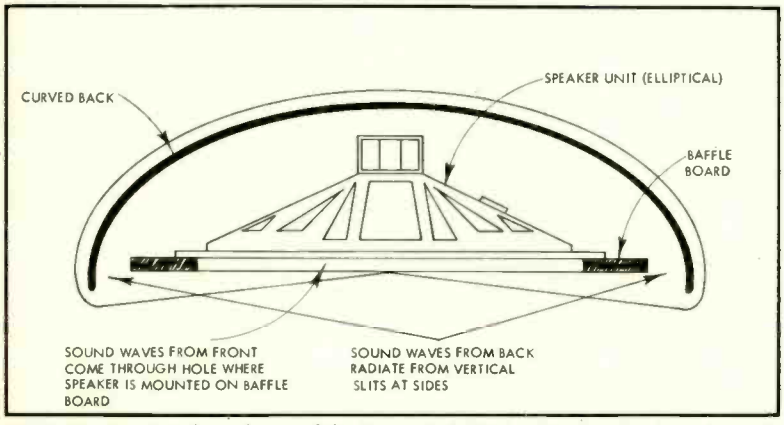


Fig. 7. Cross-section through one of the Heath "satellite" units, showing how the basic CBS isophonic is modified, physically.

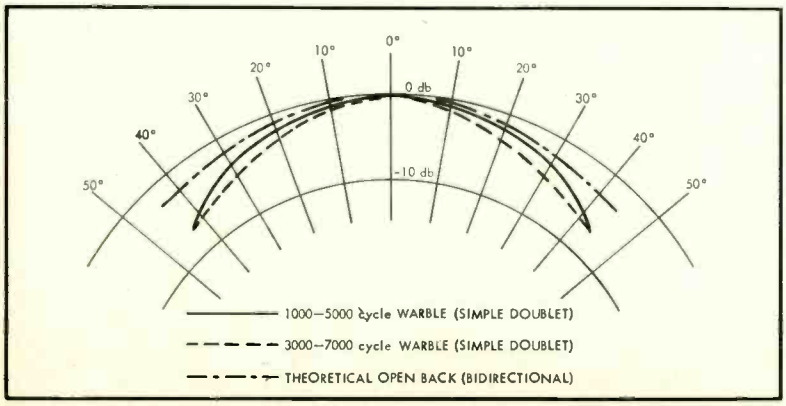


Fig. 8. Directional pattern achieved by the unit of Fig. 7. (From data supplied by Heath Company.)

Plane Waves

Some have said that headphone listening is the ideal way to hear stereo. This transmits the sound pressures directly to each ear via the short auricular canal. If the sound from each loudspeaker could be transmitted to each ear without loss or intermixing, either with sound from the other loudspeaker or with reverberation effects from the room, the stereo illusion would be improved.

A plane wave, as opposed to a spherical one, transmits sound with virtually no reduction in intensity. A hypothetical method of utilizing this form of radiation would be to have the two opposite entire walls radiate sound, each handling one channel of the stereo (*Fig.* 1). If each of these walls could also be rendered 100 per cent absorbent to waves from the other side, a very good stereo system would probably result.

However, practical wall surfaces would produce a high degree of reflection, especially to a wave striking them "full on." So, even assuming the whole wall could be rendered into one large transducer, the reflection aspect would probably negate its apparent advantage.

Cylindrical Waves

Splitting the difference, so to speak, between the spherical and plane wave, is the cylindrical wave. In a sense, this is plane one way and spherical the other. So a wave propagated from a vertical line source will travel a given distance with only half the reduction in intensity (measured in db units) suffered by a spherical wave. This will have three advantages for stereo in a normal-sized listening room.

First, the intensity of the direct wave will be greater relative to reflected reverberation components at almost any location.

Second, the difference between the intensity from two loudspeakers due to different listening locations will be reduced.

And third, reflections from floor and ceiling will be practically eliminated, because the waves do not radiate towards them. Thus the increase in ratio of the direct wave intensity over reverberant confusion is considerably increased.

One way to achieve this effect is by approximating the line source with a vertical line of loudspeaker units on each channel (*Fig.* 2). Another method approximates a similar effect by using controlled radiation, as in the Jim Lansing "Hartsfield," spreading sound horizontally and restricting it vertically.

Transverse Waves

But we still have essentially pressure or longitudinal radiations from each loudspeaker. We have not yet introduced the *piece de resistance* of this article.

At the beginning we pointed out that particle velocity at a point may not coincide with the direction in which the wave is traveling. When two radiations of the same frequency combine by intersection from widely separated sources, the particle velocity is a resultant due to both waves. Its magnitude and *direction* will vary quite rapidly with location, and beyond a simple vector sum (as does the pressure component). Even without taking reflections into account, this can become a highly complicated wave pattern at different frequencies.

The acoustic matrixing concept does not utilize the same kind of longitudinal radiation, but controls the direction of particle velocity as the waves leave the loudspeaker(s). The first experiments that deliberately applied this principle were those of Lauridsen, who used it, not for true stereo, but a form of pseudo stereo, delaying the signal fed to one of the units. The same method has been tried with M-S type stereo. In this, an edge-on unit radiates the "stereo" components, while the "monophonic" comes from a conventional pressure radiator at the same location (*Fig.* 3). In Lauridsen's experiment the same audio was fed to the "stereo" unit but with a time delay.

When used on M-S stereo program material, the transverse radiation propagated by the edge-on unit, which behaves approximately (over a limited frequency range) as a doublet sound source, combines with the longitudinal propagation from the front-on unit, to control particle velocity orientation relative to the direction of propagation at all points. The much more complicated pattern due to special separation does not build up.

At the listener's head, and in the mid-frequency range, the obstacle effect utilizes the pressure gradient coincident with the oblique-angled particle velocity to produce a pressure difference at his ears. This generates "left and right" pressure components at the respective ears.

While this method works, it has limitations too, otherwise everyone would probably be using it by now. The limitations can be seen by looking at the properties of a doublet source. First, the transverse component is strongest at the edge-on position, which becomes the front center in Lauridsen's arrangement. Moving to the side reduces the magnitude of the transverse component received from the "stereo" unit.

Second, the intensity from a transverse radiator falls off more rapidly with distance than does that from a longitudinal radiator. At short distances from the radiator, the transverse velocity is inversely proportional to distance cubed. At greater distances (more normally occupied) it is inversely proportional to distance squared. From a normal longitudinal radiator with spherical distribution, it is inversely proportional to distance squared for small distances, becoming inversely proportional to distance directly at greater distances. Thus, regardless of wavelength and distance, the transverse propagation reduces its intensity at a more rapid rate than the longitudinal components.

This means the correct stereo illusion can only be achieved over a relatively small area in front of the loudspeaker combination. If you get too close, the transverse component will be too strong (which may give accentuated separation effects!). If you get too far away, the separation will diminish, as it also will by moving to the side.

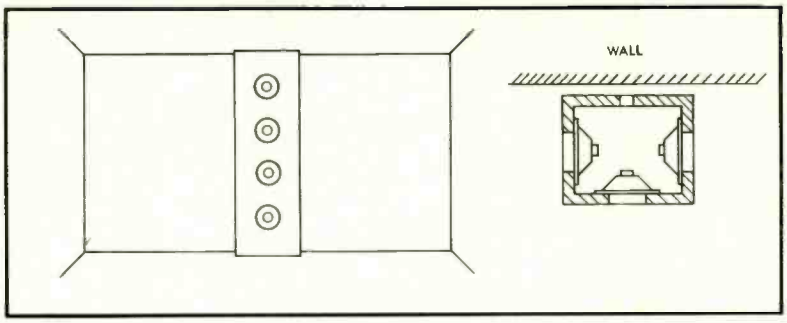


Fig. 9. The pillar of sound: (a) placement in room; (b) cross-section, showing position of speaker groups.

Widening the Control

One method of overcoming this objection uses separate loudspeakers that do utilize other than the simple transverse radiation effect. First in this group was the experimental system developed and demonstrated by CBS Labs. As there was spacial separation, this system used

(*Continued on page 77*)

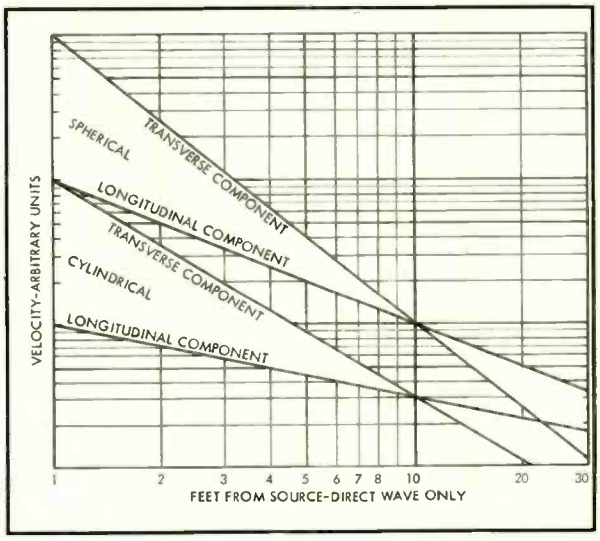


Fig. 10. Variation of velocity components with distance, using cylindrical or spherical radiation. Increased rate of change for very short distances is not shown.

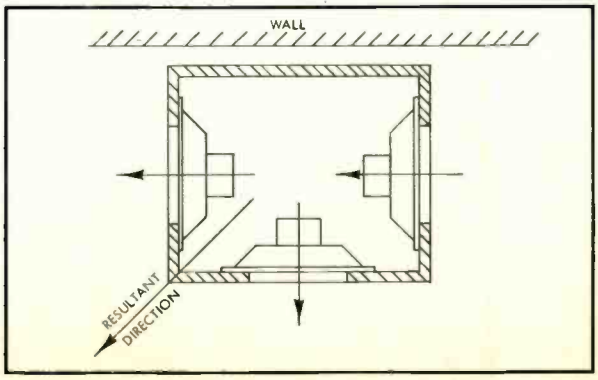


Fig. 11. Relative motion of units' cones when a signal is applied from "left" channel only—no output from "right."

An Engineer's High Fidelity System

R. A. GREINER*

We have all read about, and have seen, many decorator-oriented systems in recent years. Here is the system of an engineer who compromised appearance for the sake of the ultimate in sound.

IN TWO PARTS—PART 1

THE SYSTEM to be described in this and succeeding parts of this article must truly be called an engineers high fidelity system. It is a laboratory instrument which has not been designed to look beautiful. That is, it is not contained in a series of French Provincial cabinets. It has however a beauty of its own—that of perfection. Or, at least a degree of perfection seldom found in audio systems.

I will describe in the first part the general arrangement of the system and the details of the loudspeakers. The electronics will be described in part two.

There are fundamentally three parts to the sound system. First, we have the sources of sound and the associated equipment which is needed to change this stored information into electrical signals. Second, there is the electronics which modifies the electrical signals to suit the desires of the audiophile. Finally there is the loudspeaker system which must change the electrical signals into useful acoustical energy so that the audiofan may enjoy it.

Let us first consider the sources of sound. Live sources broadcast at the time of the performance are generally rather rare. In any case, one is then fully dependent upon the quality of the pickup, of the transmission, and of the AM or FM receiving equipment. The only control of quality that can be exercised by the listener is to use the best tuner available. (*And to write strong letters to the broadcasting station.* ED.)

The two common recorded sources are of course discs and tapes. In either case we depend upon the manufacturer to produce a high fidelity record. There are a number of modern discs which can be considered of high engineering excellence and a somewhat larger number of prerecorded tapes which fall into this category. It must be expected that the high fidelity enthusiast will make every effort to select the very best quality of source material. Unfortunately the desired choice of music and performance are not always found on the discs and tapes which are technically the best. There is some possibility that the music lover will have access to original tapes or first generation copies of master tapes. This is a most desirable position. The most avowed audiofan will make an attempt to supply himself with live recordings. This situation is the most satisfying of all in this writer's opinion. Some compromise in performance is a fair price to pay for the truly superior quality of live tapes.

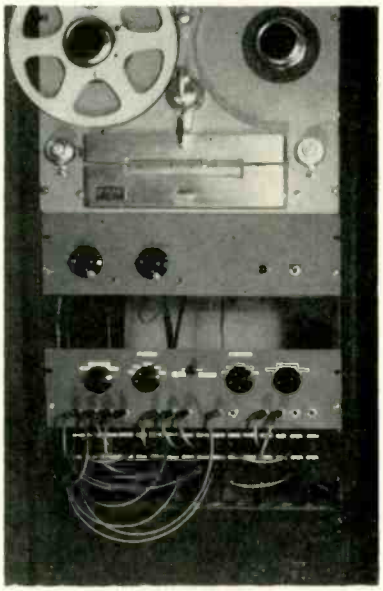


Fig. 1. This jack panel is the heart of the versatility built into the system.

Turning our attention to playing recorded source material, we find that we are dependent upon the availability of high quality turntables, pickups, and tape transports. It is indeed fortunate that there is available on the market a large quantity of very good equipment of the sort needed. The only price to be paid is, of course, the high dollar cost. The point is that the best turntables and tape transports are good enough so that they do not in any way limit the performance of the overall system. In fact there are several tape machines which sell for under $1000 which are good enough for even the most critical applications—(scientific as well as audio.)

It would seem from this writer's experience that there is still a way to go in the area of pickup improvement. While the very best pickups are good, they do not match the quality of the tapes. It may be that we are close to a fundamental limitation of the phonograph pickup and for this reason progress has been very slow for the last several years. The disc is after all a very crude method for storing information. The mechanical-electrical systems for both recording and playback are now highly refined and further progress may be expected to be very slow.

There is no doubt that tape can achieve truly superior results if the cost of the medium is not of primary concern. However it is clear that the cost of tape *is* of importance or the tape market would not be as small as it is. One can only conclude that the number of persons interested in the best quality is so small that they are not worth worrying about as far as the commercial recording companies are concerned. There is adequate evidence that this is not an idle statement. For example, tape copies can be very close in quality to the original master if they are dubbed

* *University of Wisconsin, Department of Electrical Engineering.*

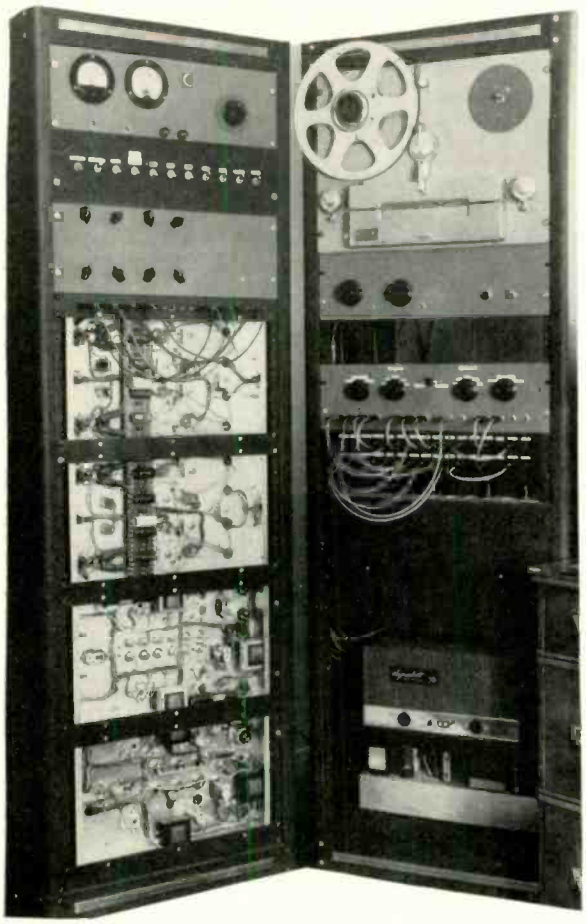


Fig. 2. Main electronics of the system with the covers removed from the power amplifier rack.

at a reasonable speed. All the same there are almost no tapes available which sound like master tapes. The reason is probably that there are few persons willing to pay the price. The recent change to four-track tapes is further proof of this.

So as not to slight the disc manufacturer, I would like to note that the sound quality of most modern discs is surprisingly good. In fact it is so good that tape may never again come to the fore. There is not much difference between a good record and a four-track tape.

Despite shortcomings in the quality of the source material commercially available, it is still worthwhile attempting to process the source signal in such a way as to not distort it any more than it already is—and thus be ready when a high fidelity signal comes along. My system for accomplishing this consists of: (1) Rondine Deluxe turntable, (2) Shure stereo and monaural pickup arms, (3) Berlant and Concertone tape recorders (4) An adequately thick pile of discs and tapes of carefully selected quality. There are many other similar pieces of equipment on the market which are about as good in quality. Certainly any of the professional tape machines are desirable.

There are some things which must be done to the source material and some things which are a matter of opinion. An individual may, it seems to me, want the orchestra to sound twice life size, or have more brilliance, or have more bass than is in fact present in the live orchestra. I shall not argue such matters but only describe a system of electronic controls which gives the audiofan rather complete control of the variables in the system. He may then use his own discretion on the matter of knob twisting.

It is relatively easy with modern feedback electronics to make controls and amplifiers which have essentially no distortion compared to the recorded sound and loudspeakers. The equipment described in this and the following parts of the article has a distortion level which is hard to measure with standard laboratory instruments. (Under 0.1 per cent total harmonic distortion and noise combined.) The power amplifiers are not quite that good but are under 1 per cent at full output.

All of the input signals from the several sources are preamplified to the O VU level and fed to the jack panel shown in *Fig.* 1. From here, the signals are plugged to the remote control amplifiers, to control amplifiers in the relay rack, or to one of the other signal processing chassis. The remote control amplifiers are located in the main listening room and allow control of the main sound system from that room. Only a single turntable and tuner are located in that room with the main speaker systems. The details of this remote control arrangement will be described in part two. After suitable control of gain, loudness, bass, and treble response, the signal is returned to the jack panel and plugged to the appropriate power amplifiers.

The main power amplifiers consist of two groups. There is the amplifier rack for the main system which is shown in *Fig.* 2. The service covers are shown removed. There are four completely independent amplifiers each of which can deliver 50 watts. A pair of electronic crossovers are located directly above the amplifiers and are arranged to drive the two main speakers with 100 watts each. An additional pair of amplifiers (Dynakit "Stereo 70") is used for monitoring in the control room. Additional single-channel amplifiers are used to drive remote loudspeakers. There is enough equipment and versatility available to handle three independent stereo channels at one time. In addition one can dub disc-to-tape or tape-to-tape at the same time.

The panel above the jack panel deserves some mention though it is described in detail in part two. It is used to control the inputs to the tape recorders. All important switching is performed on this panel along with the generation of a "third channel" made up of the sum of the program material on the two stereo channels. This channel may be fed to a third speaker in the main listening room or used to provide balanced listening at a single-speaker remote location.

Complete control of the line power for the entire system is incorporated in the power amplifier rack. The line control at the top of the rack is used mainly to insure the correct operating voltage for the tape recorders which do not at present have electronically regulated power supplies. There is a single power supply in the control rack which supplies plate and heater power to all of the control and special purpose chassis in the two racks. Thus any piece of equipment which is designed for permanent rack mounting need not have a power supply of its own.

Finally, and certainly not least, there is the main loudspeaker system to consider. The details of this system and the experimentation through which it was arrived at is dicussed in the following section. *Figure* 3 shows one of

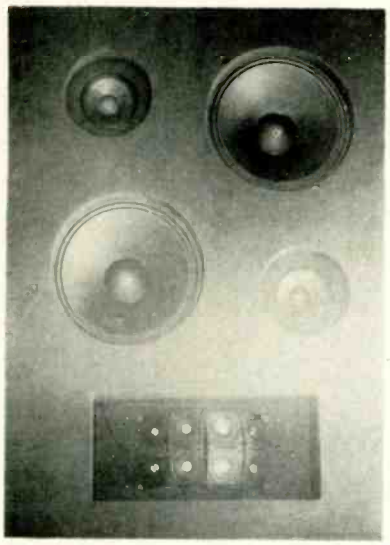


Fig. 3. Front of one of the main loudspeakers. The front panel is painted with slate-colored blackboard paint.

the main loudspeakers. There are two identical loudspeakers in the stereo setup. Each loudspeaker consists of two 15-in. woofers, two 6-in. midrange speakers, and an array of eight tweeters. A variety of smaller loudspeakers is used for monitoring and for the "third channel" of the main system.

Large Loudspeaker Systems

First let me warn you that I am an advocate of large-loudspeaker systems. There are many good reasons for my stand which are based on sound acoustical principles. I will mention several of the arguments in the following discussion of an adventure in the construction of a large-loudspeaker system.

The loudspeaker is one of the weakest links in most audio systems. There is good reason for this to be the case. One may compare progress in producing quality loudspeakers with progress in the electronic part of the system by noting that it is relatively easy to design and construct a power amplifier with a rating of 50 watts and with such a small amount of distortion that it takes the finest laboratory instruments to detect the distortion. With the loudspeaker the distortion problem is so severe that if a manufacturer could produce a loudspeaker capable of an acoustical watt of power with a distortion of less than two per cent he would be very happy. In fact, distortion is usually not mentioned at all. This should not be taken to mean that loudspeaker manufacturers are not trying very hard to make a good product, or that they are not very clever. The true difficulty with the loudspeaker part of the system is simply that it is an extremely tough acoustical and mechanical problem to change an essentially perfect electrical signal into an acceptable acoustical signal. The constant work which is going on should give us continued improvement. One must "make do" with the loudspeakers which are available.

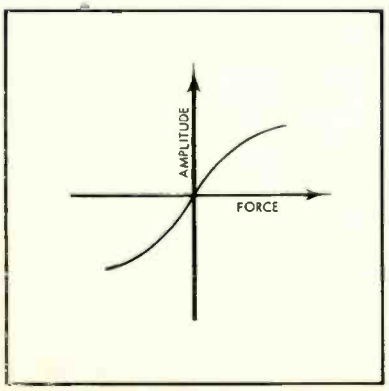


Fig. 4. The force-amplitude response of a typical loudspeaker. Note curve is linear only near the origin.

The loudspeaker is by nature a very nonlinear device. The mechanical suspension is the major nonlinear element in most loudspeakers. The force-amplitude response of a loudspeaker cone will be something like that shown in *Fig.* 4. It is clear that only small excursions of the cone about the zero position will give linear response. Thus one solution to the distortion problem is to keep the cone motion as small as possible. There are many modern loudspeakers which are reasonably linear when used at power levels well within their ratings. The only innovation in recent years has been the acoustic suspension which has a larger linear region near the origin than most ordinary speakers. Unfortunately these loudspeakers are at present made only in small sizes and with enclosures of such a size that the airload at high power-levels is not compressed adiabatically and thus some nonlinear distortion is introduced. There are other difficulties which arise when small cones are used for a wide range of low frequencies as will be seen later. In the search for high power-handling capacity at low frequencies, low distortion, uniform frequency response, and good transient response, several large-loudspeaker systems were constructed.

Over the past ten years a variety of horn-type enclosures were designed and built. Several models of a corner horn[1] were built. Eight-, twelve-, fifteen-, and eighteen-in. varieties of this horn were built with apparently good results. Horn-type enclosures are well suited to corner placement. The advent of stereo has however brought about some drastic changes in the placement of loudspeakers in the listening room. It is very apparent that the placement of the speakers in the corners of the room is not at all satisfactory. The corner of the room is the best from an acoustical viewpoint because the best coupling is obtained between the speaker and the room. If one uses a two-channel system however it is not desirable to excite the room in a uniform manner with both of the channels because the directionality of the sound sources is lost and a huge jumble of sound results. Instead, the purpose of speaker placement is to obtain a sound pattern in which distinct source areas are perceptible. The very best

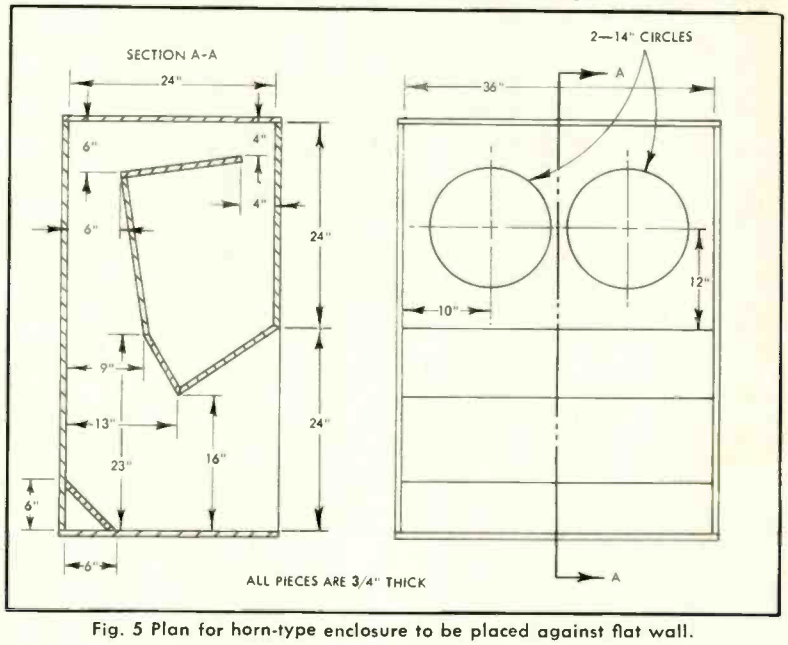
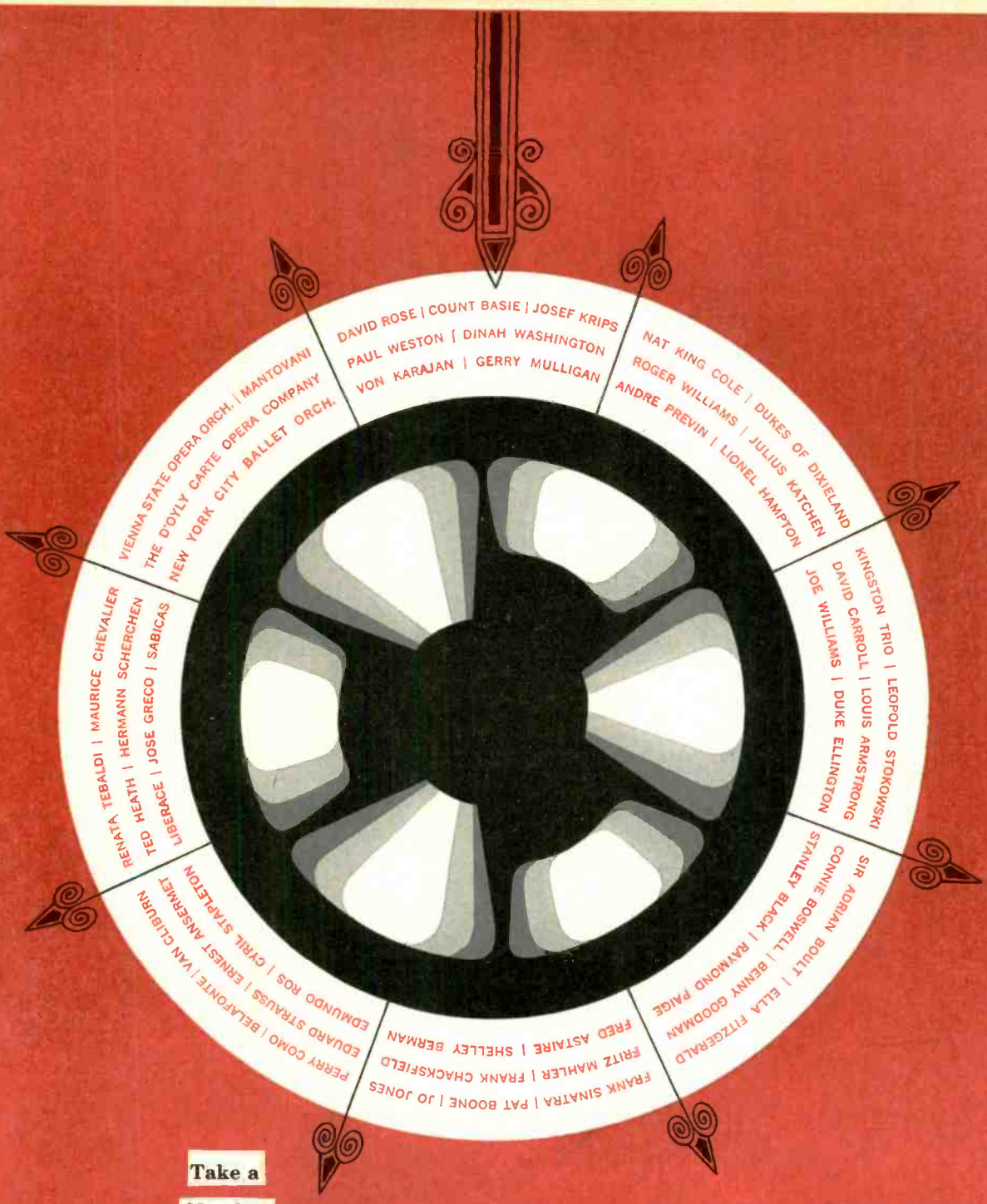


Fig. 5 Plan for horn-type enclosure to be placed against flat wall.

[1] R. A. Greiner, "A folded horn design," AUDIO, December 1956, pg. 40.



Take a Number from JAZZ to CLASSICAL

Any number... any recording artist. With 30 recording companies making more and more of their libraries available on 4-track stereo tape—you can pick your favorite musical number, recording artist or type of music from 4-track's growing list right now! And, because of the long-lasting fidelity of tape, it will always sound as good as the day you bought it. Your local hi fi salon, music store or tape machine dealer has the full story on 4-track's winning combination of quality—variety—and economy. For catalog, write: 1024 Kifer Rd., Sunnyvale, California, UNITED STEREO TAPES

MUSIC SOUNDS BEST ON TAPE / *and you can prove it to yourself... hear it*

stereo results are obtained with the usually recommended placement of the loudspeakers along a flat wall and not adjacent to other walls.

In view of the above requirement on loudspeaker placement an attempt was made to construct a horn-type system which would be suitable for placement on a flat wall instead of in a corner. The configuration chosen was a back loaded horn driven by two 15-in. woofers. The design of such an enclosure is relatively straightforward and has been used in small theater systems for years. *Figure* 5 shows the plan for the horn which was constructed. The most obvious fault of this structure is that the circumference of the mouth is only 10 feet. Without the helping effects of corner loading there is an abrupt discontinuity at the mouth of the horn and strong reflections occur at the mouth with attendent peaking of the response at the low frequency end. The requirement for smooth response for a non-infinite horn is that the mouth have a circumference greater than the wavelength of the lowest frequency to be reproduced. To obtain smooth response with a horn on a flat wall to the low audio range requires a mouth of unreasonable dimensions. Despite the indications that the horn would have seriously peaked response in the 30 to 100 cps range, it was constructed. This speaker was called the "monster horn" because everyone who saw it would say, "What a monster." The horn behaved exactly as expected. The power handling capacity was adequate with the two 30-watt woofers. The low frequency response extended to 24 cps but there were serious resonances in the 29 and 65 cps regions. While the horn was satisfactory as far as frequency response went, it was quite unsatisfactory as far as the sound went. Because of the resonances, it had the typical horn sound. There was huge bass and very poor transient response due to the driver unloading at the resonant frequencies. The sound of this loudspeaker became intolerable after only a few weeks and it was discarded. Another attack on the problem seemed essential.

The approach to the problem which finally succeeded was to use direct radiating loudspeakers. In retrospect it does not seem very surprising that this should be the case. The fact is that all of the people whom I have known for years, and who's opinions I regard as very reliable on audio systems, have ended up with direct radiating systems. Thus the type of system which I will rescribe is not at all new. However the exact combination of components and the details of the structure will, I think, be of interest.

There are several serious difficulties to be met in using direct radiating loudspeakers. Fortunately they can all be overcome with brute force methods. The efficiency of the system is very low. That can't be a real objection since it is so easy to use a high power amplifier. The main problems are acoustical in nature. The response of a loudspeaker falls off rapidly at frequencies for which the wavelength of the sound is greater than the circumference of the loudspeaker. Thus, to obtain uniform response to very low frequencies the cone must move increasingly large distances as the frequency decreases. The final result is distortion because the nonlinear suspension mentioned earlier. There is another kind of distortion, called "Doppler distortion," which occurs if the cone must move large distances to reproduce low frequencies while it is at the same time reproducing high frequencies. This latter effect is not one that the speaker manufacturer can avoid. It is a purely linear effect and even a perfectly linear suspension will cause Doppler distortion. It is in fact this type of distortion which is the limiting factor in the development of small speaker cones with very large throw. There is no doubt that a 10-in. speaker can reproduce an acoustical watt at 30 cps. There is, however, also the certainty that it can't reproduce any other frequency more than two or three octaves higher without serious Doppler distortion. The best solution to the distortion problem is to choose a loudspeaker which is specifically designed to cover a relatively narrow frequency range and to use a sufficient number of such loudspeakers in each range so that linear operation is obtained.

The low frequency end of the loudspeaker system consists of four woofers. These are 15-in. loudspeakers and are placed in two separate enclosures for use with stereo sources. The total excursion for two of these speakers, in their own infinite baffle enclosure, is about 0.1 inch for a full acoustical watt. Thus the speakers are operating very near the origin of the curve shown in *Fig.* 4 and are behaving like very linear transducers. At the same time Doppler distortion becomes negligible with the small excursions involved. Large speakers which are made specifically for low frequency operation may not be used above about 600 cps so other speaker are provided for the remainder of the range.

A midrange loudspeaker specifically designed to cover the range from 300 to 3500 cps was used for the frequencies from 500 to 2000 cps. A standard tweeter array of high quality was used for the frequencies from 2000 cps and up. Two midrange units and eight tweeters are included to match the power handling capacity of the woofers. An electrostatic array could as easily be used for the high end.

It is very important to maintain complete electrical control over the speaker system at the extremes of the operating range as well as in the midband. Both electrical and acoustical damping are needed to insure good transient response. Electrical control is especially needed if some sort of tuned port or vent is used in the baffle since this technique of obtaining low frequency response introduces resonances at the low frequencies. It is essential that a minimum number of electrical elements be introduced between the amplifier and the loudspeakers. Resistors, inductors, capacitors, pads and other junk should be avoided at all costs. For this reason, the loudspeaker

(*Continued on page 80*)

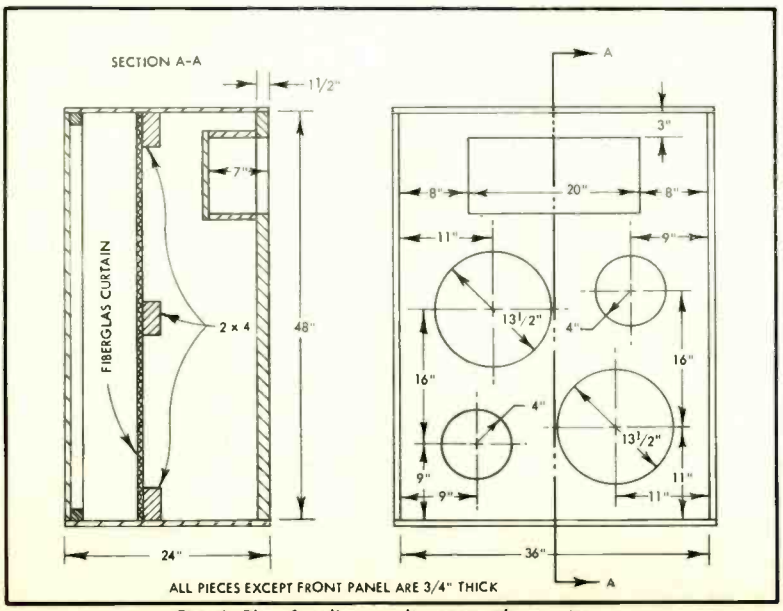
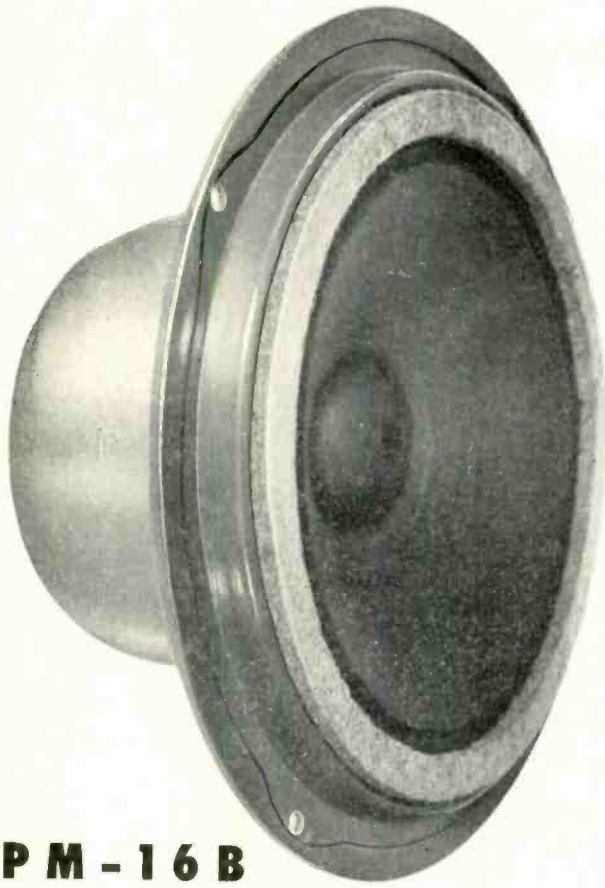


Fig. 6. Plan for direct-radiator speaker system.

LET'S ENJOY THE INTERMEDIATE RANGE MORE FULLY!



PM-16B

Is your speaker system a two-way one? Or a three-way one? If you are now using a woofer of ten inch or larger for low frequency range in your two-way system, you are likely dissatisfied with the tone quality of intermediate frequency range. Aren't you?

It's very difficult to reproduce the middle range satisfactorily if a speaker of large caliber is employed for low frequency range in a two-way system.

Can't a two-way system be converted into a three-way system easily and simply? Yes, it can be done by making use of a PIONEER Speaker Model PM-16B, which is shortly to be placed on the market, together with a PIONEER Crossover Network Model DN-5.

When constructing a new three-way system, a combination of Model PM-16B and Model DN-5 also comes in very handy.

CONE-TYPE SPEAKER MODEL PM-16B FOR INTERMEDIATE FREQUENCY RANGE WITH BACKLOADED CASE

PIONEER Model PM-16B is a new speaker which is made by thoroughly improving the intermediate-range speaker Model PM-16B sold hithertofore.

The frequency range of Model PM-16B is 400-6,000 cps, reproducing the intermediate range only, but it has an extremely smooth characteristic within its range of reproduction and enhances the pleasure of truly enjoying the beauty of middle frequency range.

Model PM-16B is provided with a back-loaded case, its rear being hermetically sealed. Therefore the back of speaker needs not be enclosed in another box, enabling it to be mounted in any type of cabinets just as is.

SPECIFICATIONS

Voice coil impedance:	8 or 16 ohms	Crossover frequency:	over 500 cps
Resonance frequency:	350 - 420 cps	Power Input:	25 watts
Frequency range:	400 - 6,000 cps	Sensitivity:	104 db/watt

TWO- AND THREE-WAY CROSSOVER NETWORK MODELS DN-5, DN-6 AND DN-7

A crossover network is a 'must' for constructing a multi-way system.

The three kinds of crossover networks Models DN-5, DN-6 and DN-7, newly placed on the market by the PIONEER, can be expediently used in either two-way or three-way system by means of a slide switch. Especially the Model DN-5, in addition to two-way or three way selection, is provided with a switch for choosing the impedance of either 8 ohms or 16 ohms as occasion demands.

Those, who have a two-way system at present and desire to convert it into a three-way system, can do so very simply by just using a Model PM-16B together with any one of these networks.

SPECIFICATIONS

Model No.	DN-5	DN-6	DN-7
Attenuation:	6 db/oct.	12 db/oct.	12 db/oct.
Crossover frequency:	4,000 cps for two-way 500 cps and 4,000 cps for three-way (selected by slide switch)	4,000 cps for two-way 500 cps and 4,000 cps for three-way (selected by slide switch)	4,000 cps for two-way 500 cps and 4,000 cps for three-way (selected by slide switch)
Impedance:	8 or 16 ohms (selected by slide switch)	8 ohms	16 ohms
Maximum transmitted power:	30 watts	30 watts	30 watts

DN-5

pioneer FUKUIN ELECTRIC, LIMITED
5 Otowacho 6-chome, Bunkyoku, Tokyo, Japan

Level-Test Tapes Aid Program Reproduction

JAY C. ABBOTT*

Wide differences in level from tape to tape have plagued the broadcaster as well as the serious tape recordist for a long time. Here is a proposal, which, if universally adopted, may well eliminate the problem.

THE ALMOST UNLIMITED level range of modern recording tape unfortunately is a contributing factor towards sadly disappointing the listener when tapes which sounded brilliant at the time of recording are played over radio or transferred to disks.

The lack of positive levels that would apply to all tape recorders, regardless of make or working condition, would, from the experience of this writer, seem to be the factor needing correction.

Perhaps this would then be a good time for tape recordists to give thought to the plight their work has brought to the broadcasting and recording industry.

For example, the working day of the station engineer finds him faced with an endless stream of records and tapes which he must get on the air, often while dubbing as announcer, phone-answerer and general office boy. Many of these same factors apply to commercial record companies who have daily production quotas to consider.

