AUDIO

SEPTEMBER 1966 60¢

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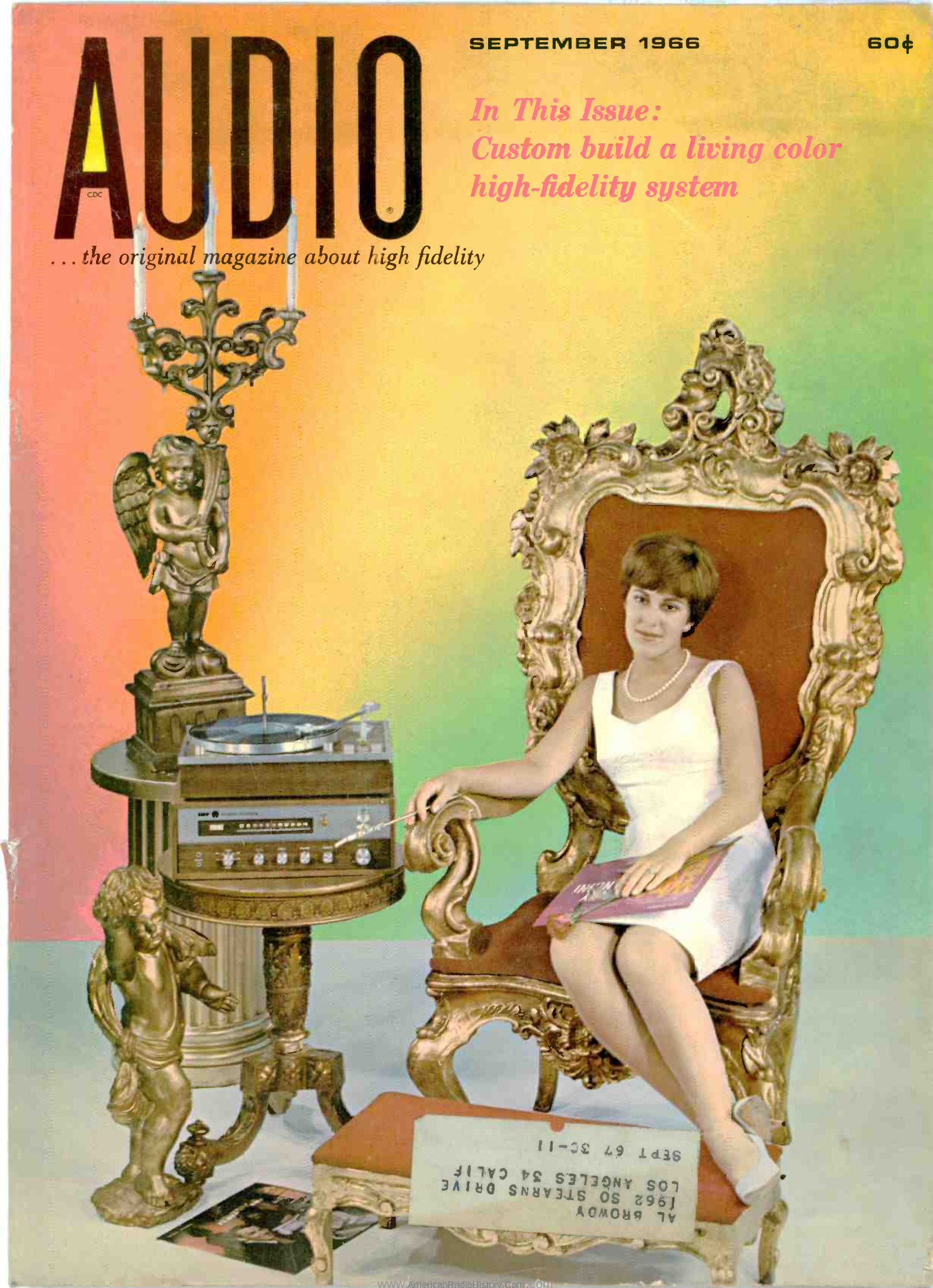
In This Issue: Custom build a living color high-fidelity system



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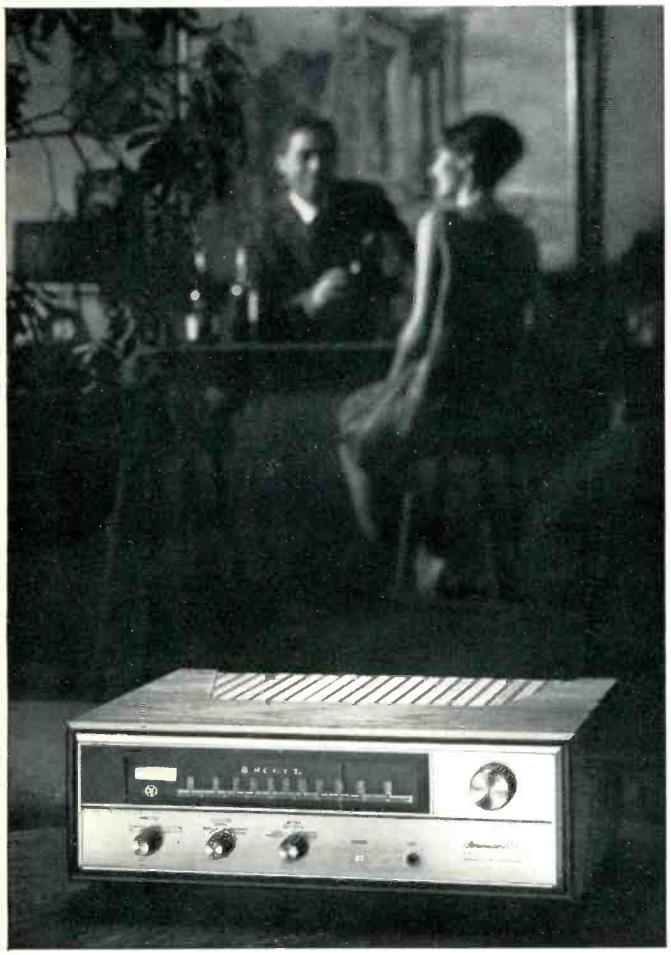