While commercial records in general are recorded within basic db level ranges, the tapes an engineer can encounter in a day might vary from a whisper to the roar of a hundred jets on take-off.

Considering that a radio station disk jockey, who nowadays often doubles on the controls, might be clear across the room engaged in the lawful pursuits that management has also found to occupy his time, it is no wonder that tapes containing a wide range of sound levels often come over the air with disastrous results.

Record engineers have the struggle of compressing tape sounds within the db range their equipment is capable of transferring to records. Within either industry the transfer of program material tape-to-tape, to the air, or record surfaces often ends up in a game of Russian Roulette due to the lack of known levels.

Level-test tapes made at the time of recording can do much to correct this

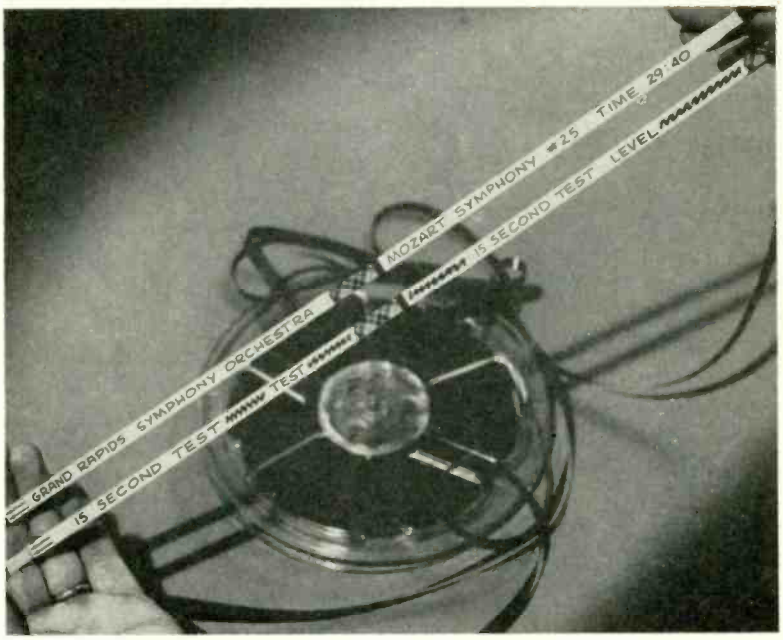


Fig. 1. Marking the level-test tape.

gap. There is a twofold purpose in having level test tapes: the first being to establish the general level used by the operator in recording his program; the second is to establish a known working level of the recorder being used. It is amazing the variance of zero db levels that one can encounter going from one tape recorder to another, even of the same manufacture.

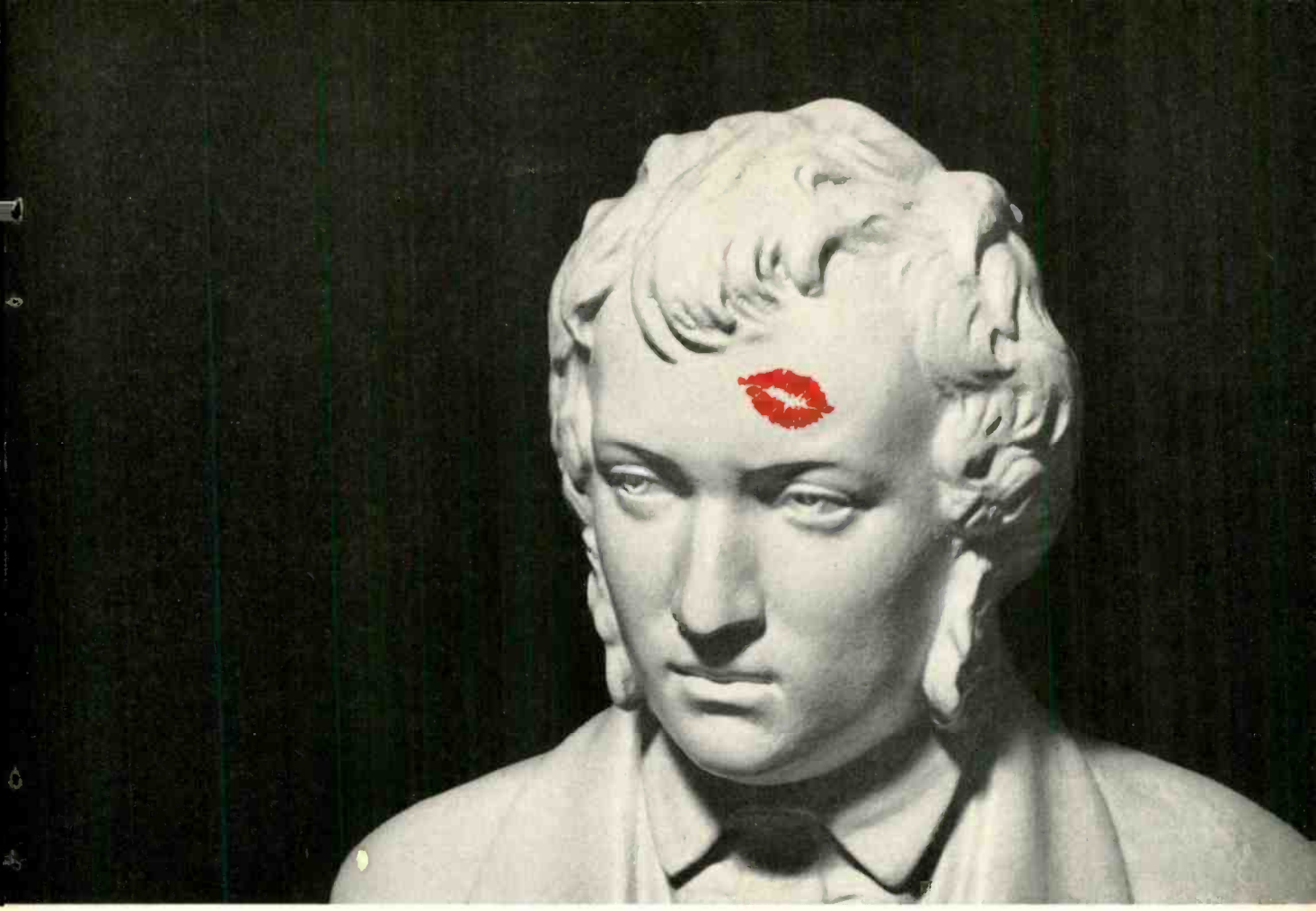
Factors controlling this variance can be bias level at the moment of recording, tube and component conditions, tape and surface condition of the record and playback heads. Level-test tapes allow for all these variances and permit, when duplicating or broadcasting, operation at the highest possible signal level without fear of overload or change in volume level during the run.

Consider for a moment an engineer faced with putting a live tape recording on Ravel's *Bolero*, on the air or a record master. This dynamic concert favorite opens with a soft roll of the snare drum and plucking of the harp. For five minutes this beat is exchanged among the various instruments of the orchestra with little increase in overall volume. Then the roof begins to bulge and the operator is faced with a db meter that doesn't seem to know any limit to its rise. At the end of twelve minutes the operator generally has overcome the single effect the conductor and orchestra have labored so hard to create—that of a constantly rising crescendo of sound, climaxed with a loud discordant noise marking the end.

With level-test tapes the operator can within seconds adjust his equipment so as to completely preserve the musical text indicated by the composer and win for himself the applause of listeners everywhere.

The problem of established levels for tape recording was encountered by the

* *2254 Audobon Dr., S.E., Grand Rapids, Michigan.*



CLASSICS THAT MADE THE HIT PARADE

— a new bonus reel from Audiotape

Some of our greatest popular songs — hits like "Full Moon and Empty Arms," "Till the End of Time," "Stranger in Paradise" — took their melodies from the classics. Eight of these lovely themes—in their original classical setting — are the basis for "Classics that Made the Hit Parade," a program with strength, variety, and, of course, rich melodic beauty.

This unusual program, professionally recorded in sparkling full fidelity on Audiotape, is available RIGHT NOW from Audiotape dealers everywhere. (And only from Audiotape dealers.) Ask to hear a portion of the program, if you like. Then, take your choice of a half-hour of two-track stereo, or 55 minutes of four-track stereo or dual-track monaural sound — all at 7½ ips. Don't pass up this unique opportunity.

"Classics that Made the Hit Parade" makes an ideal addition to Audio's first two bonus reels, "Blood-and-Thunder Classics" and "High Spirits," still available at Audiotape dealers.

DETAILS OF THE PROGRAM

"Classics that Made the Hit Parade" includes these popular symphonic themes:

Borodin	Polovtsian Dances from Prince Igor (Stranger in Paradise)
Tchaikovsky	Symphony No. 5 in E (Moon Love)
Waldteufel	Espana Waltz (Hot Diggity)
Chopin	Polonaise No. 6, in Ab Major (Till the End of Time)
Tchaikovsky	Symphony No. 6 in B (The Story of a Starry Night)
Rachmaninoff	Piano Concerto No. 2 in C Minor (Full Moon and Empty Arms)
Chopin	Fantasie Impromptu in C# Minor (I'm Always Chasing Rainbows)
Tchaikovsky	Romeo and Juliet Overture (Our Love)

DETAILS OF THE OFFER

This exciting recording is available in a special bonus package at all Audiotape dealers. The package contains one 7-inch reel of Audiotape (on 1½-mil acetate base) and the valuable "Classics that Made the Hit Parade" program (professionally recorded on Audiotape). For both items, you pay only the price of two reels of Audiotape, plus $1. And you have your choice of the half-hour two-track stereo program or the 55-minute monaural or four-track stereo versions.

See your Audiotape dealer now.

audiotape TRADE MARK *"it speaks for itself"*

AUDIO DEVICES, INC., 444 Madison Ave., N. Y. 22, N. Y.
In Hollywood: 840 N. Fairfax Ave. • In Chicago: 5428 N. Milwaukee Ave.

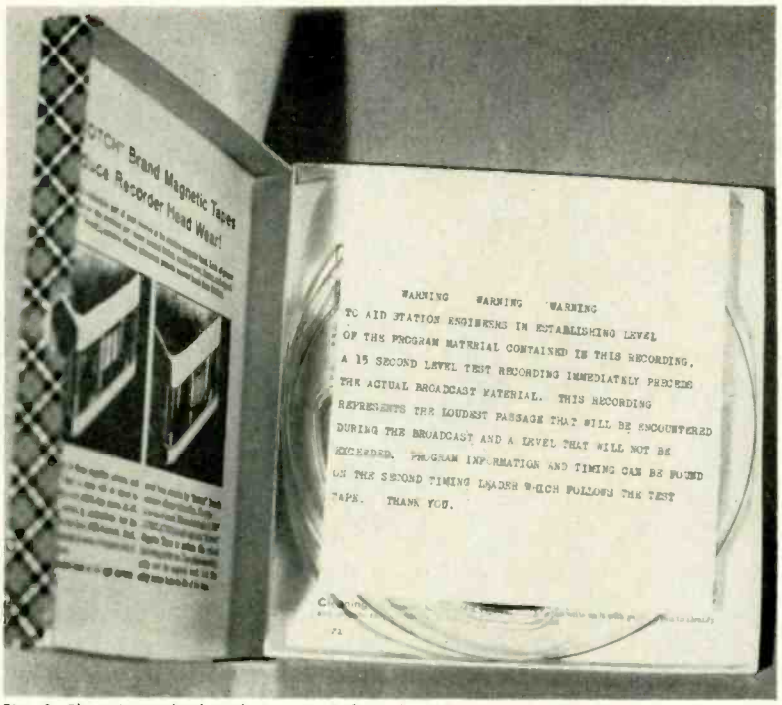


Fig. 2. Flyer is packed with tape to inform broadcast engineers about test tape. This will prevent him from inadvertently putting the test tape "on the air."

writer during production of a radio series featuring a 90-piece symphony orchestra. A group of this size is capable of producing levels that can exceed even the db level limits of tape. Add to this orchestra a 600-voice festival choir and the stage is set for a tape broadcast that would tax the ability of all but the most experienced engineer.

Let an inexperienced person happen to be at the controls for such a broadcast however, and you can imagine the disaster that would result—*and did!* This then is the reason for the effort that went into formulating this proposed idea for level-test tapes.

The solution which is offered here to correct the problem of tape level has been taken in part from a practice followed by news services in the transmission of wirephotos throughout the world.

Preceding each picture transmission, a brief interval is taken to transmit a sending level to which each set on the network is then adjusted by the receiving operator. Through this method the operator in Grand Rapids, Michigan; Spokane, Washington; or Atlanta, Georgia received identical reproductions of the transmitted image. All variations are eliminated.

Following the suggestion of creating a tape recording test signal we turned to the musical score being recorded and decided to employ the loudest passage contained in the recording and to copy this signal for approximately 15 seconds. By inserting this special recording as a leader to the actual recording the station engineer or recording studio could set their equipment for the loudest known signal they would encounter in the program which followed.

Later another procedure was developed which accomplished the same results without the time-consuming process just described. The revised system however requires audio signal generating equipment and for the benefit of those lacking such equipment or for those who would find such practice not practical "in the field," the first procedure is described in full.

To create a level-test tape without the aid of audio signal generating equipment the recordist selects that passage he knows to contain the loudest db level range. This is then recorded for approximately 15 seconds, making sure that the controls are not changed after being set. An error at this stage can throw the entire procedure off balance and destroy the intent of level-test tapes.

We first employed this system in preparing symphony recordings and the enthusiasm with which it has been received by station engineers has been most encouraging. The finished product on the air has become a true presentation of the program material contained on the tape with absolutely no evidence of overloading or a rush to adjust receiver volume. All of the dynamic range so favored by musicians is preserved especially when heard on FM transmission.

While most stations prefer full-track recording, when necessary or the occasion demands, anything will do. Here again, level-test tapes will permit an adjustment to be made to correct for the natural loss that is encountered when half-track recordings are being played on full-track equipment. The second track naturally being blank.

In practice the system offered here is achieved in the following manner, however, the individual recordist can easily alter the system to fit his individual needs.

While these notes refer to symphonic recordings, all procedures also apply to recordings of popular music, group or single performers, any recording where it is desired to preserve the full range of tone used by musicians, actor or speaker to present his performance to the public.

The symphonic series I have mentioned is first taken on what is called the music master tape, which is edited to the time limits of the program. Voice announcements are then added to, and in cases over, the music on a first duplication process.

Either during initial editing or when dubbing voice, careful note is made of the dynamic range of the symphony, concerto or suite being worked. The selected passage is duplicated making sure the controls are set so as to duplicate exactly the volume intensity.

During the second editing on what has now become the "program master" tape, the selected passage representing the loudest part of the program is attached to the lead of the tape with appropriate leader strips.

The program master tape is now ready for duplication in the required number to accommodate stations carrying the symphony broadcast. The same test level added to aid radio stations now serves to assist the duplication service, if employed, in quickly and accurately adjusting their equipment. Further, by recording at the highest possible level through the test level system, a considerable drop in tape hiss has been noticed in the duplicated tapes.

Where master tapes are released for use and duplication not employed the same procedures would apply with the test strip applied to the beginning of the program.

By specific instruction duplicated tapes are returned with the test level strip intact. However leader strips must be placed between the test and program material and so noted. (See *Fig.* 1.) The first leader strip is carefully marked in crayon or ink, "15 second test-level recording." On the second leader strip immediately preceding the actual broadcast required program information and timing is noted.

As a final step in packaging the program a flyer is attached so as to lie over the program reel. (See *Fig.* 2.) Sug-

(*Continued on page 92*)

SPECIAL PRE-PUBLICATION OFFER!

READY DECEMBER 1, 1960

ORDER NOW—SAVE 20%

PAY only $2.80 NOW for this volume published at $3.50

SPECIAL OFFER!

the 5th AUDIO anthology

MAKES AN INVALUABLE GIFT FOR THE HIGH FIDELITY ENTHUSIAST

SHOP HERE FOR CHRISTMAS

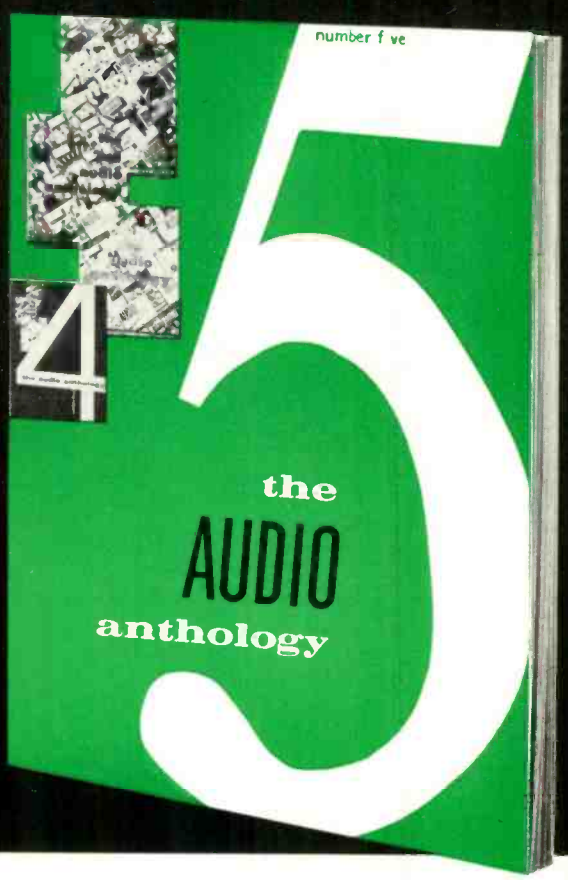
Realize additional savings by buying the **5th AUDIO ANTHOLOGY** *for your friends. We will Xmas wrap and mail free anywhere in the U.S. in time for Xmas delivery.*

SAVE MORE!

IF YOU BUY 2 you pay only $2.70 each
IF YOU BUY 3 you pay only $2.60 each
IF YOU BUY 4 you pay only $2.50 each
IF YOU BUY 5 or more you pay only $2.40 each

EXTRA SPECIAL XMAS GIFT OFFER!

Send the **4th AUDIO ANTHOLOGY** *ALONG WITH THE 5th FOR ONLY $1.50 more and save 50% below the regular price of $2.95.*
BOTH FOR AS LITTLE AS $3.90 (if you send 5 gifts or more).



- **THE BIGGEST AND BEST VOLUME EVER!**
- **MORE THAN 50 ARTICLES COVERING STEREO RECORDING AND REPRODUCTION; STEREO MULTIPLEX; MEASUREMENTS; STEREO HIGH FIDELITY TECHNOLOGY; CONSTRUCTION AND THEORY; etc.**
- **144 PAGES WITH COMPLETE ARTICLES BY WORLD FAMOUS AUTHORITIES IN THE AUDIO AND STEREO HIGH FIDELITY FIELD.**
- **ATTRACTIVELY PRINTED AND BOUND FOR EVERLASTING USE. AN IMPORTANT STEREO HIGH FIDELITY REFERENCE BOOK.**

Published at $3.50, the **5th AUDIO ANTHOLOGY** is available at a 20% saving pre-publication price of only **$2.80***, postpaid anywhere in the United States.

AUDIO ANTHOLOGY VOLUMES 1 to 4 are highly valued in reference libraries throughout the world. No. 5 of the series promises to provide the same quality of articles that has made AUDIO . . . *the original magazine about high fidelity* . . . a most valued publication among high fidelity enthusiasts and hobbyists; the professional level in the broadcast, recording and audio engineering fields; and the high fidelity radio service specialist. The AUDIO ANTHOLOGY is a convenient, handy reference volume which authoritatively provides invaluable technicana selected and edited by C. G. McProud, Editor and Publisher of AUDIO, and a pioneer in the high fidelity field . . . founding member and past President of the Audio Engineering Society.

RADIO MAGAZINES, INC., Dept. A
P.O. Box 629, Mineola, New York

Enclosed is my remittance for $..... I understand that my preview copy of the **5th AUDIO ANTHOLOGY** will be mailed to me. Add 50¢ for Foreign orders

Name.....

Address.....

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

I am: Engineer ☐ Student ☐ Audio Enthusiast ☐
Musician ☐ Other.....

***This offer at a pre-publication saving for a limited time only . . . may be withdrawn at any time without notice.**

The Tape Guide

Stereo Considerations

HERMAN BURSTEIN*

For those considering the purchase of a stereo tape machine here is an informed discussion of the merits of four-track tape systems.

MOST OF WHAT has been said in previous articles applies to mono and stereo tape operation alike (unless specifically directed at one or the other). However, stereo recording and playback entail certain special questions, which are the concern of the present article. The topics to be discussed here are four-track versus two-track stereo, the tape cartridge, coordination of the two channels, and conversion for stereo.

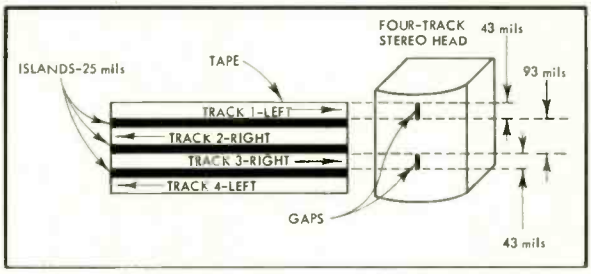


Fig. 2. Four-track stereo tape.

Four-Track Stereo

When stereo tape was first introduced, it employed the same track arrangement as half-track mono tape, shown in *Fig.* 1A, except that the lower track (for a tape running from left to right) was used for the second channel. Originally, a staggered-head arrangement, shown in *Fig.* 1B, was used to record and play 2-track stereo tape, but this eventually gave way to a single in-line head, shown in *Fig.* 1C. The staggered arrangement employed two conventional mono heads, spaced about 1¼-in. apart, and positioned so that the gap of one head spanned the upper track while the gap of the other spanned the lower track. Use of separate heads permitted individual adjustment of azimuth of each gap, assuring maximum treble response on each channel; and it avoided the problem of crosstalk between heads, namely the appearance of the left signal in the right head and vice versa.

With improvements in manufacturing techniques, the in-line head proved to be a reliable and not overly expensive device. Thus the staggered-head arrangement, innately a clumsy one, became obsolete, and so did the tapes that had been recorded by this method. It was not feasible to use an in-line head to play a tape with a displacement of 1¼-in. between channels, corresponding to a time difference of 1/6 second at 7.5 ips and 1/3 second at 3.75 ips.

Two-track stereo tape ran into problems of tape economy and convenience

(*Continued on page 35*)

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

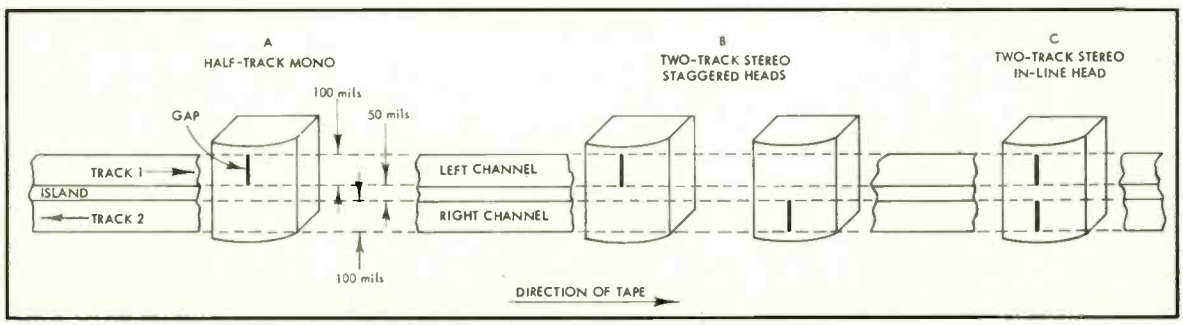


Fig. 1. Head configurations for half-track mono and two-track stereo tape.

AMPEX

PR-10 SERIES

COMPACT STUDIO QUALITY RECORDERS

An advanced concept in recorder design, the PR-10 series provides Ampex Professional Recording Standards in a new, compact instrument. These recorders assure studio quality and performance for all field and studio applications . . . for broadcasters . . . recording studios . . . educators . . . churches . . . industry . . . and advanced recordists. Major new engineering advances permit COMPACT SIZE WHILE RETAINING FEATURES AND PERFORMANCE OF STUDIO CONSOLES.

ADVANCED FEATURES AND OPTIONS

EXCLUSIVE ELECTRODYNAMIC CLUTCHES for fast, gentle, error-proof tape handling

EXCLUSIVE AUTOMATIC TAPE THREADING ACCESSORY introduces "No Hands" tape handling for speed and convenience (optional)

PROFESSIONAL PUSHBUTTON RELAY/SOLENOID CONTROLS for rugged, positive, convenient operation

COMPLETE REMOTE CONTROL of ALL functions permits expanded use of recorder

ALL NEW COMPACT ELECTRONICS with many advanced design features

ADVANCED DESIGN 4-POSITION HEAD ASSEMBLY (erase, record, playback, + space for extra head) permits changing heads in the field for special requirements

PLAYBACK WHILE RECORDING for on-the-spot quality assurance

4-TRACK STEREO PLAYBACK (optional) for fourth head position

MINIATURIZED "PLUG-INS" for flexibility of equalization and input characteristics

HYSTERESIS SYNCHRONOUS MOTOR for timing accuracy

TWO SPEEDS: 15 and 7½ ips or 7½ and 3¾ ips

RUGGEDNESS AND DURABILITY of overall design to outlast a succession of lower cost units

STEREO/MONOPHONIC MODEL PR-10-2

Important technical advances permit combination of complete, professional stereophonic and monophonic record and reproduce at little more cost than monophonic alone. The versatile PR-10-2 provides 1) complete stereophonic record and reproduce, 2) monophonic record and reproduce with many of the new two-channel techniques now being used, 3) conventional monophonic use (½ track).

In addition, separate-track erase head in combination with new "record/safe" selector permits half-track recording of either track, sound on sound, cue tracks, and other special effects. Full-track playback applications can also be met with full-track playback head in 4th position.

MONOPHONIC MODEL PR-10-1

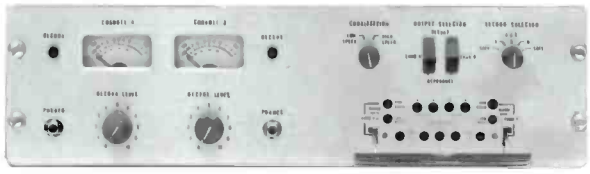
Available in full- or half-track versions. Includes all advanced features listed above plus — the single channel electronics with a built-in mixer that can mix line and microphone or two microphones (by using a plug-in preamplifier). Later conversion to two or more tracks is accomplished by changing full-track head stacks and adding an electronics. (The half-track version is originally equipped with stereo heads.)

PORTABLE OR RACK MOUNT AVAILABLE ON BOTH MODELS

As a portable, the PR-10 offers performance found only in units twice its size and weight. For rack installation, either the monophonic or stereo units require only 19" wide by 14" high mountings — a space occupied by many older recorders, permitting easy replacement without disruption of equipment racks.

CONVENIENCE, DEPENDABILITY AND LONG LIFE ARE BUILT INTO THE PR-10'S ADVANCED DESIGN

- Rigid, noise-insulated top plate of special aircraft style construction insures permanent alignment of all components for precision tape handling
- Shielded, hinged head cover fully exposes heads for easy tape editing
- Head alignment "locked" to eliminate periodic need of head adjustment
- Error-proof pushbutton operation
- Simple, guided, straight-line tape threading
- Tape lifters permit touch cuing on fast wind and rewind
- Positive, dependable speed change
- Provision for fourth head (four-track stereo, sync head, etc.)
- Motor cuts off to permit "stand-by" position when safety switch arm is released
- Lifetime, solenoid operated self-regulating brakes never need adjustment



- Hysteresis, synchronous motor for timing accuracy. Reserve power insures against stalling or overloading
- Exclusive electrodynamic drive assures permanent, adjustment-free tape handling
- Each transport component (clutches, motor, solenoids) is unitized, plugs into color coded socket on control box
- All new compact electronics with new, low noise circuits and many operating features and conveniences
- Safe-Record selector protects against accidental erasure
- Two 3" side-by-side VU meters permit simultaneous reading and balancing of channels
- All electronic alignment controls accessible through exclusive front panel door, eliminating need to remove unit from case or rack
- Individual A-B switches on each channel for quick comparison between original and recorded program

ACCESSORIES AND ASSOCIATED EQUIPMENT
optional at extra cost

FOUR POSITION TWO-CHANNEL, MONOPHONIC/STEREO MIXER
The MX-10 mixer was designed to extend the flexibility and operation of the PR-10 recorders, permitting up to four microphones, or two mikes and two lines, to be controlled and fed to either or both output channels. Request Bulletin No. 211 for full details.

PROFESSIONAL SPEAKER AMPLIFIER MONITOR SYSTEM
The finest, most flexible unit ever designed for professional monitoring. Provides quality, power, and overload characteristics essential to critical listening and evaluation. Powerful 40 watt amplifier with new stabilizing power demands circuitry and efficient, long excursion speaker in special completely separate tuned duct enclosure assure lowest distortion at critical low frequencies. Available for portable, rack or wall mounting. Request Bulletin No. 214.

REMOTE CONTROL
Greatly expands use of recorder. Plugs into receptacle provided and permits recorder to be controlled from any desired location. Duplicates all functions of record, play, fast forward and fast rewind buttons on tape transport. Record button prevented from functioning when record selector is in "safe" position. Available as a boxed or flush plate unit.

TWO-SECOND AUTOMATIC TAPE THREADING
Exclusive Ampex Professional accessory allows two-second threading without being touched by hand. Kit is either factory-installed or can be added later by user.

PLUG-IN EQUALIZERS
Interchangeable units provide NAB, AME or CCIR curves appropriate to tape speed used. Equalizers for other curves to meet special requirements available on special order.

PLUG-IN INPUT UNITS
Interchangeable units match various inputs such as zero loss transformer for balanced bridging; 40 db miniaturized microphone preamplifier for close pickup conditions and/or high output microphones — 60 db miniaturized preamplifier for distant pickup conditions or low output microphones.

GENERAL PERFORMANCE CHARACTERISTICS AND SPECIFICATIONS

IMPORTANT: AS PROFESSIONAL EQUIPMENT, THE AMPEX PR-10 SERIES OF RECORDERS IS DESCRIBED BY SPECIFICATIONS LISTED BELOW WHICH ARE ACCURATE MEASUREMENTS REQUIRED BY PROFESSIONAL STANDARDS AND DO NOT INCORPORATE EXAGGERATED SALES CLAIMS. THESE ARE THE GUARANTEED MINIMUM PERFORMANCE SPECIFICATIONS THE CUSTOMER CAN EXPECT IN LONG-TERM OPERATION.

FREQUENCY RESPONSE:	30 - 18,000 cps ± 2 db at 15 ips 40 - 12,000 cps ± 2 db at 7½ ips 40 - 8,000 cps ± 2 db at 3¾ ips
SIGNAL TO NOISE RATIO:	Better than 55 db at 7½ and 15 ips 50 db at 3¾ ips
FLUTTER AND WOW:	Less than 0.15% rms at 7½ and 15 ips 0.25% rms at 3¾ ips
TIMING ACCURACY:	Within ± 0.25%
OUTPUT:	+ 4 dbm into 600 ohm balanced or unbalanced load. Cannon XL connectors. Single and two-channel headphone jacks provided.
INPUTS:	**PR-10-1 single-channel model with two inputs:** No. 1 — Low impedance microphone input stage. No. 2 — Unbalanced bridging with provisions for plug-in balanced bridging transformers or low impedance plug-in microphone preamp. Individual gain controls on each. **PR-10-2 two-channel model with one input per channel:** Unbalanced bridging with provisions for plug-in balanced bridging transformers or low impedance plug-in microphone preamps. The MX-10 accessory mixer is designed to feed unbalanced bridge inputs.
SPEEDS:	7½ and 15 ips, or 3¾ and 7½ ips
POWER REQUIRED:	117 volts AC - 60 cycles, 1.84 amps (215 watts)
RACK SPACE:	Transport 8¾" x 19" x 6" D. Electronics 5¼" x 19" x 5⅞" D.
WEIGHT:	Unmounted 44 lbs; Portable 53 lbs.

STUDIO CONSOLE PERFORMANCE AND FEATURES AT HALF THE WEIGHT, HALF THE SIZE AND HALF THE PRICE:

PR-10-1	Monophonic recorder	$845
PR-10-2	Stereo/Monophonic recorder	$945
MX-10	Stereo/Monophonic mixer	$395
SA-10	Speaker/Amplifier	$295

Prices are for unmounted models

AMPEX

AUDIO PRODUCTS DIVISION AMPEX PROFESSIONAL PRODUCTS COMPANY
934 Charter Street • Redwood City, California • EMerson 9-7111

SEE YOUR AMPEX PROFESSIONAL DEALER FOR COMPLETE DEMONSTRATION. ASK FOR A NEW FULLY ILLUSTRATED EIGHT PAGE BROCHURE.

TAPE GUIDE

(*from page 32*)

of operation. In the case of mono half-track operation, one could record or play the tape in one direction, reverse the reels, and promptly continue operation in the other direction. But two-track stereo permitted the tape to be used only in one direction, which was wasteful of tape, particularly for commercial applications. In the case of prerecorded tape, the tape itself presents a major item of cost, whereas in the case of a phonograph disk the vinylite material is a matter of a few cents. Moreover, after a two-track tape has been recorded or played, it is necessary to rewind it in order to get it back on its original reel; this is not the case for mono half-track tape, where half the width of the tape (approximately) is recorded in one direction and the other half in the opposite direction.

The problems of tape economy and convenience of operation were solved by four-track stereo recording, as shown in *Fig.* 2. Tracks one and three are recorded (and played) in one direction, and, after the reels are reversed, tracks four and

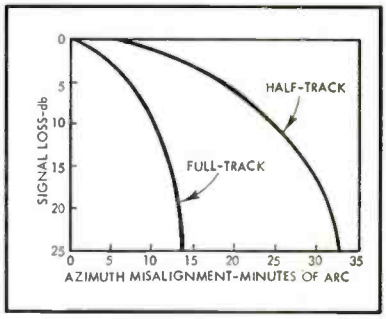


Fig. 3. Signal losses due to azimuth misalignment at 7500 cps at a tape speed of 7.5 ips.

two are recorded in the other direction.

The major disadvantage of four-track compared with two-track tape is a reduction in signal-to-noise ratio. The tracks of the former are about half the width of the latter, so that there is a proportionate reduction in the amount of signal that is recorded. Consequently the signal level obtained from the four-track tape in playback is about 6 db less than the signal from a two-track tape. This means that the ratio of audio signal to noise and hum produced by the tape recorder electronics is decreased 6 db.

However, ways are being found around this problem. For one thing, tape electronics today tend to be less noisy than those of yesteryear due to improvements in circuit design and in tubes or transistors. For another, it is possible through skillful design to produce playback heads with increased output for a

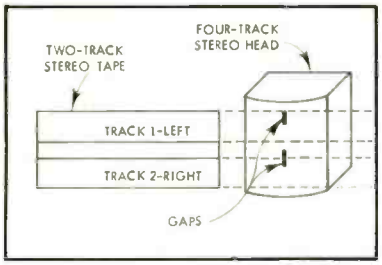


Fig. 4. Mismotch between the lower gap of a four-track stereo head and the lower track of a two-track stereo tape.

given amount of signal recorded on the tape. Third, there have been continual improvements in tape quality, and it is reasonable to believe that time will bring improvements with respect to the amount of signal that can be recorded on the tape without increasing distortion or other undesirable effects. In sum, one may look forward to eventually achieving a signal-to-noise ratio on four-track track that approaches the ratio achieved in the past on two-track tape.

On the other side of the coin, four-track stereo tape has two positive advantages over two-track tape. One is the fact that azimuth alignment becomes less critical as track width is decreased, thereby reducing treble losses due to slight departures from exact azimuth. *Figure* 3 suggests the benefits obtained from narrowing the track. It compares azimuth losses for a half-track mono recording with those for a full-track mono recording. Obviously, much greater azimuth misalignment, in relative terms, is tolerable for the narrower track. The benefits obtained by going from two- to four-track stereo are comparable with those indicated in *Fig.* 3.

The second advantage of four-track tape lies in the greater separation between the two gaps of the in-line head. Hence there can be greater separation between the two sections of the head, resulting in less crosstalk. Comparison of *Figs.* 1C and 2 shows that there is 50 mils (thousandths of an inch) separation between the gaps of a two-track stereo head, compared with 93 mils between the gaps of a four-track head.

Although it is indicated that four-track stereo tapes will supersede two-track stereo tapes, there will remain the problem of playing valued two-track tapes purchased or recorded in the past. Therefore the manufacturers of tape machines have sought to make it possible to play two-track stereo tapes with four-track heads. The problem lies in the fact that the lower gap of the four-track head does not lie fully within the recorded area of the lower track of a two-track tape. This is made clear in *Fig.* 4. The fact that part of the lower gap spans unrecorded space means less output on the lower track, with a consequent reduction in signal-to-noise ratio.

Some tape machine manufacturers have chosen to accept this limitation on signal-to-noise ratio of one of the channels. Others, however, have incorporated a mechanical device for shifting the head up and down. For four-track tape, running from left to right, the head is shifted up. It is shifted down for two-track tape. There is some danger of impairing azimuth alignment as the head is shifted up or down. Consequently in a few high-price machines a separate head has been introduced for playing two-track tapes.

Most home tape machines use the same head for record and playback. Such machines, perforce, permit four-track recording as well as playback. However, the higher-price tape machines usually employ separate record and playback heads. Some of them use two-track record heads, while others provide four-track record heads. It would appear, however, that eventually all home machines will permit four-track recording.

(As a side note, it is of interest to observe that the four-track head makes possible four-track *mono* operation, thereby doubling the playing time obtainable from a reel of tape. The recording or playback sequence is: tracks one, four, three, and two. A number of tape machines, through extra switching facilities, take advantage of this opportunity. Switching must do the following: (1) In recording, it must channel the input signal first to one section of the head (for tracks one and four) and then to the other section of the head (for tracks three and two). (2) At the same time, in recording, it must shut off the bias current to the record head section not in use and it must shut off the erase current to the erase head section not in use. (3) In playback it must channel the signal first from one section of the head and then from the other section to one of the playback amplifiers. If one uses

Fig. 5. The RCA tape cartridge.

SONY

Offers the utmost in quality

Condenser Microphone C-37 A

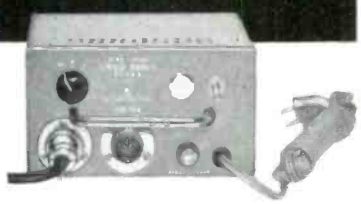
Designed to meet exacting professional standards where utmost performance, dependability and fidelity is essential.

The exceptionally smooth frequency response of 20—20,000 CPS* is completely free of resonant peaks and dips.

Uni-directional and omni-directional : Maximum front to back sensitivity of more than 15 db provides unequalled Cardioid pattern.

Output Impedance : 200 ohms balanced
Output Level : Uni directional—50 db
Omni-directional—52 db

* Actual anechoed response curve and descriptive brochure available upon request !



CP-2 POWER SUPPLY
Custom matched to each microphone

SONY CR-4

RADIO Wireless MICROPHONE

The Sony model CR-4 is a complete professional wireless microphone with an all-transistor FM transmitter, a dynamic lavalier microphone and an 8-tube FM receiver.

TRANSMITTER

- Self powered with 2 inexpensive miniature batteries
- Detachable small dynamic microphone
- Can be held, used as lavalier, or concealed
- Flexible, detachable antenna
- No FCC license is required

RECEIVER

- Small size and lightweight, very attractive for desk use
- High sensitivity and low noise
- Squelch circuit for elimination of interference
- Neon light for selective tuning
- Built-in monitor speaker with volume control

For free descriptive literature and name of nearest franchised dealer in U.S. write :

SUPERSCOPE, Inc., Audio Electronics Division/Sun Valley, California.

SUPERSCOPE®
INCORPORATED

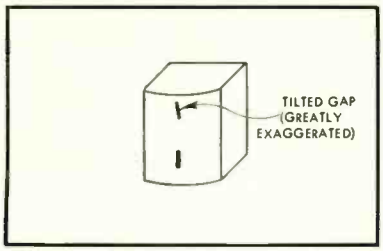


Fig. 6. Stereo head with tilted gap.

double-play tape at 1.875 ips, it is possible to record as much as 17 hours of program material on a 7-in. reel.)

The Stereo Cartridge

It has long been the goal of a section of the tape industry to simplify the playing of prerecorded tape to the point where this is just as easy as playing a phonograph disc. To this end the tape cartridge has been introduced. First on the scene was the RCA cartridge, shown in *Fig.* 5, which houses the tape in a plastic container with apertures that permit the tape to contact the heads, capstan, and guides. It is merely necessary to position the cartridge on a tape machine designed for the purpose and push a button, whereupon the machine takes over without the need for the operator ever to touch the tape. Some cartridge players are designed to stop the tape after it has played in one direction, while others will reverse the tape and play it back in the opposite direction against another head, after which the tape is automatically stopped.

The RCA cartridge can hold up to 600 feet of tape, which at 7.5 ips affords a maximum playing time of 32 minutes if the tape is operated in two directions. But to be competitive with the stereo disc, the stereo cartridge must be able to provide up to an hour of program material. Therefore it is necessary to reduce the speed of the tape cartridge to 3.75 ips. In sum, the RCA tape cartridge and the 3.75 ips speed go hand in hand.