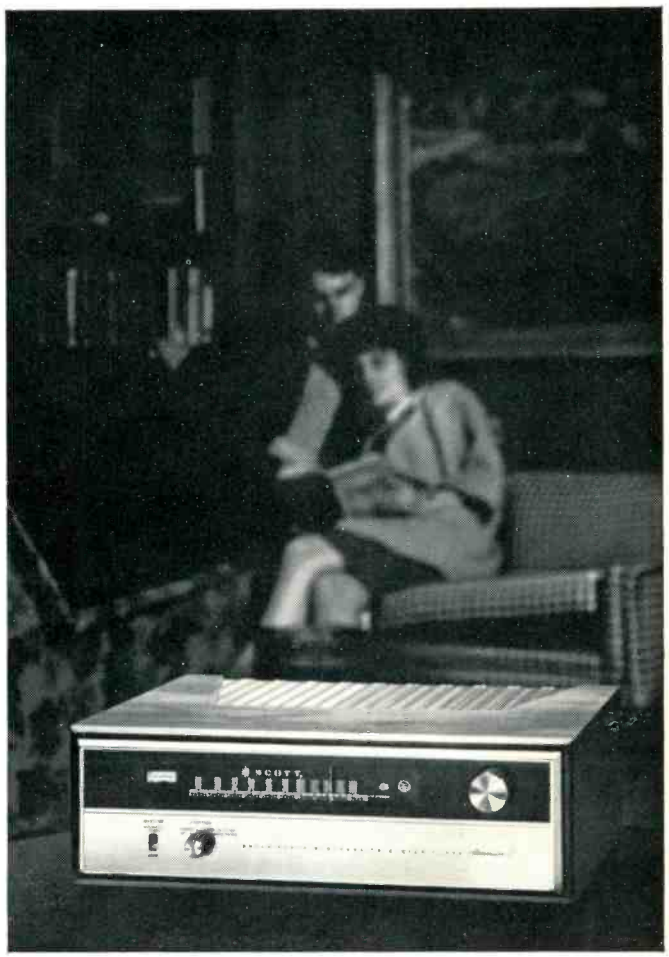

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AUDIO

September, 1966 Vol. 50, No. 9

Successor to RADIO, est. 1917.

AUDIO Articles

AUDIO Reviews

AUDIO Profiles

AUDIO in General

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COMING

Articles:

Build a Capacitor Microphone System Using Semiconductor Devices is by Robert B. Shulein. It will carry you through the process by which you can construct this FET equipped microphone.

Walter G. Wohleking concludes his extensive tour of the intricacies of FM reception in Part 4.

The Audio Measurements Course, Part 9, has Norman H. Crowhurst examining the evaluation of disc playing equipment.

Profiles:

Fisher 1000 tuner
KLH Twenty Modular System
Ortofon S-15 Cartridge

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

About The Cover

The young lady is enjoying a visualization of Colin Shakespeare's Sound Activated Color Display to be found on page 17. Keyed color projectors in the base of the candelabrum throw the pattern to wall and ceiling. Antique furnishings are by Zafero Studios, Inc., color photo by Mano Mehanian, both of Philadelphia.

AUDIO CLINIC

Joseph Giovanelli

Send questions to:
Joseph Giovanelli
2819 Newkirk Ave.
Brooklyn, N. Y.
Include stamped, self-addressed envelope.

External Cross-over Mounting Arrangements

Q. I have designed and intend to construct a new crossover network for control of the two woofers that are presently utilized in my stereo audio system. Because I want to have variable, external control over the woofer crossover point, I envision a design wherein three coils of 0.2 millihenries each will be placed in series with a four-ohm woofer of each stereo channel. By a switch, I then expect to select the value of either 0.2, 0.4, or 0.6 millihenries of series inductance for each woofer.

I fully realize that 0.6 millihenries inductance in series with the four-ohm woofer will result in a 75 per cent loss of amplifier output power at 1000 Hz. I am not concerned about the purely electrical design considerations associated with such a system. I am concerned about the mechanical problems. It is conventional to house such crossover chokes within the speaker enclosure or on an external wooden pallet. In my system it is inconvenient to use either of these arrangements. I want to place such chokes and switches near my main control panel. Under such circumstances it would be most convenient to be able to mount these chokes and switches in an aluminum utility box.

Questions: What problems will be incurred if I mount such coils in a metal box? Because aluminum is non-ferrous, will I avoid the usual mutual inductance coupling problems that prevent using steel utility boxes for coil mounting? Assuming that I mount the coils within the aluminum box in a proper orientation, i. e., standing on edge and staggered with respect to magnetic axis, will I compromise my intended design performance in any way by use of aluminum instead of wood to enclose the coils? Also, would you recommend that I separate the three left-channel chokes from the three right-channel chokes by using separate aluminum utility boxes or do you think I can use one larger box without compromise of channel separation characteristics? Bryan Geyer, Portola Valley, California:

A. I see no real problems that will be encountered when you connect your crossover inductors in the manner specified in your letter. Be sure, however, that they are spaced from the sides of the metal container by a factor of at least a coil diameter. This represents a more-than-ample safety factor at audio frequencies but is still good design procedure when using inductors enclosed in metal containers at any frequency.

If you separate the left- and right-channel inductors by about an inch an a half, you will not run into trouble of any sort so far as I can see. Remember that the impedance of the channels is very low at the crossover points and there is no amplification. Thus, any voltage which is induced from one channel's inductances to the other must be of very low magnitude and will not be increased by subsequent amplification. I think you need not worry over loss of channel separation.

You can use one large box to enclose your entire set of inductances, and if you like, you can even include the capacitors. You will not encounter problems. Of course, you will want to use rather large wire to interconnect this network with the amplifier and the speakers. By large I mean at least No. 16 or so. This becomes all the more true if the distance between the network and the speakers is greater than, say, 10 or 15 feet. At 4 ohms impedance the current in the interconnecting cable is rather high. This means that a considerable voltage drop will occur across the line which has even a moderately low resistance. You must be sure that the resistance on the line is *very* low. If the distance is even greater than 15 feet or thereabouts, then you might consider the use of No. 14 gauge wire. Another consideration which affects the wire gauge used to interconnect speakers with amplifiers or networks of this kind is the damping factor which the amplifier is going to present to the speaker. If the resistance of the line is high, the amplifier and speakers will not be mutally coupled. The bass reproduction will be affected. Whether this effect on bass is adverse or favorable will depend upon the over-all quality of the loudspeaker system.

Woofers and Tweeters With Different Impedances

Q. I have a low-efficiency woofer and a horn which I want to connect as a complete speaker system.

Question: Is there a problem in attenuating the horn to adjust for the difference in the efficiencies between the woofer (low efficiency) and the horn (high efficiency)? By problem I am referring to degradation of frequency response if a T-pad is used to decrease the output of the

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horn. 2. The woofer and the horn have impedances of 4 and 8 ohms respectively. Could I hook up the woofer to the 4-ohm tap of a cross-over network or amplifier and the horn in parallel to the 8-ohm tap without causing any distortion? Would it be better to use an auto stepdown transformer to change its impedance to 4 ohms and make the crossover-network impedance 4 ohms also?

William Pollock, Pittsburgh, Pennsylvania

A. 1. I do not see any problems which will result when using the T pad to attenuate the output of the horn so as to compensate for the efficiency of the woofer.

2. Despite that the impedance of the woofer is lower than the impedance of the horn, an 8-ohm crossover network could be used—but this is not the best arrangement possible. You could place a 4 ohm resistor in series with the 4-ohm woofer and obtain 8 ohms total. This approach is recommended in certain instances by manufacturers of low-efficiency woofers, although it does lower the effective efficiency still further.

You could use an auto transformer to match impedances between the woofer and the crossover network. Transformers are available which are strictly for this purpose.

When an auto transformer is used, it is better to step the impedance of the horn down to that of the woofer rather than the other way as could be done. The crossover network to be used in this instance is one designed around a 4-ohm impedance. You would not connect the speakers directly to the amplifier in any case because all crossover action would be lost. Further, in the case of tweeters and some midrange units, damage is likely to result because low frequencies would be able to enter these units, and such frequencies would damage the equipment.