Fortunately, improvements in tape heads, in other components, and in techniques have made it possible to obtain good fidelity at 3.75 ips. Thus it appears that the tape cartridge will prove to be a suitable medium for popularizing prerecorded tape. While the 3.75 ips speed may not be suitable (yet) for truly high fidelity, it is still good enough to provide pleasurable reproduction of music to the many persons who own moderate-price sound systems and who do not demand the ultimate in available quality.

On the other hand, for those who demand the best it appears that for some time to come the 7.5 ips speed will be used, combined with four-track stereo recording on open reels.

At 3.75 ips, it is possible today, owing to playback heads with extremely fine gaps, to preserve frequency response substantially out to 15,000 cps, closely rivalling the performance at 7.5 ips in this respect. Still, in terms of distortion and signal-to-noise ratio, 3.75 ips recordings lag behind those at 7.5 ips. To achieve response out to 15,000 cps or thereabouts at 3.75 ips, it is necessary to reduce bias current fed to the record head below the value employed at 7.5 ips, thereby reducing treble losses due to bias erase. The decrease in bias current results in an increase in distortion. The increase in distortion can be offset by lowering the recording level. But the latter measure means less signal on the tape and therefore a lower signal-to-noise ratio in playback. In practice, the course usually followed is to accept some increase in distortion and some decrease in signal-to-noise ratio, rather than just one or the other.

As stated just before, response to 15,000 cps is feasible at 3.75 ips. But to achieve such response, greater attention must be paid than at 7.5 ips to factors that can adversely affect treble response: too wide a gap in the playback head; incorrect azimuth alignment; poor tape to head contact because of dirt, brittle

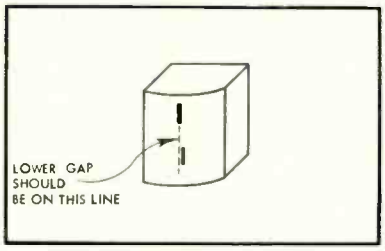


Fig. 7. Stereo head with displaced gap.

tape, improperly adjusted pressure pads, etc.; excessive bias current to the record head; improper record or playback equalization.

Although the 3.75 ips speed has only quite recently, and after much striving, proven capable of good quality, the 1.875 ips speed is hard on its heels in vying for serious consideration. The further reduction in speed would make prerecorded tapes still more economical and would permit tape cartridges and cartridge players to be more compact. Along this line CBS and the 3M Co. recently announced a tape cartridge designed to be operated at 1.875 ips. While commercial production was estimated to be several years distant, demonstrations to the trade were convincing as to the possibilities of good results at this speed. Moreover, the machine designed to play this cartridge incorporated a changer mechanism, putting tape fully on a par with the phono disc for simplicity and convenience of operation.

It may be added that a number of open reel tape machines already incorporate the 1.875 ips speed. While they do not claim high fidelity performance at this speed, the results are surprisingly good. For example, they can reproduce music quite satisfactorily for background or party purposes, where the presence of competing sounds makes it pointless to strive for high fidelity. But the 1.875 ips cartridge proposes to go a major step forward by lifting the quality at this speed to meet at least minimum high fidelity requirements.

Coordination of Channels

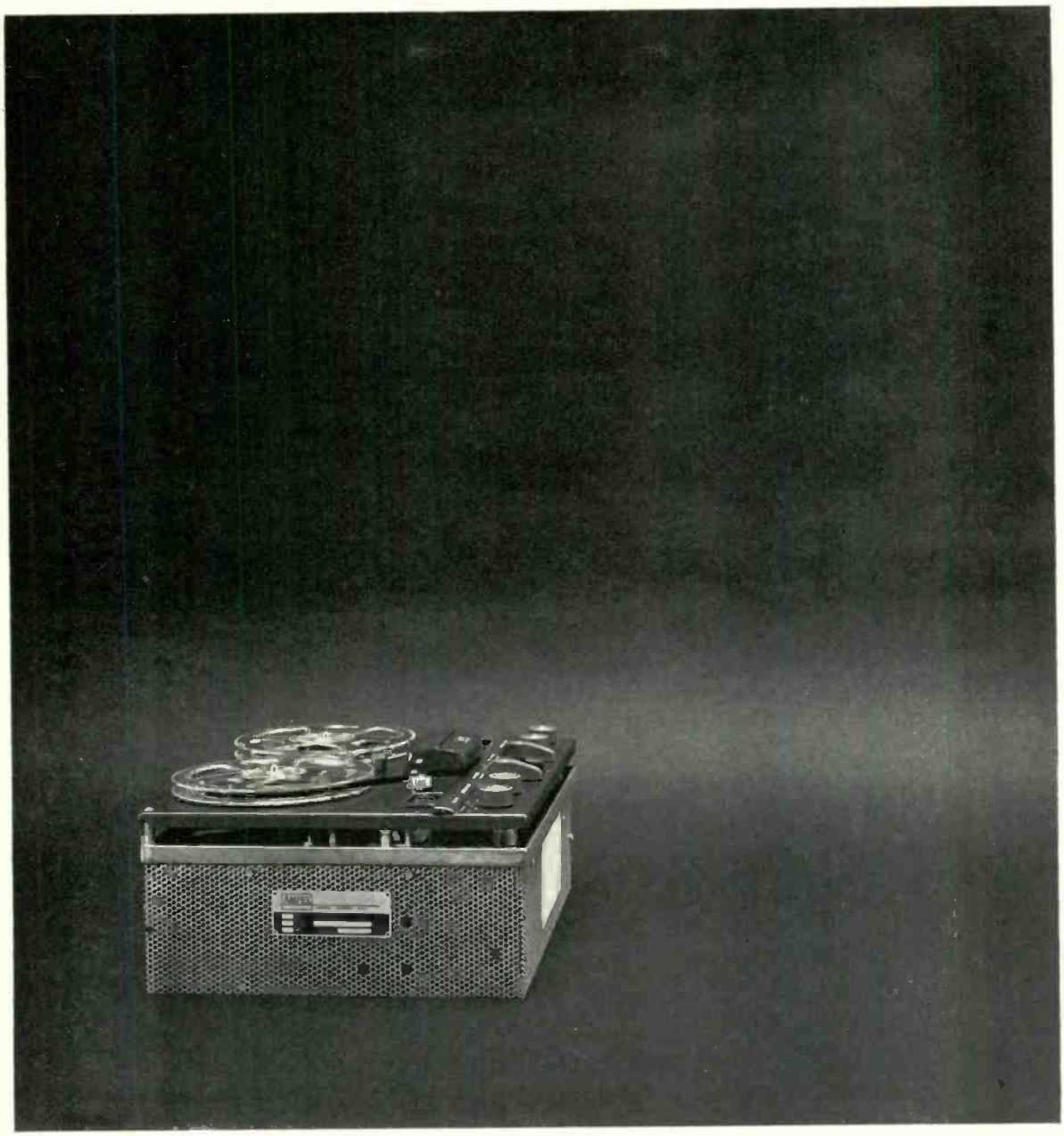
A unique problem of stereo tape machines is that of properly coordinating the two channels in various respects. This problem may lie with the manufacturer of the machine, with the user, or partly with both.

1. *Co-Linearity of the Stereo Head Gaps.* One of the problems of manufacturing a good stereo head is to insure that the gaps are in exactly the same straight line. If one gap is tilted with respect to the other, as illustrated in *Fig.* 6, then it is not possible to achieve correct azimuth on both channels simultaneously; hence high frequency response will suffer on one channel or the other, or both. If one gap is displaced with respect to the other, as illustrated in *Fig.* 7, then the time relationship between the left and right signals will be altered. Some experts have claimed that extremely small changes in the time relationship can significantly alter the stereo effect.

2. *Equal Playback Levels.* One section of a stereo playback head may produce a few db more signal output than the other for the same amount of signal level recorded on the tape. Or one playback amplifier may have more gain than the other. To determine the relative playback levels on each channel, set the playback gain controls at the position most apt to be used, and play a full-track test tape. Compare the signal levels with a VTVM or by ear, assuming in the latter case that the channels of the rest of the audio system are balanced right through to the speakers. Adjust one of the gain controls on the tape machine for equal volume on both channels. If the tape machine does not have separate playback gain controls for each channel, then it becomes necessary to use the input level sets, if any, on the audio system amplifier to equate the signals. If there are no input level sets, then the balance control of the stereo amplifier must be used for this purpose. It is then necessary to take note of the balance control setting which achieves signal equality on tape playback.

3. *Equal Recording Levels.* Some tape machines use a single switched record level indicator for both channels, while others use separate indicators for each channel. The fact that both indicators

(*Continued on page 95*)



This Christmas you can afford an Ampex

(Now priced from $349.50 to $595)

The work of science no longer is costly. Ampex prices are down, but the quality of its tape players and recorders remains brilliantly Ampex. At last these coveted instruments are within reach of every stereophonic high fidelity enthusiast.

The 970, in portable case with built-in speakers, records monophonic and stereo, plays single, 2-track, and 4-track tape. Price reduced from $750 to $595.

The 960, in portable case, records monophonic and stereo, plays single, 2-track, and 4-track tape. Reduced from $650 to $495. The 952, unmounted deck, records stereo, plays single and 2-track tape. Reduced from $595 to $450. The 902, unmounted deck, records monophonically, plays single and 2-track tape. Reduced from $449.50 to $349.50.

For listening, more than 1,000 pre-recorded tapes are available now — 10 times as many as last year. And don't forget the recording fun of starting a new kind of souvenir — the family album on tape for hours of pleasant playback.

Tape players and recorders by Ampex, world leader in magnetic recording, at your dealer everywhere. See and hear them today. Ampex Audio Company, Sunnyvale, Calif.

AMPEX

"THE CITATION SOUND" "...FOR THE SAKE

"Over and above the details of design and performance, we felt that the Citation group bore eloquent witness to the one vital aspect of audio that for so many of us has elevated high fidelity from a casual hobby to a lifelong interest: the earnest attempt to reach an ideal—not for the sake of technical showmanship—but *for the sake of music and our demanding love of it.*"

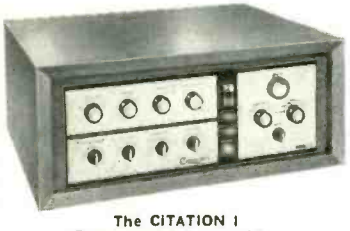
A truly remarkable commentary about a truly remarkable group of products—the Citation Kits by Harman-Kardon.

Mr. Reid's eloquent tribute to Citation is one of many extraordinary reviews of these magnificent instruments. We are proud to present a brief collection of excerpts from Citation reviews written by outstanding audio critics.

"When we first heard the Citations our immediate reaction was that one listened through the amplifier system clear back to the original performance, and that the finer nuances of tone shading stood out clearly and distinctly for the first time . . . bass is clear and firm, and for the first time we noted that the low frequency end appeared to be present even at low volumes without the need for the usual bass boost . . . The kit is a joy to construct." **C. G. McProud, Editor, Audio Magazine**

"The unit which we checked after having built the kit, is the best of all power amplifiers that we have tested over the past years . . . none have had distortion that was quite as low as we found in this new Citation II . . . the amplifier should provide the very finest in hi-fi stereo reproduction . . ."
William Stocklin, Editor, Electronics World

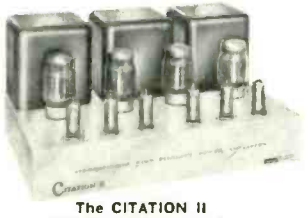
PRESENTING THE 1961 CITATION LINE FEATURING



The CITATION I
Stereophonic Preamplifier
Control Center

Here is the first brilliant expression of the advanced design concepts which sparked the new Citation Kit line—the incomparable Citation I, Stereophonic Preamplifier Control Center. The Citation I consists essentially of a group of circuit blocks termed "active" and "passive" networks. The "active" networks are treated as one or two stage amplification units, flat over an extremely wide frequency range and each is surrounded with a feedback loop. This results in levels of distortion so low as to prove unmeasurable. The "passive" networks provide precise equalization with no phase shift.

The use of professional step type tone controls overcome the limitations of continuously variable potentiometers. Each position on a step control is engineered to perform a specific function—which is absolutely repeatable when necessary. The many professional features and philosophy of design expressed in Citation I permit the development of a preamplifier that provides absolute control over any program material without imparting any coloration of its own. **Citation I—$159.95. Factory Wired—$249.95. Walnut Enclosure, Model WCI, $29.95.**



The CITATION II
120 Watt Stereophonic
Power Amplifier

This remarkable instrument has a peak power output of 260 watts and will reproduce frequencies as low as 5 cycles virtually without phase shift, and frequencies as high as 100,000 cycles without any evidence of instability or ringing. At **normal listening levels the only measurable distortion comes from the laboratory test equipment.**

Video output pentodes are used in all low level stages for exceptional wide frequency response and low distortion. Multiple feedback loops for increased degree of usable feedback (30 db overall) result in lower distortion without sacrificing stability. The power supply consists of four silicon diode rectifiers, choke, heavy duty electrolytics and potted power transformer for precise regulation and long life. The use of rigid component boards, heavy duty components, special Cable Harness assure the kit builder that the unit he constructs will be the exact duplicate of the factory built instrument. Because of its absolute reliability and exceptional specifications the Citation II has gained widespread acceptance among professionals as a laboratory standard. **The Citation II—$159.95. Factory Wired—$229.95. Metal Enclosure, Model ACII—$7.95.**

The CITATION III
Professional FM Tuner

Citation III is the world's most sensitive tuner. But more important—it offers sound quality never before achieved in an FM tuner. Now, for the first time Harman-Kardon has made it possible for the kit builder to construct a completely professional tuner without reliance upon external equipment. To meet the special requirements of Citation III, a new FM cartridge was developed which embodies most of the critical tuner elements in one compact unit. The cartridge is completely assembled at the factory, totally shielded and perfectly aligned—eliminating the difficult problems of IF alignment, oscillator adjustment and lead definition.

The Citation III's front end employs the revolutionary Nuvister tube which furnishes the lowest noise figure and highest sensitivity permitted by the state of the art. A two-stage audio circuit patterned after the Citation II is employed. By utilizing a high degree of feedback and providing a frequency response three octaves above and below the range of normal hearing, the Citation sound quality is maintained and phase shift is eliminated. The Citation III is styled in charcoal brown and gold to match all the other Citation instruments. **Citation III—$149.95. Factory Wired—$229.95. Walnut Enclosure, Model WCI—$29.95.**

OF MUSIC AND OUR DEMANDING LOVE OF IT."

"Its listening quality is superb, and not easily described in terms of laboratory measurements. Listening is the ultimate test and a required one for full appreciation of Citation . . . there is a solidity, combined with a total ease and lack of irritation which sets this amplifier apart . . . The more one listens to the Citation II, the more pleasing its sound becomes . . . Anyone who will settle for nothing less than the finest will be well advised to look into the Citation II."

Hirsch-Houck Labs, High Fidelity Magazine

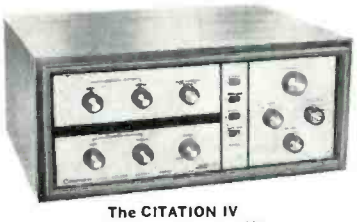
"At this writing, the most impressive of amplifier kits is without doubt the new Citation line of Harman-Kardon . . . their design, circuitry, acoustic results and even the manner of their packaging set a new high in amplifier construction and performance, kit or no."

Norman Eisenberg, Saturday Review

"Specifications published by the manufacturer are so astonishing that our sister publication, Electronics World, has subjected them to critical examination and found performance wholly consistent with claims . . . Nothing can faze it . . . we have heard this particular amplifier loaded with four big speaker systems glide over the steepest orchestral hurdles without the slightest trace of strain . . . The realism of the virtually distortion-free music was nothing less than startling. Our initial amazement soon gave way to an easy, relaxed enjoyment that was sustained for hours without a trace of that tension known as "listening fatigue." Here was a sound system that fulfilled the most difficult of all high fidelity requirements: to provide an awareness only of music, and oblivion of technicalities."

Herbert Reid—Hi Fi Stereo Review

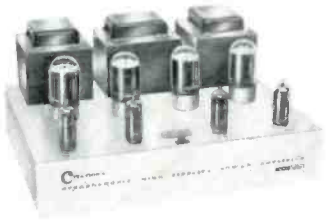
THE NEW CITATION III PROFESSIONAL FM TUNER



The CITATION IV
Stereophonic Preamplifier
Control Center

The new Citation IV is a compact stereophonic preamplifier designed in the best Citation tradition. It offers performance and features rivaled only by Citation I. Square wave tracings at 20 and 20,000 cycles reveal no difference between the response of the Citation IV and the signal generator.

The Citation IV provides separate bass and treble tone controls for each channel which may be switched out of the circuit completely to eliminate phase shift and transient distortion inherent in all tone controls. D.C. on all heaters and the use of low noise resistors in critical places reduce thermal agitation and hum. A zero to infinity balance control allows complete cut-off for either speaker. Military type terminal boards make for rigid, professional appearance and facilitate construction. The control over program material provided by the new Citation IV enables the user to perfectly recreate every characteristic of the original performance. The Citation IV is handsomely styled in charcoal brown and brushed gold. The **Citation IV — $119.95. Factory Wired — $189.95. Walnut Enclosure, WCI—$29.95.**



The CITATION V
80 Watt Stereophonic
Power Amplifier

The Citation V is a compact version of the powerful Citation II. Designed with the same lavish hand, it is conservatively rated at 40 watts RMS per channel with 95 watt peaks at less than 0.5% distortion.

The availability of rated power at the extreme ends of the frequency range enables the amplifier to effortlessly drive any of today's most inefficient speakers. It clips clean without breakup. The output stage consists of two 7581's per channel operating conservatively in a fixed bias, ultra-balance circuit. A bias meter is provided to statically and dynamically adjust each pair of output tubes. The power supply consists of four silicon diodes (hermetically sealed) and heavy duty electrolytics for excellent B+ regulation and long life. This results in instantaneous recovery time and superb transient response.

Here is an all new power amplifier which truly reflects The Citation approach to audio design: no compromise in quality regardless of cost. The Citation V is styled in charcoal brown and brushed gold. **The Citation V — $119.95. Factory Wired — $179.95. Metal Enclosure, ACV—$7.95.**

CITATION KITS *by*

harman kardon

INCORPORATED
PLAINVIEW, NEW YORK

For complete information on the new Citation Kits, including reprints of independent laboratory test reports, write to: Dept. A11, Citation Kit Division, Harman-Kardon Inc., Plainview, New York.

All prices slightly higher in the West.

Be Professional—Rack Mount

WILLIAM G. DILLEY*

If you would rather put your money into equipment than cabinets—rack mount. You may then be able to afford that new piece of equipment you've been wanting.

Most serious audiophiles are easily identifiable by the constant changing of equipment that occurs within their homes—either expanding their capability and performance, or experimenting with new equipment or designs. Even the newcomer, who retains his interest, goes through the evolution of improving his initial installation—the number of changes being limited only by his enthusiasm and his pocketbook.

The effect of all these changes is usually reflected in the additional expense required to revamp the equipment cabinet, the cramped quarters, the increased amount of heat, a reduction in functional efficiency, or at the very least, exposed components because of insufficient housing. Nothing is quite so disheartening as to own an expensive console or built-in cabinet that has been rendered functionally obsolete by changing requirements. In fact, decisions to make necessary changes often are avoided because of a reluctance to rebuild beautiful but outmoded cabinets.

Such problems, decisions, and expense can, for the large part, be avoided by rack mounting your components. The advantages of rack mounting are numerous: flexibility, accessibility, serviceability, and convertibility, not to mention such by-products as improved ventilation, and professional appearance. Equally important to the audiophile, however, is the added advantage of the availability of necessary materials and the ease of construction required to produce that professional appearing equipment. A few highlights of these advantages are:

* *577 East Avery Street, San Bernardino, Calif.*

Fig. 1. Six-position stereo mixer that doubles as a portable unit.

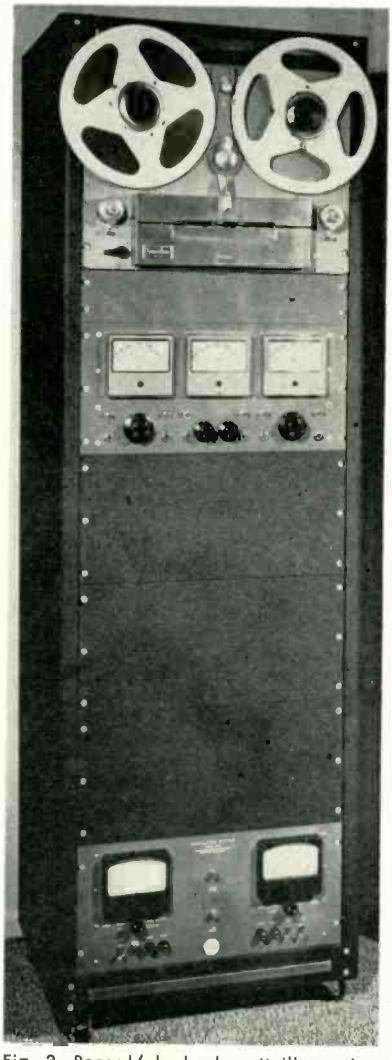


Fig. 2. Record/playback unit illustrating the use of blank panels pending further expansion.

Flexibility: Rack mounting allows complete freedom of component placement in a vertical direction. Units may be changed from top to bottom merely by removing panel attaching screws. Units may be interchanged as required for specific uses thus permitting the use of only one rack where economy is a factor. Units may double as portable components when removed and placed in a portable housing. (See *Fig.* 1.) Also, the use of rollers or casters on racks, makes possible ease of movement of the entire equipment from one room to another as required for recording, patio music, etc.

Accessibility/Serviceability: All components are readily exposed by opening a door in the back of the rack for tube changes, rewiring, lead changes, etc. The individual units are easily removed from the front for inspection, repair, and/or modification. As one who is constantly removing the efforts of amateur cabinet makers from mazes of wires and wooden platforms, I cannot stress too emphatically the importance of accessibility (upon electronic performance). The action of successfully stuffing all wires into a hole, just prior to sliding in the component, is just not compatible with good electronic performance.

Convertibility: Herein lies the greatest saving to the individual who is constantly making changes and who houses his equipment. Control functions may be added, deleted, or moved without changing the basic equipment by simply replacing the front panel at a very small cost. Inter-unit wiring changes are facilitated by complete accessibility to all units from the rear. Obviously, such changes in a furniture-type housing can be quite costly.

The disadvantages of rack mounting are two: Women are inherently opposed to such items in their household (my wife refers to mine as "The Iron Monster") and if you should feel inclined to sell your equipment, the buyer's wife may defeat you for the same reason.

For those dedicated individuals who recognize the merit of such an installation, and who would like to rack mount their equipment, in spite of the disadvan-

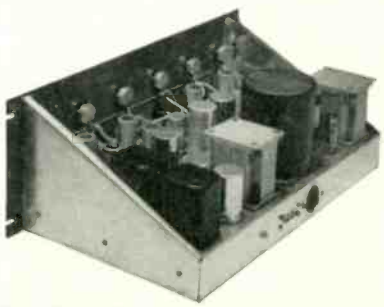
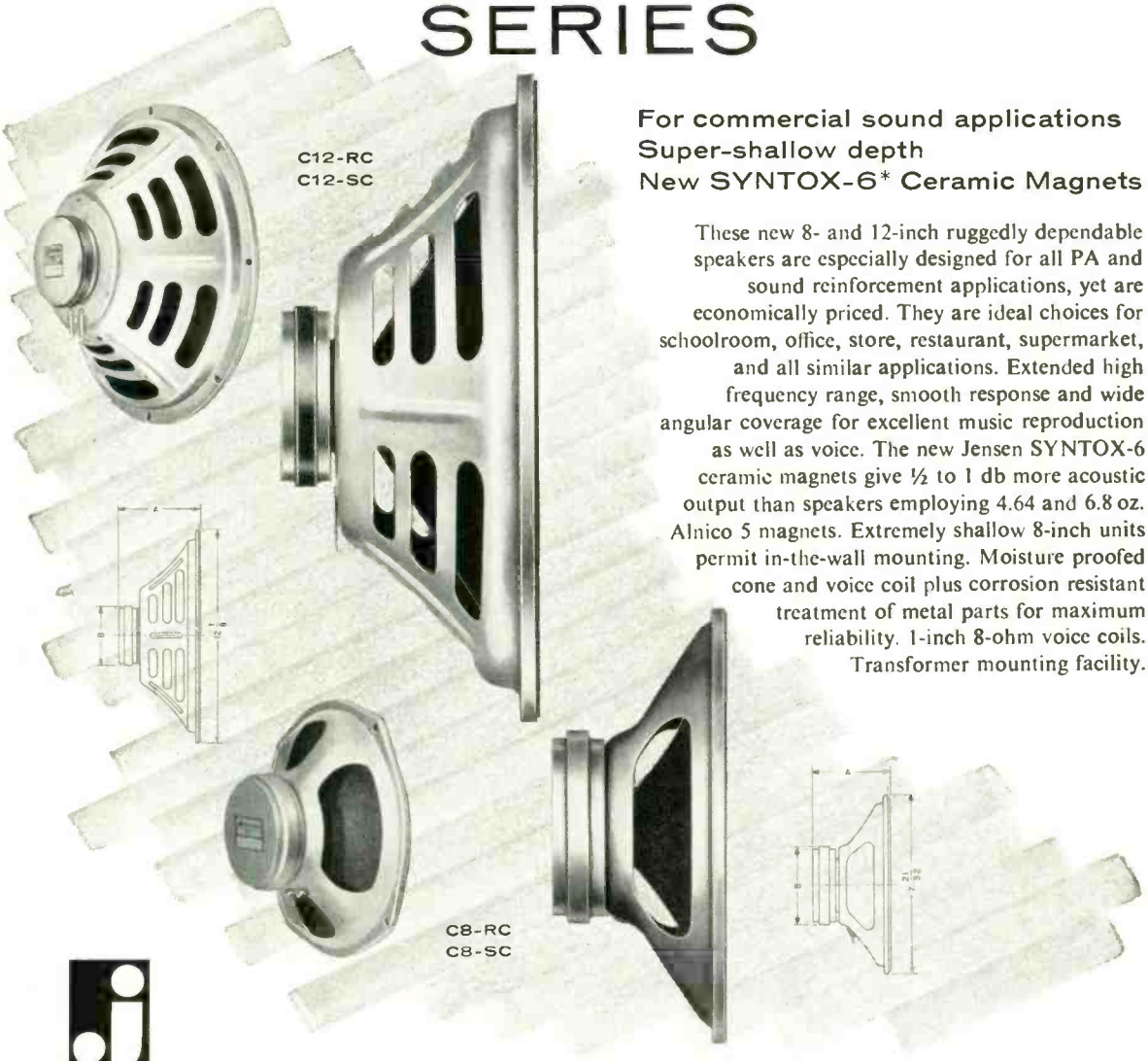


Fig. 3. Portable mixer removed from cabinet and ready for rack installation.

NEW Jensen PROFILE* LOUDSPEAKERS SERIES



For commercial sound applications
Super-shallow depth
New SYNTOX-6* Ceramic Magnets

These new 8- and 12-inch ruggedly dependable speakers are especially designed for all PA and sound reinforcement applications, yet are economically priced. They are ideal choices for schoolroom, office, store, restaurant, supermarket, and all similar applications. Extended high frequency range, smooth response and wide angular coverage for excellent music reproduction as well as voice. The new Jensen SYNTOX-6 ceramic magnets give ½ to 1 db more acoustic output than speakers employing 4.64 and 6.8 oz. Alnico 5 magnets. Extremely shallow 8-inch units permit in-the-wall mounting. Moisture proofed cone and voice coil plus corrosion resistant treatment of metal parts for maximum reliability. 1-inch 8-ohm voice coils. Transformer mounting facility.

MODEL	NOM. SIZE	POWER RATING	MAX. DIMENSIONS			MAGNET WT.		NET WT.	LIST PRICE
			O.D.	DEPTH A	MAGNET DIA. B	SYNTOX-6	EQUIV. AL 5		
C8-RC	8"	12 watts	8⅛"	3"	3 7/16"	10.0 oz.	6.8 oz.	2 lbs.	$12.50
C8-SC	8"	11 watts	8⅛"	2 5/16"	3¼"	6.0 oz.	4.64 oz.	1¾ lbs.	10.35
C12-RC	12"	14 watts	12⅛"	4½"	3 7/16"	10.0 oz.	6.8 oz.	5 lbs.	16.00
C12-SC	12"	13 watts	12⅛"	4 7/16"	3¼"	6.0 oz.	4.64 oz.	4¾ lbs.	14.75

NOTE: Mounting holes conform to all existing EIA standards.

*T.M.

THERE IS ALWAYS A BETTER LOUDSPEAKER FROM . . .

Jensen / MANUFACTURING COMPANY
DIVISION OF THE MUTER CO. 6601 S. Laramie Avenue, Chicago 38, Illinois
In Canada: Renfrew Electric Co., Ltd., Toronto In Mexico: Universal De Mexico, S. A., Mexico D. F.

tages mentioned, a typical installation will be described.

The initial decision in rack mounting is one of determining the total space required to house all of the components. Racks are available in various heights from approximately 36- to 77-in. in a standard width sufficient to accommodate a 17-in. chassis. When the height has been decided upon, it would be well to add a margin for error—and expansion. You will surely need the additional space once you embark on the road to rack mounting. Blank panels preserve a neat appearance for any unused portions until filled (see *Fig.* 2). Panels (19-in.) are available in various sizes from 1¾ to 21-in. in height. These panels are aluminum and are easily worked. Even a wood file can be used to cut the material. Standard 17-in. rack chassis are available in heights of 2- to 4-in. and in depths of from 4- to 13-in.

It is a simple matter to connect the chassis to the front panel. Commercially manufactured side plates of heavy gauge steel may be purchased, or the builder may construct his own of light aluminum. Straight side plates may be used for most chassis, but if weight is a consideration, a 90 degree bend of ¼- to ½-in. on the top of the plate will provide the necessary strength to support all but the heaviest of components. (See *Fig.* 3.)

The panel supports the entire assembly when suitably connected to the chassis and attached to the rack.

Control identification can be approached in two ways: panel marking to indicate function; or placement, direction of motion, and coloring to indicate function, with no markings required. This latter method is usually referred to as function determined by association.

Panel marking materials available to the home constructor are rather limited and may be broadly classified in two general categories: "hard" and "soft" type markings.

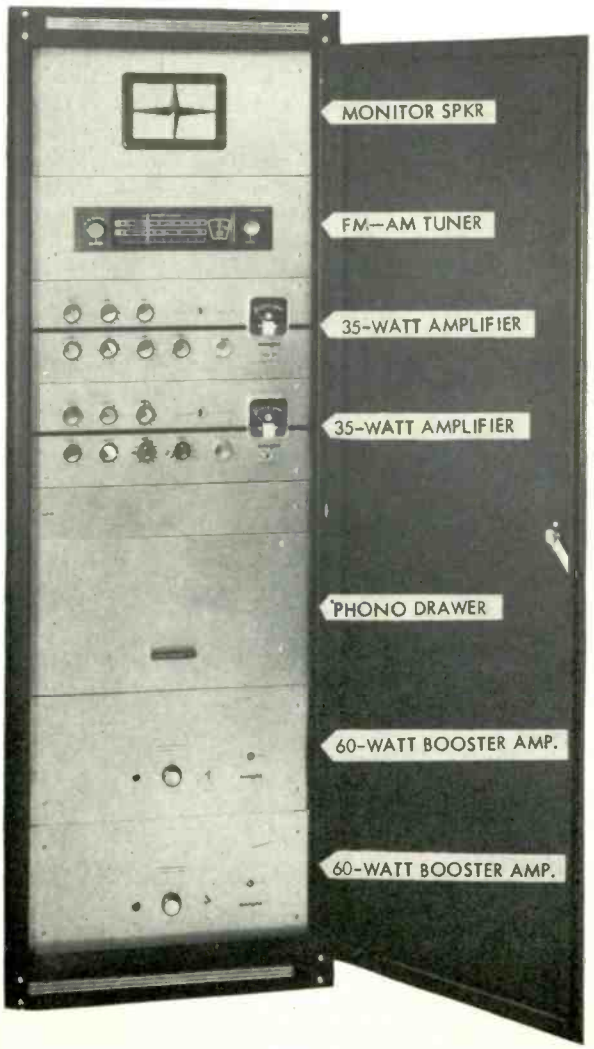


Fig. 4. Rack-mounted sound distribution system used by Allied Radio Corporation.

Fig. 5. Rack-mounted stereo record/playback system constructed by the author.

"Hard" types refer to metal, plastic, or fiber plates or disks that are attached to the panel front by mechanical means (screws, nuts, bolts). Metal dial plates for various functions are fairly abundant, but specific control marking plates are almost non-existent. The constructor may, of course, make his own with photographic paper covered with plastic or other such methods. However, an economical and effective method is to use engraved plastic door markers, made to order in most dime stores.

"Soft" types of markings refer to painted or direct application markings. Most common in this category are decals such as "Techni-cals." They are available in white, black, and gold and are purchased in book form for specific uses, such as: Communications, Audio, Workshop, and etc. Panels are available in three standard finishes—gray wrinkle,

from McIntosh

. . . the finest performance available

the MacKit 30

A 30-Watt Unity Coupled Amplifier Kit*

*Identical to the renowned McIntosh MC-30 Amplifier

Price $120

Enjoy the wonderful experience and satisfaction of putting the finest amplifier together yourself.

A "Mark of Excellence" Product by

McIntosh
LABORATORY, INC.
4 Chambers St., Binghamton, N. Y.

Now available at Franchised McIntosh Dealers

INTRODUCING ALTEC 707

STEREO AM-FM TUNER-AMPLIFIER

Advance with Altec to the new, true sound of music—the larger-than-life sound of stereo at its finest! The all-new Altec 707 Stereo AM-FM Tuner-Amplifier brings you Altec engineering at its best—the same engineering which has made Altec sound the universal standard of theatre and broadcast sound. Here is that all-in-one control unit every stereo enthusiast has demanded—but one which makes no sacrifice in circuitry or component performance. In the 707, there is no compromise with quality! It took Altec speaker engineering to turn the trick—the kind which created the matchless sound of Cinerama and Todd-AO for theatres, the speaker used by almost all major broadcast and recording studios.

Enjoy the sure simplicity of professional controls, the unequalled performance of the 707 in your own stereo set-up. Compare the specifications, then listen to it at your Altec dealer's. Experience that great moment when you are introduced to the true sound of music—the Altec sound of music. Priced at only **$387.00.**

NOW AT LAST, a home-sized 800 cycle speaker with components similar to those used in the world-famous A7 Altec "Voice of the Theatre" system.

Visit your Altec professional high fidelity consultant and ask him to demonstrate the new 837A "Avalon" speaker system and the new 707 Stereo AM-FM Tuner-Amplifier, that will bring the full range and dynamics to your living room.

The 837A "Avalon" is a professional 2-way system with frequency response of 40—20,000 cycles. 25 watt capacity. Dimensions, 29¾" H by 35" L by 17¾" D.

Other complete speaker systems from $89.50.

Compare ALTEC advances and superior specifications at your ALTEC DEALER'S. ALTEC offers you the most complete line of quality stereo and mono high fidelity amplifiers, speakers, and systems in the world. Write for descriptive brochure. Address Dept. AD-7D

ALTEC LANSING CORPORATION, a subsidiary of Ling-Temco Electronics, Inc.

1515 S. Manchester Avenue, Anaheim, California

161 Sixth Avenue, New York 13, New York

THE ALL-NEW

FM

Antenna: Standard 300 Ohm.
Maximum Sensitivity: 2 Microvolts.
Quieting Sensitivity: 2.9 Microvolts for 20 db.
7.0 Microvolts for 30 db.
Frequency Range: 86.5 to 109 mc.
Image Rejection: 45 db.
IF Rejection: 55 db.
Detector Peak Separation: 450 kc.
Frequency Response: ±1 db 20—20,000 cps.
Antenna Radiation: Meets FCC Requirements.

AUDIO

Power Outputs: 80 watts Stereo Program Peak Power (40 watts per channel); 48 watts Music Power Output (24 watts per channel); 40 watts, rms continuous, Stereo or Monophonic (20 watts per channel).
Distortion: Less than 1% THD at 20 watts, 1,000 cps, each channel.
Frequency Response: ± .5 db 20—20,000 cps at 1 watt.
Tone Control Range: ± 12 db at 50 cps, 12 db at 10,000 cps.
Rumble Filter: 12 db per octave below 30 cps.
Input Sensitivity for 20 watts output: Tape, Multiplex—350 mv 1 kc; Magnetic Phono—3.0 mv 1 kc; Tape Head—1.5 mv 250 cps.
Input Impedance: Phono—47,000 Ohms; Tape Head—47,000 ohms; Multiplex—100,000 Ohms; Tape Machine—100,000 Ohms.
Load Impedance: 4, 8 and 16 Ohms.
Noise Level: Phono—55 db below 20 watts; Tape Head—52 db below 20 watts; Tape Machine—78 db below 20 watts; Multiplex—78 db below 20 watts.

AM

Antenna: Built-in Ferrite Antenna, plus external antenna connection.
Maximum Sensitivity: 3.2 Microvolts.
Loop Sensitivity: 35 Microvolts per meter.
Frequency Range: 537 to 1630 kc.
Image Rejection: 65 db.
IF Rejection: 50 db.
Selectivity: 6 db bandwidth, 13 kc "Broad", 6 kc "Sharp".
Whistle Filter: 10 kc Attenuation better than 40 db.

GENERAL

Front Panel Controls: Input selector switch, channel balance control, Dual gain control, Dual bass control, Dual treble control, AM Broad-Sharp selectivity switch, FM AFC defeat switch, Stereo-Monophonic Mode switch, Stereo Standard-Reverse switch, Loudness contour switch, Rumble filter switch.
Internal Control: Squelch threshold control.
Inputs: 9, Stereo or Monophonic—Magnetic Phono, Tape Head, Tape Machine, Multiplex Input, FM antenna, AM external antenna.
Outputs: 6, Stereo or Monophonic—Channel A and Channel B Recorder, left and right speaker, Center speaker, Multiples Outputs.
Tubes: 1-6GY8, 1-6AL5, 5-6BA6, 1-6BE6, 2-EM84, 1-12AU7, 5-12AX7, 4-7355.
Power Consumption: 145 watts, 117 volts, 60 cps.
External Power Available: One AC outlet controlled by power switch.
Color: Platinum gold or platinum pink. Weight: Apx. 35 lbs.
Dimensions over knobs and antenna: 5⅞" H x 15" W x 12⅝" D.

ALTEC® LANSING CORPORATION

THE TRUE SOUND OF MUSIC

Space Diversity Techniques Improve FM Reception

DANIEL VON RECKLINGHAUSEN* and MARTIN L. BORISH*

Having trouble with signal fading on your FM tuner? Two or more tuners connected together can improve your reception and may entirely eliminate fluttering of the signal caused by moving planes, other objects.

IMPROVED FM reception, especially in fringe areas where signal strength is extremely low, is now practical through use of space diversity techniques with two or more H. H. Scott 310-D FM tuners. Adaptation of this technique to FM allows the critical music listener to obtain usable FM even though he is located in areas where ordinary tuners would fade frequently.

Diversity reception is familiar to many professional shortwave operators. It has received considerable publicity for its use in tropospheric scatter transmissions such as used on the DEW line as well as in transoceanic communication. However, to our knowledge very little has been done with diversity techniques for reception of standard FM broadcasts. Certainly the H. H. Scott 310-D Wide-Band Broadcast Montior FM tuner, *Fig.* 1, is the first commercially available tuner to have provisions for diversity reception built in.

To those unfamiliar with diversity, it can be described simply as a system of two or more antennas as far apart as possible, supplying signal to two or more tuners. The tuners in turn feed the playing system. The unique feature of the 310-D switch diversity system is that if one of the tuners is receiving a poor signal it will immediately switch out. In cases of short term fading it may often happen that only one antenna at a time gets a good signal. Using 310-D's only the tuner receiving a usable signal will feed the amplifier. The automatic switching between tuners can occur as rapidly as forty times a second without any adverse effects (such as low-frequency transients) audible in the speakers. Thus, the problem of signal fading can be considerably improved.

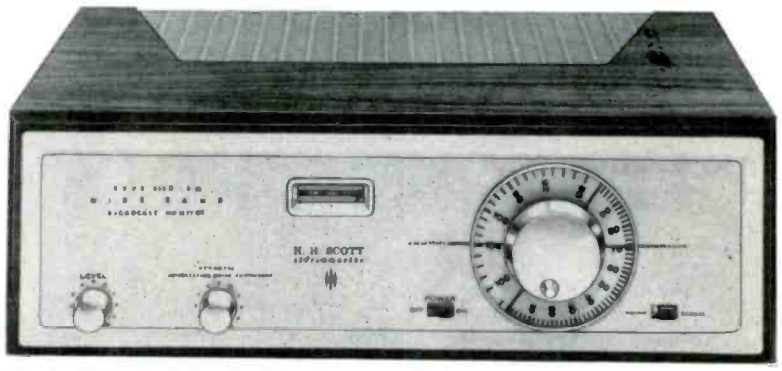


Fig. 1. H. H. Scott 310-D Wide-Band Broadcast Monitor FM Tuner which can be connected for dual- or triple-diversity interference-free reception.

The Problem of Fading

Just how serious is the problem of fading in regular FM reception? Many listeners are near the transmitter and should receive a signal of considerable strength. Investigation discloses that the field strength may not be nearly as great as expected.[1] The average measured field strength of a 30-foot receiving antenna placed in a variety of locations is as much as 20 db below computed values based on standard formulas using the refractive index of atmosphere, conductivity of ground, and the dielectric constant of the earth.[2]

Long-term fading further complicates this picture.[3] Ten per cent of the time the signal may be as much as 13.2 db below the average (exceeded 50 per cent of time) field strength. One per cent of this time, the signal may be 25 db lower. Minute variations in the location of an antenna will also cause changes, due to reflection from ground or other nearby objects. Most people do not live near smooth ground which is one of the assumptions used to calculate field strength.

It is obvious that one does not have to be far from the transmitter for signal strength to be quite low on occasion. This can also be due to attenuation caused by the terrain (hills, buildings, and so on). The appearance of short-term fading on top of this causes the signal to drop below the threshold of usability of even a sensitive wideband tuner. At distances far removed from the transmitter, these problems become more severe and more common.

The greatest single cause of short-term fading is reflection from moving objects on the ground or the air. Ground reflections from cars, trucks, and so on disturb the field of the receiving antenna only slightly. It is the reflections from flying man-made objects (as opposed to flying saucers) which are the major factor. In *Fig.* 2 we have a typical situation. The plane is somewhere near the path between the transmitter and the receiving antenna (it does not have to be directly between). The amount of signal reflected by the plane and picked up by the tuner may be as strong as that from the transmitter, depending on path length. If the signal along path A and that from path B + C arrive in phase, the resultant signal at the tuner will add. If they arrive out of phase the signal will subtract and, thus, may cancel completely.

As the plane moves, the signal at the tuner will increase and decrease rapidly

* *H. H. Scott, Inc., 111 Powermill Road, Maynard, Mass.*

[1] Phillip L. Rice, "Tropospheric fields and their long-term variability as reported by TASO." *Proc. I.R.E.*, Vol. 48, pp. 1021–1029; June, 1960.

[2] Alfred H. LaGrone, "Forecasting television service fields." *Proc. I.R.E.*, Vol. 48, pp. 1009–1015; June, 1960.
G. Birnbaum and H. E. Bussey, "Amplitude, scale and spectrum of refractive index inhomogeneities in the first 125 meters of the atmosphere." *Proc. I.R.E.*, Vol. 43, pp. 1412–1418; October, 1955.

[3] G. R. Sugar, "Some fading characteristics of regular VHF ionospheric propogation," *Proc. I.R.E.*, Vol. 43, pp. 1432–1436; October, 1955.

any 2 different HI-FI programs
to several places in the home simultaneously
all thru one BOGEN-PRESTO instrument!

ONLY SOUNDSPAN T.M. DOES IT!

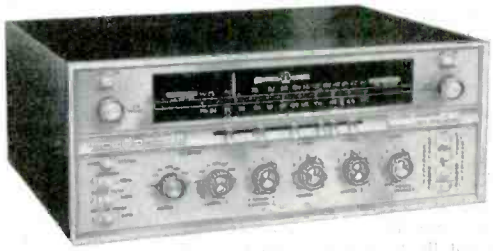
ANY 2 DIFFERENT HI-FI PROGRAMS—Family music and entertainment tastes can be satisfied—*really* satisfied—with SoundSpan. Pop tunes for the youngsters—while the grownups listen to classical music—from AM or FM radio, records, tape, TV sound—any two, and at the same time! No longer need the family be bound by the personal tastes of one of its members. With SoundSpan you have music to suit the *individual* taste—entertainment *when* you want it.

SEVERAL PLACES IN THE HOME SIMULTANEOUSLY—Whether you live in a 3-room apartment, a suburban split level or a very large home, you'll find SoundSpan versatility the perfect answer to your family needs. Think of it—Mother can enjoy FM in the kitchen while the children dance to records in the playroom... thru one system! Later the whole family together can thrill to stereo in the living room. The bedroom, den, and the patio or terrace are other places you might locate loudspeakers operating from BOGEN-PRESTO's SoundSpan RP-40 Receiver or AP-40 Amplifier. There are four controlled output lines. How you use them is entirely up to you.

ALL THRU ONE BOGEN-PRESTO INSTRUMENT — Operating SoundSpan is simplicity itself. Programming Selectors direct mono or stereo programs to either or both channels. A lighted panel indicator shows the program sources and channels in use. Your choices of these programs are directed to speakers individually controlled by a simple switching arrangement. Only the RP-40 or AP-40 with SoundSpan can channel two different mono programs—or one stereo program to several loudspeakers located anywhere in your home... and without input program limitations. Owning the RP-40 is like having two independent high-fidelity systems in your home—for the price of one. Send for free literature; get the *whole* story on SoundSpan and the many other wonderful features incorporated in the model RP-40 Receiver and AP-40 Amplifier.

AP-40 40 WATT AMPLIFIER
$199.50 LESS ENCLOSURE

TP-40 AM-FM TUNER
$189.50 LESS ENCLOSURE



NEW BOGEN-PRESTO RP-40 HOME MUSIC CENTER—40 WATT AM-FM STEREO RECEIVER WITH SOUNDSPAN! $329.50 LESS ENCLOSURE.

Prices slightly higher in the West

BOGEN-PRESTO

DESK A-110, PARAMUS, N. J. • A DIVISION OF THE SIEGLER CORPORATION

BP SIEGLER

60-7

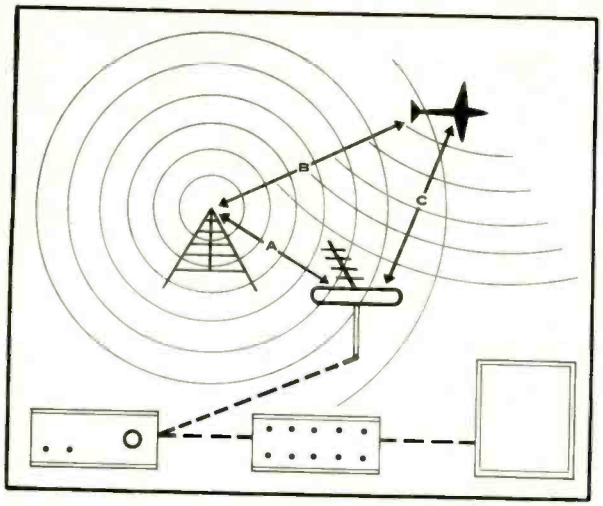


Fig. 2. Cancellation effect due to different transit times of direct and reflected signals.

(a plane moving at 300 mph may vary the signal between zero and 100 times per second). In a strong signal area, with a high-quality wideband tuner, the output of the tuner is independent of the signal strength. The AGC and limiting action of the tuner are the only controlling factors. Therefore, there will be no audible fading. However, there will be an increase in background noise during this period.

If this same fading occurs at the threshold of the tuner's sensitivity, there will not only be an increase in noise, but also moments when the signal becomes completely unusable.

To the discriminating listener this is a most objectionable situation. The person adding to his tape library by recording off the air can have a valuable recording completely ruined. For the various FM networks that are linked together by means of off-the-air reception, fading is a major difficulty.

Requirements for Diversity

The first requirement for diversity reception is a tuner with exceptionally good usable sensitivity. This is a basic requirement for good performance with or without diversity. Other necessary design features have been clearly specified in the report on diversity prepared by a research team at the MIT Lincoln Laboratory. "These design features include wide-band high-speed limiters and wide-band high-linearity discriminators. Receivers embodying these features have superior performance under multipath conditions."[4] It comes as no news to be told that the H. H. Scott 310 pioneered these very features years ago.

The next requirement in diversity reception is to locate the antennas as far apart as possible. Under these conditions, it is not likely that the signals reaching the two antennas will be cancelled at the same time, as can be seen from *Fig.* 3. With antennas 3½ wavelengths apart, the correlation between the signal reaching the two antennas is up to 50 per cent. However, if the separation is increased to 6½ wavelengths, the correlation decreases to 30 per cent. It is understood that it is desirable to have as different a signal as possible reaching the different antennas, so the correlation should be as low as possible. Correlation will not be greatly affected by the direction of the line between the receiving antennas. If only two are used, it is best to keep the line normal to the signal from the transmitter. As a rule of thumb, let us say that at a frequency of about 100 mc for FM, the separation of the two (or more) antennas should be a minimum of 35 feet, and preferably several times this amount. Here it might be remembered that our wavelength at 100 mc is approximately 10 feet.

The second requirement is to combine the outputs of the two or more tuners used.

The simplest method is to connect the outputs in parallel. The audio output will be identical and in phase. There is no correlation between the background noise so the total noise of the two tuners in parallel, assuming identical noise level, will be 3 db below that of either one. If one tuner is noisy and one quiet, the background noise will be up to 6 db below that of the noisy tuner. This is not desirable since the poorer signal controls the quality of the resultant audio output. It is therefore necessary to have automatic means of control of the audio output of each tuner actuated by the signal available to each tuner.

One approach is known as "Combiner Diversity." This procedure, much used in scatter propagation, has the tuner with the poorer signal simply fade out, while the one with the better signal stays in. The controlled devices are bass-band amplifiers with variable output impedances actuated by the amount of noise detected. This method provides perhaps the least resultant signal-to-noise ratio. However, it also creates low-frequency transients that would be disastrous in wide-range music systems. In scatter reception, a typical system may operate down to 300 cps, with the combiner cutting off at 100 cps to prevent transient problems. This is not satisfactory for high fidelity performance.

Switch-Type Diversity

The best method for quality performance is to arrange it so that the tuner with the poorer signal is switched out. This is referred to as "Switch-Type Diversity." It can be done with tuners that incorporate "squelch" circuits. With a squelch circuit the tuner is set so that the audio output will be turned off if the signal strength falls below a certain value. All tuners to date do this by means of a tube. In this case the transient created by turning the audio output on and off causes an enormous low-frequency pulse to be transmitted to the amplifier. This pulse can be as much as twenty times as strong as the audio output from a 100-per cent modulated sig-

(*Continued on page 90*)

[4] G. L. Mellen, W. E. Morrow, A. J. Pote, W. H. Radford, and J. B. Wiesner, "UHF long-range communication systems." *Proc. I.R.E.* Vol. 43, pp. 1269–1280; October, 1955.

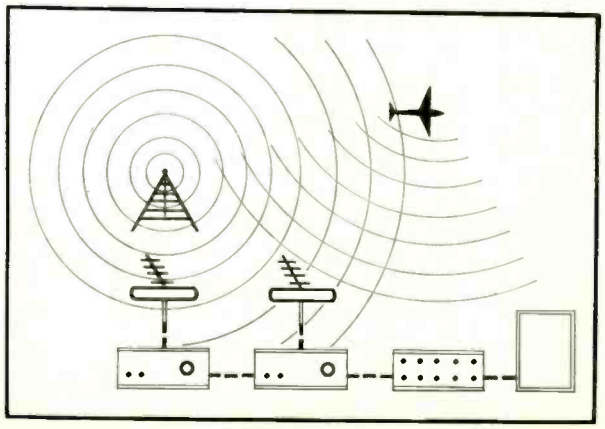


Fig. 3. With two spaced antennas and two FM tuners, connected as described, only the output from the usable signal is fed to the amplifier.

STEREO SYSTEM FOR A MILLIONAIRE: 4 SELECTIONS

Gentlemen's Quarterly magazine asked James Lyons, editor of *The American Record Guide* (the oldest record review magazine in the United States), to poll hi-fi authorities on which audio components they would choose for the best possible stereo system, without any regard for price.

Three writers in the audio field and one audio consultant made up independent lists. The ideal systems they projected in the April, 1960 issue of *Gentlemen's Quarterly* are suitable for discriminating millionaires—one of the systems, using a professional tape machine, would cost about $4000.

ACOUSTIC RESEARCH AR-3 loudspeakers are included in three of the lists,* and these are moderate in price. (There are many speaker systems that currently sell for more than three times the AR-3's $216.) AR speakers were chosen entirely on account of their musically natural quality.

Literature on Acoustic Research speaker systems is available for the asking.

In two cases alternates are also listed. For the complete component lists see the April, 1960* ***Gentlemen's Quarterly,* *or write us.*

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

REVIEWS LIKE THESE...

The PR-500 Turntable . . .

". . . a single speed (33⅓-rpm) turntable with an integrally mounted arm . . . employs a somewhat unconventional drive system which results in a totally inaudible rumble level, and low wow and flutter. The arm is simple yet effective, with a mounting system which makes the unit relatively insensitive to shock and vibration."

"The arm tracks well at the lowest stylus forces recommended by the cartridge manufacturer."

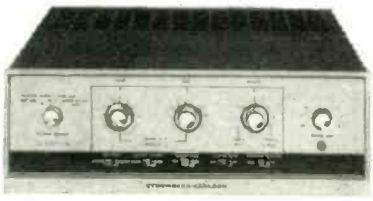
"The hum field surrounding the PR-500 is very low, and no difficulty should be experienced from this source even with poorly shielded cartridges."

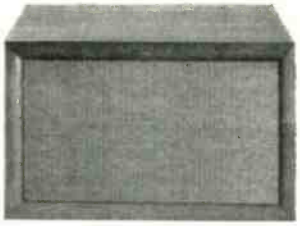
". . . the Stromberg-Carlson PR-500 performs in a manner comparable to that of the most expensive turntables and arms, yet sells for much less."

"The PR-500 is an excellent value at **$69.95.**"

Hirsh-Houck Laboratory—
High Fidelity Magazine, May '60

...hint at the performance of new





New Amplifiers...

ASR 660—an extremely clean, beautifully designed stereo amplifier • **Continuous power:** 36 watts (18 watts per channel) • **Music power:** (IHFM standard): 44 watts (22 watts per channel) • **Total harmonic distortion:** 0.6% at 18 watts per channel • **Intermodulation distortion:** 1% at rated output (4:1 ratio, 60 and 7,000 cps) • **Frequency response:** ± 0.5 db, 20-20,000 cps • Separate channel, clutch-type bass and treble controls • Scratch filter (18 db/oct); Rumble filter "Twin T" filter, null at 20 cps • Loudness contour switch; Balance control; Channel reverse switch; Program selector; Master gain control • DC on pre-amp heaters for low noise; A plus B center speaker terminals.

Suggested Audiophile net: **$149.95**

ASR 220C — an unusually versatile medium power stereo amplifier • **Continuous power:** 24 watts (12 watts per channel) • **Music power** (IHFM standard) 28 watts (14 watts per channel) • **Total harmonic distortion:** 0.7% at 12 watts per channel • **Intermodulation distortion:** 2% at rated output (4:1 ratio, 60 and 7,000 cps) • **Frequency response:** ± 0.5 db, 20-20,000 cps • Separate channel clutch-type bass and treble controls • Scratch filter (18 db/oct); Rumble filter "Twin T" filter, null at 20 cps • Magnetic phono pre-amp with new, low noise tubes • A plus B center-speaker terminals.

Suggested Audiophile net: **$119.95**

New Speaker Systems

Three new, wide range speaker systems. A new elliptical tweeter with a heavily silver-plated voice coil prevents harshness caused by cone breakup in conventional circular speakers. Woofers of extra-heavy cone stock are capable of long, linear excursions for outstanding low frequency power handling without distortion. Tweeter level switches included on all models. Enclosures are carefully matched to the woofer.

Suggested Audiophile net: (prices vary with finish)	RS511	59.95 to 84.95
	RS514	74.95 to 99.95
	RS516	105.00 to 135.00

For the sheer joy of listening . . . "There is nothing finer than a Stromberg-Carlson"

The FM-443 Tuner . . .

"The Stromberg-Carlson FM-443, one of the least expensive FM tuners on the market, approaches the performance of more expensive equipment. It is therefore an especially good value for anyone who wants to obtain the highest level of performance in a moderate-priced system."

"The distortion at 100% modulation is about 1% for signals stronger than 10 microvolts."

"The sensitivity measurement of the FM-443, according to IHFM standards, is amazing. Its usable sensitivity is 3 microvolts, a figure not usually found in tuners in this price range. This high sensitivity has not been obtained at the expense of IF bandwidth."

"The tuner sells for **$79.96.**"

Hirsh-Houck Laboratory—
High Fidelity Magazine, June '60

The ASR-880 Amplifier . . .

". . . a compact integrated stereo amplifier rated at 32 watts per channel. Noteworthy . . . it exceeds its rated power substantially over most of the audio range, has excellent power-handling capabilities at both ends of the spectrum."

"Each channel delivered 50 watts at 2% harmonic distortion, or 48 watts at 1% distortion. This is unusual in an amplifier rated at 32 watts . . ."

"The distortion of the ASR-880 is very low at usual listening levels when correctly operated . . . it has a rare combination of very high gain and very low hum. The amplifier has a number of special features, such as center channel output and a very effective channel-balancing system, as well as the usual stereo control functions found in all good amplifiers."

"Only 0.6 or 0.7 millivolts at the phono inputs will drive the amplifier to 10 watts output per channel. At normal gain settings . . . the hum level is better than 70 db below 10 watts even on phono input. This is completely inaudible."

"With a listening quality matching its laboratory response, the Stromberg-Carlson ASR-880 must be considered a very good value at its **$199.95** price."

Hirsh-Houck Laboratory—
High Fidelity Magazine, Sept. '60

Stromberg-Carlson components like these:

New Tuners

FM-443A—an improved version of the highly rated FM-443 • New, high-accuracy, precision dial • Precision components in de-emphasis network, giving improved frequency response: 20-20,000 cps ± 1 db • Sensitivity: 3.5 microvolts for 20 db quieting • Improved local-distance control in RF stage for lowest distortion and best signal-to-noise ratio on both local and distant stations • Total harmonic distortion; less than 1% full deviation.
Suggested Audiophile net: $79.95

SR-445A—a combination of the FM-443A and an entirely new, wide-band AM section. FM specifications: identical to FM-443A • AM frequency response: Broad: 25 to 9,000 ± 1½ db • Sharp: 25 to 2,500 cps ± 1½ db • AM noise level: 60 db below 1 volt output • AM harmonic distortion: less than 1% at 100% modulation • Separate tuning indicators for AM and FM.
Suggested Audiophile net: $139.95

All the new Stromberg-Carlson components have so many impressive features, you'll find a visit to your Stromberg-Carlson dealer most rewarding. He will be glad to demonstrate either an individual component or a complete Stromberg-Carlson Component Ensemble. See him or write: Stromberg-Carlson, 1418-011 North Goodman Street, Rochester 3, New York.

STROMBERG-CARLSON
A DIVISION OF **GENERAL DYNAMICS**

The Series-Parallel Speaker Array

CHARLES MAHLER, JR.*

The multiple-speaker system using an array of small speakers has stirred up a great deal of interest ever since this author introduced his system in AUDIO last year. Now we present his latest improvements plus some thought about using this system for stereo.

WHEN WE CONNECT speakers in a series-parallel array we must modify our conventional ideas. Practically all loudspeaker theory has been written about *single* units and how they react under various operating conditions. These writers have been talking about a single unit or at best a two- or three-way system. Therefore it is not difficult to understand why there has been so much interest in the series-parallel array. This type of array, besides being different, eliminates many of the speaker problems that have been confronting engineers for years. It clearly puts a whole new slant on loudspeaker system design.

The series-parallel speaker array consists of a large number of inexpensive small speakers so connected as to work in unison (in phase). The purpose of this arrangement is to move a large wavefront of air at the low frequencies. Because the output of the amplifier is distributed across all the speakers, each speaker is required to do a very small part of the overall job. If the number of the speakers is large enough, the intermodulation distortion and frequency doubling effects are almost entirely eliminated. This is explained by the fact that each speaker in this array is moving a fraction of an inch in the magnetic field available at the voice coil. At no time does the cone move in a nonlinear fashion. This fractional movement of the cone prevents the cone material, which is generally a paper substance, from buckling or distorting in its movements. Thus expensive and sophisticated speakers are not required for the array.

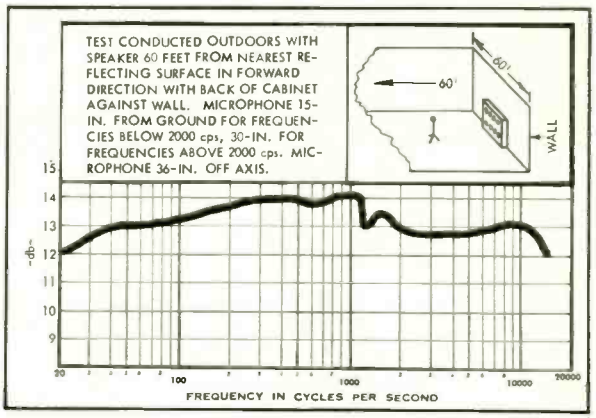


Fig. 2. Frequency response of series-parallel array using 22 six-inch speakers and six four-inch tweeters.

Practically all loudspeaker design in the last decade or longer has been concerned with one or all of the following problems:

1. Cone material breakup.
2. Linear movement of voice coil in magnetic field.
3. Outer rim suspension and spider design.
4. Cone resonance at low frequencies.
5. Eliminating peaks and resonances at higher frequencies.
6. Magnet arrangement and shaping.
7. Increasing efficiency at lower frequencies.
8. Voice coil wire size, shape, and arrangement.
9. Extending high frequency response.

Perfection in the loudspeaker system has been elusive and costly. The type of systems offered to the public today are still a long way from ideal. Because of the audio engineer's failure to solve complex obstacles in system design, the public has had to compromise. At least at the price it is willing to pay. As a result, the sound he listens to is a compromise.

The series-parallel array comes closest to solving all these problems.

We must keep in mind that all loudspeakers, regardless of who makes them, consist of a vibrating diaphragm which is a very basic and simple thing to construct. The reason so many speakers sound different is primarily due to the change each designer makes in this simple vibrating diaphragm. Some designers put metallic domes or phenolic cone extensions on this diaphragm. This must alter the sound in some manner. The metallic horns, which are popular, use a vibrating diaphragm loading into a metal or other type horn. This horn in-

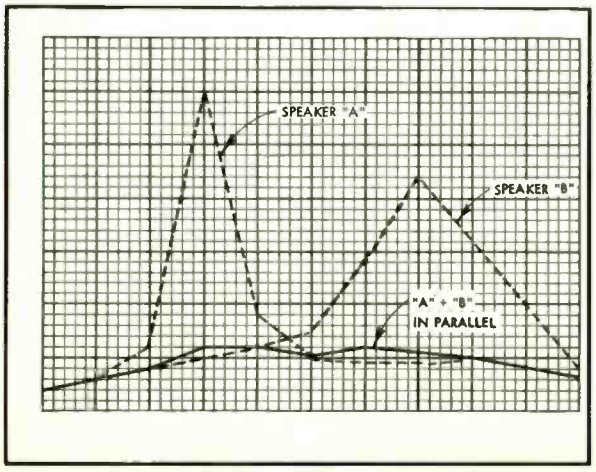
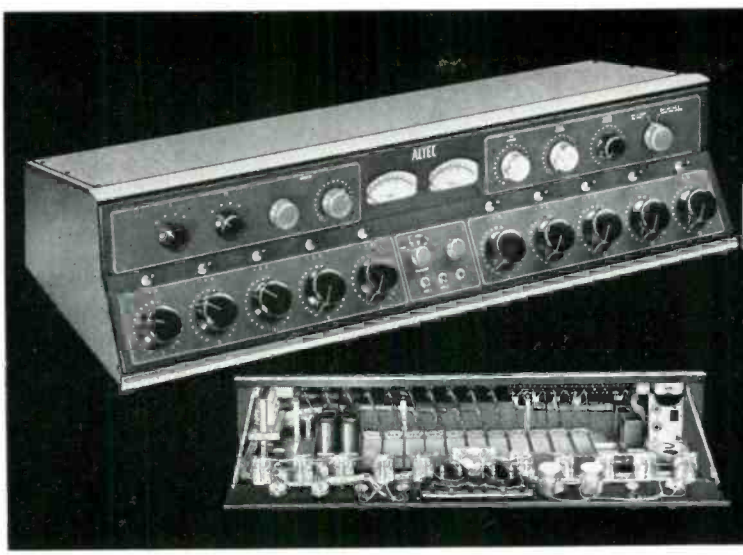


Fig. 1. Illustration of how resonant impedance is smoothed when two speakers with different resonant points are connected in parallel.

* *958 Arguello Drive, San Leandro, Calif.*



Plug-in reliability with ALTEC professional audio equipment

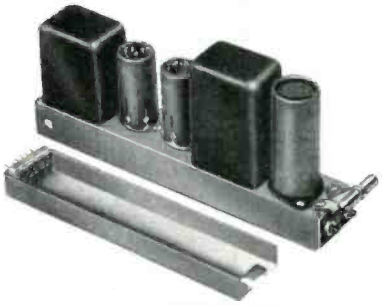
250 SU CONSOLE Combining compact simplicity with maximum flexibility through Altec advanced design, the new 250 SU Altec has proven to be the ultimate in control consoles for TV, AM, FM, recording studio or sound system use. Newly designed miniature plug-in preamplifiers, and utility input devices of uniform size and interchangeability permit free range in number and type of amplifiers used per console.

Characterized by single unit construction for simplicity (amplifiers and controls within same housing) and economical installation, Altec's 250 SU features an externally mounted power supply for cool operation and isolation of strong magnetic fields.

Providing complete circuitry for all stereo or universal operating functions, there is no finer, more reliable control console serving the audio industry. Individual components are available complete with plug-in trays for custom and rack installation.

THE 250 SU FEATURES:

- Meets NAB, EIA, and recording requirements
- "Plug-in" units completely interchangeable
- Low impedance mixing
- Speech-music filter
- D.C. heater supply
- Utility input devices for tape-disc-line-networks, etc.
- Tube testing provisions
- Expandable to jack fields, equalizers, etc.
- Up to 10 mixing channels
- Single channel operation
- Two channel operation
- Two channel/three channel operation
- "Stereo" operation
- Illuminated meters
- Color coded controls
- 16 connected inputs
- Microphone level or "high level" on any input



458A "PLUG-IN" PREAMPLIFIER An extemely simple, highly reliable, low noise preamplifier, the 458A incorporates a single stage push-pull cross-neutralized vacuum tube circuit, transformer coupled to source and load. Maximum reliability with unfailing performance are achieved through simplified design featuring fewer components, extremely accurate balance of input and output transformers, and premium quality pre-aged, shielded tubes. The failure of either tube will not cause loss of program.

SPECIFICATIONS GAIN: 40db unterminated input, 34 db terminated. **POWER OUTPUT:** +20 dbm at less than .5% THD 50 to 15,000 cps. +25 dbm at less than 1% THD at 1 KC. **FREQUENCY RESPONSE:** ± 1 db 20 to 20,000 cps. **SOURCE IMPEDANCE:** 150 or 600 ohms (centertap for 600 ohms). **LOAD IMPEDANCE:** 150 to 600 ohms (centertap for 600 ohms). **OUTPUT IMPEDANCE:** Equal to load impedance. **NOISE LEVEL:** Equivalent input noise: −126 dbm. **POWER SUPPLY:** 15ma at 275vdc and .7a at 6.3vdc. **TUBES:** 2—6072/12AY7. **DIMENSIONS:** 1 3/4" W x 3 15/16" H and 9 11/16" L. **COLOR:** Cad plate, dichromate dip. **WEIGHT:** 3 1/2 lbs. (including tray). **SPECIAL FEATURES:** Push buttons for individual tube test. 40ma dc can be applied to center taps for simplexing. **ACCESSORIES:** 13225 Rack Mounting Assembly (for 9 units). 13401 Mounting Tray Assembly. 5981 Tube Test Meter. 535A Power Supply.

459A "PLUG-IN" PROGRAM AMPLIFIER A highly reliable, low noise program amplifier with exceptionally large power capability, the 459A consists of a 2-stage push-pull circuit with a balanced negative feedback loop. Push-pull operation of all stages provides reliability, interchangeability with preamplifiers for added gain and power. Superior overall performance results from special input and output transformer design of ultrafine balance combined with premium quality pre-aged shielded tubes. Program transmission is not interrupted by failure of either output tube.

SPECIFICATIONS GAIN: 56 db unterminated input, 50 db terminated. **POWER OUTPUT:** +30 dbm at less than .5% THD 30 to 20,000 cps. +35 dbm at less than 1% THD at 1 KC. **FREQUENCY RESPONSE:** ±1 db. 20 to 20,000 cps. **SOURCE IMPEDANCE:** 150 or 600 ohms (centertap for 600 ohms). **LOAD IMPEDANCE:** 150 or 600 ohms (centertap for 600 ohms). **NOISE LEVEL:** Equivalent input noise: −126 dbm. **POWER SUPPLY:** 40ma at 275 vdc and 1.6a at 6.3vdc. **TUBES:** 1—6072/12AY7, 2—12BH7. **DIMENSIONS:** 1 3/4" W x 3 15/16" H x 9 11/16" L. **COLOR:** Cad plate, dichromate dip. **WEIGHT:** 3 1/2 lbs. (including tray). **SPECIAL FEATURES:** Push buttons for individual tube test. 40ma dc can be applied to center taps for simplexing. **ACCESSORIES:** 13225 Rack Mounting Assembly (for 9 units). 13401 Mounting Tray Assembly. 5981 Tube Test Meter. 535A Power Supply.

535A POWER SUPPLY Compact, highly reliable, the 535A is the DC power supply for furnishing the operating voltages to the Altec 458A and 459A amplifiers used together with the Altec 250 SU Console. Externally mounted to preclude hum, the 535A employs silicon rectifiers in both the filament and "B" supplies. The 535A connects to the 250 SU by means of a 4-foot multiple conductor cable terminated in a type P306CCT Jones plug which "mates" with a Jones receptacle in the 250 SU Console. A single screw frees the power supply unit from its mounting bracket for inspection.

SPECIFICATIONS POWER OUTPUT: 275vdc at 275ma. At 275ma ripple is .02v peak to peak max. 6.3vdc at 13a. At 13a evc ripple is 1.5v peak to peak max. **POWER INPUT:** 117v 50-60 cps 245 watts at full load. **RECTIFIERS:** Silicon. **CONTROLS:** 1. Power Switch. 2. Circuit Breaker (Push to reset). 3. 4 Position tap switch (provides adjustment of voltage by autoformer action to accommodate 2 to 1 range of loads). **COLOR:** Dark Green. **WEIGHT:** 16 pounds. **SIZE AND MOUNTING:** 7 3/16" W x 9 5/8" H x 7" D overall.

ALTEC LANSING CORPORATION
Dept. ADB-2D
A subsidiary of Ling-Temco Electronics, Inc.
1515 Manchester, Anaheim, Calif. · 161 Sixth Avenue, New York 13, N.Y

troduces an effect of its own into the nature of the sound being generated. In spite of all these refinements and gimmicks, the direct radiator with the common moulded-paper cone is still the most accurate and popular vibrating diaphragm. Because of its simple cone material, the direct radiator reproduces sounds with practically no coloration as compared to some of the brassy and metallic sounds which are generated from so-called high-fidelity speakers using metal horns and diaphragms.

The big problem with the direct-radiator speaker has been relatively low power-handling characteristics. The sound is good at low volume but poor at higher volume levels. One reason is that the travel of the voice coil within the magnetic gap becomes nonlinear. To reduce these problems, the manufacturers have had to make heavier cone material, larger voice coils, heavier magnets, and less rigid spider and outer rim suspensions for the cone. The only difference is that these sophisticated radiators can now be operated at louder volume levels and at lower frequencies with less distortion. But the vibrating diaphragm has not changed in basic theory or application. The inexpensive six-inch speaker, as an example, when used at low volume levels, has extremely low distortion and excellent fidelity. Because of the limited piston area, however, a single six-inch speaker cannot project the lower frequencies so that the human ear can hear them. The series-parallel array allows us to use this simple vibrating mechanism to an advantage.

With all due respect to G. A. Briggs, who has done tremendous work in the audio field, I must take exception to his remarks about multiple speakers. In his book, "Sound Reproduction," he says, "The main objection to such speakers (inexpensive multiple speakers) is the fact that the cone resonance is high." This statement is true to a certain extent. But I can demonstrate how this objection can be eliminated. Perhaps a discussion of resonance is in order at this time.

As we know, resonance is a condition which occurs when the moving system of a loudspeaker resonates sympathetically at some fixed frequency. This resonance causes the amplifier to see an increase in electrical impedance. So the amplifier output is increased at this resonant frequency. This results in an increased audio output from the loudspeaker. The result is a "boom" or "roar" at this frequency.

Since we cannot easily change the resonant frequency of a loudspeaker, then we must change what the amplifier sees. If the amplifier were to see no increase in impedance at the resonant frequency then there would be no resonant "boom." By a certain arrangement of an array of loudspeakers we can eliminate this impedance change that the amplifier sees. To illustrate what actually occurs you can see that speaker "A" in *Fig.* 1 has a resonance at 60 cps. (We are looking at the output of the amplifier and not the output of the speaker.) Speaker "B" in *Fig.* 1 has a resonance at 100 cps. If these two speakers were connected in series, the amplifier would see two humps; one at 60 cps and the other at 100 cps resulting in two resonant points. But if we connected these two speakers in parallel, we have changed the impedance load to the amplifier. Perhaps we can explain what happens by illustrating with resistors. Suppose we connect a 100-ohm resistor across the output of the amplifier; now, the amplifier sees only the 100-ohm resistor. Now let us connect in parallel with this 100-ohm resistor a 20-ohm resistor. Now the amplifier does not see the 100-ohm resistor. Instead, it sees some value less than 20 ohms. This is simply an application of Ohms Law. The important thing to remember, however, is that the 100-ohm resistor is still there, but the amplifier cannot now see it as well. The lower value resistor takes practically all the output of the amplifier. When speaker "A" is shunted by speaker "B" the same thing happens. We have shunted the speakers so that they cannot resonate at their natural resonant frequency. Of course, it is important to note that both speakers had *different* resonant points. If they were the same then we could not shunt out the impedance humps. With different resonant characteristics the speakers are unable to resonate because the amplifier will not see the impedance change. Therefore the amplifier does not increase its output at this resonant frequency; a very simple, but highly significant, occurrence.

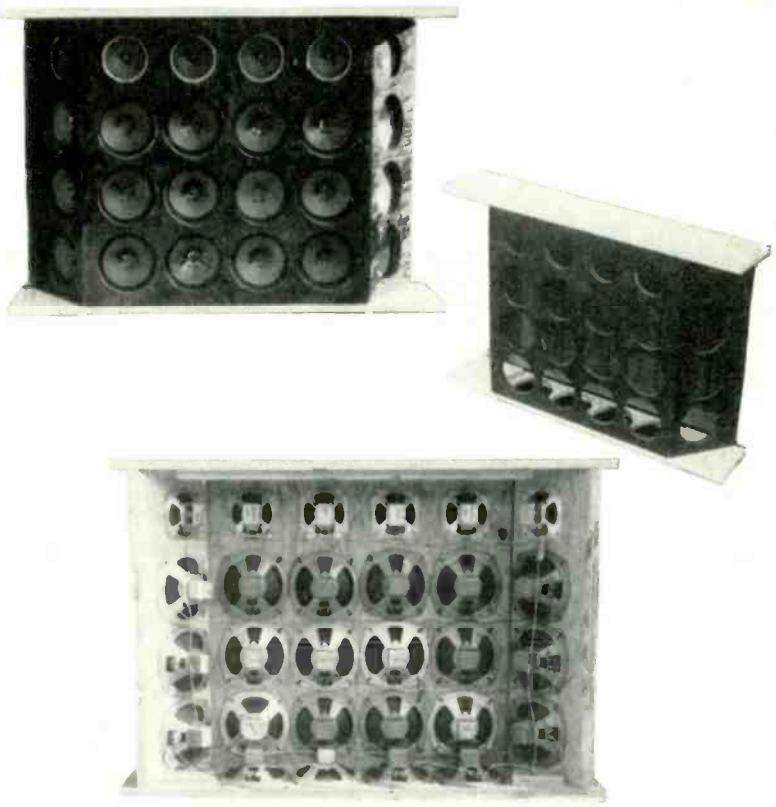


Fig. 3. Layout of speakers as seen from both front and rear of baffle.

This "resonance shunting" effect is the reason why the response curve of a series-parallel array is unlike any other loudspeaker system curve. If there are any "peaks" or "valleys" in any individual speaker of this array, they are levelled by this series-parallel connection. This has the desirable effect of reducing the violent dips and peaks so common to most loudspeaker systems. By careful and painstaking selection of speakers it would probably be possible to eliminate all response curve variations. However, it is not necessary to go to this great a degree of selection to obtain results as shown in the response curve of *Fig.* 2. When you consider that this response curve does not vary more than 2 db from 20 to 15,000 cps, you can appreciate the significance of this series-parallel array principle. The more speakers

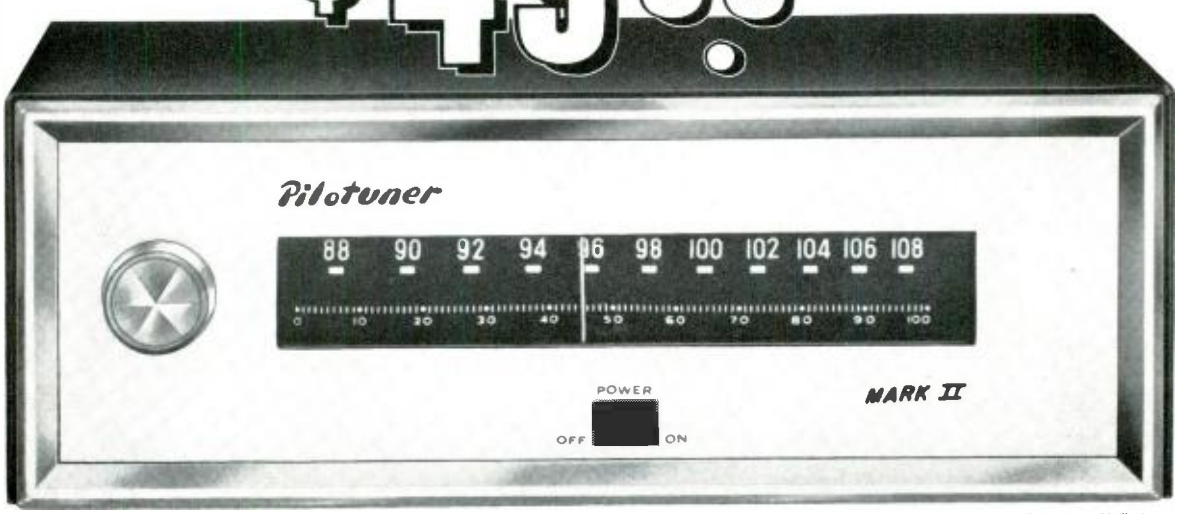
(*Continued on page 99*)

The most important FM News for 1961 !

Pilot

ANNOUNCES A QUALITY FM TUNER

$49.95

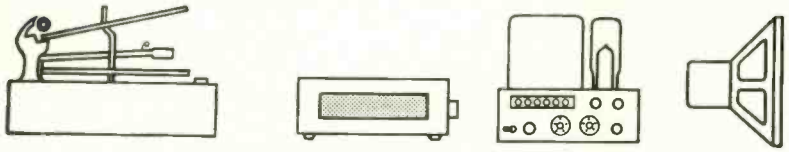


DIMENSIONS: 9¾" wide x 3¾" high x 6⅛" deep

Only Pilot, the first manufacturer of FM tuners, could offer so much quality at such a modest price. The MARK II delivers performance that will amaze even the most critical audiophile. A value packed instrument, the MARK II features: ■ Complete power transformer operation ■ Wide band detector for 100% modulation with minimum distortion ■ New high gain 6GM6 and 6EW6 IF tubes ■ Separate logging scale ■ Shielded front end ■ Built-in line cord antenna ■ Multiplex output jack. Each MARK II is sweep aligned on the industry's most modern test equipment. In its handsome black and brass enclosure, the MARK II makes a handsome addition to any component system. Use the MARK II for FM reception through most TV sets, table radios, phonographs or tape recorders. See and hear the MARK II at your nearest authorized Pilot Dealer today. Write for complete technical specifications.

Pilot RADIO CORP. 37-02 36th STREET, LONG ISLAND CITY 1, N. Y.

EQUIPMENT PROFILE



- TANDBERG MODEL 6 TAPE RECORDER
- SHURE M232 AND M236 PROFESSIONAL PICKUP ARMS
- GARRARD SPG3 STYLUS FORCE GAUGE

TANDBERG MODEL 6 TAPE RECORDER

The Tandberg Model 6 is a light, compact, handsome, versatile, three-speed tape machine with separate record and playback heads for four-track stereo and mono operation. There is no head-shift device for playing two-track stereo tapes, now becoming semi-obsolete; such tapes may be played nevertheless, although at some loss in signal-to-noise ratio on the right channel. In the main, design and construction are of professional caliber and so is performance at 7½ ips. In the machine tested there was some question as to frequency response and equalization at the low end. The price is approximately $500.

Features and Functions

The Model 6, shown in *Fig.* 1, operates at 7½, 3¾, and 1⅞ ips. It permits sound-on-sound recording without the necessity for an external mixer, echo effects, A-B monitoring, and mixing of input sources. For each channel there are separate gain controls for recording and playback—four in all. Each channel has a microphone input and two inputs for medium and high-level sources. However, insertion of a microphone plug disconnects the other two sources from the recording amplifier.