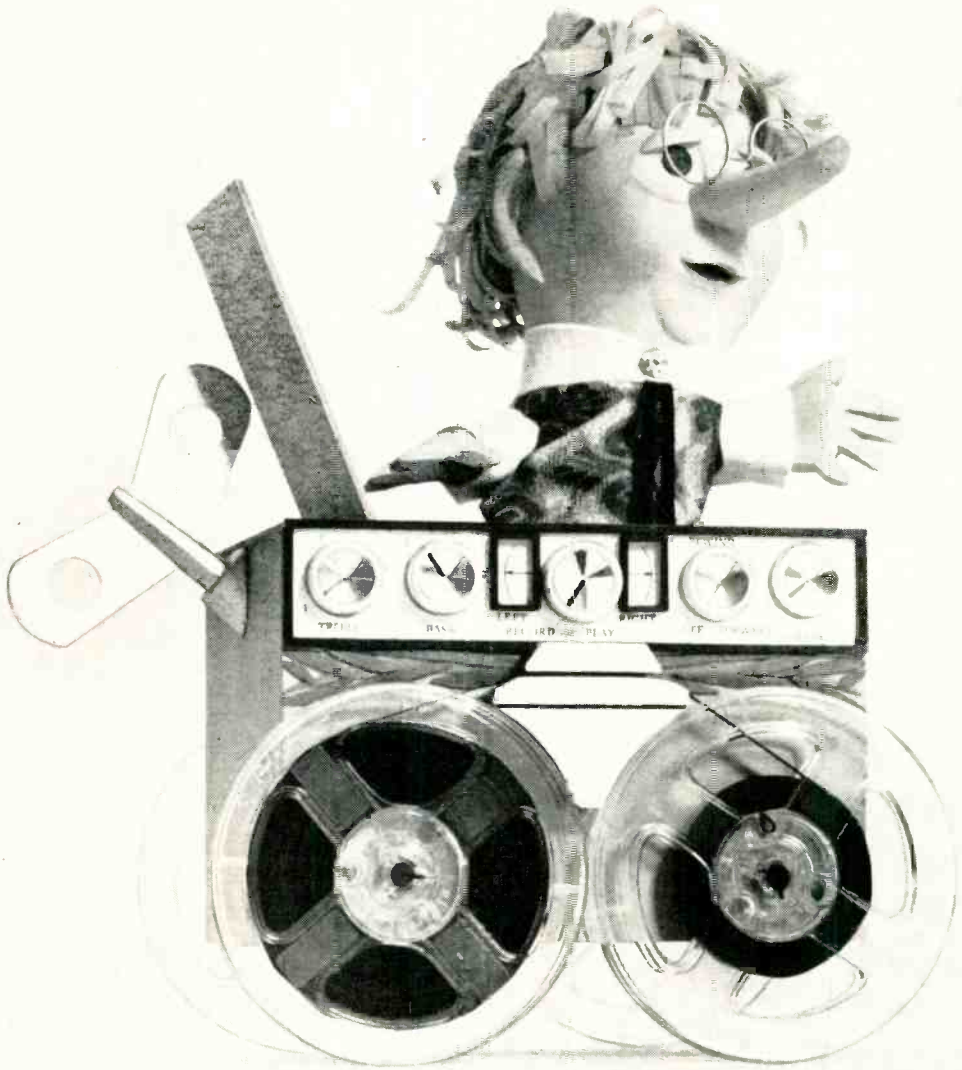
There is a good reason why it is better to transform the impedance of the horn down to that of the woofer. Less power-handling capacity is required in the auto transformer. If the impedance of the woofer were to be stepped up to that of the horn, the transformer would have to handle considerable power because most of the power delivered by an amplifier is used to produce bass tones.

Choosing a Stylus Tip

Q. I have a monophonic system. I want to purchase a new cartridge, presumably stereo. It will be at least one year before I consider "going stereo." Holding variables such as compliance, required tracking force and stylus mass constant, what is the most appropriate stylus tip radius with respect to record wear and fidelity? Using such a stylus, would I achieve less distortion with mono or stereo records? Ken Perchonok, State College, Pennsylvania

A. If you are planning eventually to use your cartridge for the reproduction of stereo records, and plan to continue playing monophonic discs, you probably should use a stylus having a tip radius of about 0.7 mil. Your cartridge, of course, must be

(*Continued on page 41*)



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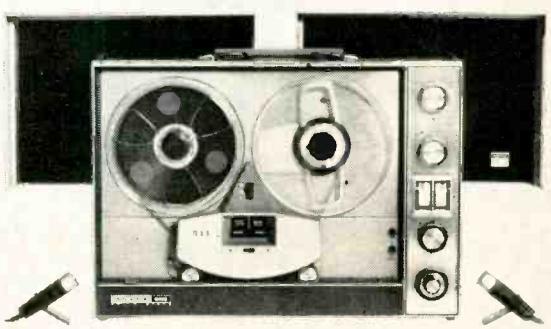

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LETTERS

SIR:

In relating the measurement of an amplifier's power-handling ability to music power, Mr. Crowhurst says (Audio Measurements Course, Part 3, March, 1966): ". . . A composite musical tone, made up of many instruments playing different notes, contains many sine waves, superimposed. The total power in these sine waves is the sum of their individual average powers." But suppose two musical instruments when sounded separately produce sine waves of identical frequency but 180 deg. out of phase, each with an acoustic power of 1 mW. In this (unlikely) case, if the distance between the musical instruments is much smaller than one wavelength, then the total power is zero (the waves cancel), while the sum of the individual powers is 2 mW.

Mr. Crowhurst continues: "For example, suppose there are ten individual sine waves in a composite music signal, all of equal magnitude . . . The amplifier will need ten times the voltage- or current-handling capacity of any one of them, which represents 100 times the individual power requirement . . ." I believe this will only be true in the most unlikely event that all ten individual sine waves have the same frequency, and a phase difference of zero. Generally the ten sine-wave voltages may all have equal "magnitudes," but at any instant of time some of their signs will be positive and others negative. Hence the sum of the instantaneous voltages is less than the sum of the instantaneous magnitudes.

I imagine Mr. Crowhurst's concluding sentence, ". . . a 50-watt amplifier (is needed) to handle 5 watts of music power . . ." is nonetheless correct. However, I can think of no alternative example to "prove" its correctness.

LARRY GREISEL,
P.O. Box 79,
Jimma, Ethiopia

Suggested Articles

SIR:

I would like to thank you for the enterprising articles that are appearing in the magazine, and to let you know how much I enjoy reading them.

I should like to request that you look into the possibility of having more articles on electronic organs in future issues.

I am an organ enthusiast, having built my own three-manual Artisan, and I would appreciate some articles on the custom organs currently being built, such as Rogers, Allen, and others.

Do you think other readers might enjoy reading them?

JOHN E. FRENCH,
2403 Pine Street,
Beaufort, S.C. 29902

SIR:

I am building a guitar speaker system for my oldest son and am looking for a schematic of a good transistorized amp-preamp combination with tremolo, reverberation, and so on, and with 50 watts power output at least. Do you know where I might obtain such a circuit?

Audio always has many construction projects, but during the past two years I have not seen anything pertaining to guitar amplifiers.

Presently I am using a Dynaco Mark III 60-watt amplifier and a PAM-1 preamp (for mike input) to drive two Jensen 12-in. guitar speakers in a 7 cu. ft. infinite baffle. This combination sounds good, but is too heavy and complex for my son to hook up.

Your help would be appreciated.

JOHN J. KEMPEL,
1154 Irwin Dr.,
Pontiac, Mich. 48054

SIR:

Some years ago you had some articles on eliminating audio rectification in hi-fi sets. I am a radio "ham" and my neighbors do not like to hear my nice golden voice on their hi-fi sets. It would save me time trying to locate the data if you have it handy.

F. W. SCHUBERT,
1824 Franklin Street,
Oakland, California 94612

(There are three good subjects on which we—and these readers, who are probably typical of many others who have similar problems. ED.)

SIR:

I was glad to see Hernan Burstein's discussion of synchronous motors in THE TAPE GUIDE. Somehow or other popular audio jargon has come to divide turntable or tape machine motors into two types, the hysteresis and the 4-pole. It is as though all synchronous motors were of the hysteresis type, and as though hysteresis motors do not have poles, or at least never have four of them.

The actual basic categories, of course, are the synchronous and the induction, and of the synchronous motors the hysteresis is only one type. In my article "A New Turntable-Arm Design" in the October, 1962, AUDIO I explained why I had chosen a permananent magnet synchronous motor rather than a hysteresis unit for the AR turntable. Hysteresis synchronous motors will work happily at sub-synchronous speeds (where they operate as induction motors, with the poles slipping), while permanent magnet synchronous motors will conk out rather than run slow.

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LIGHT LISTENING

Chester Santon

Mame (Original Broadway Cast)
Columbia KOS 3000

Due primarily to the presence of Angela Lansbury in the title role, "Mame" finally gives the 1965-'66 season a show the musical stage can be proud of. Under present Broadway conditions of creativity (or lack of it), the safest bet a producer can make is to put his money into an established story and then hire a female star who can sell it to the large potential audience that always exists for a good attraction. Certainly that was the case when Carol Channing first appeared in "Dolly." The same high demand for tickets occurred when Angela Lansbury revived a few months ago the famous part of Mame first found in the novel by Patrick Dennis and later in the play "Auntie Mame" by Jerome Lawrence and Robert Lee. Rosalind Russell, you may recall, first brought the zany antics of Auntie Mame into national prominence. In the current musical, the setting is still a Manhattan penthouse just before the Crash of 1929 but the Lansbury treatment of the role brings out more of the pathos in the story as well as its regular quota of whacky moments. No one can complain of thinness in the contents of this plot. A large cast goes through enough antics to make a story line for a half dozen musicals and Columbia's original cast album keeps the home patron fully informed with a blow by blow rundown of the antics on stage. The disc definitely reflects the fact that this is Miss Lansbury's show. There aren't many bands on the record that don't have her deeply involved in the action. A conspicuous exception is the title tune lauding the more obvious attributes of the theatre's favorite aunt. The play ran 639 performances on Broadway and the musical version shows every sign of racking up records of its own.

Superman (Original Broadway Cast)
Columbia KOS 2970

Before its appearance in record form, "Superman" achieved a certain amount of notoriety through the simple act of being praised by Stanley Kauffman, drama critic of *The New York Times*. Since replacing that paper's Howard Taubman as chief drama critic, Mr. Kauffman had been hard at work demonstrating that the town's most influential paper deserved a theatre critic less benign than Mr. Taubman in dealing with Broadway's turkeys when they were presented in the guise of musicals. Kauffman's reviews, stringent but fair-minded, soon earned him the undeserved reputation of a sorehead from producers who were used to unstinting praise from most of the critics—no matter how sorry their stage productions. By the time "Superman" arrived in town toward the end on March, 1966, Stanley Kauffman decided he had to unbend a bit and devote generous praise to a musical that would have caused only a mild stir during more successful Broadway seasons. Most of the kind words he had for Superman's stage impact have proved valid enough with the majority of theatre goers but the score has long stretches of dreariness on records where the show's comic strip action cannot come into play. On the disc, Superman is overshadowed, believe it or not, by the vastly superior singing and acting of Jack Cassidy in the role of Max Mencken, gossip columnist of the Daily Planet of Metropolis, U.S.A. Nothing much catches fire on the disc until Cassidy comes on with the best all-around song in the score, "The Woman For the Man." It's not an easy song to sing with its sudden leaps up the scale but Cassidy makes it sound like child's play. He's come a long way since his first appearance on the Main Stem. Patricia Marand in the role of Lois Lane is also an attractive singer, offering her best work in "What I've Always Wanted" and "I'm Not Finished Yet." The stereo setting is used with very good effect by Columbia's engineers when the full company is deployed "on stage." The sound has the freshly-scrubbed cleanliness of Columbia's latest show mikings. A puzzling drawback in this production which I trust is only a temporary departure in Columbia show albums is the absence of even the outline of "Superman's" plot structure on the jacket liner. Columbia Records has been among the most lavish of the record firms in giving the home listener an idea of the action taking place in their original cast albums. Here's one vote for a quick return to that policy.

South American Suite
Columbia ES 1862

Any fancier of orchestrally treated South American folk music isn't much of a fancier if he's been unfamiliar with this outstanding Columbia album. I say "been" because the release first came out in the Columbia EX mono series and is only now making its appearance in electronically re-channeled stereo. I think it's a terrific album even though the Schwann LP catalog doesn't seem to feel it merits listing anywhere in its pages. At any rate, I can't find the mono listing under any category that would normally contain a disc such as this. This suite, recorded in Argentina, features the Columbia Symphony Orchestra of Buenos Aires under the direction of the young Argentinian composer, Waldo de los Rios, who made the arrangements. The four sections of the suite cover the tremendously rich folk music of Paraguay, Argentina, Peru, and Uruguay. Some indication of the suite's authenticity can be found in the names of native dance rhythms on which so much of the music is based. How many north of the Border have ever heard terms such as "guarania," "vidalita chayera," "hyano," or the "pericon"? The orchestra is excellent and the sound is remarkably clean (at moderate level) for a mono recording that's been processed into stereo. If you value the spontaneous flow of melody that has always characterized the native music of South America, you'll make it a point to hear this disc.

Meet Marilyn Maye
RCA Victor LSP 3397

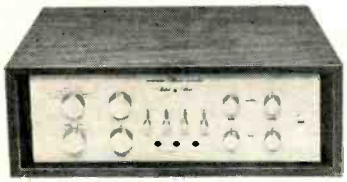
I'm sure I don't know the average age of female vocalists at the time they make their record debuts. It's undoubtedly an earlier age than that of the singer Victor introduces in this disc and therein lies the main interest in a better-than-average debut album. AUDIO readers within commuting distance of Kansas City may already be familiar with the voice and personality of Marilyn Maye. With her husband and accompanist, Sammy Tucker, she has appeared for many years at *The Colony* in downtown Kansas City. Partly through the good offices of comedian-musician, Steve Allen, she now makes a bid for the bigtime in a wide-ranging program designed to give full play to a flexible and easy-to-take voice. If nothing else, the album may encourage other record companies to look beyond New York City when considering new talent.