Other features include: separate "magic eye" record-level indicators for each channel, with a "floating action" circuit to facilitate reading transient peaks; automatic demagnetizing circuit for the record and erase heads which operates whenever the record buttons are released; provision for automatic shutoff at the end of a reel, requiring attachment of a metallic leader to each tape; a four-digit tape counter with reset knob; a jack for attaching a remote on-off foot-pedal control; cathode follower outputs in playback; d.c. on all tube heaters except the oscillator; easy removal of head covers for cleaning and demagnetizing heads and other parts; azimuth adjustment screws; head-height adjustment screws.

A "tape motion lever," operating in a T-slot, puts the machine into the rewind mode, fast-forward mode, or else in a preset position for normal forward operation. A stop-start pushbutton actually starts or stops the tape when the lever is in the normal forward mode. The lever moves the pressure roller within about ⅛-in. of the capstan and allows the motor to come up to full speed. Then the start-stop button moves the pressure roller the rest of the way, so that rapid starts and stops are possible without noticeable slurring.

Four additional pushbuttons plus the start-stop button control electrical operation. Two buttons, one for each channel, are for recording, and the other two for playback. The record buttons are linked with the tape motion lever so that they can be locked down only when the lever is moved into normal forward position. Putting the lever into neutral causes the record buttons to pop up.

The pushbuttons provide a fascinating example of switching logic. With only the left record button down, all input signals, whether fed to the left or right input jacks, are routed to the left tape track, and similarly for the right record button. But with both record buttons down, left and right input signals are routed to their respective tracks. The playback buttons work in an equally logical manner. With only the left button down, the left playback signal goes to both output jacks, and similarly for the right button. But with both playback buttons down, each playback signal goes to its respective ouput jack. When the playback button for a given channel is up, the input signal for that channel is routed to the output jack. Thus an A-B comparison can be made during recording by alternately releasing and depressing the playback button for the desired channel.

Signal routing operates as just described when the start-stop button is down and the tape is in motion. But with the button up and the tape at rest, the incoming signal is directed to the output jacks.

The high-level input jack provides about 18 db attenuation compared with the medium-level input jack, to prevent overloading the first two recording stages. The medium-level jack presents an impedance of about 100,000 ohms, which may be too low for certain signal sources, such as a piezoelectric cartridge. The high-level input impedance is about one megohm.

Fig. 1. The new Tandberg Model 6 stereo tape recorder.

Performance

The measured signal-to-noise ratio was 52 db on the left channel and 51 db on the right at 7½ ips while recording a 400-cps tone at 3 per cent harmonic distortion. This is excellent for quarter-track operation. Tape hiss was much more predominant than machine noise.

On each channel, the "magic eye" closed exactly at the 3 per cent harmonic distortion level, which is as should be.

The wow and flutter characteristics are excellent at 7½ ips. A professional tape editor, musically trained, lent an ear in this test and observed on listening to a 3000-cps tone being recorded and played back that the Tandberg's steadiness of motion equalled or possibly surpassed some of

ELECTRO-VOICE MODELS 636 AND 630 eliminate critical placement . . . assure remarkable fidelity. Omnidirectional from all points.

For truly uniform microphone response—for slim-trim case styling—for complete application versatility, the Electro-Voice Model 636 Dynamic is unsurpassed. Designed especially for public address and general purpose applications, the Model 636 blends easily, unobtrusively into PA stagings, eliminating placement problems and improving audience enjoyment. The baton design provides a convenient, easy-to-handle shape for hand carrying. This modern, streamlined model measures only 1 1/16 inches in diameter, yet provides output levels equal to microphones four times as large. *Other Features:* Exclusive E-V Acoustalloy diaphragm. Adaptable to either high or low impedance inputs; convenient ON-OFF switch for instant control; uniform response from 60 to 15,000 cps; wire mesh grille to minimize wind and breath blasts; tiltable through 90° arc toward sound source. List price (less stand). Satin Chromium Finish—$72.50; Gold Finish—$77.50.

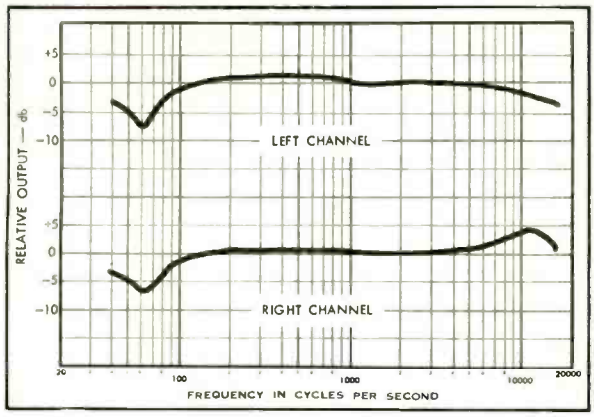
Omnidirectional also describes the performance of the popular Electro-Voice Model 630 Dynamic Microphone. Designed by the same top acoustical engineering talent that developed the slim Model 636, this versatile microphone also provides optimum performance for an unusually wide range of professional, commercial, and personal applications. An exceptionally rugged instrument, the Model 630 may be mounted on a floor or desk stand or it may be hand held. List Price (less stand) $52.50.

Complete specifications available upon request. For a trial demonstration of either of these fine, omnidirectional microphones, visit your Electro-Voice dealer—today.

MODEL 630

Electro-Voice®

Commercial Products Division
ELECTRO-VOICE, INC.
Dept. 11A Buchanan, Michigan



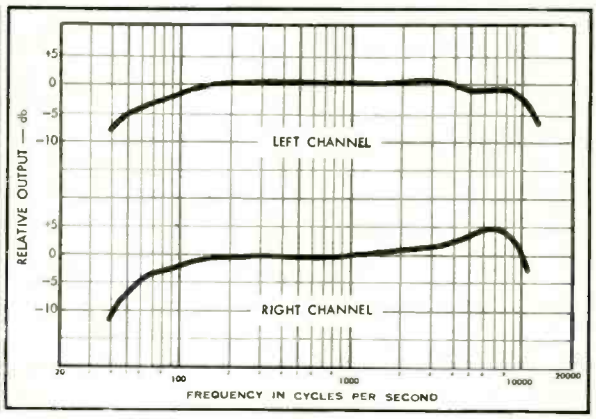


Fig. 2 (left). Frequency response curves for the Tandberg Model 6 at 7½ ips. Fig. 3 (right). Response curves for 3¾ ips.

the professional machines he works with. At 3¾ ips, wow was barely discernible on a sustained tone—still very good. But at 1⅞ ips wow became definitely apparent.

Speed measured 0.6 per cent fast; professional machines usually claim 0.2 per cent accuracy. Under 1 per cent is very good.

Figures 2, 3, and 4 show the frequency response measured at each speed while recording at a level 25 db below "magic eye" closure on a 1000-cps tone. At 7½ ips, response was within 3 db of flat from 80 to nearly 15,000 cps on the left channel; on the right channel, treble response was greater, with a slight tendency to "peakiness" in the 10,000 to 14,000 cps range. Perhaps there was somewhat less bias current in the right channel section of the record head.

The major difference in frequency response at 7½ ips occurred at the low end, with a dip, in response between 50 and 70 cps. On A-B testing through a fine audio system, this made a significant change in the "color" of both voices and music. Moreover, it seems, the lack of bass caused the apparent signal-to-noise ratio to sound less than the measured ratio. That is, fuller bass would have masked tape hiss to a greater extent.

At 3¾ ips, high-frequency response held up very well to 10,000 cps. Bass response held up reasonably well to about 50 cps on one channel and 60 cps on the other. At 1⅞ ips, response was good from about 60 to 4000 cycles.

It must be stated that the measurements are definitely better than the listening at 3¾ ips. This appears substantially due to an increase in tape hiss, partly as the result of treble boost in playback (obtained by resonating the playback head with a capacitor) and partly to smaller playback bass boost (which is equivalent to smaller treble cut). Here is a machine that is very well designed and constructed, yet gives scant support to the thought that 3¾ ips is suitable for high fidelity.

The Model 6 requires about 85 seconds to wind or rewind a 7-in. reel bearing 1200 feet of tape, which is about medium, which is to the good, preventing tape stretching and stresses leading to distortion. Professional machines usually take about 45 seconds; the average "hi-fi" machine is nearer two minutes.

Construction and Circuitry

Parts are of first quality, neatly laid out, and readily accessible on four printed circuit boards: record amplifiers, playback amplifiers, oscillator circuit, "magic eye" circuits. One motor is used, a hystresis synchronous unit. Low-noise resistors and hermetically sealed capacitors are liberally employed. The power transformer has toroid windings to minimize its external hum field.

There are four separate amplifiers—two for recording and two for playback. Each amplifier has four triode stages, employing ECC83's, with the exception of ECC82's (12AU7's) for the last two stages of each playback amplifier. Feedback equalization is employed both in recording and in playback. For treble boost in playback at 3¾ and 1⅞ ips, resonating capacitors are switched across the playback head.

Some questions are raised by the equalization characteristics. In recording, a small coupling capacitor between the first and second stages produces a bass rolloff commencing (3 db down) at approximately 65 cps. Yet in the next stage, feedback equalization produces just enough bass boost to bring response up to or slightly above flat.

In playback, equalization is claimed to be NAB at 7½ ips, and a reading of the schematic indicates this is so. Measurement shows that equalization conforms to NAB above 1000 cps, except for about 3 db too much treble in the region of 10,000 to 14,000 cps, not a serious fault. But below 1000 cps there is substantially less bass boost than called for by NAB. Bass boost comes to a halt at about 100 cps, reaching a maximum of 14 db. The NAB curve calls for 19 db boost at this frequency, and 23 db at 50 cps.

The fact that response, nevertheless, is down only 3.5 db at 40 cps at 7½ ips makes it appear that the contour effect is employed to maintain low-frequency response. The contour effect refers to the fact that at low frequencies the whole playback head, particularly a small one, behaves in the same manner as the gap, augmenting response at some bass frequencies and decreasing response at others.

The Model 6 has a profusion of *internal* controls that permit the technically qualified individual to adjust performance to optimum. Each channel has the following five internal controls: recording level pot, providing the proper amount of signal to the record heads at a given distortion level; playback level pot, permitting the playback output signal to be equated to the input signal for A-B comparison; record-level indicator pot, causing the "magic eye" to just close at the 3 per cent harmonic distortion level; bias level pot; variable inductance, forming part of a resonant trap to keep bias current away from the "magic eye" tube and elsewhere. There are three more controls which affect both channels: bias-frequency adjustment; variable capacitor to ground, to keep bias current out of the wrong places; balance control in the grid return of the push-pull oscillator, for obtaining the purest possible bias waveform and thereby minimizing noise in recording.

Accessories available for the Model 6 include microphones, a footpedal for remote start-stop control, a carrying case, and headphones. (*H.B.*) L-21

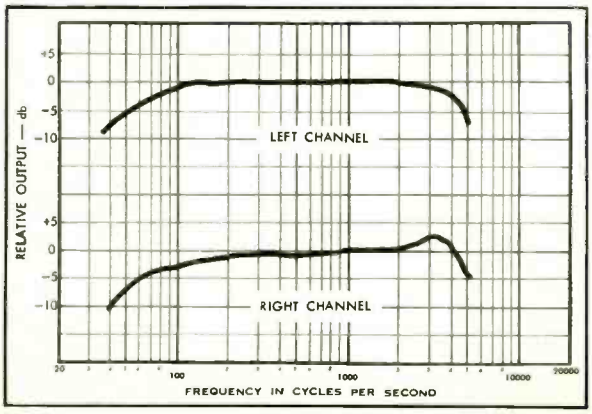


Fig. 4. Response curves for 1⅞ ips.

NOTE: *Recent shipments of the Model 6 have been corrected as to the low-frequency response at 7½ ips. Mr. Burstein will retest a later unit and the results will appear next month.* Ed.

"Theoretically, and in fact, it is impossible to reproduce, totally intact, the sound of a pipe organ in the home. Yet, it has been my observation that loudspeaker systems made by James B. Lansing Sound, Inc., come close to doing the impossible. In the course of my professional activities I believe I have investigated all transducers commercially available. Perhaps I prefer JBL products because there are so many apparent parallels between these loudspeakers and a well-wrought pipe organ. Neither is mass produced. Each is the product of skilled hands. Their excellence is the result of painstaking attention to details both conspicuous and unseen . . . the result of following without compromise the route to perfection laid down by the accumulated precepts of experience guided by the cold eye of science."

— JUSTIN KRAMER

Justin Kramer, Mus. M., A.G.O., musician, musicologist, campanologist, theology student, inventor, acoustical consultant, designs and installs pipe organs. Mr. Kramer personally attends to the final voicing of each pipe. At left, with Mrs. Kramer, he inspects the instrument he installed in the Church of St. Paul the Apostle, Westwood, California.

. . . choice of the talented listener

Hear the speakers preferred by talented listener Justin Kramer in the demonstration room of the JBL Signature Audio Specialist in your community. Write for his name and address. Ask, too, for the guidebook that will lead you to the speaker system that meets your own standards of perfection, JBL Catalog SC508.

JBL

Photo by George Strock

PRODUCTS OF JAMES B. LANSING SOUND, INC., ARE MARKETED BY JBL INTERNATIONAL, LOS ANGELES 39, CALIFORNIA

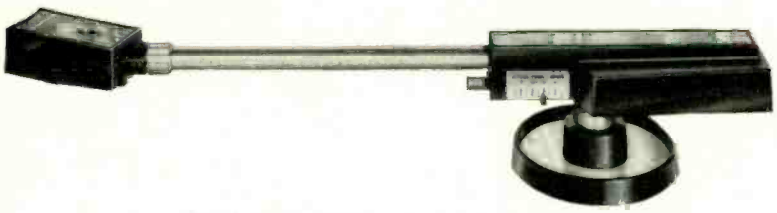


Fig. 5. Shure M232 professional tone arm.

SHURE M232 AND M236 PROFESSIONAL TONE ARMS

Incorporating most of the features which have been considered essential in high-quality phono arms, these two units by Shure Brothers are attractive in appearance, easy to install and adjust, and effective in operation.

The two models are similar in appearance, differing only in length and such other parameters as may be governed by length alone. The M232 has an over-all length of $12^{11}/_{16}$ in., and is thus intended for use in high-quality home systems. The M236 is 14½ in. long. Our own observations refer to the M232.

These arms are mounted by means of a phenolic base, using three wood or machine screws as the motor board requires, at a distance of 8¼ in. from the turntable center. The M236 is to be mounted $10^{19}/_{64}$ in. from the spindle. Both can be mounted from the top of the motor board, with only a single plug at the bottom of the pivot post carrying all necessary connections. The pivot post may be adjusted over a height range up to 2¼ in., and is locked in place by a single set screw. An anodized aluminum disc covers the mounting screws.

The head of the arm is removable, with four contacts carried through to the cartridge. The cartridge itself is attached to a mounting plate, using the hardware furnished. Some cartridges require spacers, of which two lengths are furnished, and for very light cartridges it is necessary to use two mounting plates—both of which are furnished. Explicit instructions are furnished for practically every currently available cartridge so that the weight will fall within the range of the balancing adjustment. The cartridge mounting plate is attached to the head by a single screw which allows for about ¼ in. backward and forward adjustment of the exact stylus position, which is indicated by two small projections molded into the head, thus making sure that the stylus overhang is exactly correct. Only in such a manner as this can the user be sure that the tracking error is held to the minimum designed into the arm by the manufacturer. In many arms, the actual position of the stylus is dependent on the physical relation between the stylus and the mounting holes in the head, and since these are actually not standard (although there are presumed to be some standards about this spacing), it becomes necessary to mount the arm on the basis of stylus overhang rather than to a fixed position of the arm pivot with respect to the turntable spindle. With such a construction, the optimum position of the stylus may not be attained as cartridges are changed unless the arm mounting is changed to fit the required overhang.

Referring to *Fig.* 5, a short calibrated scale will be noted on the body of the arm, with a knurled knob at its left. Under the rear of the overhanging portion of the arm body is a weight to counterbalance the entire arm. This weight is adjusted by a knurled balance knob under the arm. The method of adjusting the arm is to pull the stylus force adjustment knob forward and down, which releases the spring tension, then turn the balance knob to obtain a static horizontal balance. After this is done, the stylus force adjustment knob is slipped back into its recessed slot and the knob turned to give the required force as indicated by the pointer.

Both horizontal and vertical pivots employ precision ball bearings for minimum friction, and limiting stops are provided inside the main pivot post so that the arm can be set so as not to allow the stylus to contact the turntable spindle. A plastic arm rest with provision for height adjustment is furnished with the arm. At the bottom of the main pivot post is a 4-terminal socket which carries three leads from the cartridge—the common sides are connected together in the arm—and a fourth lead which connects to the metal parts of the arm. A 4-foot connecting cable is furnished with the plug for the arm already attached, and with two phono plugs and a single wire at the other end for plugging into the preamplifier jacks. The single wire connects the metal parts of the arm to the amplifier ground and thus eliminates static pops caused by touching the arm. The signal leads are separately shielded, and a plastic jacket covers the two shielded leads and the ground lead, making a single cable for the connections.

The M232 arm is thus seen to be very easy to install, and equally easy to adjust for various conditions. The supplementary instruction sheet for mounting the cartridges is one of the most complete and most specific we have ever seen. In operation, the arm works smoothly and consistently even at stylus force adjustments around 1 or 2 grams, and the scale was found to be within 0.5 grams at any point. While no pickup available for the testing would operate properly at the extremely low stylus forces, we found reliable and satisfactory operation at 3 grams with a Shure M3D and at 5 grams with a Shure M7D. The M232 arm is a handsome addition to any turntable, and it works as well as it looks portend. **L-22**

GARRARD SPG3 STYLUS FORCE GAUGE

Most gauges for measuring stylus force have been makeshift devices—some deriving directly from some other application, and others designed for indicating a single predetermined force. The Garrard SPG3 gauge appears to have been designed for one specific purpose, and it fulfills that one purpose excellently. It consists of a molded plastic housing which encloses a calibrated dial which is turned by an external knob to a desired setting anywhere from 0 to 12 grams in alignment with a setting line on the transparent cover. Extending from the right end of the case is the scale arm to which is attached a swinging balance lever, and at the bottom of the lever is a plastic scale pan. To use, the calibrated dial is first set for the desired stylus force and then the unit is placed on the turntable and the stylus simply placed in the depression in the plastic scale pan. A red pointer should then move to the setting line if the stylus force is that to which the dial is set. If it is not, the force adjustment on the arm is changed so the red pointer moves exactly to the setting line.

While this may appear to be somewhat complicated, there are reasons for this type of construction. To make an accurate measurement at the actual point where the arm will be operating, it is necessary that the scale pan be at a certain height above the turntable surface. With this design, when the force exactly balances the indicated value, the pan must be at the same position at all times, regardless of the force required. To make sure that the downward pull is applied to the same point on the scale arm at all forces within the range of the gauge, the balance lever must be free to swing. The position of the stylus pan is thus exactly the same distance above the turntable every time, which ensures accuracy of measurement.

One further refinement is the provision of a 5-gram checking weight which is carried in a small compartment of the housing and kept in place by a sliding door so the weight need never be lost or misplaced—it is always handy when desired to check the accuracy of the gauge.

To determine the accuracy of the unit, we checked it first with the 5-gram weight and found it "right on the nose." Then we checked with a set of photo-scale weights at every gram from 1 to 12 and still found it exactly right at each point. Beyond the most important element of accuracy it can be said that the method of use is simple and convenient, making it ideal for original installation as well as for the occasional check that the careful audiofan gives his equipment. **L-23**

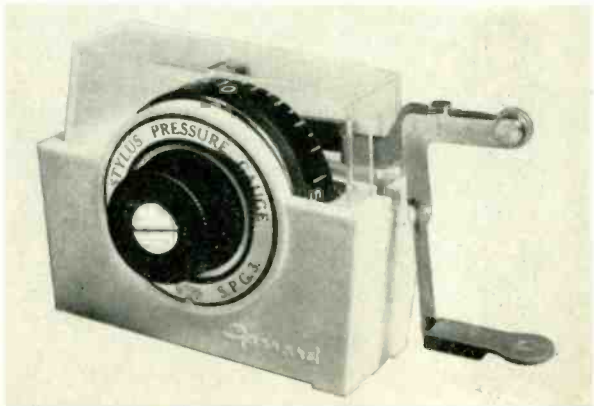


Fig. 6. Garrard SPG3 stylus force gauge.

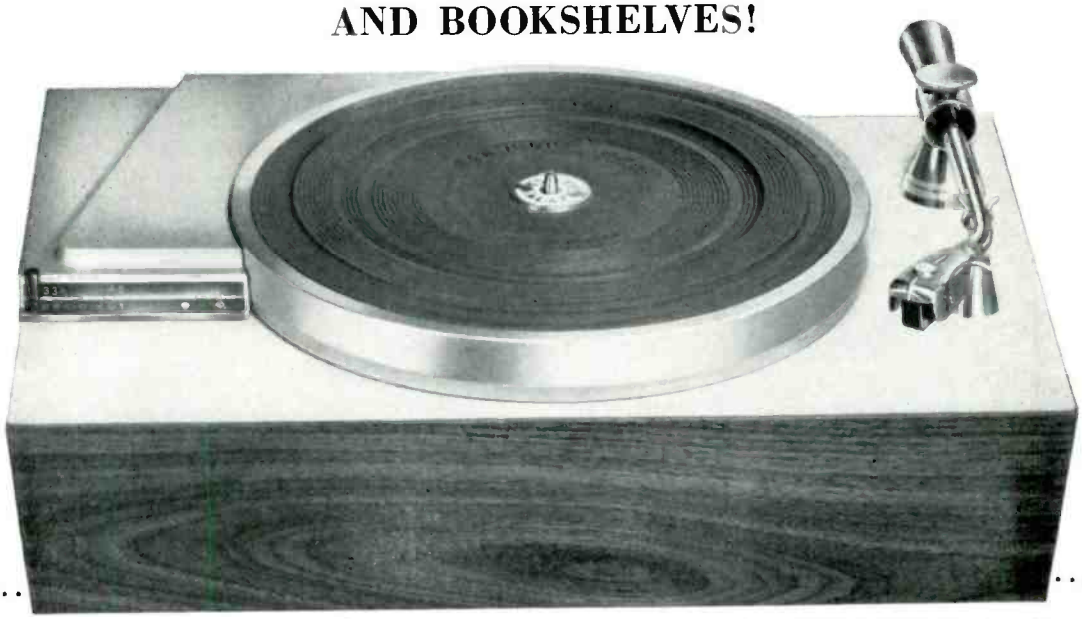
"REK-O-KUT"— the safest word you can say to your dealer

For sixteen years, Rek-O-Kut has been synonymous with quality and integrity in the design of turntables. As other brands have risen, fallen and even completely disappeared, Rek-O-Kut has won consistent acclaim as the overwhelming choice in its field. In performance ratings and engineering contributions to the art of turntable design, Rek-O-Kut has compiled a record unchallenged by any other turntable producer. Now, this tradition is again emphasized by the introduction of the magnificent new N-34H StereoTable... a professional quality two-speed (33⅓ and 45 rpm) turntable. Quiet power is furnished by a Rek-O-Kut hysteresis synchronous motor and an efficient new belt-drive system. Speeds can be changed even while the table is rotating, merely by pressing a lever.

The N-34H is a symphony of crisp, clean lines accentuated by the unusual deck design. Mated with the new tapered base, the N-34H becomes one of the proudest and most beautiful components ever to grace a home music system. Insist on seeing it at your dealer's.

*N-34H STEREOTABLE only—**$79.95** net. Shown with new Rek-O-Kut Micropoise Stereo Tonearm, Model S-220, $29.95 net. Tapered base in hand-rubbed, oiled walnut, $14.95 net.*

A NEW DIMENSION IN TURNTABLES—12⅝" x 19"— DESIGNED TO FIT NARROW CABINETS AND BOOKSHELVES!



SPECIFICATIONS: *Noise Level:*—53db below average recording level; *Wow and Flutter:* 0.15%; *Drive:* Nylon, neoprene-impregnated endless belt. 2-Speeds, 33⅓ and 45 rpm. Simple lever-action changes speeds.

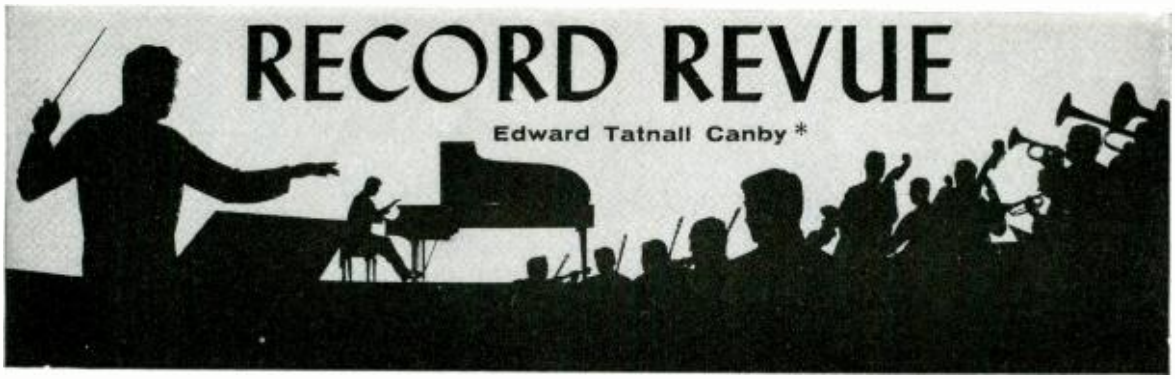
NOTE: COMING SOON... ANOTHER GREAT DEVELOPMENT... Rek-O-Kut AUTO-POISE —makes any Rek-O-Kut tonearm you buy now—fully automatic!

REK-O-KUT STEREOTABLES

Export: Morhan Exporting Corp., 458 Bway, N.Y. 13
Canada: Atlas Radio, 50 Wingold Ave., Toronto 19

Rek-O-Kut Company, Inc., Dept A-11
38-19 108th Street, Corona 68, N.Y.
Please send me complete details on the new N-34H STEREOTABLE:

Name_____
Address_____
City_____ Zone____
State_____



RECORD REVUE

Edward Tatnall Canby*

REAL CLASSICS . . .

Dvorak: New Word Symphony (No. 5). London Symphony, Leopold Ludwig.
Everest SDBR 3056 stereo

One hears rumors of changes at Everest lately—and the news is the more disturbing because of such imaginative recordings as this, which could so easily have been just another potboiler to fill up a prestige line, plugging standard items. This is surely a standard item, but the playing is far more interesting than such works usually receive from our overworked orchestral musicians and conductors. And as usual, the Everest stereo recording is no less than splendid, both in terms of technical hi-fi and in the musical sound itself.

Dvorak's big works have three particular aspects that are, all of them, increasingly difficult to get across today. One, of course, is the sweet, lilting Czechish lyricism, the melting songfulness of "Goin' Home" in this symphony (a title after the fact, of course). The second, and a less well understood aspect, is the tortured violence of intensity that appears in many pages—expressed in what are for us now such dated orchestral terms that we tend to find them merely noisy, unless the playing is unusually expressive and well managed. It is—here. The third element, of course, is that of startling harmony—and here, too, we easily miss the impact of sudden harmonic changes that in his day were strikingly effective, with a thrill of modernity.

As with any well written music, Dvorak's is open to informed interpretation that can still bring out these features, even to us with our radically changed ears. The effects are more than mere show. They are part of the fabric of the music and if the musical sense is projected whole, the original impact can be felt again.

Just try the opening slow introduction to this "New World" to see what I mean. Perhaps Dvorak himself would find it strange (but, then, he would be stupified by any phonographic hi-fi sound, after all . . .). Yet in terms of our day and of the recorded medium—this is it. The dark, bleak, terrifying side of the Dvorak expression is right there, and convincingly. Even so simple a touch as an extra-intense roll from the timpani can do it (with such lovely transients, too).

The other aspects, as per above, receive a similarly reasoned, expressive and effective treatment in this Anglo-Germanic collaboration. I'm all for it.

Bruno Walter Conducts the Orchestral Music of Brahms. (The four Symphonies; the Overtures; Variations on a Theme by Haydn.) Columbia Symphony.
Columbia M4S 615 (4) stereo
(mono: M4L 252)

The first thing that will catch your eye in this new Columbia "spectacular" is the picture layout entitled "Bruno Walter, an Affectionate Portrait," by his daughter, Lotte Walter Lindt. The Walter family album, starting in the last century, depicts little Bruno, Bruno the wavy-haired boy, the earnest young man, the young papa with beard, the still young conductor (without beard), and then onwards, Walter sitting, standing, chatting with practically Everybody in music—even Toscanini (twice). First-person comments by the daughter are nicely Germanic: *"Perhaps my favorite, this so Victorian photograph. My father was seven."*) The booklet continues with a long British essay on the numerous orchestral works (Neville Cardus) and a tribute to the Hollywood players, technically a pickup orchestra, who have worked together with Walter long enough to have become in fact a major symphony orchestra as well as an orchestra in name.

This is no place for an analysis of these many performances, nor as a music listener myself can I sit down right now and play the entire orchestral works of a major composer at a sitting for the sake of a few brief comments here! The album is of course of phonographic importance, further documenting the later phase of this man's long and musically vital service to orchestral performance in terms of Columbia's quite definitive stereo technique.

(The four symphonies were recorded in mono by Walter some years ago. A musical comparison with the new versions might be interesting but, I suspect, would not reveal any startling innovations nor deteriorations. The old man is still full of musical vigor.)

In general terms, you can count on Bruno Walter for a sane, balanced, somewhat old fashioned but thoroughly "authentic" Brahms, with a minimum of fancy personal idiosyncrasies, a maximum of plain, common-sense high musicianship in the portraying of the Brahms style. This music is Walter's own home language; it comes from the same place and times as he does himself, speaking broadly. And so it is both impeccably styled and deeply traditional. A very far cry from, say, Toscanini's Brahms, but probably more important, even so.

Tchaikowsky: Romeo and Juliet; Nutcracker Suite. Philhormonia Orch., Markevitch.
Angel S35680 stereo

The intense youngish conductor of this recording has developed into a powerful and earnest interpreter of ballet and pictorial music. You can hear in seconds of listening that he will never do a pot boiler of the blandly effective type we get so often on records. These aren't, decidedly.

The Nutcracker isn't too successful here, for that very reason. It is full of interesting phrasing, lively and well balanced on the whole; but there are numerous moments of what can only be impatience, as though to get the job on and over. Thus the opening of the miniature overture is hasty and a bit out of time, but quickly it solidifies into a lilting production such as the piece seldom gets in more conventional versions. Still—this isn't Markevitch's meat, this little suite.

What really counts here is the enormously bigger "Romeo," surely one of Tchaikowsky's most intense, cogent works of musical construction and drama. It has challenged all the great conductors; few can make it sound today more than effectively rhetorical. This version is the most compelling I've heard since Mengelberg—and that's a long time. It combines the passionate intensity of the older conductorial master with the economical drive we favor today, for an almost definitive expression of the music in terms of 1960.

Mengelberg's poetic, rubato-laden version (styled out of the turn of the century) made the great love tune its high point. Markevitch turns his version on the loud and violent passages—which so often today seem like so much orchestral mumbo jumbo, noise, sound and fury! Here, these tremendous passages take on an extraordinary intensity which is not mere outward drama; the playing itself does the trick, the intensity of shape and phrase and rhythmic impact that must be credited to Markevitch and to the superb orchestra that works with him. It's a spellbinder of a performance and I recommend it if you want to know how Tchaikowsky can come to life in modern terms.

Respighi: The Fountains of Rome; The Pines of Rome. London Symphony, Sargent. Everest LPBR 6051 (mono)

Everest has got the mistaken idea that I want mono—that's the version I listened to for this recording. But even in mono form the marvelously high quality of the sound itself is entirely evident. There is no doubt that at the moment Everest is leading the industry in pure sound terms, at least in the wider classical field and in terms of over-all batting average.

The fountains and pines of Respighi have never done much for my musical ear and I am likely to be inattentive even to the most eloquent performance. This one, in addition to fine sound, boasts a modest, well shaped and careful playing of both works so that the tired ear is more than likely to be refreshed, not blasted. Good. Even that eternal recorded nightingale is unobtrusive—where do they dig him up, year after year, for such performances? This one appears to be a modern hi-fi bird, probably very authentic. Bird watchers please check me.

Beethoven: Symphony No. 1; Symphony No. 2. Detroit Symphony, Paray.
Mercury SR 90206 stereo

I'd rate this tops in sheer hi-fi quality, good in other respects but subject to arguable differences of opinion. In this it is like other records in the Mercury family.

It isn't easy to judge this sort of disc as to the impact of the original performance in musical terms—for so much is involved in the recording technique that is used.

Here, for example, the strings, especially the fiddles, are heard close-to and sharply separated in space, the ever-working first violins almost obstinately to the left; the surrounding liveness is small. The violin sound, in this environment, is brilliant but scratchy—not via distortion, but through faithful reproduction—and the individual violins do not blend into a butter-smooth ensemble, as they theoretically should. It is an effective sound and "faithful" to the mikes. But is this the "live" sound that Paray, the conductor, thought he had achieved? Is this the recorded sound that we ourselves, as

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

exciting new releases on . . .

AUDIO FIDELITY® records

PERCUSSIVE BIG BAND JAZZ, Bobby Christian... Everything's Coming Up Roses, On the Street Where You Live, Bolero Americano, Wonderful One. **DFM3005/DFS7005**

BALDWIN ORGAN AND BONGOS, Eddie Osborn... Washington Post, El Cumbachero, Barbara Polka, Tennessee Waltz, Hawaiian War Chant, Buttons and Bows, Frenesi. **DFM3004/DFS7004**

More of the Hit Series ...DOCTORED FOR SUPER-STEREO! You haven't heard anything if you haven't experienced the stimulating sound of these recordings. Ask your dealer to play them!

DFM (Monaural) — **$4.95**
DFS (Stereo) — **$5.98**

Unusual, distinctive entertainment... unsurpassed sound reproduction! Here is the powerful, vital impact of sound in its purest, most natural form.

AFLP (Monaural) — **$5.95**
AFSD (Stereo) — **$6.95**

BERLIN WITH LOVE, Jo Basile . . . Lili Marlene, Liebe War Es Nie, Das Ist Die Liebe Der Matrosen, Stern Von Rio, Mackie Messer (Mack the Knife) **AFLP1944/AFSD5944**

PATACHOU SINGS, Jo Basile his Accordion & Orch.... Ah, Dis Donc, Chanson di Irma, Avec Les Anges, April in Paris, I Could Write A Book, Hello Young Lovers. **AFLP1948/AFSD5948**

CLANCY HAYES' DIXIELAND BAND ...Original Dixieland One-Step, East Street, Nobody Knows You, Ballin' The Jack, Careless Love Blues. **AFLP1937/AFSD5937**

A complete catalog of records and tapes is available. Write to: **Department A11**
Audio Fidelity, Inc.
770 Eleventh Ave., N.Y. 19, N.Y.

AVAILABLE AT RECORD & AUDIO SHOPS EVERYWHERE!

listeners, find most effective in projecting Beethoven's meaning?

Let's remember that we are *not* reproducing the concert hall, nor Beethoven's "live" music, but are, always on records, reinterpreting that sound in terms of a new medium.

It is the wonder of the phonographic art that this reinterpretation, for the living room, can be so widely successful in so many musical areas, that, indeed, it offers such extraordinary flexibility of means, to suit a thousand different situations, periods, composers.

Mercury is on entirely solid ground, then, as far as principle is concerned. There is only a question of aesthetic values within the phonographic medium. It is wholly legitimate to work towards a phonographic sound that will project Beethoven effectively via those very new transducers, the stereo loudspeakers. I am all for Mercury's point of view and only disagree, mildly, on the type of new sound that might project Beethoven's sense most imaginatively.

The Detroit is not the world's finest ensemble yet, nor is Paray a Beethoven specialist of world repute. It is, thus, a question here how much of the slightly uneven string ensemble is the orchestra's and how much a purely phonographic magnification, via the close-up mikes. The same with that slightly scratchy fiddle sound.

My feeling is that, for Beethoven at least, a warmer, more reverberant, less sharply separated mike pickup would produce a better Beethoven product from the same original performance. But this, of course, is a matter for aesthetic argument and personal preference. Mercury's hi-fi does pretty well for itself among record buyers.

Having said all this, I must add emphatically that there are aspects of the interpretation that do come through direct from the players and conductor, mikes or no mikes. That curiously French ability to play down counterpoint in the German manner, to hit for the main tune, is nicely evident here, and would be with any mike set-up! You'll hear it, for instance, in the counterpoints, the added melodic figurations, that surround the main tune of the Second Symphony's slow movement—played down, somewhat indifferently phrased, where more Germanic-minded conductors play up the double melodies for their undoubted architectonic strength. Subtle, but a profound difference, and Beethoven is weakened here in terms of his own intent, phonographically or no.

Sound Off! Marches by John Philip Sousa. Frederick Fennell, Eastman Wind Ensemble. Mercury SR 90264 stereo (mono: MG 50264)

I was really astonished by this record—or rather by John Philip Sousa. Here are no less than a full dozen Sousa Marches one right after the other with no more than the regulation five-second pause between each (and one quick record flip); and yet I listened straight through both sides and was ready for more at the end.

The fact is that, within this very special medium, Sousa was an expert and authoritative composer, of an almost limitless imagination and freshness as well as concentration. His grasp of form was impeccable, he never lacked new ideas for more march material, his rhythmic sense is terrific—even in the one, same march tempo, over and over—and above all, he knew how to achieve tight harmonic contrasts.

In these respects, Sousa is right up with two other earlier pops men (if you will)—Johann Strauss, Jr. and Offenbach. Sousa has taken his technique from both of these, the semi-rondo, endless-chain of lilting episodes from the Strauss waltz, the zippy, peppy snappiness from Offenbach. You can hear both of these Europeans whenever you want to in Sousa. But you can also hear America singing, all the time.

The Fennell "wind ensemble" makes a good Sousa band where in other popular wind music it has for my ear played with a too-precise and rather academic stuffiness. The reason might seem clear enough—these are professional conservatory musicians who must cover the whole of music; they are aware that

Sousa's work is a long cut above most march material and they play it with both respect and enthusiasm. Good stuff.

SEVERAL LINES OF THOUGHT

Andor Foldes plays Beethoven. (Waldstein, Appassionata Sonatas).
Deutsche Grammaphon DGS 712021 stereo
(mono: DGM 12021)

It's good to hear from my ample Hungarian friend Andor, he of the enormously powerful hands and driving technique, housed in a big, friendly frame of fat with an energy-less voice suggesting indolence and comfort! To look at him, you'd think piano playing was more than he could rouse himself to try. To listen to him, you'd think the devil was let loose at the keys. Andor Foldes travels, these days, a million miles and a thousand concerts a year. His records drop in every so often, between postcards of the "wish you were here" type—plus postscript telling of his latest important dates. He keeps us informed.

This would seem to be a kind of Hungarian temperament, this smouldering, volcanic personality, highly educated and urbane, yet ever near to violence of a sort. Bartok had it, and showed mainly chill to the outside world (though anybody could see the fire in his face and eyes). The genial Dohnanyi played like a joyous fiend in his 82nd year—then died. In any other national guise, Foldes would surely be a merely aimable pianist, in such a body. As a Hungarian, he is formidable.

Not a warm, though severe, player, like Schnabel, not a cloudy pianistic Byron, like some of the big Germans, nor a sentimental Romanticist in the sweet Viennese manner, Foldes plays hard and cold, expressively, overpoweringly just the same. He hardly makes for easy-going listening, but he does give you a potent insight into major aspects of Beethoven structure and emotional content, not the bigness of Beethoven but the enormous inner intensity.

A Memorial Album: Ernst von Dohnanyi Plays His Own Music for Piano.
Everest SDBR 3061 stereo

This is quite an extraordinary memorial, both in the sound and in the circumstances. It will have considerable appeal simply as a fine piano recording, and as a testimonial to the amazing powers of an 82-year-old Hungarian pianist.

The strangest aspect of this recording is that the man died almost immediately after completing it (heart attack, complicated by flu)—and as you listen you will be tempted to feel that it wasn't surprising. Such fabulous pianistic energy as is here displayed is hard to believe! But surely it was his own pleasure to play in this fashion; he was not in any mood to spare himself, and the triumphant feeling of success that the old man must have felt at such performances for hi-fi posterity shows itself in every measure. It is an exuberant record, from beginning to end, and a happy memorial as well as a truthful one.

The Dohnanyi music is of the late-Romantic school, like Rachmaninoff but lighter, more airy, far less inhibited. It isn't great music, and a few pieces go a long way, for most of our ears. But in these all-out and authentic performances, limited only by a finger stiffness that the old man is simply determined to ignore, and does, you will find a gusto and truthfulness in the Romantic vein that isn't at all common any more. I'd recommend the disc for almost anybody who likes musical gusto.