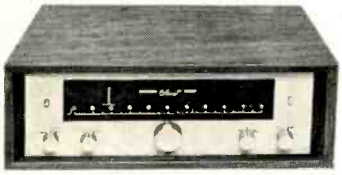
Harold Sings Arlen
Columbia OS 2920

Most of us know that one of the hazards of traveling exclusively with the smart set is the business of parties. Sooner or later at one of these affairs, a composer of popular tunes is prevailed upon to sing a few of his tunes, which he then proceeds to do for the rest of the evening. Unless the chap happens to command the comedy talent of an Abe Burrows, the experience can be a harrowing one for everyone except the blithely happy performer. On this particular recording, Columbia Records has arranged to have the well-known composer, Harold Arlen, regale us with a group of his songs and I cannot say that I approached the disc with any but mixed feelings. Any composer who got his start contributing songs for the historic Cotton Club shows of the Depression years can hardly be called a young vocalist today. The album, however, is a surprise and no time should be wasted in pointing out that the surprise is a welcome one. Unlike most composers who insist on giving us a "deeper insight" into their favorite works, Arlen still has a voice at his disposal. The jacket notes of this album gave me the first inkling of the fact that he began his professional career as a singer with local bands in and around his native Buffalo. The fact that his father was a cantor adds further explanation to the early direction of his career. To an adequate voice, Harold Arlen contributes a matchless sense of rhythm and a natural penetration of the song's lyrics. It

(Continued on page 47)

Marantz components are too good for most people.





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The Marantz components illustrated, top to bottom: SLT-12 Straight-Line Tracking Playback System • Model 15 solid-state 120-watt Stereo Power Amplifier • Model 7T solid-state Stereo Pre-amplifier Console • Model 10B Stereo FM Tuner

Circle 108 on Reader Service Card

ABOUT MUSIC

Harold Lawrence

Recording "Messiah"—Part Two

COLIN DAVIS had just returned to London tanned and refreshed after spending a vacation in Iran with his Persian bride.

We got down to business on a sunny June afternoon to the accompaniment of the roar of sports cars careening down Sloane Street and the cooing of pigeons outside my hotel room.

First we talked about the kind of *Messiah* we did *not* want to record: the all too familiar mélange of mournful tempi, adulterated harmonies, and nineteenth-century orchestration—Handel under Victorian wraps. Then Mr. Davis brought out the Urtext score into which he had pencilled hundreds of ornaments, bowing and phrasing marks, and dynamic instructions.

We began with the Overture. The first part is a moving *Grave* based on a dotted-note figure. I pointed out that in all the eleven recorded versions of *Messiah* I played at home in preparation for this project, the slow introduction was performed exactly as written, instead of with the rhythmic alterations, (double-dotting) understood in Baroque French-style overtures; and that, apart from an occasional trill, the reprise was merely a blind repetition of the first time, sometimes played at a softer level. To students of the Baroque, double-dotting and decoration of repeats are fundamental practices. Still, otherwise sophisticated interpreters persist in playing their Handel "straight." But the choice of ornamentation and rhythmic inequality is extremely tricky and requires taste, scholarship, and flexibility.

French double-dotting, for instance, meant that a dotted note was played as if it had two dots after it instead of one. Applied indiscriminately, however, the results could be jerky and angular. Jens Peter Larsen described the Overture to *Messiah* as a modified French overture because it lacked the flourishes and rapid scale passages so characteristic of the Lullian style. To double-dot the *Messiah* Overture *à la française*, Davis said, would rob the movement of its majesty and poignancy. "Why not lengthen the dotted note just short of a full double dot?" Davis suggested. "Overdot it, in other words." To illustrate his point, Davis beat time and hummed the first few bars. It sounded just right.

For the repeat of the *Grave*, Davis added some expressive ornaments: violin trills in bars 2 and 9, an appoggiatura in bar 4, a *tremblement appuyé* (appoggiatura followed by trill) in the next bar, and others. "Besides this," he added, "what do you think of reducing the strings for a more intimate effect; to give the feeling of the concerto grosso?"

In his approach to *Messiah*, Davis had taken nothing for granted. He compared Handel's part-writing with that of Henry Purcell, every line of whose music "moves independently with the most wonderful results. Actually Handel does the same, except that he is not quite so outlandish in his harmonic clashes. That's why if the viola needs a trill in a certain bar in *Messiah*, well then, it shall have it! That just gives the inner voices more life."

During the days leading up to the first recording session, Davis transferred in his own hand all the markings he had pencilled into his score and wrote them into the individual orchestral parts. In rehearsals with the chorus, he stressed the meanings of the text at all times, always reminding the singers that this was a dramatic work with a capital "D." The chorus, trained by John Alldis, responded eagerly. It was a joy to hear them trip lightly through "His Yoke is Easy," singing with flawless articulation and "spot-on" rhythmic precision. Our objective was to prepare a *Messiah* that would be of a piece stylistically. Accordingly, the soloists (Heather Harper, soprano; Helen Watts, contralto; John Wakefield, tenor, and John Shirley-Quirk, bass) all ornamented their parts. The result: an *ensemble* of singers, rather than a collection of "stars" each going his or her own way. Organist Ralph Downes was to accompany the chorus on a Baroque portative organ, and Leslie Pearson (a brilliant young harpsichordist about whom we should be hearing more) improvised his part from the complete score, in true Baroque style.

The recording sessions took place in Watford, a prosperous, middle-class borough lying at the far northwest reaches of the London Underground. Watford's attraction for record producers is a sprawling Town Hall building which houses one of the finest auditoriums for recording I know of. But because it takes anywhere from one hour to 75 minutes to travel from London by car, record firms prefer halls that are more centrally located.

The chairs in the large hall were cleared from the floor and the orchestra of 31 strings, 2 oboes, 2 bassoons, 2 trumpets, and timpani was placed with its back to the stage. On platforms in front of the stage were ranked the forty-voiced choir, with sopranos and tenors on the left, altos and basses on the right, and the pipes of the portative organ in the center. The harpsichordist was to the conductor's right.

Three Schoepps microphones set to an omnidirectional pattern constituted the entire pickup. No special voice or accent microphones were used for the sessions. Philips had shipped recording equipment from Holland by air, because of the shipping strike then in effect (June-July). In the monitor room upstairs, engineers Hans Lauterslager and Henri de Frémery had set up a closed-circuit television receiver which relayed a picture of the auditorium.

Colin Davis, who lives in a small remodeled private house in London, eschewed a chauffeur-driven limousine to drive himself back and forth through heavy traffic to Watford. Tall, athletic, blond, and with neat features, Davis makes one think more of a Greek discus thrower than an orchestral conductor. At the sessions, he was informal, playful, and humorous. But underneath the almost casual air, this was an intensely serious and passionate man who urged rather than commanded the musicians who performed for him. It is difficult to assess whether the excitement that grew from one session to the next among us all during the three-week period of recording was due more to Davis's qualities of leadership than to his fresh, improvisational approach to the work. By adding ornaments and constantly re-examining each movement during the actual recording sessions, Davis had all the musicians sitting up straight. For this *Messiah* was no warmed-over performance taken out of a musical deep-freeze. Æ

COURTESY RIVERSIDE RECORDS AND HIFI/STEREO REVIEW

Jazz Group

Jim Robinson, Ernie Cognolotti, and Louis Cottrell participate in a Riverside Records recording session in New Orleans. The AR-3 in the background (one of a stereo pair) is being used to monitor recording quality.