Ede Zathureczky. (Franck: Sonata in A. Beethoven: Sonata in G, Op. 30, No. 3, Bartok-Zathureczky: "For Children".) Ede Zathureczky, violin, Menahem Pressler, piano. **Vox EZ-1 mono**

This memorial album is part of the last concert of a top Hungarian violinist, colleague of Bartok, Kodaly, and the rest, who died suddenly in this country in early 1959. The

record consists of a portion of a "reference tape" made at the concert, which took place at Indiana University, and it poses some interesting questions. On its face value (for those not present on the actual occasion, or who do not know the man's work as a whole) it is quite disappointing. The faults are both musical and technical, adding up to what is undoubtedly a misleading surface impression. And yet—who is to say that a man's last concert is not a fitting memorial, at least to all who did know his greatness and can discount the shortcomings of a single recorded occasion?

Musically, it is evident that at this time Zathureczky must have been very tired and/or ill; the playing is highly musical but physically weak, full of tell-tale slurred passages, uneven intonation, tired entrances, a thin, quavery tone. This is heightened by casual miking—mostly his own fault; he sways from side to side, in and out of mike range. (Remember that this was merely a "reference tape".) In contrast, the immovable piano's sound is much better and its impact is heightened by a powerful and intense player, Manahem Pressler, who practically carries the fiddle along with his own energy. Too much piano.

The inadequate recorded effect, then, is a product of circumstances—a specific time and place. Good recording, we must remember, is always timeless, without reference to any specific occasion; it must sound out strictly on its own built-in merits. And so this is not a good recording, though it may be a moving memorial to a great man.

So-so editing doesn't help. Applause is shot at you like a gun burst (cut in without fade-up) before each piece— quite unnecessary since the music begins and ends without applause overlap. There's nothing wrong with well-managed applause to indicate that a concert is taking place; but it must be tailored to the recorded medium. This isn't, by a long shot.

These technical matters will not bother those for whom the memorial is intended, and the friends and admirers of a notable violinist will surely want to own a copy of the record. It was good that Vox could undertake its production on its regular label, for wider availability.

Franck: Sonata in A Major.
Debussy: Sonata in G Minor. Isaac Stern, violin, Alexander Zakin, piano.
Columbia MS 6139 stereo
(ML 5470 mana)

These days, a big performing artist is supposed to be able to play the whole repertory of music in his field (or sing it), whatever the style or nationality. This is not good, for it militates against individuality and, in fact, against style itself.

Isaac Stern plays everything; but the Stern-Zakin team seem to me to be best in the more Germanic types of music. Their Brahms, for instance, is superb. This foray into two French works is, as I hear it, a slightly qualified success—good, for both musicians are top-drawer, but still not what it should be stylistically. Even the recording interferes, with well-meaning intent. Too fancy in the sound.

The Franck sonata is overly eloquent and forceful, as though it were a German work, thereby somehow dampening that fresh, pastel-like and almost naive Romanticism that was Franck at his best. Too complicated, this playing, too involved in "meaning," where the piece is best played impeccably, yet simply.

And as for Debussy, the playing again is full of fire and "meaning," recorded in a huge big liveness; and once more, it seems to me, the essentially dry sound of this work of craftsmanship is made too expressive and thereby loses its best strength. Moreover, the Debussy work is above all a piece of intimate chamber music, at its best in close proximity, without liveness. The big sound Columbia applies here gives an unduly symphonic effect that is quite out of style.

In both works it seems to me that the important piano part is subordinated to the fiddle in the mike set-up, for still another stylistic fault. Not serious, but noticeable, nevertheless. All in all, a noble but not too successful exposition of French music.

Ravel: String Quartet.
Prokofiev: String Quartet #2. Carmirelli Quartet. **London CS 6174 stereo**

I like the way this forthright group of Italian players tackles the familiar music of Ravel and the folkish, Russian-bear Quartet of Prokofieff. The group seems to have its own rather individual approach to what are, by this time, pretty much standard items in quartet literature. They have an Italian sense of drama and lyricism, warm and positive but a bit on the soft side. They avoid very thoroughly that academic "quartetty" sound that many players feel is somehow the mark of good quartet playing. Maybe so, but imagination counts heavily, when well applied as here.

The Ravel is all mystery in its more impressionistic parts, sounding really like the fresh, enthusiastic early work that it was when composed. The Prokofieff, however, is quite unlike other recent performances I have heard. The taut, hard, intense quality, the gutty expression, is largely missing in favor of warmth and song—whenever Prokofieff allows it. Some well known passages just seem to mystify these players, judging by the sounds they make; but they have a good try at them anyhow, in their best Italian manner, and the results, while not exactly Russian in flavor, are winning and musical to hear.

Debussy: String Quartet
Ravel: String Quartet. Juilliard String Quartet. **RCA Victor LSC 2413 stereo**

I played this record just after I had spent a morning in Philadelphia and the same afternoon in New York. No doubt about it—this Juilliard Quartet plays in the tempo of New York.

In Philadelphia I had a feeling that people walked just a trifle slower, cars waited a bit longer at the light (and honked less when

held up), the cops were more suave and unhurried, there was always a bit more room to move around in than in my normal place of residence, Manhattan. If the Juilliard Quartet can be taken as standing for American music-making versus European, I think their impeccably "Manhattan" intensity is perhaps typical of our way, in contrast to that of, say Vienna or London.

Both of these works are given fast, intense, highly charged performances, beautifully worked out, driving but never less than smooth in ensemble. They are, if you wish, musical chrome plate, but a solid, enduring layer of it, good for the ages. "Our tempi are generally faster than fifty years ago because the pace of life is faster," says the first violinist of the ensemble in the album notes here. That's precisely the idea. This is modern playing, expressing 1960, for better or worse.

Music of Edgar Varèse. (Ionisation; Density 21.5; Intégrales: Octandre; Hyperprism; Poème Electronique.) Robert Craft conducts woodwinds, brass, percussion. **Columbia MS 6146 stereo**
(mono: ML 5478)

You've heard, and you remember, the famous EMS-401 hi-fi recording of "Ionisation," that fascinating collection of noises, including two sirens, that dates from the late Twenties—the music, not the record; it was 1950. Here it is in stereo, and added to it for a representative survey of the man are other works from the same incredibly remote period, plus his latest opus, tape-composed, the three-channel "Poème Electronique" that was assembled (at Philips in Holland) for the 1958 Brussels World's Fair and projected there in a building designed by Le Corbusier, via some 400 built-in loudspeakers.

Maybe its literal prejudice—I've heard him before—that makes me feel that the "live" portions of this record are a bit less healthily energetic than earlier versions I've experienced as led by other conductors than Mr. Craft. His somewhat chilly intellectualism gives us superbly accurate playing (as far as I can tell) but omits a certain zest that is inherent in every Varèse production, as in the irrepressible man himself. But the essential potency of these works will fascinate and shock you even so. This is a real screamer, controversial in the finest sense imaginable. You'll be violently pro, or insanely against; you won't stay neutral; you can't. I think the man is a real genius of his sort. I suspect he is so far the only big musical mind, at least of an older generation (who knows yet how the youngsters are endowed) so far to have invaded the electronic field.

Only one small question in my mind—has Varèse dropped the odd last letter of his name, or has Columbia made the usual boo-boo? It's Edgard, not Edgar.

P.S. There's a Folkways mono recording of "Ionisation," same conductor as the old EMS 401 (Folkways 6160), with Juilliard School players. Folkways ignores us, here at AUDIO, so I haven't heard it. Also a withdrawn Urania, in both stereo and mono. The original EMS record included four of the works on this new Columbia record.

La Harpe: Classique et Moderne. Marcel Grandjany. **Capitol SP 8514 stereo**

M. Grandjany is one of the greatest and most musical harpists of all time and a communicator of the harp's musical idiom who is so magnetically persuasive that many of us who would not look a horn or an oboe in the face will listen endlessly to his harping, no matter how corny the substance—and corny it often is.

Don't be misled by that pretty word "moderne": look the other way when you read "Jazz Band" as one of the included titles. M. Grandjany's modern music might conceivably have sounded modern back in the depths of the Impressionistic age, which is the modern harp's true home anyway. As for Jazz, the harp is the harp and jazz isn't its forte. Not under this man's fingers, anyhow.

(Continued on page 76)

CHARLES A. ROBERTSON*

STEREO

Ernie Wilkins: The Big New Band Of The '60s — Everest SDBR1104

In the midst of a thriving career as arranger for several bandleaders, Ernie Wilkins is dangerously close to assuming the full responsibility of an organization of his own. A good excuse for contemplating such a risky step is the success of his first effort for Everest, "Here Comes The Swingin' Mr. Wilkins (SDBR 1077)," which introduced him to the pleasures of assembling a big band and taking complete charge in the studio. The current release results from a return invitation and is even more promising. Unless the urge is conquered, Wilkins may leave security behind and realize an expressed desire to venture out on the road at the head of a similar group.

Wilkins grew to maturity as an arranger during a four year period in Count Basie's sax section and learned a great deal from studying the inner workings of the band. When he left five years ago to devote all his time to writing, it was because he had the Basie style down pat and was hard pressed to meet all the demands for his work. Besides doing scores for Quincy Jones, Harry James, Ted Heath and Dizzy Gillespie, he has kept close to the creative source of jazz since then by assisting many small groups on record dates. One of the reasons why he has escaped settling into a rigid mold is the stimulus derived from soloists at these sessions. Wilkins, who learned long ago where productive ideas may best be found, always gives credit to former Basie colleagues for inspiring a number of his themes.

While boasting a reputation founded on an ability to project the relaxed swing and ensemble impact of the Basie band, Wilkins also is noted for his skill at mixing modern overtones with the basic riffs of Kansas City jazz. Excellent examples of how he has branched out in recent years are his big band settings for Sonny Rollins, available on the M-G-M label. An extensive work surveying the history of jazz saxophone, done on a commission from the Monterey Jazz Festival, permitted him to write for Ornette Coleman as well as the veterans Ben Webster and Coleman Hawkins. Continued growth as a composer since Basie days, however, is only a partial solution to the problems Wilkins will meet as a leader.

Too much a product of the Basie organization to be called an imitator, Wilkins also knows that any new band following the style too closely will run second for a long time to come. If Wilkins goes to the other extreme and departs from the Basie style completely, he will no longer be doing what he is trained to do best. The planning of the two Everest albums indicates how he intends to disentangle himself from this predicament. As a starter, the lists were ransacked for show tunes and pop standards not usually included in the Basie book. Soloists were judiciously picked to fit each tune, but few are Basie alumni and none is a member of today's band. Consequently, Wilkins avoids direct comparison with his former boss and the sound of his new band is fresh and vital.

There always will be a touch of the Basie tradition in everything Wilkins does, which is as it should be. On three originals, prepared for the second LP, he comes nearest to open competition, but then dodges the issue by giving two principal roles to Yusef Lateef, who is best known for exotic excursions into Asiatic music. The multiple reedman from Detroit enlivens *Fresh Flute*, and turns to tenor sax for idiomatic statements on *Ernie's Blues*. Another tenor player, Seldon Powell, underlines *A Swing Serenade*, while still a third, Zoot Sims, propels Gershwin's *Fascinating Rhythm*. Trumpet parts are assigned to a trio of equally varied soloists, with Charlie Shavers featured on *Satin Doll*, in addition to his own *Undecided*. Clark Terry, a Basie graduate, is lyrically expressive on *Very Much In Love*, and switches to flugelhorn for *Lover Man*. Richard Williams, one of the most promising of the newer brassmen, is heard on *I'll Get By*. The mellow trombone of Henderson Chambers is just right for *Speak Low*.

Leading the reed section is Earl Warren, a melodic alto saxist who held the same post with Basie for more than a decade. The band executes unison voicings with the ease and repressed power of a 70-watt amplifier handling the dynamics of a Meyer Davis dance set. Appropriately enough, Wilkins seems to be aiming at those Meyer Davis followers who like to be adventurous once in awhile. A spirited rhythm team, sparked by the supple guitarist Kenny Burrell and drummer Charlie Persip, should start them swinging again. Armchair listeners, immersed in the aural satisfactions of amply proportioned stereo, will be impelled to resume foot tapping.

Luckey Roberts & Willie 'The Lion' Smith: Harlem Piano — Good Time Jazz S10035

The dean of Harlem piano demontrates the art of piano tickling, assisted on the program by a robust and swaggering cub from the litter which included James P. Johnson, Fats Waller, and Duke Ellington. Luckey Roberts, who helped found the school, learned to play by ear at the turn of the century and worked in a carnival at the age of six. He rose to the top of the heap by World War I and wrote several ragtime hits. Less adept at self-promotion than certain other pianists, he appears for the first time on LP playing his own tunes. Quite a bit of piano history is covered on the six chosen, from *Nothin'*, an acrobatic exercise of fifty years ago, to the contemporary *Outer Space*. Stately waltz themes are heard on *Inner Space*, while the titles alone explain *Spanish Fandango*, and *Railroad Blues*. Luckey's powers seem undiminished and he strides along in fine two-handed fashion. It will be one of the tragedies of jazz if he never records the rest of his compositions. With all the money floating around for less useful projects, someone might set up a Harlem Piano Foundation to preserve some of the vast repertoire.

Willie "The Lion" Smith has recorded most of his works before, but never in stereo, or in sound anywhere near as good. Among the titles enjoying the benefit of Dave Hancock's engineering are *Morning Air*, *Rippling Water*, and *Tango La Caprice*.

Les McCann Ltd: The Shout — Pacific Jazz 7

Rarely has a new jazz pianist caught on as quickly with the public as Les McCann, whose first album deals with "The Truth" and became a best-seller overnight. Its success stems in about equal measure from his persuasive pianistic powers and a capacity to create ecstatic neo-gospel themes, especially in waltz tempo. Recorded just before McCann was about to take his trio on a cross-country tour, the present album is a revelation of the whole group's ability to grip the attention of an audience and hold it. The location was The Bit, a coffee house on Hollywood's Sunset Strip, and Dick Bock's engineering of the trio, in stereo, proves it to be as finely balanced as any now working. The dynamics are wide-ranging throughout, and the speaker system that can handle Leroy Vinnegar's sixty-fourth bass notes is one worthy of the name.

McCann uses choice humor to introduce several numbers and almost bursts into song on the title tune, his sole original of the set. Vinnegar is a powerhouse on *C Jam Blues*, and Ron Jefferson lets loose a masterful drum roll on *Night in Tunisia*. The lead is shifted from one member to another often, always without a hitch. The audience can hardly contain its enthusiasm. When the pianist fades down to a whisper on *But Not For Me*, however, the drop of a pin would be audible.

Count Basie: Not Now, I'll Tell You When — Roulette SR52044

The album title refers to Count Basie's practice of occasionally cocking a warning finger at an expectant soloist. His other methods of signaling the band include arched eyebrows, distinctive piano chords, and his private version of the Benny Goodman eye. This time his instructions remain secret, however, as they were used to extract a sheaf of arrangements and new numbers from various members. Trumpeter Thad Jones proves to be the hardest worker, coming up with the title piece, *Sweet And Purty*, and also rescuing Jule Styne's *Mama's Talking Soft*, a catchy tune cut from "Gypsy" at the last moment. Frank Wess provides his own flute settings on *Blue On Blue*, and *Swinging At The Waldorf*. Frank Foster contributes *Rare Butterfly*, and the pivot man in the rhythm section, guitarist Freddie Green, is the writer of the pulsating *Daly Jump*. These are the sort of compositions the Basie team does best, and they sound all the better for originating within the band.

The Count adds a characteristic opus himself, called *Back To The Apple*. Sonny Payne encores his showpiece, *Old Man River*, but the other members, instead of walking into the wings, remain on the stereo stage for the record, and his drum solo is nicely integrated with the full band sound all the way through. Credit the engineers for an unusually good assist in the studio.

Ray Bryant: Little Susie — Columbia CS8244

The best all-around pianist to develop in recent years is undoubtedly Ray Bryant, who can sit in with traditional or modern groups and have something to say in either context. Approving audiences welcome him at The Roundtable, a dixieland outpost on Manhattan's East Side, or at Birdland Monday nights. His reputation as a composer is also growing, largely due to *Little Susie*. Written and named for his daughter, it holds rhythmic appeal for teenagers as well as middle-aged admirers of two-handed piano. Before Columbia signed him to a contract, at least two other companies had already paid him for recording the tune. Columbia outdid the others by pushing the single version, however, and now *Susie*, newly framed in stereo, is ready for further adventures.

The program also uncovers two other Bryant originals in *Big Buddy*, and *Blues For Norine*. His affinity for the blues is well established, but he proves equally attuned to *Misty*, *So In Love*, and *Greensleeves*. Brother Tommy is on bass, and Eddie Locke and Gus Johnson alternate on drums.

* *732 The Parkway Mamaroneck, N.Y.*

A SPECIALLY COMMISSIONED RECORDING

. . . LIMITED EDITION

NATURAL BALANCE

Westminster®

LONG PLAY HI-FI RECORDS

SHURE

NOT FOR SALE

"The Orchestra . . . The Instruments" No. LS661

Without a doubt, the most ambitious, musically sound, entertaining and informative privately commissioned recording to date. Superbly original in concept, extraordinary in scope, it shows how each instrument (and instrumental choir) emanates from the orchestra in the correct spatial relation to all other instruments. It is uniquely stereo-oriented, so much so that it cannot purposefully be made into a monophonic disc or played on monophonic radio. Conceived and supervised by Dr. Kurt List, winner of the Grand Prix du Disque, renowned composer, critic and Musical Director of Westminster; recorded by the Vienna State Opera Orchestra in the acoustically brilliant Mozartsaal concert hall; Franz Bauer-Theussl conducts, with first desk soloists. Program material is a cohesive musical entity with works of Cimarosa, Debussy, Dittersdorf, Dvorak, Handel, Haydn, Lalo, Mozart, Rachmaninoff, Respighi, Rimski-Korsakov, R. Strauss, Tchaikovsky, Wagner, and Weber represented. No one can buy this record—and there is no record like it. It is yours only with the purchase of the Shure Products* listed below:

Only Shure would commission such a technically demanding record—for they know full well that Shure Stereo Dynetic Phone Cartridges are equal to its incredible range and stereo channel separation requirements. Shure cartridges are the overwhelming choice of critics, musicians and audiophiles for their own music systems. They are the lowest cost, yet most critical components in quality stereo systems. They are completely accurate and honest throughout the entire audible sound spectrum.

. . . a gift to you when you buy the one indispensable accouterment to perfect sound re-creation

*You will receive the Westminster/Shure recording at no charge with the purchase of a Shure Professional Cartridge (Model M3D $45.00 net), Custom Cartridge (Model M7D $24.00 net), Studio Integrated Tone Arm and Cartridge (Model M212, M216 $89.50 net) or Professional Tone Arm (Model M232 $29.95 net, Model M236 $31.95 net).

Offer limited. Full details at your local high fidelity dealers' showroom. (See yellow pages under "High Fidelity," "Music systems—home," etc.)

. . . incomparable

SHURE

Stereo Dynetic

hi-fi phono cartridges and tone arms

Music lover's record selection booklet . . . send 25c.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Dept. BBB

Andre Previn: Like Previn!
Contemporary S7575
Dinah Shore: Dinah Sings Previn Plays
Capitol ST1422

It would be a remarkable LP that contained all aspects of the musical personality of the multi-talented Andre Previn. The first presents him as jazz pianist and writer of eight originals in the company of bassist Red Mitchell and drummer Frankie Capp, the regular members of his trio. Three tunes are named for the musician's wives, but the leader also takes recent jazz trends into account and makes one a blues waltz, adds a camp-meeting flavor to another, and then shows off his ballad style. While not of the roistering school of humor, Previn strikes a witty vein on *Tricycle*, and comes back for an encore during brisk exchanges on *Three's Company*. The bassist's solo on *Rosie Red*, dedicated to his helpmate, explain why he is the pride of the Mitchell household.

Dinah Shore joins in on a relaxed session that allows Previn to display his considerable skill as accompanist and weaver of romantic moods. The rhythm men take a breather on several tunes, on which just the singer and pianist together create a quiet and timeless feeling. It makes quite a change from her appearances before television cameras. Among the songs given the casual touch are *The Man I Love, Melancholy Baby,* and *That Old Feeling.*

Cannonball Adderley: In Chicago
Mercury SR60134

When still working for Miles Davis, during an engagement at Chicago's Sutherland Hotel, Cannonball Adderley took the rest of the leader's sidemen into the studios in February, 1959. Both he and John Coltrane, the group's tenor saxist, had attained a pinnacle in their careers while with Davis and would soon set out on their own. The time was ripe for a joint discussion of their experiences together, and a new revelation of progress made. The breezy Chicago atmosphere also seems to have affected Adderley, who wastes no effort in purposeless rhapsodizing on *Limehouse Blues*, and *Stars Fell On Alabama*. His alto-sax playing follows direct and functional lines on *Wabash*, a composition of his own. Coltane contributes *Grand Central* and *The Sleeper*.

Rather than depart on unexpected tangents, each is content to work as a team and feed the other ideas from a bountiful supply. Pianist Wynton Kelly spins a balladic tale on *You're A Weaver Of Dreams*. Paul Chambers, bass, and drummer Jimmy Cobb complete the quintet. Bernie Clapper, of Universal Recording, provides a stereo setup that never renders asunder what Miles Davis put together.

Johnny Griffin: The Big Soul-Band
Riverside RLP1179

Every good big band hopes eventually to play with relaxation and flexibility of a small band. When good fortune strikes and everything begins to move at once, it usually happens late at night after the members have worked months together. Most musicians engaged to fill studio dates have experienced the feeling, at one time or another, and are hired because they can stir up a semblance of the real thing on short notice. The occasions when ten men catch fire with the intensity of those surrounding Johnny Griffin are so rare, however, that it is difficult to believe a studio group is involved. It is even more difficult to think of his fiery "soul-band" in conventional big band terms.

While the liner notes stretch a point by insisting no one else thought of welding gospel fervor with full band sound before, this is the first LP to be quite so thoroughly steeped in the subject. Norman Simmons, a young Chicago arranger and composer who served a stretch as Dakota Staton's pianist, sets older spirituals and new originals as texts for the leader's sermonizing tenor sax. In addition to three of his own compositions, he provides full-scale scorings of Bobby Timmons' *So Tired*, and Junior Mance's *Jubilation*. His writing, aside from evoking the gospel spirit in a fresh and novel manner, never impedes the band and each declaration seems wholly

spontaneous. Even Charlie Persip, on *Meditation*, is allowed to preach to the congregation in a drum part that almost talks.

Griffin is the main soloist, taking several emotion packed choruses on all numbers, and does the best work of his career. His fluent delivery has frequently lacked the sense of direction which Simmons supplies on *Wade In The Water*, *Nobody Knows*, and *Deep River*. Griffin attacks each with a personal urgency that drives the band full tilt. Clark Terry, Matthew Gee and Timmons also have solo roles. The arrangements demand much call and response from the sections, and engineer Ray Fowler tosses the exchanges back and forth in faultless stereo.

George Shearing: On The Sunny Side Of The Strip — **Capitol ST1416**

Despite all the efforts with surrounding strings, woodwinds and voices, the George Shearing Quintet still performs best unencumbered and before a live audience. Capitol made this discovery when the pianist was recorded in concert at Claremont College, and again when he accompanied Peggy Lee before assembled disk jockeys. At last, the microphones follow him to a more customary habitat on Hollywood's Sunset Strip, permitting the cash customers at the Crescendo to be heard enjoying a typical program of ballads and modern jazz standards. Emil Richards, vibes, and Toots Thielemans, guitar, give expert assistance on *Jordu*, *Confirmation*, *Bernie's Tune*, and *Joy Spring*. The leader, aided only by bassist Al McKibbon and drummer Percy Brice, charms old and young lovers everywhere on *The Nearness Of You*.

The concluding number of each side brings on conga drummer Armando Perrazza, whose Latin rhythmic effects are a treat for stereo listeners on *Mambo Inn*, and Ernesto Grenet's *Drume Negrita*. Capitol engineers have developed a real aptitude for location work and turn in an excellent recording.

Maynard Ferguson: Newport Suite — **Roulette SR52047**

A mischance resulted in the title *Newport Suite*, which is actually a blues-based Slide Hampton piece of slightly more than average length, and only by virtue of an interpolated waltz theme does it become a suite. Still unnamed when the band arrived for the 1959 jazz festival, it was christened and launched on the spot because Maynard Ferguson learned at the last moment that a blues program was scheduled. It builds, like any proper blues, through a series of minor explosions to a point where the listener is thoroughly prepared for the final climactic detonation. Frank Farrell, tenor sax, and Jimmy Ford, set the stage for the leader's entry, and his solo heightens the sense of anticipation by understatement before ascending ultimately to the upper reaches of the trumpet. No doubt the time elapsed between Newport and the studio enables the band to offer an improved performance—a powerful one in every respect.

Although Ferguson describes all seven numbers on the LP as "applause-getters," an adequate amount of space is allotted to something besides pyrotechnical displays. His attitude is thoughtful and profound on *Sometimes I Feel Like A Motherless Child*. Hampton shares the writing chores with Bill Maiden, a fellow bandsman of humorous bent. Maiden's idea of a good time is to inveigle his boss into playing baritone horn, and then match him with baritone-saxist Frank Hittner for some eventful stereo sounds on *The Jazz Bary*. Ferguson should try to get as much fun out of a trumpet once in awhile.

June Christy: The Cool School — **Capitol ST1398**

The headmistress of the cool school of vocalizing opens the fall term with a lesson in fundamentals, designed especially for new aspirants and older students in need of a refresher course. Because June Christy starts right out with a review of first principles, the LP should be forwarded to graduates who now believe their personal mannerisms are more important than the substance of a song. Not only does teacher know that a distinctive style depends upon the ability to sing, she

shows how on Gershwin's *Looking For A Boy, Swinging On A Star,* and *Scarlet Ribbons.*

But the main part of the Christy message is aimed at a younger generation. As though to prove her point, she romps through such juvenile favorites as Ann Ronnell's *The Magic Window, Small Fry, Give A Little Whistle,* and *Kee-Mo-Ky-Mo.* By scarcely bending a note along the way, she makes the practice seem elementary and surprising once again. Joe Castro, playing piano and celeste, heads the accompanying quartet which consists of Leroy Vinnegar, Larry Bunker, and a guitar manufacturer by the name of Gib Fender.

The Kingston Trio: String Along
Capitol ST1407

There being little new to say at this late date about the Kingston Trio, whose albums sell like hotcakes anyway, let it suffice for this review to say that the boys seem twice as rambunctious through binaural earphones. The copy writers insist on calling them stereophones, and Mr. Canby has expresed his views on the subject in September's AUDIO ETC column. There is no disputing the validity of any of his statements, but the fact remains that such aids are a necessity to many listeners. Quite a few people were distressed when Permaflux stopped making them a few years ago. (They still make them—see *New Products* in the October issue of AUDIO, ED.)

Earphones, however designated, are selling almost as fast as Kingston Trio albums this season. With the return of tape for home listening and the advent of FM-multiplexing, the demand is likely to gain greater momentum. Aside from the obvious reasons of necessity and convenience, one incentive for the purchase of this piece of accessory equipment is plain, ordinary curiosity. Audiofans waiting for further improvements in stereo components suddenly decide to try earphones for want of anything else to buy.

While all the shortcomings mentioned by Mr. Canby quickly become evident, earphones often remain as a handy adjunct because of these same characteristics. Where the proper room placement of speaker systems conceals the means of achieving stereo effects, earphones clearly define the engineering techniques employed. By keeping earphones within reach, the listener can satisfy his curiosity and obtain two distinctly different kinds of dual-channel sound without rising from his easy chair.

It would seem that the creation of true stereophones is within the grasp of Dr. Amar G. Bose, the M.I.T. professor whose design of a new speaker system is about to be placed on the market. His invention calls for twenty-two small speakers vibrating together on the curved surface of one-eighth of a sphere, with a radius of twenty inches. Resembling a section of honeycomb in appearance, it can be placed in a floor or ceiling corner and is reputed to reproduce low bass frequencies without distortion due to the vibrations of the whole surface.

All Dr. Bose needs to do now is reverse the position of a proportionate number of speakers and extend the sphere into the dome shape of a space helmet. Plexiglas might vibrate as effectively on bass notes as the unspecified material used in Dr. Bose's new system. If Mr. Canby, or anyone else, turns purple at this suggestion, they are hereby nominated to become the first to don a Man-from-Mars globe.

Deluxe models might be air conditioned and completely enclosed, with air intake from an oxygen tank. Oxygen is a sure cure for hangover and should lessen any vertigo induced by kettledrums reverberating from channel-to-channel and back again. Regulations in public places would require that all transistor radios be contained in portable models—a real boon for captive audiences at beaches and ballparks.

Mention should be made in passing of several new additions to the Kingston repertoire. Jane Bowers, the guardian angel of the group and Dave Guard, are credited with *When I Was Young,* and *Buddy Better Get On Down The Line.* Other trio members assisted on *Who's Gonna Hold Her Hand,* and *The Tattooed Lady.* Carl Sandburg, Cisco Houston, Bobb Gibson, and Lee Hays are among the composers of the remaining tunes.

Perez Prado: Big Hits By Prado
RCA Victor LSP2104

This is one of the happier results of the practice of bringing hit recordings up-to-date by means of stereo. Not only is the sound benefited enormously, but Perez Prado takes the occasion to review his blockbusters of the past ten years with a calculating eye and improves upon many of the original performances. The smouldering trumpets burst into flame on *Cherry Pink And Apple Blossom White,* and compulsive rhythms charge through *Mambo Jambo.* The arrangements of the Cuban pianist are especially suited to the panorama of stereo. At the same time, his custom of interjecting guttural cries seems less forced, and the electric organ less overbearing on *Patricia.* The engineers do a splendid job of handling both the organ and rampaging brass.

MONO

Shakey Jake: Good Times
Prestige/Bluesville 1008

Besides bringing back some of the older blues singers, plans for the Bluesville series evidently extend to younger men not recorded before. Shakey Jake currently sings weekends on Chicago's South Side, works the rest of the time in a gas station, and earned his nickname while shooting craps to further supplement his income. Although he was born Jimmie Harris in Arkansas, sharecropping forms no part of his past and most of experiences are urban. He came to Chicago as a boy during the depression and learned about the blues there, listening to other singers and studying the harmonica style of Sonny Boy Williamson.

While of uneven quality, all the tunes are his own and several of the dozen heard can stand beside the best in the genre, notably *Just Shakey,* and the title tune. No great shakes as a vocalist yet, he does know how to create a real blues feeling and will undoubtedly improve. His harmonica playing, however, is more powerful and plumbs deeply on *Jake's Blues,* and *Sunset Blues.* Bill Jennings, guitar, and Jack McDuff, organ, assist admirably.

Jazz Scene 1

Epic LA16000

Jazz Scene 2

Epic LA16001

The aim of this series is to include "artists who have influenced jazz growth and the directions it would take." Some of the choicest items to appear on the old Vocalion label are reissued on the first volume. Along with Bunny Berigan's *I Can't Get Started*, there are four Ellington small groups under Rex Stewart, Johnny Hodges, Barney Bigard and Cootie Williams. Most significant are Jones-Smith, Inc. playing *Lady Be Good*, the number which introduced Lester Young to jazz listeners, and Roy Eldridge's *Heckler's Hop*. That Eldridge forged the connecting link between the trumpet styles of Louis Armstrong and Dizzy Gillespie is best observed on four sides recorded at this 1937 session. The remaining three should be considered for future releases in the series.

While the first volume is essential for closing a gap in many collections, the second contains items from LP's still on the market. Its value depends entirely on the individual collector's stock of Ahmad Jamal, Herbie Mann, Phil Woods and Conte Candoli.

The Happy Jazz Of Rex Stewart

Prestige/Swingville 2006

Feeling that jazz needed a little fun and frolic for a change, Rex Stewart remembered the record sales of Red McKenzie's Mound City Blue Blowers during Prohibition Days and decided the group's high spirits might be worthy of revival. The popularity of this type of music is now largely confined to England, a country where skiffle bands sprout at the end of every hedgerow. But McKenzie's knack of blowing choruses through comb and tissue paper has eluded musicians on both sides of the Atlantic. The more prosaic kazoo is substituted on this session, with Stewart and John Dengler taking turns at imitating the enraged buzzing of a swarm of angry honeybees. In addition to filling the breach with accustomed cornet solos, Stewart is encouraged by the general informality to vocalize on *Red Ribbon, Nagasaki*, and *Four Or Five Times*. Dengler rumbles like a bear after honey on bass sax, and settles the hive by beating on a washboard. Wilbur Kirk's harmonica is soothing, while two guitarists and a drummer help out.

The LP might serve at a party as a change from dixieland fare. Mound City tunes reclaimed are *San*, and *One Hour*. The group performed best when Coleman Hawkins and Pee Wee Russell were present. Perhaps Stewart will invite them to the next outing.

King Pleasure: Golden Days

Hifijazz J425

A prophet and philosopher under the name of Clarence Beeks since the age of six, King Pleasure later adopted the avocation of show business, but abandoned it in 1956 to reclaim his real identity. The formulation of a new theory of existence called Planetism has required all his attention since then. From a partial outline of his findings noted on the liner, it is easy to believe that earlier studies helped him to think of his voice as a disembodied object in space. In any event, he learned to play on his vocal chords as he might on an instrument and was the first to develop the idea of setting lyrics to improvised jazz solos. Most singers would envy his vocal projectoin and control, but the King never calls himself a singer and always speaks of his work as interpretation.

The popularity of the Lambert-Hendricks-Ross Trio has created a new demand for this style of vocalese and snatched the King from his research momentarily. Restored are his justly famed *Moody's Mood For Love*, and *Parker's Mood*. Also explored are solos originated by Stan Getz and Illinois Jacquet, while the title tune is based on Pleasure's own theme. Undoubtedly a jazz musician at heart, the King is right at home as part of a sextet headed by Gerald Wiggins, which includes Harold Land, Matthew Gee and Teddy Edwards. AE

RECORDS

(*from page 69*)

A wee, thin trace of semi-syncopation, a few "dissonant" sweeps of the hand over high strings, serve to give this mid-twenties "jazz" piece its jazziness; it is just another nice salon opus.

But such limpid, liquid, wonderfully intelligent playing! Almost beyond belief. I love it and always will. (And note that the harp sounds really good in stereo. Surrounds it with what it needs, a plastic sense of space and liveness.)

Marcel Moyse, Flutist. "The French School at Home". A Marcel Moyse Flute Recital. Sixteen Classical Selections for the Flute. Marcel Moyse, Blanche Honneger-Moyse, flutes; Louis Moyse, piano.

Marcel Moyse Records
(183 Western Av., Brattleboro, Vt.)

Here are three LP's out of a series of musical documentaries—documenting one of the great flute players of a past generation, who brings both the techniques and the attitudes of the age of French Romantic flute playing to our ears today in hi fi sound.

Don't let me carry you away; you'll have to love the flute dearly to get through this wealth of flute, flute, and more flute (with more to come, I expect). Nevertheless, every flute student, every historian of instrumental music, every lover of high instrumental technique, will want at least one of these. Not to mention all the music schools in the country—they'll need 'em all.

As for the music, it's mostly so much sentimental doggerel. If not that, then it is classic stuff played in a fine Romantic way. A Bach and a "Haendel" on the classic disc display two flutes—lovely but in snail's pace fashion; a short Beethoven item is nearer to the mu-

sical norm; a hundred-odd show pieces and arrangements fill out the rest of most sides, just as in every specialized instrumental recital that comes along on records.

If you want incredible flute acrobatics, try the Recital disc. It's full of corny variations, each one faster than the last until the flute is playing at thousands of npm (notes per minute). Look out for "The French School at Home"— it is a pair of sides entirely devoted to flute exercises, probably the classic familiar ones in every flute player's early years. Musically zero and most of them don't even sound spectacular, for they emphasize the subtler aspects of flute technique, especially the varieties of tone color, of rhythm and portamento, of melodic allveness. One will go *"wowooo, wowooo, wowooo"*, for a special melodic curve, another will be all *"ta, ta taaah, ta, ta, taah"*, for tonguing.

No doubt about it, the priceless sound of the great flute age is right here. But no doubt, too, most of us will say, not for *my* brass ear.

The recording is technically good (you can hear all the breathing-in sounds) but is miked rather amateurishly. Living room sound. Piano tinny and in the background, evidently not considered in the miking, where it should be given careful treatment to back the flute itself. AE

MATRIXING

(*from page 21*)

"left" and "right" channels, rather than "mono" and "stereo" (*Fig.* 4).

The major listening area was not in the edge-on position of either speaker, where transverse radiation predominates. But the characteristics of this type of radiator were used. Each unit was a doublet, but only the front lobe of the "figure 8" pattern was used.

The theoretical explanation accompanying the verbal presentation of the paper was based on relative intensity from the two units, as controlled by the "figure 8" patterns. But there can only be a simple intensity combination at the point where their lines of pure longitudinal radiation intersect (*Fig.* 5).

At this point, resultant velocity, as well as pressure, is controlled by the phase relation between the radiation from the two units (*Fig.* 6). At other points, some transverse radiation is inevitably present too, and undoubtedly helps the intensity gradient in creating the necessary difference at the two ears.

A practical limitation to such a system, using true doublet sources, is the presence of the rear lobe of the "figure 8." If the unit is placed at all near to a wall, reflection occurs and complicates the radiation pattern to the extent of invalidation.

The Heath engineers, who developed a similar system (for kit builders) under license from CBS, controlled the back radiation by allowing it to "escape" through slits at the sides of the unit, pointing forwards (*Fig.* 7). This retains the essential method of the CBS system, without the speaker placement limitation.

Its front radiation is somewhat more directional than the simple doublet

(*Fig.* 8). It probably limits the useable area in similar proportion, but not so much as the CBS method would be limited by misplacement of the units to reflect the rear lobe.

Complex Cylindrical Radiation

Another variation of this approach was developed by the writer for an inexpensive "basement" loudspeaker, called the "pillar of sound" (*Fig.* 9). Although this was arranged to be connected to conventional "left" and "right" amplifier outlets, it used acoustic matrixing.

For monophonic components in the left and right channels, the speakers facing in all three directions, forwards, left and right, work in unison. For "stereo" components (in which left and right are in phase opposition) there is no sound output from the front units and the internal air behaves as a fluid coupler between the backs of the left and right units, so their combined operation is essentially as in Lauridsen's original edge-on unit.

Use of four units vertically in-line for each group results in approximately cylindrical radiation. This reduces the rate at which both longitudinal and transverse waves reduce magnitude with distance. Due to the length of the composite source, the initial rapid reduction does not occur at all. Curious listeners who put their ears close to individual units to find out "how it works," obtain the illusion that each unit (as they listen to it) is not working appreciably: all the sound must be coming from somewhere else. So getting much too close does invalidate the effect.

At greater distances, a cylindrical wave (which this then approximates) reduces its longitudinal magnitude in inverse proportion to the square root of distance, while the transverse component reduces in inverse proportion to the one-and-one-half power of distance (*Fig.* 10). There will still be a variation of effect with listening location. The transverse velocity always reduces a unit power "faster" than the longitudinal component, because it is not accompanied by the usual pressure drop.

But the fact that both follow a lower power order, and the restriction to a horizontal radiation, improves the ratio between the controlled sound waves and unwanted reflections responsible for confusion effects.

Ready action of the air as a coupling fluid for stereo (phase opposition) components will occur throughout the mid-range frequencies. Above this, where the distance between the backs of the units becomes comparable with wavelength, the three sets of units will begin to behave more or less independently, working as left, right and mixed center groups.

Notice that this approach uses a philosophy that is the opposite of other systems that put two stereo radiators in one "box," with various means of reflecting the "left" and "right" sound outwards, in that the design depends on close integration in a horizontal area, whereas other systems try to "bounce" their sound out, beyond their physical boundaries. In this approach, reflection effects are avoided, rather than utilized.

Over the mid-range particularly, an acoustic matrixing occurs, to produce a radiation similar to that from Lauridsen's arrangement on mono and stereo sources. However, the vertical line arrangement produces a cylindrical radiation pattern and the acoustic matrixing avoids any lack of integration due to vertical displacement between the mono and stereo radiators.

A signal originating wholly from the "left" channel will have the left and right units working in phase opposition, which is the same direction in space, and the left ones will be in phase with the front ones. So the resulting sound wave is radiated to the left of the listening area (*Fig.* 11). Similarly sound from any other original position will be radiated in a resultant direction to correspond.

Effect of Program Miking

This last statement is predominantly

true only if the program is miked either with the M-S or Stereosonic technique, or with close-in mikes using electrical mixing to achieve the desired "position" effects. But this does not mean a satisfactory effect cannot be obtained if the program is miked by a method that introduces time as well as intensity differences between individual program components in the two channels (left and right).

Experiments have shown that smaller listening rooms, of the size most often used in homes, achieve the most natural stereo effect *on a given program,* when the loudspeakers are arranged in close proximity and utilize directivity to obtain acoustic channel separation. In the extreme case, where the time differential between channels is such that instantaneous sound in each is virtually unrelated to the other, the matrixing method can be regarded as projecting each channel (left and right) at the extreme angle of its control area.

Thus even program that used a microphone technique not best suited to reproduction in smaller listening rooms, can be projected at least as well by an acoustic matrixing system as by completely separate left and right loudspeakers.

Perhaps one more thing should be clarified. One of the multiplex systems proposed, that we alluded to in our opening paragraph, has made reference to the term "acoustic matrixing," but with a connotation not compatible with that we have used. The system in question proposed to substitute a cross-mixture, consisting of something like 2L-R for "left" and 2R-L for "right," as the transmitted channels. It was suggested that "acoustic matrixing" would cancel the L-R part of "left" with the R-L part of "right," leaving pure L and R which the ears should interpret into a stereo effect.