AR-3 LOUDSPEAKERS ARE USED ALONGSIDE THE LIVE INSTRUMENTS THEY REPRODUCE.

AR-3 (one of a stereo pair)

COURTESY SAN DIEGO SYMPHONY ORCHESTRA

Symphony Orchestra

During rehearsals the San Diego Symphony Orchestra pauses now and then to listen to a taped recording of the passage they have just played. AR-3 loudspeakers were chosen for the stereo playback system because of their lifelike, uncolored reproduction of orchestral timbres.

COURTESY CONCERTAPES-CONCERTDISC

String Quartet

Members of the Fine Arts Quartet listen to the first playback of a Beethoven Quartet, checking both their performance and the fidelity of the recording. The AR-3 speakers being used as monitors were chosen by the musicians themselves, who felt that AR-3's would create musical carbon copies of the live performances, free of hi-fi gimmick effects.

AR speakers ($51 to $225) are often used professionally as shown here, but they are primarily designed for natural reproduction of music in the home. Literature will be sent on request.

ACOUSTIC RESEARCH, INC., 24 Thorndike Street, Cambridge, Massachusetts 02141

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AUDIO ETC.

Edward Tatnall Canby

The Quonset Bird & Friends

For better or worse, you folks are going to get my early-summer enthusiasms this September—what with the long publisher's deadline I work against, straddling the most violent change of season known to man. Yep, I've got assorted audio projects in hand at this moment—but as I write it's fully early summer. They'll wait. The weather today is just too gorgeous, the trees are too green, the skies too blue and the birds too sing-prone. Yesterday the weather was too HOT; also the day before and many days previously. Audio simply will not thrive in this summer climate. Even for a September deadline, which is, of course, July 1. How can I think about September? I just can't.

Instead, I get to thinking of the Quonset Bird and his friends. These birds live around my house and my land and you'd think they owned the place. From their viewpoint they do. They sit around all summer and make astonishingly loud audio, 'way up in the high highs with all sorts of interesting overtone coloration. I can't avoid them; I live, by their permission (so it seems), in their midst and I can't shut them up when I want to work. Maybe I don't want to.

Of course I haven't been introduced yet. I don't know most of them from Adam, or the Dodo bird, except one or two whose real names have come down to me traditionally, so to speak. And so I can't *identify* them. Not in the proper terminology. Not as to sight—I never seem to see them and hear them at the same time. It's either a disembodied voice or a voiceless birdie hopping around out on the lawn, zooming around through the trees. Never the twain shall meet.

Worse, I can't tell if "they" are singular or plural, when I listen to them. Birds make more than one kind of noise—but which, and how many? Is it three different birds I'm hearing, or just one with a triple repertory? Very hard to know and I do worry about it. For all I can tell, maybe the whole crowd of them, making all these noises, is just one masterbird with an omnibus repertory. (Mocking birds, after all, imitate dozens of other birds right down the line. Mynah birds imitate people.)

I'll admit that once in a while I do see a bird close enough to tell what he is. I can spot old Robin Redbreast on the lawn, and I know what *he* has to say. It can't be put into words. Not by a long shot. Except when he's mad; then he cheep-cheeps like an old wet hen, bouncing around in a fury of nerves. He and the Pheobes, Mr. and Mrs. The Pheobes (pronounced *fee*-bee) are collective old ladies. They spend most of their time scolding in high, querulous voices, "phoe-BE, *Phoe*-bih, *Phoe-beee*!!" And when that isn't enough, they go into hysterics, simply screaming "uhh-hahahahahahahahaha!!!" all in a breath until you want to go out and pour cold water on them. They live around the house, and they aren't house broken either. Take 'em away, I say. But it's no use. They're always with me.

It's the Sound that Counts

What does a Phoebe *look* like? Just one of those dull grayish affairs, utterly without visible charm, for *my* eyes. But then, most birds look that way to me. I'm an audio man and I go by my ears. Here are all these loud, lovely, piercing, enormously powerful *sounds* emanating from all over the place, carrying for hundreds of yards—and there are those insignificant little bundles of feathers, not even worth a second glance, mostly. So much noise from so little bird! I can't see how people get excited about looking at birds—and don't even know what they sound like when I ask them. To me, the sound is the whole bird. I guess I'm too much of an audio buff; but in all truth, the bird song is so much bigger than the bird that there just isn't any comparison in my mind.

Some birds are grayish, some are brownish, some are just speckled or mottled or generally mixed. Up in the trees, against the light, they all look black, and they won't stay still. Chasing them with binoculars is as crazy as hunting four-leaf clovers on a bicycle. All you see is enormous quantities of greenery, dizzily moving across the field of vision; and if you ever get within ten feet of a bird, he's not there any more anyway. 'Nuff to make you seasick.

A chestnut-sided warbler? To me he's just a warble-sided chestnut. Until he sings. THEN I get interested. I'm all ears. I hardly dare move a muscle. Because maybe, just maybe, he'll sing not one but THREE different songs. And then I will have a three-in one shot, three of my bird neighbors pinned down to a single feathered beastie. That's fun. (Only the little devils never sing their three songs one after the other. They pick different moods at different times of day. So they keep you fooled, all right.)

I know a few more by name and by sound, if not by sight. There's the aristocratic Whip-poor-will, who like the Phoebe says his name. In the dark of night he whoops and whips for hours in perfect rhythm — *whip-poor-WILL, whip-poor-WILL, whip-poor-WILL,* until you go crazy beating time. Every so often he misses a beat and the bottom drops out. Then there's the chickadee, who says just that, only more so—*chickadee-dee-dee.* I have recently discovered that this nervous little creature, much nicer in his fits of anxiety than the silly Phoebes, is also the author of one of the loveliest bird calls I know, the faint, wispy, distant two-tone call, dropping down one note of the scale, which seems to contain all the wistfulness in the world and a lot of the music too. Two of these often answer each other at different pitches, for a continuous tune, like Three Blind Mice far away. "Three Blind," sings one. "Blind Mice," sings the other, quarering. Lovely. Chicadees! Who'd have believed it!

Two-tone Audio

There are only two audio birds in my territory who sing the same song *at different pitches.* That is rare in the bird tribe. Most of them just say the same thing over and over again, or indulge in all manner of warbles and wobbles without fixed pitch. These two are related thrushes (I know *their* names from 'way back when I was a kid), the Wood Thrush and the Hermit Thrush. Woody the Wood is gregarious and likes to be near houses, so he's loud. He says, sort of, "doo-dee-doo! Sputter-sputter"—the doo-dee-doo is a cheerful whistle, more or less a chord (overtone relationship of simple numbers) and it is at a different pitch each time. The undignified sputter at the end doesn't carry far; he's better at a distance. The Hermit Thrush is a shy bird (they tell me he's very little and very inconspicuous to look at) but he really sings. His chord-whistle starts with a long held note, then a chord-warble, and he moves up and down, different pitch level each time, often high up in the near-supersonic region. I once tried to write down the opening-note pitches of a long series of his songs, but gave up after five minutes or so. He kept to no recognizeable pattern that I could figure out, though he did repeat himself every so often. The Hermit keeps his distance in the woods and his audio signal carries extraordinarily far. It's best at a distance, barely audible. (Sounds all wrong in those close-up parabolic-mike recordings.)