Quite evidently this use of the term has no reference to the employment of acoustic effects in the ways discussed in this article, and the suggestion itself contains a serious fallacy. Assuming an out-of-phase component (the L-R and R-L parts) *would* cancel acoustically, then *any* differences between one channel and the other would be similarly "averaged out." Stereo is impossible. In point of fact, it is the *failure* of such cancellation, even when the sources are in close proximity, as in the pillar system, that makes acoustic matrixing possible. So, not only is such use of the term incompatible—it is contradictory to the facts.

Conclusion

It is suggested that closer attention to arrangements that employ true acoustic matrixing will probably yield some more effective loudspeaker systems for home

stereo listening than have been presented so far. As well as producing more consistent realism, of which two-channel stereo is capable, they avoid the need for two separate locations, at the mystic spacing of seven or eight feet, where separate units are usually recommended. So this approach will also make stereo much more acceptable in the average living room. Æ

SOUND SYSTEM

(*from page 26*)

described here is driven by a pair of 50-watt amplifiers. An electronic crossover is used to divide the audio range at about 500 cps. There are two reasons for the choice of 500 cps as the crossover frequency. In the first place, the woofers should not be used much above that frequency because they tend to break up. In the second place about one half of the total acoustical power lies on each side of that frequency and thus it is convenient to use identical power amplifiers. It may surprise some readers to hear that average program material has as much acoustical power above as below 500 cycles per second but this seems to be the case. The electronic crossovers have gain controls which allow for easy matching of the low frequency and high frequency speakers which are in fact of considerable different efficiencies.

Transient response of the loudspeaker-enclosure system is at best a very elusive feature to discuss. All vents, ports, pipes and other tuned gadgets must be avoided at all costs. While these devices give loud and efficient bass they are by nature resonant and must be carefully damped to achieve controlled response. Such adjustments are critical. The most reliable enclosure is the infinite baffle. It need only be made solid, be well padded, and be large. How large? The answer to this question depends upon the loudspeaker which is used. The box may be considered large enough if its presence has only a small effect on the resonant frequency of the loudspeaker. With most modern 15-in. speakers, a volume of 10 to 12 cubic feet is probably about right. Unfortunately, loudspeaker manufacturers give almost no useful information with their loudspeakers except the size hole that should be cut in the baffle and the price. A convenient size for the baffle under discussion was 2×3×4 feet. This gives an enclosed volume of somewhat less than 24 cubic feet.

The plan for the enclosure is shown in *Fig.* 6. The front panel is 1½ inches thick and is most easily made from two pieces of plywood glued together. This thickness is essential for rigidity because

of the large area removed by the loudspeaker openings. The midrange loudspeakers are mounted on subpanels and relieved in front. The finished box is shown in *Fig.* 3. The back panel must have some added rigidity and this is provided by glueing a pair of 2- by 4-in. boards to it. The box which houses the tweeter array is constructed separately and screwed and glued into place last. The entire interior of the box is lined with 1-in. Fiberglas. In addition, a curtain of Fiberglas is placed in the center of the box conveniently supported on 3 2- by 4-in boards as shown in *Fig.* 7.

The enclosure is made of fir plywood. For a more finished job the panels could be veneered. The total weight of the enclosure is about 300 lb. and therefore it should be mounted on casters. I must admit that the box is rather large and that when two of them are used as in a stereo system they tend to dominate the room. Indeed some people might go so far as

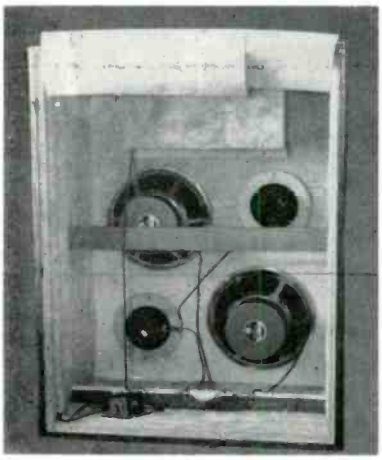


Fig. 7. Enclosure with back cover removed.

to say that they are unsightly. They sound *very* nice however and one can get used to having them around the house.

I would by no means consider the present loudspeaker system the end-all of systems. There are certainly improvements being worked on all the time. Perhaps a full-range electrostatic array will some day be available. However, when better systems are built, I am sure they will be large. One simply can't escape the need for a large piston to move the large amount of air necessary at low frequencies and that is that. We may some day reach the state of perfection with loudspeakers that we have with other parts of the audio system and then manufacturers will start using terms other than silky, smooth, clean, gooey, brilliant, etc., etc.

Next month we will talk about the electronics of the system.

TO BE CONTINUED

ABOUT MUSIC

HAROLD LAWRENCE*

Report On The New York High Fidelity Show

It is always easy to tell when New York is holding a High Fidelity Show. The vicinity of Herald Square comes alive with the bright colors of shopping bags sporting the name of a components firm (1960 version: white emblazoned with red). These harbingers of the high fidelity industry's fall season are indispensable to the audio showgoers. Upon entering the Trades Show Building, the latter notes the name on the bags carried by the departing visitors. After purchasing his ticket of admission, he consults the Directory for the room number of the thoughtful exhibitor providing the complimentary receptacles, and heads straight there to collect his copy. Now, properly equipped, he begins his tour of inspection.

To spare his eardrums, the audioman will try to spend his time in the most efficient manner possible. He has probably heard about most of the new products being introduced at the show and marks these exhibits as priority stops on his itinerary. A glance in the doorway will suffice for those exhibits of peripheral interest to him, such as, say, record changers and "packaged hi-fi." At the conclusion of the tour, his feet are sore, his ears are ringing, he is tired of squeezing in and out of crowded rooms, and his shopping bag is loaded with high fidelity literature, but he is now *au courant*.

The Visual Element

Like most audio show veterans, he has come principally to see rather than hear the new products, because he is aware of the futility of attempting to evaluate components on the basis of a show audition. And, at this fall's show, there was more to see than in previous events. Decor, for example, played a prominent role in many of the exhibits. In fact, one often had the impression of having wandered accidentally into the furniture wing of a large department store: there was the model living room, with its shelf of 'rare' books in old bindings, the paintings on the wall, the floor-to-ceiling lamp, and the ubiquitous piece of African aboriginal sculpture of a dour old tribal chieftain holding his belly. In transplanting the living room to the high fidelity show, exhibitors hoped to win over the housewife by demonstrating how their components can blend gracefully with elegant home surroundings. Mindful, too, of female sensitivity to the upper frequencies, they omitted high-powered audio warhorses from the repertoire of musical selections chosen for demonstration. Ropes were stretched across the rooms to prevent visitors from overrunning the exhibits; this gave the public a clear view of the display and an unobstructed path for the stereo signal—a case of "better sound through decor."

Interior decoration of another sort was used to appeal to the serious audioman. Under the beams of pinpoint spotlights, he could examine the insides of a preamplifier, the drive mechanism of a turntable, or a speaker system stripped of its grill cloth.

Spotlight on Sound

A few exhibitors neglected lighting and decor and concentrated on providing better-than-average audition setups for their guests. In one of the finest presentations compact speaker systems were arranged one on top of the other in a pair of columns, with identification cards next to each cabinet. Through a switching device, the exhibitor could relay the same recording from one system to another in rapid succession, and pilot lights indicated which speakers were in operation. The recordings were selected with care; there was music for orchestra, string quartet, piano, and voice, illustrating how these transducers behaved under a wide variety of program material. Rows of chairs had been placed in front of the speakers, and no attempt was made to "ventilate" (as the Editor would put it) the area at regular intervals by lowering the volume level or removing the seats—the visitor was welcome to stay as long as he cared. Not surprisingly, the exhibit was jammed with people, and there was an overflow crowd.

One could hardly accuse the exhibitors at the New York show of sonic understatement, but there was a perceptible decrease in output compared to aural levels at previous shows. Steam locomotives were nearly as extinct this year as their real-life counterparts, and this writer did not have to dodge ping-pong balls or run from tropical rainstorms. The new "soft-sell" approach is due as much to the high fidelity industry's growth as to the IHFM's meter monitor. There are solid indications of a return on the part of wayward firms to standards that had prevailed before so many record companies and components manufacturers galloped off in all directions at the approach of stereo. However, there was the usual lag between the achievements represented by the new products and the manner in which they were exhibited: too few of the people who actually conducted the demonstrations treated their equipment with the respect and consideration it deserved.

Loudspeakers

There is, of course, no fixed method of placing loudspeakers in a stereo setup. The distance between them depends on the size,

* *26 W. 9th St., New York 11, N. Y.*

shape, and acoustical properties of the room. However, we know that certain things should not be done. For example, when speakers are placed on different levels, the stereo effect is often eliminated. At one exhibit, the left speaker was lying on its side, and the right was in a vertical position. Ostensibly, this was to demonstrate the decorative versatility of the enclosures. It didn't help the sound—with the tweeter unit in the erect cabinet (right) approximately three feet higher than its reclining partner (left), the right cone tweeter naturally predominated over the left, thoroughly upsetting the musical balance.

Beaming was another frequently encountered defect in stereo setups. A pair of large speaker systems was being demonstrated in a medium-sized room. The distance separating them appeared to be correct, but the speakers were angled toward each other. When the exhibitor's attention was drawn to the lack of spread and the channel-cancellation effect resulting from this placement, he went off to "remedy" the situation. But instead of arranging the speakers straight out, he angled them in even more!

It was surprising to learn once again how many exhibitors were unaware that their systems were out of phase. When Edward Tatnall Canby conducted an informal survey earlier this year, he came up with the report that, out of approximately one hundred rooms visited, forty-two stereo systems were out of phase. Things haven't changed much since Mr. Canby's dispatch.

Finally, one often encountered channel-blocking at the show; that is, the spectacle of the exhibitor standing directly in front of one of the speakers in a stereo system he is supposed to be demonstrating.

Program Material

Although some exhibitors pre-selected their musical examples, it is apparent that insufficient control was exercised by most manufacturers over the recordings used. A mediocre recording will certainly reflect adversely on the component or system being demonstrated. A dull-sounding disc, for example, may give the impression of poor transient response; the presence in a recording of hum (50-cycle hum mars certain European recordings) could sully the reputation of a perfectly acceptable turntable; and inner diameter distortion could make a cartridge appear to be suffering from inadequate compliance. All of this points out that a demonstrator cannot be too careful about the recordings he utilizes.

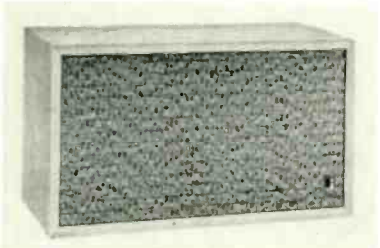
Level

In the past, the universal complaint of audio show visitors has been directed at the threshold-of-pain volume chosen by exhibitors to show off their equipment. Compared to previous years, this show might be described as almost soft-spoken. In fact, the sonic pendulum has swung over to the opposite pole at certain major exhibits, and the formerly annoyed show veteran now found himself frustrated, for, too often, he would enter a room featuring large speaker systems and hear muted music with no real dynamic range and with about as much instrumental contrast as a late evening Muzak program. Now this may be ideally suited to an exhibit of cabinetry or a radio

(*Continued on page 101*)

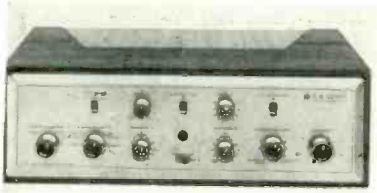
NEW PRODUCTS

• Economy Three-way Speaker System. Intended to be a budget system that is low in cost yet high in performance, the Jensen Model TF-3 is a four-speaker three-way system using a specially designed 10-in. long travel woofer for a bass response to 25 cps. Two specially designed mid-



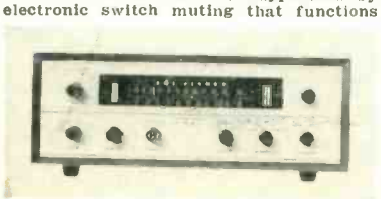
range units take over from 2000 to 10,000 cps, and a new spherical-sector super-tweeter extends response to beyond audibility. This system is housed in a tube-loaded, vented enclosure which is rigidly constructed of ¾-in. plywood, and is lined with heavy layers of Fiberglas acoustic insulation to provide acoustic damping. Though vented, the enclosure employs the "air suspension" principle, and is tightly sealed at all joints. Input inpedance is eight ohms, and power handling capability is 25 watts. The frequency range is twenty-five cps to beyond audibility. Crossover frequencies are 2000 and 10,000 cps. The TF-3 is furnished only in unfinished, grained hardwood. Jensen Manufacturing Company, 6601 South Laramie Avenue, Chicago 38, Ill. **L-1**

• Improved Stereo Amplifier. Now rated at 15 watts per channel, or a total of 30 watts overall (by IHFM standards), the H. H. Scott Model 222B is an improved version of their popular Model 222 stereo amplifier. Among the new features are tape monitoring facilities, separate tone controls on each channel, tape head inputs, aluminum chassis, oversized 20-watt trans-



formers and an input for electronic organ. The frequency range of this improved amplifier extends to below 25 cps. H. H. Scott Inc., Dept. P, 111 Powdermill Road, Maynard, Mass. **L-2**

• Highly Sensitive FM-AM Stereo Tuner. Featuring a sensitivity of 0.5 microvolts for 20 db of quieting with a 72-ohm antenna, the Fisher 202-R utilizes six IF stages following the sensitive "Golden Casode" front end to achieve the stated sensitivity plus unusual selectivity. Incorporating an exclusive Fisher "Micro-Tune AFC," AF tuning becomes relatively simple. By touching the FM tuning knob, the AFC is automatically shut off. When the knob is released, the AFC clicks back on. Interstation noise is suppressed by electronic switch muting that functions



even during multiplex operation. The 202-R also boasts wide-band design and five limiters to enable a capture ratio of 1.5 db. The AM section includes a four-position bandwidth switch, a rotatable ferrite antenna, and an automatic volume control. On AM, a 5-microvolt antenna signal produces a 1-volt output. Selectivity at 1 megocycle is 68 db. On FM, the signal-to-noise ratio is 68 db at 100 per cent modulation. Harmonic distortion is 0.35 per cent at 100 per cent modulation. Frequency response is 20 to 20,000 cps ± ½ db. Output voltage is 2 volts rated, 4 volts maximum. Hum is 76 db below rated output. The Model 202-R is available in a vinyl-covered metal cabinet or a wood cabinet. Fisher Radio Corporation, 21-21 44th Drive, Long Island City 1, New York. **L-3**

• Automatic Automobile Record Player. There are two basic requirements for an automobile record player. The first is obvious—it must be extremely simple to operate. The second is that it must be impervious to the various shocks due to road conditions. Operationally the Norelco "Auto Mignon" more than satisfies the basic requirement. It is so simple to use that even a child can operate it. In answer to the second requirement, the "Auto Mignon" is provided with special built-in shock absorbers which compensate for sharp turns, car sway, abrupt braking, accelerations, or bad roads, without jarring

the stylus or affecting the records. Designed to operate through the car radio, the "Auto Mignon" requires no more attention on the part of the driver than in operating a radio. The only additional step required is sliding the records into the slot with one hand. All operations thereafter are automatic. After the record is played it automatically slides out of the slot, available for easy removal. Operating off either 6- or 12-volt car batteries, the "Auto Mignon" has a power consumption of 50 milliwatts. Switching from phonograph to radio, or from radio to phonograph is done by pressing a pushbutton switch which is located on the front panel of the "Auto Mignon." The turntable is driven by a stabilized d.c. motor and a specially constructed drive mechanism. The diamond stylus is automatically cleaned between playings. A pilot light indicates when the record player is on. The "Auto Mignon" plays all 45 rpm (large center hole) records. North American Philips Co., Inc., High Fidelity Products Division, 230 Duffy Avenue, Hicksville, Long Island, New York. **L-4**

• Integrated Stereo Tone Arm and Cartridge. Intended to provide optimum stereo performance by integrating the cartridge into the tone arm, the Lafayette Model PK-449 is supplied complete with a .7 mil diamond stylus. The *raison d'etre* of integrating the cartridge into the tone arm is to provide exact positioning of the stylus in the record groove and produce a relationship between tone arm and cartridge which is not usually achieved in non-integrated units. Arm structure, balance and compliance can be precisely engineered to complement the cartridge. The cartridge utilizes the "moving-magnet" principle, with cartridge, coils, and other components housed in a Mumetal case to reduce hum and noise. In addition, Mumetal shielding is employed throughout the entire length of the arm, providing a signal-to-noise ratio well over 100 db. Frequency range is from 20 to 16,000 cps and is flat ± 2db from 20 to 15,000 cps. Replacement of the stylus

may be accomplished without special tools within a few seconds. Each arm is individually factory balanced to track at 3 grams. Lafayette Radio Electronics Corp. 165-08 Liberty Avenue, Jamaica 33, New York. **L-5**

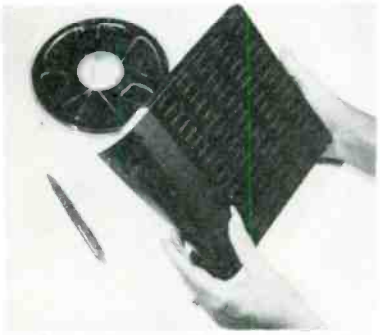
• Portable Disc Recording and Playback System. Billed as the world's only professional 13¼-in. portable disc recorder, the Rek-O-Kut "Imperial II" is designed to meet the needs of professional recordists, musicians, educators, and home recording enthusiasts. The unit will cut master records at 33 1/3 and 78 rpm, and comes with an idler and adapter from 45 rpm recording. The overhead recording lathe has a calibrated scale for timing, a hand crank for run-in and run-off spiral grooves, and provision for interchanging lead screws for standard and microgroove recording. A safety cam automatically raises the cutter as the center of the disc is approached. Frequency response of the recording head is 30 to 13,000 cps. The playback arm is equipped with a dual sapphire magnetic cartridge and can be used for records up to 12 inches. The recording and playback amplifier has an output of 20 watts and a frequency range from 20 to 20,000 cps. It

has inputs for microphone, tape, phonograph, and high-level tuner, as well as sufficient controls to adjust level, tone, and volume for all functions. A panel meter with a calibrated scale indicates the correct recording level. Rek-O-Kut Company, Corona, N. Y. **L-6**

• 35-Watt Amplifier Kit. A high-quality monophonic amplifier with a modest price tag, the new Heath Model AA-10 provides 35 watts (IHFM standards) with an adequate amount of distortion-free reserve. Among the features in this easy-to-assemble kit are: EL34/6CA7 output

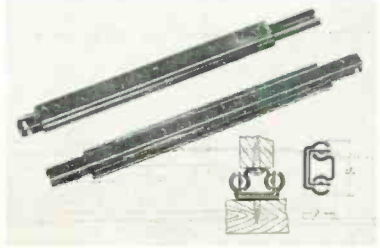
tubes; Heath "Bass-bal." circuit for balancing; two a.c accessory sockets; and a specially designed output transformer. The amplifier is 12-in., wide, 8-in. deep, and 6⅛-in. high. At 35 watts, response is within one db from 30 to 15,000 cps. IM distortion is less than two percent at full-rated output power and input sensitivity is approximately one volt for 35 watts out. Impedances are four, eight, sixteen, and thirty-two ohms. Heath Company, Benton Harbor, Michigan. **L-7**

• **Premium Grade Tape Line.** Produced and marketed by Orr Industries Company, a Division of the Ampex Corporation, and distributed by United Stereo Tapes, a Division of Ampex Audio, the new Ampex "500" series of premium grade tapes marks



the first consumer tape to carry the Ampex name. The new series features personalized "signature binding;" a leather-finished backing that can be inscribed by the owner with the use of gold foil and attached to the back edge of the tape box for quick, easy identification. The self-adhesive backing and gold foil is contained in each tape package. United Stereo Tapes, Sunnyvale, California. **L-8**

• **Phonograph Slides.** Complete ball-bearing action for smooth, noiseless operation is combined with easy side or underneath installation for radios, amplifiers, phonographs, etc. in the new Selby slide. Permanently lubricated and engineered for vibrationless performance, the steel slides have load capacities up to 60 lbs. and are black-oxide finished. Only ¾-in. clearance is required for either side or underneath mounting. Track lengths of the four standard sizes range from 13 to 21 inches, channel lengths from 10 to 18 inches, and normal travel from 9¼ to 17 inches. Slides may be made to individual specifications. Selby Furniture Hardware Co., 11 West 17th Street, New York 11, N. Y. **L-9**



• **Danish Oil Finish.** Fast, easy oil-finishing of component cabinets is the feature of the Watco "Danish Oil Finish" now available for the first time to the home craftsman. Recommended by the American Walnut Manufacturers Association, the "Danish Oil Finish" may be used on walnut, birch, oak, cherry, teak, mahogany and other similar woods. A simple application seals, primes, and finishes at the same time. Compounded of special oils and additives, this finish is claimed to solidify the oil within the wood to eliminate the non-drying qualities of usual oil formulas. It is available in 16-oz. aerosols, pints, quarts, and gallons. Watco-Dennis Corporation, 1756 22nd Street, Santa Monica, California. **L-10**

• **CORRECTION**—Last month, in reporting the details of the new Fisher SA-300B stereophonic amplifier, we stated that it was conservatively rated at 35 watts per channel. This was indeed a conservative statement, since the SA-300B is actually rated at 45 watts per channel for an over-all amplifier rating of 90 watts.

NEW LITERATURE

• **Shure Brothers, Inc.,** 222 Hartrey Ave., Evanston, Illinois describe their complete line in catalog No. 60A which was just issued. The 28-page catalog covers more than 30 microphones, plus microphone accessories, high fidelity components, magnetic recording heads, and replacement phono cartridges. Also included is the Shure line of Dynetic moving-magnet stereo and monophonic cartridges, stereo and monophonic tone arms, broadcast equalizer, and line preamplifier. Copies of the catalog are available at no charge by writing to the company. **L-11**

• **Rek-O-Kut Company, Inc.,** 38-19 108 St., Corona 68, N. Y. has just released an 8-page brochure entitled "How to Decorate with Music." Illustrated in the brochure are five interesting room arrangements incorporating stereophonic music systems. The room settings—two in modern decor and one each in contemporary, traditional and early American—feature Rek-O-Kut/Audax components as suggested by "Living for Young Homemakers," a leading home decorating magazine. An artist's drawing of each room is accompanied by an easy-to-follow floor plan showing placement of components. The placement of speakers is especially interesting and illustrates how today's small-sized units can be blended with any interior setting. "How to Decorate with Music" may be obtained free by writing to the company. **L-12**

• **North American Philips Company,** Commercial Sound Department, 230 Duffy Ave., Hicksville, N. Y. announces an illustrated brochure describing the Norelco line of industrial sound systems and components. Included are loudspeaker columns, amplifiers, preamplifiers, microphones, intercoms, delayed sound equipment, and inductive paging systems. Detailed specification sheets, in addition to the brochure, are available free from the company. **L-13**

• **Motorola Semiconductor Products, Inc.,** 5005 East McDowell Road, Phoenix, Arizona has published a Power Transistor Handbook. Prepared by the Motorola Applications Engineering Dept., this 200-page handbook is devoted entirely to power transistor theory, design, and applications. Chapter headings include: Semiconductor Electronics, Transistor Characteristics, Power Amplifiers, Switching Applications, Electronic Ignition Systems, Special Transistor Circuits, Power Supplies and Power Rectification, Transistor Testing, and Transistor Specifications. Important factors such as voltage and current ratings, bias considerations, thermal stability, efficiency, and distortion are discussed fully. Circuits include high fidelity amplifiers, converters and inverters, oscillators, time base generators, and TV horizontal deflection systems among others. Copies are available for $2.00 from Motorola Semiconductor Products distributors or from the Technical Information Center at the address given.

• **American Standards Association,** Dept. PR 185, 10 East 40th Street, New York 16, New York provides a uniform set of criteria for the sound pressure level of allowable background noise in their recently approved publication, "Standard Criteria for Background Noise in Audiometer Rooms," The number of this bulletin is S3.1-1960. The standard pertains to earphone listening and pure-tone audiometry. Its criteria enable the designer to plan appropriate acoustic treatment in a room used for audiometric tests. The criteria are based upon psychophysical data, but stated in physical terms, and the determination of them is influenced by individual differences in the ability to detect noise and in the fit of the earphones on the ears. Copies are available at $1.00 each from the Association.

AUDIO ETC

(from page 14)

each special case. And he seldom has the circuit—he can't even open up the speaker box in many systems to find out what's inside. It's a thing worth thinking about, since it involves a crucial macro-factor in sound reproduction. (The difference between two good pickups is, as I see it, a micro-factor on the same scale.)

In its correctly balanced form, then, the little Pilot PSV-3 makes good use of its three rather inexpensive cone-type tweeters, all of them carefully doctored for optimum performance in the three ranges. Its sound-dividing arrangement strikes me as effectively simple, too, and I really do like the solid little cabinet. Nothing cheap about that, I'm not claiming that this speaker sounds as good as the "best," but Pilot probably isn't either. It does sound good, though, and I'll bet it sounds a whale of a lot better than most of the other small speakers you'll find in your local radio-TV store. If the price seems a bit high under the circumstances, you may accurately gauge it by figuring the full retail markup that Pilot must provide, if it is to sell at all in this market. You can complain, but if you think something ought to be done, don't chase after Pilot. Go out and abolish the retail stores. By the time you get through there won't be any PSV-3's left, anyhow.

KLH Model Eight

At first thought it may seem strange to include an FM receiver of the relatively high cost and standard of quality displayed by this new unit among the "in-between" items—between component hi-fi and mass-production appliance areas—that I am discussing this month. But a glance at Model Eight will show you why.

The question is not one of pricing in this case, but of typing. This integrated, two-unit small-size tuner-speaker combo opens up a wholly new area in its field—which, as with the other items here mentioned, Granco and Pilot—is territory not in either camp. The Model Eight is not quite a component, but not quite a "radio" either. It is in two sections, but neither one can be used on its own; they are built for each other. It is compact—tiny, indeed, as compared to component FM tuner-amplifier-speaker systems in the component area. But it is large as compared to many home FM-AM standard radios, not to mention transistor models. And its voice, not as big as that of big component systems, is positively enormous next to any home radio roughly its own physical size. Unusual, and interesting.

Model Eight consists of two cabinets about the same in size, and you'll goggle at the speaker unit, less than eleven inches by six by seven. The tuner, with simplified controls, comes in a matching cabinet, the two connected (banana plug at the tuner) by a slim 30-foot twisted cord, white covered. The price of the two together is about $140—this is clearly no low-priced unit. It's a full-scale a.c. circuit (no a.c.-d.c. here) temperature-compensated so that AFC is unnecessary (each unit is individually compensated), plus a push-pull audio section that uses 14 db of feedback. The tuning dial is geared down for precise and accurate adjustment, the three other basic

control knobs provide on-off, volume, and a modest tone adjustment, up only slightly from flat but down far enough to act as a noise filter as well as room-sound adjuster. On the rear are provisions for multiplex in the future; a high-quality phonotape preamp unit is coming up soon, to fit unobtrusively out of the way as an attachment. And if you insist, you may tap off the tuner into your own hi-fi amplifier—though this is obviously not the idea of the Model Eight at all. It speaks for itself, and its voice is quite portentous.

The little speaker unit contains a most ingenious tweeter-turned-woofer (a pair of them), none other than the basic 3-inch tweeter used in the Model Six speaker system, here revamped for extended cone excursion and much increased bass response, to complement the original upper end. This is the first genuine 3-inch tweeter unit I've ever seen adapted as a woofer—such audacity! And it really qualifies as full-range, believe it or not. Pretty full, anyhow. I didn't try any 30-cps sine waves through it (I couldn't, via the FM tuner) but the pizzicato plucked double bass on a number of broadcast jazz recordings came through virtually in the original octave—not merely the harmonics; nor was there undue doubling, according to my ear. Amazing, and the volume is positively stupendous for a speaker system literally the size of a shoe box. Enough to drive any next door neighbor to fury at eleven o'clock of a quiet night—*"Turn off that d···d hifi system!"* It would fool almost anybody. You really have to hold it down.

The trick in Model Eight is integration. I have not discovered, though you may have by the time you read this, just where the ingenious rigging is done, whether via impedance trickery or in amplifier output of a nonlinear sort; but Model Eight's speaker isn't supposed to be plugged into anything but Model Eight's tuner, and that is that. A sort of baby Integrand.

I was frankly fascinated by Model Eight's performance the first few days I had it, and so I soon ran into a few peculiarities, none of which do much to weaken my feeling that here is a really unusual item. A fine tuner, high quality and ingeniously simple. I got everything in New York City, of course, with a built-in antenna, nondirectional and invisible. Sounded terrific on speech, with the familiar smooth top of the Model Six tweeter in evidence. Maybe the bass is rigged—it must be—but there is no boominess on voice. No bass-range peak, as in many a larger home-type console system.

On music I ran into an interesting difference in aesthetic philosophy between my ear and KLH's. First item I heard was a solo Koto player, Japanese-American, who produced no bass at all and so sounded just fine. But as soon as I tuned in on some Beethoven, I found that the flat treble outbalanced the somewhat rolled off bass in the full orchestra sound. I rolled down the top, via the tone control, and achieved what for me was a lovely balance. Extraordinary.

Minus balance-by-boom, the bass end in this tiny speaker is, relatively, somewhat less than of full strength all the way down. The treble, on the other hand, is 100 per cent, equal to that from speaker systems twenty or forty times this one's cubic volume. For my ear, given the standard musical repertory for orchestra, a balance between bass and treble content is a necessity—either more bass, or less in the highs. With other music, with new types of music, Romantic-style organ (big bass but weak highs), and of course, music for bass-less combinations, the roll-off is unnecessary and, in fact, meaningless.

KLH itself disagrees. The company, at or at least one of its partners, feels that "flat is flat" and a flat high end should stay flat regardless of bass content. Interesting point, and you are wisely given the means to make your own choice in this receiver-speaker. Suit yourself.

One minor unsolved point of disturbance came from the tuner, via the excellent high-end reproduction. On louder passages the Model Eight showed a slight tendency to break up every so often, even with an apparently strong signal. Just what adjustment this involved, or whether it had to do with the built-in antenna and the vast quantities of competitive interference inherent in New York's FM listening, I could not say. But with such a sensitively balanced high end, a very slight transitory distortion shows up only too quickly, in the listening.

I had two diabolical thoughts the instant I saw the integrated Model Eight. Tuner and speaker designed for each other—natch, I had to be perverse and try them separately, just to see what would happen. But an irrelevant tragedy has left this bit of testing incomplete for the moment. An old friend, my college roommate, was seriously ill in the hospital, could not read though he loved it, needed a boost in morale. In a burst of compassion, knowing he loved music, I thought of the Model Eight as a perfect bedside companion for him, on brief loan. But he had a semi-private room and, I found, was deadly afraid to play classical music on a radio for fear his neighbor would take the cue and turn on mood music and disc jockey stuff on his. So I had a brilliant thought—earphones. Aha! says I, to myself, with low-impedance phones, via that banana-plug facility on the tuner, here's my chance to get an idea what one half of Model Eight sounds like minus the other half. No sooner said than done, though it took me about five cables hooked together to progress from my phones to a banana plug that would fit. I hate re-wiring.

Well, the half-Model Eight tuner-amplifier sounded a bit odd in the phones, I'll admit; but you could hear the music fine, especially with the highs rolled down a ways. So I turned the system over to my friend and went away feeling virtuous.

When I retrieve it I plan to try the other half of my experiment, using the speaker as it was never intended to be used, with a standard amplifier.

One significance of this system is its unity-from-diversity, in the two-piece integrated design. Also, I'd suggest, there's significance in the KLH desire, here, to see just how far the idea of a tiny speaker with a big voice can be successfully pushed. But most of all, I think, Model Eight is important in that it clearly heads into the uncharted "in-between" area, combining features of componentry and home-style simplicity. This is the radio for people who don't like components. And it's the component-style tuner for people who don't like radios. It has virtues taken from both and it ought to please a lot of folks, once they get used to it.

2. EARPHONES— THE BAUER CIRCUIT

Readers with extra-sharp noses and keen logical minds will have noted a slight *non sequitur* in my September discussion of earphone listening to stereo. (The rest will have missed it, as we did in the proof.) I noted only one reservation, as far as this sort of listening is concerned and then inserted a parenthesis: "(aside from what follows below)." It did not follow.

The material I had written to follow, we decided, should wait until after the AES convention in October, where it was the subject of a paper. Herewith, then, my continued earphone discussion, concerning an ingenious way to make a pair of earphones produce stereo sound—pretty much as heard via speakers. The idea was worked out, as a sort of hobbyist's sideline in the midst of his more major tasks, by Ben Bauer, late of Shure (the Dynetic cartridge) and now veep at CBS Labs. To be sure, it was demonstrated in an earlier AES convention, on the West Coast last February. But we Easteners are entitled to our own "opening" and we got it on October 14 in New York. Now that the idea is out, both East and West, I'll merely suggest the interesting principle to you.

I did try the earphone stereo circuit, however, right in Mr. Bauer's CBS office, and was immediately convinced that, for a careful listener the difference was quickly noticeable between straight earphone listening to stereo and the modified sort here proposed. I suspect, moreover, that over a period of time, more than I had to listen, the difference in earstrain would mount up very rapidly in favor of the Bauer circuitry, attached to your earphone set-up.

The principle is, as usual with such ideas, blindingly simple. How do we listen to stereo? Via loudspeakers, *each ear hearing both speakers* (in a two-speaker setup). Therefore (a) we must blend the two signals being fed to the earphones, so that each ear hears both signals, in the proper loudness proportion. Cross-feed them in your circuit.

Now how do we get the separation and the sense of space in our loudspeaker stereo? By actual directionality, the interaction between the two signals as propagated from two different sources, in the space in front of your ears. (Oh how nice it would be if the stereo industry could get back to that simple truth—speaker separation!)

How do we locate those sources? By phase differences, between the same sounds as heard in the two loudspeakers; as well as by volume differences.

So (b), let us re-phase our channels before mixing them, for each ear. One phasing mixture for the left ear and a different one for the right. That will put the apparent sound of each channel out in space where it belongs, *via the interaction of both channels in each ear*. That is the way stereo does it.

All that remains is to do what the imaginative inventor must always do, get down to details and figure the circuitry. Mr. Bauer is the sort who can manage that quite nicely, and so he did. His black box, I gather, is quite simple and can be made by anybody who can hook up the handful of components.

With the Bauer circuit you'll get a real approximation of true stereo sound via your phones. If you're just a listener, you'll get truer stereo, and you'll avoid a lot of earstrain, over the long pull. And if you're a professional, you'll stop fooling yourself that you're getting stereo through those monitoring phones you've been using. If you're trying to judge stereo results by phones, you're barking up a very wrong tree unless your ears have been trained to interpret stereo in binaural terms, like judging positive photo prints from the negatives. Can be done, but it's hard on the senses.

P.S. I understand that the Bauer circuit for earphones will be embodied in a commercial product via Stephen Temmer of Gotham Audio Corporation for those who are unable to build the thing for themselves. Like me, for instance. Æ

FM RECEPTION

(*from page 50*)

nal. This is sufficient to overload any amplifier, including those with low-frequency cutoff filters.

In the new 310-D this problem has been eliminated by having the Dynaural Interstation Noise Suppressor (DINS) circuit actuate a mechanical relay. In one position of the relay, the audio output is fed to the output jack. In the alternate position, the signal is fed to ground. The action of the relay introduces no switching transient into the audio output. It is also capable of remarkable speed. Referring back to *Fig.* 1 A, if the plane is traveling at 300 mph, fading will normally occur at a rate of up to thirty times per second. 310-D's set for switch diversity reception can alternate up to forty times per second.

Most squelch circuits operate either of two ways: One approach is by means of the AGC voltage. This works quite well although it does lead to a partial time delay. Another method is to utilize the noise output above 100 KC at the detector stage. This noise output is created by the limiting and detecting process and does not include any broadcasting material or either the main channel or any multiples channel. The amount of noise is directly proportional to the degradation of the signal. Any excess amplification of this noise for control purposes, however, can create crosstalk and overload problems in the tuner.

In the H. H. Scott DINS a combination of both methods is employed. The AGC voltage is amplified by a two-stage d.c. amplifier which actuates the relay. The amplifier also serves as an a.c. amplier for the noise output of the detector, which it rectifies and applies as an additional d.c. control signal to the d.c. amplifier and relay circuit. In this way the advantages of both methods are utilized and the disadvantages minimized

A d.c. reference bias controllable from the front panel is the DINS threshold control. A differential sensitivity of approximately 2 db is obtained.

For diversity operation, the differential sensitivity is reduced by using only one-half of the AGC voltage. This is accomplished by inserting a shorting plug in a special jack provided on each tuner. This is to allow simultaneous fading in each tuner and still have an available audio output. A cable is provided to couple the d.c. amplifiers of each tuner together. By this method, fading at one receiver will lead to a differential sensitivity between tuners of up to 0.5 to 1.0 db in the other tuner allowing it to supply the audio output.

Operating the Tuners for Diversity Reception

With only a single tuner in use, the DINS is set so that only an acceptable signal will pass. If a weaker signal with greater noise can be tolerated, the DINS control can be further reduced. Whenever the signal fades below the predetermined threshold, the mechanical relay clicks into operation and turns off the audio output. (This same phenomenon occurs when tuning from one station to another.)

When setting up for diversity operation, the following procedure is suggested:

Connect an antenna to each tuner (the minimum desirable distance between antennas is 35 feet as was pointed out above). Only one tuner is connected to the amplifier. A shorting plug is inserted in the input marked J-1. of each tuner. The tuning dial is turned off station to a point where the meter indicates a minimum. The DINS control is turned to 0 (point of maximum sensitivity). The typical interstation noise is now heard. If it is not, then the Diversity Threshold control accessible on the top of the chassis should be turned with a screwdriver until the noise appears. It should not disappear until the front panel DINS control is rotated at least 20 per cent. This is to make allowance for different d.c. levels when the shorting plug is inserted.

This same procedure is repeated in the other tuner(s). Then they are all set to the desired station with the DINS set for an acceptable signal-to-noise ratio on each tuner. The actual setting may vary between tuners because of the adjustment of the pot, the relay sensitivity, the amount of AGC voltage available, and the amount of noise level from each antenna system.

Set the level controls for identical audio outputs using a meter if available. If not, then adjustment by ear will be satisfactory. Connect the Channel A or B "high" output jacks of each tuner together. Connect a lead from *one* of the tuner's "low output" to the amplifier (as described in the instruction booklet). And finally, connect a shielded cable between the J-2 jack (on top of the chassis) of each tuner. This will ensure rapid switching.

Actual Performance

With the system in operation, employing dual diversity (two tuners) it was obvious that the problem of fading has been virtually eliminated. When a satisfactory signal was present at both antennas, both tuners operated with their audio outputs in parallel. As soon as a poor signal appeared on one tuner, the suppressor went into action and eliminated the output of that tuner, with the other tuner continuing to perform. The passage of an airplane nearby could only be detected by noting that the tuners were switching back and forth. This can be done by watching the indication of the signal-strength meters on each tuner. *However, it was impossible to observe that this was happening by listening to the speakers.* The station continued to come in cleanly, with no noise, and no unpleasant transients.

Naturally if the Dynaural Suppressors are set too high, the signal will drop out in both tuners. With triple diversity (three tuners in use) the possibility of this happening is less. Therefore, in weak signal areas it may be necessary to set the DINS control quite low on one or both tuners with dual diversity. Another advantage accruing from the remarkable high-speed relays in the 310-D is that even on the infrequent occasions when both tuners drop out, it happens so rapidly that only a small portion of the sound is lost. Frequently it goes undetected.

Certainly for the home recordist, the FM broadcasting station, or even the critical music listener, space diversity techniques present an opportunity to obtain usable (or better) results in regions where this had not been previously possible. Æ

LEVEL-TEST TAPES AID PROGRAM REPRODUCTION

(*from page 30*)

gested copy for this flyer might be as follows.

WARNING WARNING WARNING TO AID STATION ENGINEERS IN ESTABLISHING LEVEL OF THE PROGRAM MATERIAL CONTAINED IN THIS RECORDING, A 15 SECOND LEVEL-TEST RECORDING IMMEDIATELY PRECEDES THE ACTUAL BROADCAST MATERIAL. THIS RECORDING REPRESENTS THE LOUDEST PASSAGE THAT WILL BE ENCOUNTERED DURING THE BROADCAST AND A LEVEL THAT WILL NOT BE EXCEEDED. PROGRAM INFORMATION AND TIMING CAN BE FOUND ON THE SECOND TIMING LEADER WHICH FOLLOWS THE TEST TAPE. THANK YOU.

On those recording machines that do not employ db level meters but favor other devices to indicate peak recording levels, the same means that have been outlined can be employed. For "magic eyes," the eye would just approach overlap, or for neon lamp the overload lamp would just flicker.

The principal fault with the original procedure was the time-consuming factor of finding and reproducing a duplication from the loudest musical passage. Further the operator had to find a passage where the sound was sustained long enough to give the operator time to set his equipment.

Returning to the original idea employed by wire-photo transmission where a single note is used to set level it was decided to experiment with the possibility of employing a generated tone signal that could be set to zero db level.