Then there's the Oven Bird (his nest is that way) whom I would not recognize by sight, but often locate by sound via his irrelevant "teacher-teacher-teacher." (Actually, it's "tcher-teach, tcher-teach" as I found to my surprise. He isn't concerned with education.) And there's that weirdie of a bird who sings rolling cadenzas inside a large cast-iron pipe. Sounds that way, anyhow. Very strange hollow coloration —wish I knew how he produces it. He's one of the V-birds, I forget which. Is it

(Continued on page 56)

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Selecting the brilliant new Sony Solid State 350 to fulfill the stereo tape recording and playback functions of your professional component music system will also enduringly compliment your impeccable taste and passion for music at its finest. With an instant connection to your other stereo components, the versatile two-speed Sony 350 places at your pleasure a full array of professional features, including: 3 heads for tape and source monitoring. Vertical or horizontal operation. Belt-free, true capstan drive. Stereo recording amplifiers and playback pre-amps. Dual V U meters. Automatic sentinel switch. Frequency response 50-15,000 cps ± 2db. S.N. ratio plus 50db. Flutter and wow under 0.15%. Richly handsome gold and black decor with luxurious walnut grained low profile base. This remarkable instrument is yours at the equally remarkable price of less than $199.50. Should you want to add portability to all this, there's the Model 350C, mounted in handsome dark gray and satin-chrome carrying case, at less than $219.50. *For information write Dept. 17, Superscope, Inc., Sun Valley, Calif.*

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EDITOR'S REVIEW

With the end of summer and the beginning of September, the entire high fidelity industry looks forward to what the new season will bring. And from the viewpoint of the still-summery middle of August, when this must be written, it doesn't seem that there will be a fall season, or even a winter. It is easy to understand the doldrums of the summer months—we always let up on our kit-building, for example. Of course, this summer we underwent a major change—moving from an office we had occupied for nearly fourteen years with the attending losses of immediately wanted materials and the compensating uncovering of other items which we had thought permanently lost. And the similar personal moving after six years in one location turned out to be a traumatic experience, reminding us once again—as it does every time one moves—of the old cliche that people should move once every two years just to throw away the accumulated paraphernalia of living. Since the national average for moving seems to be about once every five years, nearly everybody must meet with the same problem. We have hopes of conquering this particular problem any day now.

HI-FI's EVENT OF THE YEAR

We're probably a little prejudiced, but the most important single item on the hi-fi agenda for any year is the New York Show. This will get some arguments here and there, but the buying season—in the East, anyhow, begins about Show time. Manufacturers have been getting ready for this show for months, and some just didn't have the final information to give us in time for the August Product Preview Issue, so there will be some new things to see at the show, even if you are an avid reader of the Preview. To make sure that these new items are properly charted, we will prepare an addendum to the Preview section just to include those items which were not quite ready for publicity in the August issue, and this will be a feature of the coming November issue. December, of course, is our annual Tape Recorder round-up.

Elsewhere in this issue is the announcement of the AES Convention, and still elsewhere is a list of the papers to be presented. It is beginning to appear as if the annual AES convention will have to be expanded to two weeks, since there are almost too many papers for the one-week event—enough that there are evening sessions throughout the week, although not on Thursday night, which is the traditional Banquet night.

The dates?—the New York High Fidelity Music Show opens to the public at 3:30 p.m. on Wednesday, September 28. We have often been chided for announcing the opening for the day preceding the public presentation, since the first day is restricted to dealers and the press, although the show is usually announced as taking place from the Tuesday dealer day to the following Sunday. The location is still the New York Trade Show Building.

The AES Convention opens with the annual Business Meeting on Monday, October 10, and continues through the entire week at the Barbizon Plaza. And don't forget the *Plaza*—the Barbizon is strictly a girls' hotel.

DEFINITION OF HIGH FIDELITY

In a recent issue of the Langevin Engineering Letter—a most readable and enlightening publication of the Langevin company of Santa Ana, California, we encountered a new slant to the undefineable "high fidelity." We quote, "A friend who is not in the business asked the meaning of the term 'Hi-Fi' in the advertising of home-type sound reproduction equipment. We gave this some thought, and came to the conclusion that it means nothing.

"Back in the thirties and forties, the term "wide range" was used in connection with good audio systems. It denoted extended frequency bandwidth. At least that meant *something*. Now, 'high fidelity' *ought* to imply general incorporation of all the factors involved in the faithful reproduction of sound. But it doesn't. The hucksters have been at it.

". . . When it comes right down to definitions, any reproduced sound that is 'high fidelity' or 'Hi-Fi' should be indistinguishable from the original performance. Given this stipulation, we must admit that we have never heard 'Hi-Fi.' "

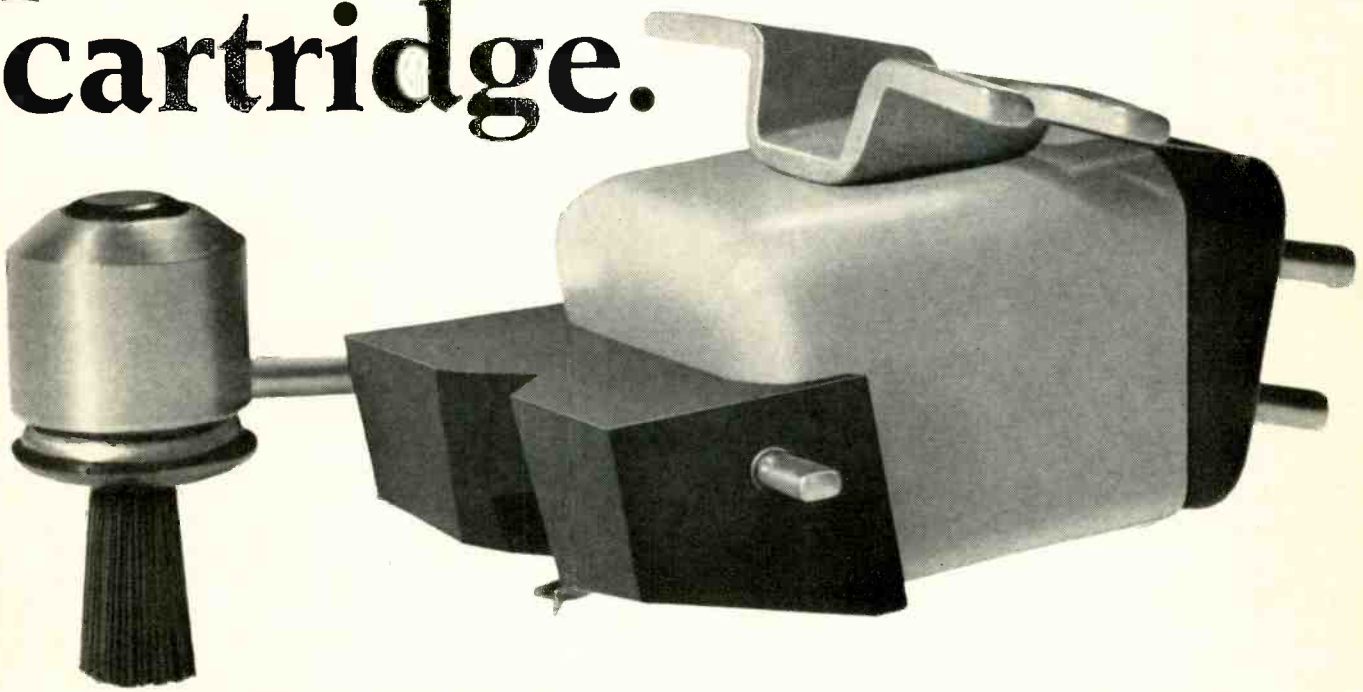
And all this from a manufacturer of professional equipment for recording studios, broadcast stations, and top-quality sound reinforcement systems. We must agree, of course, even in the face of some pretty fine systems now available.