In practice the tone system for preparing level-test tapes has proved quite simple and is a procedure that does not necessarily have to be performed on the spot or in the field.

First a series of duplications were made and on completion and with the controls still at the same level, input connections were transferred to an audio generator. The note selected for this test was 400 cycles and the generator output control adjusted until the recording meter reached the 100 per cent or zero db level. 10 to 15 seconds of tone was then recorded for each program. These test tone tapes were then affixed to the program tapes as previously outlined.

In each case and regardless of the program material the tone level test satisfactorily performed the task of establishing a positive known playing level. Satisfied that this revised system could be depended upon a second series of broadcasts were released with the tone test system. A call from the first station confirmed that this system could be depended upon and further the steady tone signal permitted an even faster setting of controls.

Where the operator is not planning duplication of the program, he should record a test tone signal at zero db on the machine used to make the original recording and attach it ahead of the program.

If a recording has been made where inadvertently the level creeps into the red zone or, say plus 2 db in level, then the operator must select this point in preparing his test tape and not zero db. If overlooked or a regular zero db tape is attached then overload can certainly be expected. As with the musical level test tapes, operators should make a definite point of indicating the presence of such material on tapes released for record or air-time use.

When a large number of duplications are being prepared, sufficient tape can be recorded as zero-level test tape to supply the current production, providing the test tape is recorded at the same time to preserve the original intent of this system—to present a true picture of recording factors at the time the production was undertaken.

The procedures outlined in this article represent a start in what is hoped will be an aid to those engaged in the recording field. Experience undoubtedly will show the system can be modified or simplified and still achieve the same results. For example, tape manufacturers might come out with a line of colored timing strips which could be used to denote or identify test recordings to the industry. Possibly a 15 second test may be felt to be too long. Indeed a host of other suggestions may be forthcoming.

Meanwhile, however, the challenge is given to recordists to recognize the plight their work has brought to the broadcasting and record fields and what, if willing, they can do to overcome the problem. Local experience with this system has conclusively proved that in giving engineers a break in their daily work they have more than reciprocated in presenting the program material so offered.

Æ

BE PROFESSIONAL—RACK MOUNT

(*from page 44*)

black wrinkle, and hammertone gray. For hard-type markings, any of the three are satisfactory, but if decals are to be applied, the smooth finish panel will yield the best results.

For illustration purposes, photographs of two rack mounted installations are shown. One, a commercial installation by Allied Radio Corporation using commercially available components, and the other, a home constructed unit by the author.

Allied's new sound distribution system, *Fig.* 4, is a rack-mounted unit installed in the telephone switchboard room, functioning as both a plant-wide paging system and a music distribution system. The rack is a standard model,

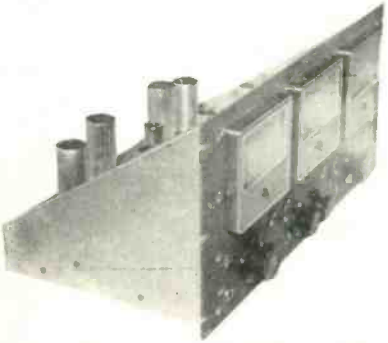


Fig. 6. Top of record/playback amplifier.

and polished steel panels (optional accessories sold with the amplifiers), are used to "dress up" the installation.

Looking from top to bottom of the rack (see photo), it employs these components: a monitor speaker, the Knight Model KN-110 FM-AM Tuner, two Knight Model KN-3035 35-watt public address amplifiers, blank panel, phono drawer, and two Knight Model KN-3061 60-watt booster amplifiers.

Immediately alongside of the rack, is placed the Ampex Model 450-D tape console, since recorded tapes are used as the main source of music. Sound is fed into a wide variety of speakers interspersed throughout the building, ranging from 8-in. ceiling baffle units to radial trumpets. The monitor speaker at the top of the rack, is a low-cost unit of the type used in rear-deck auto installations. The rack has a hinged front door with lock, and the entire unit is set on casters for easier servicing.

If it is necessary to page a person, pressing the switch that covers this section "mutes" the music for the area being paged. Sound level of each of the areas served by the system is independently adjustable. For areas where the noise level is high the level of sound is raised—for quiet areas sound level is lowered.

Music is turned on or off at preset times by a program timer switch, located in the tape console, and easily accessible for setting. The system is inoperative during the night. A "silent sensing" device on the tape console, allows a musical selection to run to completion even if the time switch is set to shut off the program in the middle of the selection.

The unit of the author, *Fig.* 5, is a two-channel record, three-channel playback machine that functions as part of a stereo playback system, doubles as a piece of test equipment (component substitution) and triples as a small studio recorder.

Looking from top to bottom of the rack are the following: American Electronics Concertone tape deck, blank panel, record and playback amplifier, six-position stereo mixer for both high and low impedance mikes, blank panel, two d.c. heater supplies for all tubes in amplifiers and mixers, and regulated high-voltage supply.

Switching is accomplished by a com-

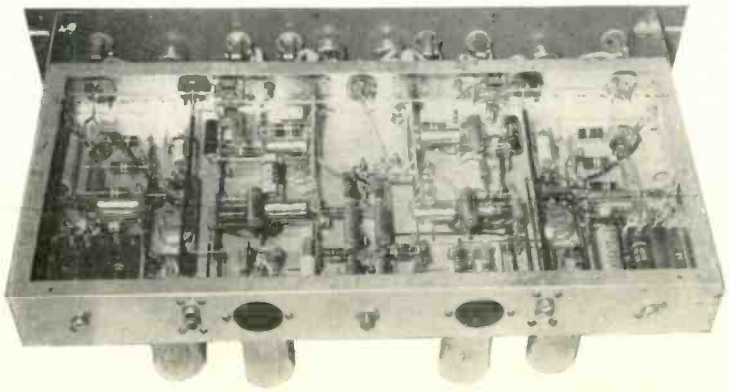


Fig. 7. Bottom of Record/playback amplifier showing component layout.

bination switch-jack operation. With all jacks switched off, the unit functions as an integral unit, receiving all signals from a main stereo console for recording, and plays back through the main console, external amplifiers, and speaker systems. Switching the jacks on, divorces that part, or parts, from the main system, and complete flexibility is obtainable by various combinations of jacking arrangements. Live recording is accomplished by simply jacking from the mixer to record inputs after switching main inputs off the line thereby making the jack positions hot.

The recorder has provisions for monitoring incoming *and* recorded signals by meters, headset, and speaker systems —all from separate cathode follower outputs so as not to have the audio signal loaded or affected by switching transients. Provisions for monitoring and adjusting B+ voltage and current, d.c. heater voltage to each unit, and bias current are included on the front panels.

These examples are, of course, just two approaches to rack mounting, but illustrate that complete flexibility is possible while retaining a professional appearance. Whatever your specific needs, rack mounting offers a custom solution. Be professional—rack mount. Æ

LIGHT LISTENING

(*from page 8*)

tion by the New York City Center Light Opera Company.

The most obvious stereo advantage shows up in some of the more farfetched E. Y. Harburg lyrics. When Howard Morriss reveals Og's leprechaun reaction to mortal girls in the tune *Something Sort of Grandish*, the twist of each syllable can be easily unscrambled. The highlight of the album is the performance of Jeannie Carson in the starring female role of Finian's daughter. The best-known songs such as *How Are Things in Glocca Morra?*, *Old Devil Moon* and *If this Isn't Love* fall within her responsibilities. She carries the show over the boundary line that demarcates secondary attractions.

Charles K. L. Davis: Adventures in Paradise

Everest SDBR 1106

Songs with a South Sea Island locale are the special province of the Hawaiian lyric tenor, Charles Davis. (The initials are handier than some people suspect—the K standing for Keonaonalaulani and the L for Llewellyn.) This release is the latest in a series of Everest stereo discs by Davis that occupies a special niche in the relaxation corner of the catalog. The Pacific islands have produced their share of native singers who have made a name for themselves here on the mainland but Davis has the advantage of remarkable vocal resources and the comprehensive background of a schooled musician. If you've already heard his work in more ambitious fare, you know that Davis is thoroughly at home in operatic and light concert items but he really comes into his own in the lush "island" favorites programmed here. The sheen of his distinctively bright voice can now be heard to full advantage in a collection that includes Lionel Newman's theme song for the television series Adventures in Paradise. In the rest of the disc the *Pagan Love Song* and *Now Is The Hour* really blossom when this guy applies his Hawaiian brand of sunshine to the lyrics.

Tak Shindo: Accent on Bamboo

Capitol ST 1433

Now that percussion in every form has taken the center of the stage, Capitol has assigned a second album to Tak Shindo. In his initial release, arranger-conductor Shindo introduced the concept of ancient oriental instruments used within the framework of big-band dance arrangements. Apparently the first project did not exhaust his supply of exotic drums because one of the items featured in his original "Festival in Swingtime" is a Gagaku drum which rests suspended within a large circular frame. The unusual rhythmic pattern of this swing tune stems from Japanese music of the eighteenth century. The other Shindo original is a Japanese-motif blues based on a six-tone scale. The arrangements of *Cherokee*, *For You*, and *It's So Peaceful in the Country* include background use of a female voice. The thirteen-string Koto and a Japanese xylophone called the mokkin round out a highly nonstandard lineup within the reeds and brasses of a conventional band.

Robert Merrill and Vivienne della Chiesa Sing Porter and Youmans

Everest SDBR 8001

The appearance of opera singers on records devoted to show tunes is hardly a novelty. One of the great American opera stars, Eileen Farrell has recently gone a step further in a Columbia album called "I've Got A Right To Sing The Blues." This release, however, boasts one unusual twist. Vivienne della Chiesa, in the course of the past three years spent singing popular songs in night clubs, has developed a voice of remarkably low pitch. I barely recognized her on this record despite the fact that I used to hear her voice almost daily back in the days when she was a fixture on transcriptions available only to radio stations. So low is her current register that, when heard for the first time, more than one listener may momentarily blame the speed regulation of his turntable. Both Miss della Chiesa and Mr. Merrill are more convincing in the Cole Porter and Vincent Youmans tunes that can be taken at a slow tempo. Individually and in duet, Everest has attained exceptional results in the stereo recording of voice. Robert Merrill's voice has never before been processed with the crispness and range audible on this disc. In fact, any listener who considers a baritone voice to be one of the better indicators of true response in a sound system is hereby advised to take along this item when he attempts to evaluate one or more unfamiliar components in the course of a shopping tour.

Tutti Camarata: I Want To Be Happy

Everest ✪ T 41062

They've figured out a way to touch all bases with this tape. Starting with the great show tunes of Vincent Youmans, Everest has lined up Camarata's orchestra to supply the pliable and easy rhythmic beat preferred by today's dancing crowd. Gene Lowell's eight-voice group furnishes the wordless vocal coloring that seems to be mandatory these days. Just-the-right-distance miking in a rigorously up to date studio and a bump-free recording curve deliver a tape that's worthy of playback on an "ultra-linear" system.

Listening to the gibberish these choral groups have to use these days instead of words, I occasionally find myself wondering how long this current vogue is going to last. It was a great idea when it first appeared—voices used as instruments to give new colors to the sound patterns of jazz and popular favorites. As employed by Duke Ellington decades ago, it was a startinig device. It still has its uses in the pop field where the music naturally lends itself to a high degree of coloring. Ray Conniff's arrangements of light classics on the Columbia label are a case in point. The end of this reel found me convinced that the music of Vincent Youmans, despite the

best efforts of the Gene Lowell Choir, is not the best choice for wordless voicing.

Ray Anthony: Dancing Alone Together
Capitol ST 1420

The Ray Anthony trumpet is surrounded by smooth and subdued strings in this background release. The album may remind some listeners of the famous Jackie Gleason Capitol recordings that made the trumpet a new star in the take-it-easy department. In place of the usual rank of brasses, arranger Don Simpson uses viola, violin and a group of cellos in this collection of standard torch ballads. Following a swing through the night club circuit with a small combo, Ray Anthony has returned to the format of the full-size band. A logical move in the opinion of this listener. AE

TAPE GUIDE

(*from page 38*)

give the same reading does not necessarily signify that the same level is being recorded on each channel of the tape. For the same signal input, there may be differences in recording level due to variations between the sections of the stereo record head. Or, for the same signal input, the recording level indicators may each give a slightly different reading. To check for equal recording level and the relative indications by the record level indicators, the following procedure can be used.

Assume that the position of the playback gain controls for equal signal output has already been determined. Feed the same signal, say from a mono phonograph disc, into each recording input. Adjust the input gain controls for equal indications on the record-level indicators. Play back and compare the signal outputs with a VTVM, or by ear. If these signal outputs differ substantially, repeat the process, but after reducing the recording gain control setting for the channel with the louder signal. Continue this procedure until the playback signals on the two channels appear equal. Now note the relative indications on the record-level indicators, and be guided accordingly in the future.

4. *Matched Frequency Response.* A check for reasonably similar frequency response on each channel can be made quite easily. Record a high quality mono disc on both channels; the disc should be one that substantially covers the audio range. Then in playback compare one channel with the other by switching between the left signal and the right signal, as most stereo amplifiers enable one to do. If there is a significant difference in frequency response between channels, this can be due to such factors as differences in equalization, in bias current, in playback head gap width, and in azimuth alignment. The last three factors named will primarily affect treble response.

5. *Common Bias Frequency.* It is im-

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, JULY 2, 1946 AND JUNE 11, 1960 (74 STAT. 208) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF

AUDIO, published Monthly at Lancaster, Pa., for October 1, 1960

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher: Charles G. McProud, 204 Front St., Mineola, N. Y.; Editor: Charles G. McProud, 204 Front St., Mineola, N. Y.; Managing editor: David Saslaw, 204 Front St., Mineola, N. Y.; Business manager: Henry A. Schober, 204 Front St., Mineola, N. Y.

2. The owner is: Radio Magazines, Inc., 204 Front St., Mineola, N. Y.; Henry A. Schober, 204 Front St., Mineola, N. Y.; Charles G. McProud, 204 Front St., Mineola, N. Y.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: none.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required by the act of June 11, 1960 to be included in all statements regardless of frequency of issue). 26,210

(Signed) HENRY A. SCHOBER, Business Manager.
Sworn to and subscribed before me this 20th day of September, 1960.
(Seal) Donald F. Mattone, Notary Public.
State of New York. No. 30-7766600. Qualified in Nassau County. Term expires March 30, 1962.

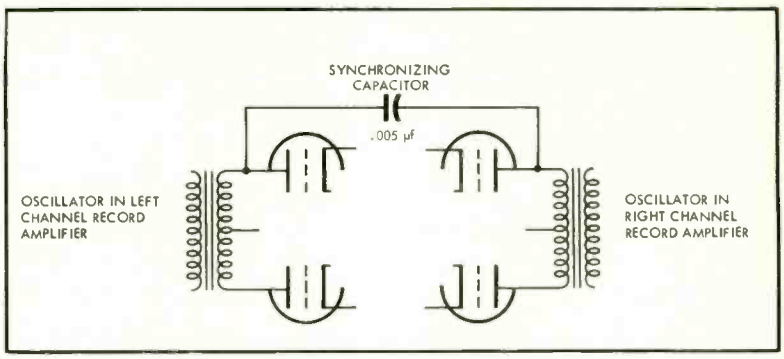


Fig. 8. Synchronizing the frequencies of two bias oscillators.

portant that the bias frequency be the same on each channel. Bias current passing through one section of an in-line head tends to leak through to some degree to the other section. Hence there are two bias currents through each section, although of different magnitude. If the frequencies of these two currents are different, there will be resultant beat frequencies that are recorded on the tape. If the stereo tape recorder employs separate record amplifiers for each channel, each with its own bias current supply, it becomes necessary to synchronize these two frequencies so they are the same. This is a simple matter, at least for the audio technician. As shown in *Fig.* 8, a small capacitor can be connected from the plate of one bias oscillator to the plate of the other for synchronization. This assumes that the two bias frequencies were originally fairly close together, say within about 10,000 cps of each other.

6. *Crosstalk.* Coordination between channels in this case means keeping the left signal in the left channel and the right signal in the right channel. Crosstalk can occur because of improper vertical positioning of the head or because of construction of the head. In modern high quality heads, crosstalk within the head has been reduced to negligible proportions by shielding between sections and by other design factors. Such crosstalk as does occur consists primarily of the higher audio frequencies, so that crosstalk due to the head characteristically has a tinny sound.

Conversion for Stereo

Converting a tape machine for stereo purposes may mean either (1) converting from mono to stereo or (2) converting from two- to four-track stereo.

In the latter case, the conversion is usually quite simple, involving the replacement of the two-track head by a four-track one in the same mounting fixture, and possibly the addition of an electronic component or two. *Figure* 9 shows a conversion kit put out by Ampex that enables owners of its two-track stereo machines to convert a four-track stereo for playback.

Most tape recorder manufacturers offer a conversion kit. If they do not, it is possible to purchase a stereo head from one of several prominent manufacturers of tape heads, such as Brush, Nortronics, Shure, and Viking. Sometimes the head is available in a variety of mounting styles so as to fit the

Fig. 9. Four-track conversion kit.

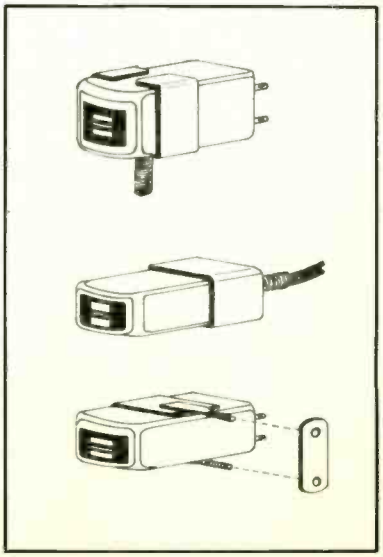


Fig. 10. Various head mounting methods for four-track stereo conversion.

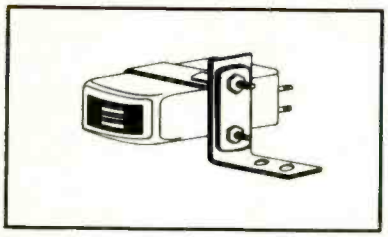


Fig. 11. Mounting the head "outboard".

mounting fixture in a particular machine. For example, as shown in *Fig.* 10, Nortronics makes three mounting styles, which among them will fit the majority of tape machines on the market. For all other machines, Nortronics has a fourth mounting style, with an accompanying mounting bracket, as shown in *Fig.* 11. In the last instance it is necessary to attach the mounting bracket to the tape deck with self-tapping screws. The bracket has slotted mounting holes to permit proper vertical positioning of the head relative to the tape. Azimuth adjustment is performed by bending the bracket. It is usually desirable when using an "outboard" head installation of this kind to also install a tape guide post, such as that in *Fig.* 12, to insure proper passage of the tape across the head.

If the tape machine is a mono device, then it is necessary to install not only stereo heads (including a stereo erase head), but also additional electronics for the second channel. If the tape machie is intended for playback only, at least for stereo, it is likely to be unnecessary to purchase a second playback amplifier because most stereo amplifiers provide an input for accommodating the signal directly from a tape head. On the other hand, if it is desired to record as well as play stereo tapes, then a second tape record amplifier, which incorporates the required amplification and equalization for the second channel, must be acquired. Such tape amplifiers are available from several manufacturers. As discussed previously, when separate record amplifiers are used for each channel, it is necessary to synchronize their bias oscillators to avoid beat notes. *Æ*

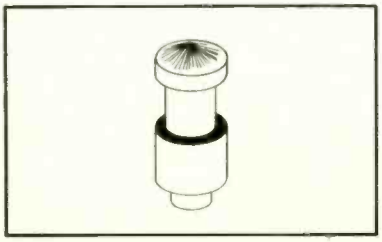
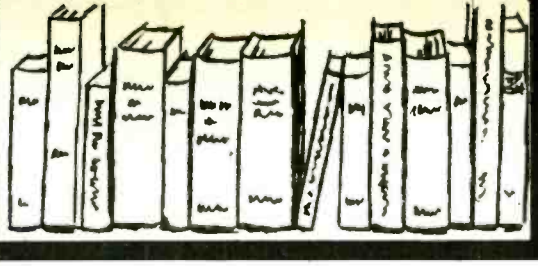


Fig. 12. Guidepost used in conjunction with "outboard" head mounting.



NEW!

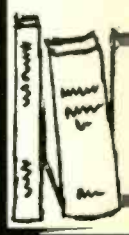
No. 120
THE 4th AUDIO ANTHOLOGY
$2.95 Postpaid

This is the biggest Audio Anthology ever! Contains a wealth of essential high fidelity know-how in 144 pages of complete articles by world-famous authors.

"the best of AUDIO" No. 124

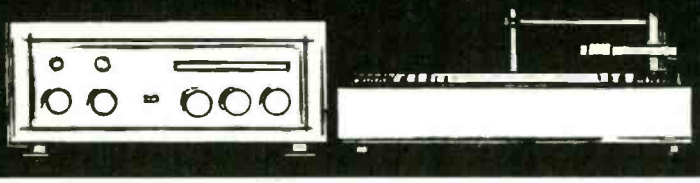
A new compendium of AUDIO knowledge.

Here is a collection of the best of AUDIO—The AUDIOclinic 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 on the performance of leading makes of high fidelity components. Volume I $2.00



the AUDIO bookshelf

A convenient service to AUDIO *readers. Order your books leisurely by mail—save time and travel, we pay the postage.*



NEW! Greatest Reference Work on Audio & Hi Fi No. 123

"The AUDIO Cyclopedia" by Howard M. Tremaine

Up to the minute, including stereo!

- 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. $19.95

No. 115
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 perfect guide. *$2.50 Postpaid.*

No. 112
TAPE RECORDERS AND TAPE RECORDING
by 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. *Hard Cover $3.95. Paper Cover $2.95 Postpaid.*

HANDBOOK OF SOUND REPRODUCTION No. 110
by 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. Regularly $6.50...offered for a limited time at only $3.75.

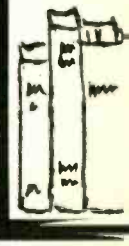
SPECIAL! You pay only $2.75 for this book when you order it with any other book on this page.

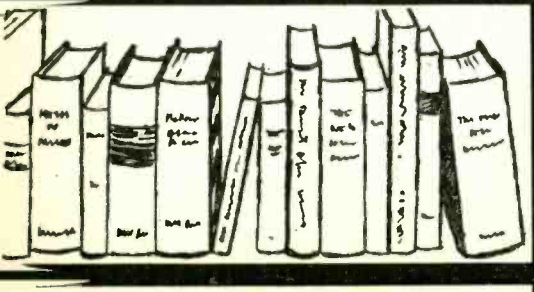
NOVEMBER SPECIAL! SAVE $5.40

Save over 50% with this collection of AUDIO books. 4th Audio Anthology ($2.95) McProud High Fidelity Omnibook ($2.50) best of AUDIO ($2.00) Tape Recorders & Tape Recording ($2.95)

TOTAL VALUE OF ALL FOUR BOOKS $10.40
Your cost ONLY $5.00 POSTPAID

This offer expires November 30, 1960
Good only on direct order to Publisher
CIRCLE OS611





AUDIO Bookshelf
RADIO MAGAZINES, INC., Dept. 611
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.)

All U.S.A. and CANADIAN orders shipped postpaid. Add 50¢ for Foreign orders (sent at buyer's risk).

BOOKS: 110 112 115 120 123 124 OS611

NAME_____ ADDRESS_____

CITY_____ ZONE____ STATE_____

SERIES-PARALLEL SPEAKER ARRAY

(*from page 56*)

we have in this array, the better the response curve becomes. Each unit, because of manufacturing tolerances, is just a little different than the next one. So the chances of having say twenty speakers with identical characteristics would seem to be improbable.

The reason that we must connect the speaker array in a series-parallel, rather than simple parallel arrangement, is primarily because we would like to keep the overall impedance of the array at a value that will permit connection to conventional amplifiers with impedance taps of 4, 8, or 16 ohms.

The response of the array at the low frequencies depends entirely on the number of loudspeakers used. The greater the number of units working in unison, the greater the efficiency at the low frequencies. The author prefers to use a large number of six-inch speakers. These speakers can be very inexpensive units. Magnet weight of over one ounce is unnecessary. Voice coil size and cone material are not critical. About 20 six-inch speakers will guarantee that you can never overload or cause the cone movement to become nonlinear for average home listening conditions. This number will also give you superb low frequency response down to 20 cps. These small speakers with their lightweight cones and high rigidity give a transient response which is fantastic. The whole array is highly damped.

The high-frequency response suffers beginning at about 8500 to 9000 cps. The quality is excellent but the overall output is down in db. This is due simply to the fact that these inexpensive speakers do not have the voice coil design required to put out much above these frequencies. In order to resolve this problem we should use a tweeter system to bring the response up on the high end.

The small four-inch hard-cone tweeters which sell for $2 or $3 are excellent for our purpose. These hard-coned tweeters do not sound very good by themselves. Because of the small magnets and other considerations a single four-inch tweeter leaves much to be desired. Just as a single six-inch speaker sounds terrible when played on today's wide-range equipment at high volume levels. But if we use about six of these small tweeters instead of one, we again take advantage of the "response levelling" characteristic and we end up with a velvety-smooth high end that is free from peaks and distortion.

I will now describe a loudspeaker system which incorporates all the principles of the series-parallel array. There are 22 six-inch speakers arranged as shown in *Fig.* 3. In addition, there are six four-inch tweeters arranged along the top row. You will note the speakers on the angled side. This arrangement gives an excellent polar response pattern on the higher frequencies. *Figure* 4 shows how two of these systems arranged for stereo present the ideal stereo dispersion all the way across the front of the listening area.

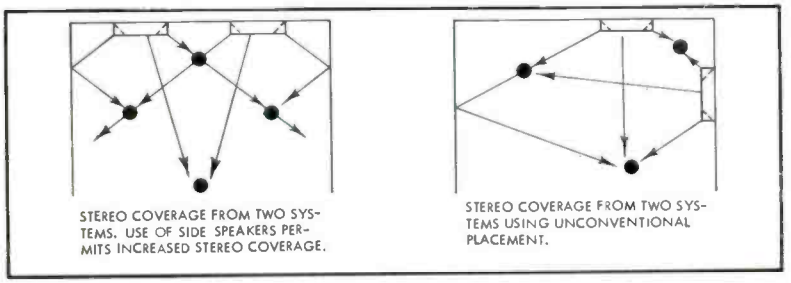


Fig. 4. Stereo coverage of a pair of series-parallel systems in various room positions.

There are four loudspeakers facing directly at the floor. This gives a surprising sock to low frequency transmission along the floor plane.

Because of the wide high-frequency pattern there is no "focusing" of high-frequency energy in a narrow beam in front of the system. This is an annoying problem with conventional speaker systems.

The low, narrow cabinet takes little floor space. It does not have to be in a corner or any special place for satisfactory reproduction. My previous array[1] using 32 six-inch speakers was extremely long and heavy. However, by reducing the number of speakers to 22 and ar-

[1] Charles F. Mahler, Jr., "Hi-Fi performance from small speakers," AUDIO, December 1959, p. 22.

ranging them closer together, we have a smaller cabinet without any serious sacrifice in sound quality. The completed system weighs about 65 pounds. In my previous article, I had stated that it was essential to rigidly brace the cabinet because of the great low frequency output. I am afraid that I was led astray by the volumes of information printed on the subject. Some writers have suggested brick or concrete enclosures for their speakers. The reason for all this fuss was the tremendous amount of cone excursions on these other "sophisticated" speakers which caused the whole cabinet structure to shake and rattle. Large cone excursions are necessary when a single loudspeaker tries to reproduce 20- and 30-cycle tones. So, cabinets had to be rigid and strong. In our series-parallel array we are moving a large wall of air with no cabinet vibration. There are no violent cone excursions. Instead we move small amounts of air which combine with other small amounts that result in a large wall of air which was generated with practically no effort at all! So our main concern with cabinetry is to keep the cabinet from exerting some resonance of its own into the system. This can be avoided by packing sheets of Fiberglas in the rear of the cabinet. This damps any standing waves and cabinet resonances.

In conclusion, I would like to list some of the advantages and disadvantages of the series-parallel loudspeaker array.

Advantages

1. Excellent low-frequency response.
2. Excellent transient response.
3. Very low distortion.
4. No frequency doubling.
5. Simple cabinet design.
6. High efficiency.
7. High power-handling ability.
8. Low cost.

Disadvantages

1. High labor time necessary to cut holes and mount and wire 28 speakers.

Æ

AUDIOCLINIC

(*from page 4*)

the coil. This must be done carefully, however, or the wedge will cut through the insulating paper and possibly break or short-circuit some of the turns. This will ruin the transformer.

As a general rule it will do no good to pour resinous material into the laminations, for this is usually done in a vacuum which enables deeper penetration. It is occasionally possible, but it is very messy, and it is often impossible to separate the core from the laminations without completely dismantling the core. The dipping would then serve no purpose. Æ

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 confidential money-saving prices on your Hi-Fidelity amplifiers, tuners, speakers, tape recorders. Individual quotations only; no catalogs. Classified Hi-Fi Exchange, AR, 2375 East 65th St., Brooklyn 34, N. Y.

SALE: 78 rpm recordings. 1900–1950. Free lists. Collections bought. P. O. Box 155 (AU), Verona, N. J.

LOW QUOTES on everything. Hi Fi and Stereo tapes. Bargain list. HIFI, Roslyn 4, Pa.

COMPONENTS, recorders, free wholesale catalogue. Carston, 125-N East 88th Street, New York 28, N. Y.

AMPEX, Concertone, Crown, Magnecord, Norelco, Presto, Bogen, Tandberg, Sherwood, Rek-O-Cut, Scott, Shure, Dynakit, others. Trades. Boynton Studio, Dept. AM, 10 Pennsylvania Ave. Tuckahoe, N. Y.

RENT STEREO TAPES—over 1500 different—all major labels—free catalog. Stereo-Parti, 811-H Centinela Ave., Inglewood 3, California.

INCREASE CLARITY, PRESENCE, DEPTH with the new DUO-PHONIC INDUCTOR on Stereo or Mono. Send for FREE FACTS or order now $29.90. MONEY BACK GUARANTEE. The Audionics Co., 8 West Walnut St., Metuchen, N. J.

RENT-A-TAPE/stereo or monaural. No deposits—no minimums. Free catalog. Columbia, 9651 Foxbury Way, Rivera, California.

VAN EPS disc recorder, Fairchild 541 cutter, $125. Pickup only. C. Zak, 139 Grand St., Jersey City 2, N. J.

PRESTO 75-A, 16" recording table in portable case, 112 and 224 lines, 1-D cutter, G. E. turn-around playback, $100.00 FOB Omaha, New RCA MI-9449 15" woofer $50.00 FOB Omaha, G. E. AI-501 16" transcription arm with 4 slides $10.00, G. E. AI-901 compensator $10.00, G. E. AI-903 rumble filter $5.00. Gray 602 equalizer $25.00, McProud "Miniaturized Pre-Amp with Presence," with tubes $25.00. Stephens Tru-Sonic C2S-OD5 condensor microphone system with case $95.00. Charles F. Craig, 5813 Blondo St., Omaha 4, Nebr.

SEVERAL efficient 4" deep-cone tweeters. 16 ohm; 2000–15,000 response. $5.35 each postpaid. G. Cain. 15 Manet Circle, Chestnut Hill, Mass.

FACTORY SELL OUT, Germany's finer 12" coaxial speakers, full range, formerly $49.50. Send $18.50 each, 2 for $35. No COD. Cheshire Co., Parcus Str. 10, Mainz, Germany.

MAGGIE: 521 E. 162 St., New York 51, N. Y. WE SAID TRANSIENTS, NOT TRAMPS. COME HOME M. S. 1.

INTERNATIONAL RECORD COMPANY

Musical and Technical Coordinator available spring 1961 seeks responsible position utilizing full qualifications. State details of position available in first reply. Box No. CE-1.

Give The UNITED Way

Industry Notes...

AMPEX APPOINTS HARVEY. **Harvey Radio** was appointed exclusive distributor of **Ampex** Professional and Instrumentation Tape and Ampex Videotape in the Metropolitan New York, Lower Connecticut, Northern New Jersey area. A totally new sales force, headed by Thomas B. Aldrich, has been set up to handle this new line. Mr. Aldrich was formerly Industrial Sales Manager of **Presto Recording Corp.** and a well known figure in the electronics industry for more than 20 years. According to Harvey Sampson, Sr. this move will strengthen Harvey Radio in the industrial field.

HARMAN-KARDON MOVES PLANT. With all the pleasure of a pretty lady in a new dress, **Harman-Kardon** announces the completion of their move to a new plant. Located in Plainview, Long Island, N. Y., the new and improved surroundings are expected to permit increased production. Good luck—wear it well!

AUDIO DYNAMICS CORP.—NEW COMPONENT MANUFACTURER. Housed in an air conditioned plant in Ridgewood, N. Y., the newly formed **Audio Dynamics Corp.** is headed by Peter E. Pritchard, formerly an engineer with **G. E., Shure Bros.,** and the English firm of **Kelvin, Hughes, Ltd.** Bert Gedzelman, long known in the audio field as a manufacturer's representative, will be responsible for sales. Included in the plant are a machine shop, a test laboratory, and automatic assembly equipment. Their first product is a stereo cartridge.

George Alexandrovich has been appointed as Chief Engineer of professional and consumer product lines by Fairchild Recording Equipment Corp. Mr. Alexandrovich has been with Fairchild for many years. His latest developments include the new Model 440 turntable and Model 500 arm and cartridge,. Congratulations!

Rene Snepvengers has been elected Vice President of Electro-Sonic Laboratories, Inc. Long identified with the audio field, Mr. Snepvengers was formerly Director of Engineering of Fairchild Recording Equipment Corp. and before that served with CBS and RCA. The election of Mr. Snepvengers is in keeping with the expansion of the ESL high fidelity and industrial lines.

Frank C. Bumb has been named by American Concertone, Inc., a Division of the Astro-Science Corp., as Vice President for Engineering. Prior to joining Concertone, Mr. Bumb was Chief Engineer, Space Science Department, of Consolidated Electrodynamics. Mr. Bumb is past President and Chairman of the Board of Cal-Tech Alumni Association.

ABOUT MUSIC

(*from page 85*)

station devoted to background music, but it is totally inappropriate to an exhibit in which a loudspeaker or a stereo cartridge is the center of attention.

Traffic

Clogged corridors seem to be an integral part of New York audio shows, and probably of other shows throughout the land. The French, however, have developed a solution for this problem. At the Paris Hi-Fi Show of 1959, one-way traffic was strictly enforced, with notable success. The Palais d'Orsay Hotel is shaped rather differently than the Trades Show Building, of course, but the idea is worth consideration. Æ

ADVERTISING INDEX

For more information, use the card below. Circle the appropriate code for items in NEW PRODUCTS, NEW LITERATURE, and EQUIPMENT REVIEW, and circle the number corresponding to the page on which advertisements appear, using the small letter indicated when more than one ad appears on a page. "Cov" refers to covers.

READER SERVICE

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

AUDIO — Please send me further information about the coded items circled below and about those advertised on the circled pages of the November issue.

(PLEASE DO NOT USE THIS CARD AFTER MARCH 1, 1961)

L-1	L-11	L-21	3	15	43	63	75	83	92-93	100b
L-2	L-12	L-22	4	17	45	65	76a	85	94	101a
L-3	L-13	L-23	5	25	46-47	66	76b	86	95	101b
L-4	L-14	L-24	6	27	49	67	77	87	96a	101c
L-5	L-15	L-25	7	29	51	68	78	88a	96b	101d
L-6	L-16	Pages	9	31	52-53	69	79	88b	97a	101e
L-7	L-17	Cov3	11	33-34	55	71	80a	89	97b	101f
L-8	L-18	Cov4	12	37	57	72	80b	90a	98	101g
L-9	L-19	1	13	39	59	73	81	90b	99	101h
L-10	L-20	2	14	40-41	61	74	82	91	100a	102

CUT APART ON DASHED LINES

PLEASE PRINT NAME AND ADDRESS CLEARLY

AUDIO, P. O. Box

GENTLEMEN:

PLEASE ENTER M

FOR:

1 YEAR — $4 ☐ (Foreign - $5)

2 Y (Fo

This card is for su

NAME _____

ADDRESS _____

CITY _____

No Postage Stamp Necessary If Mailed in the United States

DON'T FORGET YOUR NAME AND ADDRESS

Postage Will Be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

First Class Permit No. 142, Mineola, N. Y.

AUDIO

P. O. Box 629

Mineola, N. Y.

BEYER

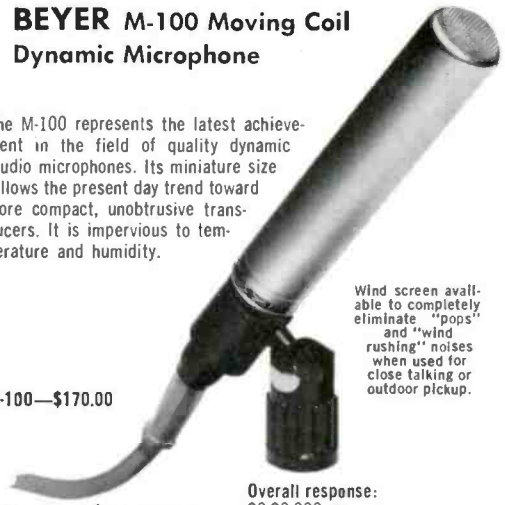
BEYER DT-48 Dynamic Peak-Performance Headphones

DT-48—$79.50

A hand-built, high-fidelity transducer used in critical evaluation of recorded and transmitted sound, yet in a reasonable price class. Frequency range: 30-15,000 cycles, down no more than 7 db at 15 kc, and perfectly flat at 30 cycles. Comfortable exchangeable foam rubber pads and separate cords for each ear for stereo application. Impedance: 5 ohms each side; input voltage required: 0.1 volt; peak power demand: 0.4 watt; weight: 12½ ozs.

BEYER M-100 Moving Coil Dynamic Microphone

The M-100 represents the latest achievement in the field of quality dynamic studio microphones. Its miniature size follows the present day trend toward more compact, unobtrusive transducers. It is impervious to temperature and humidity.



Wind screen available to completely eliminate "pops" and "wind rushing" noises when used for close talking or outdoor pickup.

M-100—$170.00

Directional characteristic: Omnidirectional
Frequency response: 50-16,000 cps ± 2.5 db
Overall response: 20-20,000 cps
Impedance: 50/200 ohms
Sensitivity: 0.100 mv/microbar
Dimensions: 4¾" x ⅞"
Weight: 4.5 ozs.

BEYER M-160 Dynamic Ribbon Microphone (Ultra-directional)

An ultra-directional characteristic has now become possible in a ribbon microphone. The warm, transparent classical ribbon quality—in a miniaturized form, with response approaching near theoretical limits through miniaturization of the vibrating system. Close tolerances in manufacture assure uniformity of characteristic between microphones, permitting paired use for Stereo.

M-160—$195.00

Directional characteristic: Ultra-directional
Rejection ratio: 20 db
Frequency response: 50-16,000 cps ± 2.5 db
Overall response: 20-20,000 cps
Impedance: 50/200 ohms
Sensitivity: 0.060 mv/microbar
Dimensions: 1½" x 6"
Weight: 6 ozs.

M-100 and M-160 microphones are plug-in and are supplied with mating receptacle and swivel microphone stand adapter coupling for ⅝-27 thread. Velvet-lined jeweler's cases protect the units when not in use.

BEYER M-61b Ultra-directional Dynamic Microphone

The ideal microphone for theater and night club sound systems, recording, and remote broadcasting, as well as conference and musical recording for the advanced audiophile. Its ultra-directional characteristic discriminates against random, unwanted sound and permits higher non-feedback output levels from public address systems.

M-61b—$67.20

Directional characteristic: Ultra-directional
Rejection ratio: 17 db
Frequency response: 50-15,000 cps
Impedance: 50/200 ohms (high impedance on special order)
Sensitivity: 0.200 mv/microbar
Dimensions: 1¾" x 4¾"
Weight: 6.5 ozs.

GOTHAM AUDIO CORPORATION

2 WEST 46 STREET, NEW YORK 36, N. Y. . . . COLUMBUS 5-4111

BULLETIN....BULLETIN....BULLETIN....BULLETIN....BULLETIN....BULLETIN....BULLETIN....

THE TEC S—15 NOW IN PRODUCTION

ACTUAL SIZE

TEC NEW ALL-TRANSISTOR OUTPUT TRANSFORMERLESS (OTL) STEREO AMPLIFIER STOP GREAT ENGINEERING ACHIEVEMENT, SURPRISING LOW PRICE STOP JUST 129.50 AUDIOFILE NET STOP TRANSISTOR CIRCUIT ELIMINATES OUTPUT TRANSFORMER RESULTING IN HIGH QUALITY, LOW DISTORTION STOP NO HEAT, NO HUM, NO MICROPHONICS STOP MUSIC POWER RATING 40 WATTS (20 WATTS EACH CHANNEL), DISTORTION UNDER 1%, FREQUENCY RESPONSE -3DB, 8 CYCLES TO 45,000 REPEAT 45,000 CYCLES, POWER REQUIREMENTS 117 VAC OR 12 VDC STOP NOTHING LIKE IT. GO

TEC

TRANSIS-TRONICS, INC.

1650-21st STREET, SANTA MONICA, CALIFORNIA