Another bit of wisdom from the same Engineering Letter concerns "transistor sound." It continues, "It is claimed by some that solid-state power amplifiers inspire loudspeakers to produce cleaner and truer signals than did tube-type amplifiers. The common adjective is *crisper*, whatever that means. . . . Modern broadband loudspeakers demand to be driven from low-impedance sources with excellent transient-handling ability. Practically any transistor-type power amplifier has very low true output impedance. It is difficult to design one any other way. Good transient response is another matter entirely, but most transistor amplifiers perform fairly well in this regard providing they are not overdriven."

The letter continues to point out that one of their tube amplifiers is indistinguishable in sound from the equivalent solid-state unit on an A-B test *providing levels are the same.*

And in that last phrase lies an important answer.

The total performance cartridge.



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Compare these new Sherwood S-8800 features and specs! *ALL-SILICON* reliability. Noise-threshold-gated automatic FM Stereo/mono switching, FM stereo light, zero-center tuning meter, FM interchannel hush adjustment, Front-panel mono/stereo switch and stereo headphone jack, Rocker-action switches for tape monitor, noise filter, main and remote speakers disconnect. Music power 140 watts (4 ohms) @ 0.6% harm distortion. IM distortion 0.1% @ 10 watts or less. Power bandwidth 12-35,000 cps. Phono sens. 1.8 mv. Hum and noise (phono) —70 db. FM sens. (IHF) 1.6 μv for 30 db quieting. FM signal-to-noise: 70 db. Capture ratio: 2.2 db. Drift ±.01%. 42 Silicon transistors plus 14 Silicon diodes and rectifiers. Size: 16½ x 4½ x 14 in. deep.

Now, look at the *new* Sherwood specs!

Model	V-Vacuum Tube S-*ALL-SILICON* T-Germanium Transistor	Power (IHF) 2 channels 4 ohms Watts	FM Sensitivity Microvolts	Price	Dollars Per Watt
Sherwood S-8800	S	140	1.6	$ 359.50	$ 2.57
Altec 711A	S	100	2.2	378.00	3.78
Bogen RT8000	T	70	2.3	319.95	4.57
Dyna FM-3, PAS-3 & S-70	V	90	4.0	404.85	4.49
Fisher 700T	T	120	1.8	499.50	4.16
Fisher 440T	T	70	2.0	329.50	4.70
Harman-Kardon SR-900B	T	100	1.85	449.00	4.49
McIntosh 1500	V&T	85	2.5	499.00	5.87
Marantz 8B, 7T, & 10B	V&T	75*	2.0	1340.00	17.87
Scott 348	V&T	120	1.9	479.95	4.00
Scott 342	T	65	2.5	299.95	4.61

References "T" or "V&T" (above) may include some silicon transistors.
Figures above are manufacturers' published specifications except (*) which are published test findings.

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COVER STORY

Sound Activated Color Display

COLIN SHAKESPEARE*

Experimenters often find a need, or at least a desire for a "color organ" but do not know just how to start with the circuitry. Here is a simple one with which to start —and one which could make an interesting adjunct to a hi-fi system. Try it out!

THE UNIT DESCRIBED in this article operates from any Hi-Fi, record player, television receiver, or the like, and requires no additional power supplies or batteries other than the source that operates the lamps. By means of four frequency-selective filter networks, the intensity of four lamps can be made to change by the characteristics of music input.

Red, yellow, green, and blue lamps were selected. The filter circuits select the sound in frequency bands as shown in *Fig.* 1: Red—below 200 Hz; Yellow —200 to 400 Hz; Green—400 to 1000 Hz; Blue—1000 Hz and up. Such a division of the frequency spectrum may be questioned by some Hi-Fi enthusiasts; by trial and error, however, it has been determined that all the action for a display of this type is in the bands indicated.

The red light responds to such instruments as the double bass, bass guitar, and bass drum. Voice, depending on the vocalist, brings up either the yellow and green or green and blue. Saxophones light the green and blue, while instruments like cymbals or snare drums light the blue alone. Variations will occur: the trombone, for example, will often activate only the blue because of its high harmonic content.

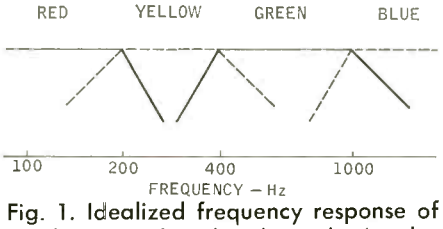

Fig. 1. Idealized frequency response of the filters employed in the author's color organ.

The Filter Networks

The red and blue filter networks are simple low-pass and high-pass filters respectively and are designed with a slope of 18 dB per octave beyond the cut-off or "corner" frequency. This is done with three simple RC stages. The two middle filters are band-pass types and are formed by a combination of high- and low-pass stages. To minimize the series loss through the filters, these filters have a slope of only 12 dB per octave—only two RC stages for each high- and low-pass section. By making the filters slightly narrower than the theoretical 200 to 400 and 400 to 1000 Hz, adequate selectivity is obtained.

Input impedance is approximately 25 ohms above 200 Hz so it performs satisfactorily when connected to the 15-ohm output of an amplifier if the isolating transformer employed has a 1 to 1 ratio. (*Figs.* 2 and 3.) The transformer used is required to isolate the audio amplifier from the 115-volt supply that activates the lamps. It is recommended that if the audio is not driving a loudspeaker, then a dummy load of 15 ohms (5 watts) be connected across the output of the amplifier.

Figure 2 shows the layout of the complete system, and gives in detail the component values of the power supply for the lamps and also the 12-volt power supply for the lamp-driver circuits.

Figure 3 shows the circuit for one of the colour channels and indicates the component values for the lamp-driver section. This circuit works as follows: The 1N34 diode acts as a detector and capacitor C_1 is charged to the peak voltage of the audio signal. The discharge time constant which governs the way the brightness of the lamp diminishes after the note has finished is controlled by C_1 and R_1. Potentiometer R_2 controls the brightness of the lamp and by having an adjustment in each of

*Electronics Div., Canadian Westinghouse Co. Ltd., P.O. Box 510, Hamilton, Ont.,

" . . . arrangements include edge-lighting frosted glass panels in a room divider to illuminating an entire ballroom in this fashion! "

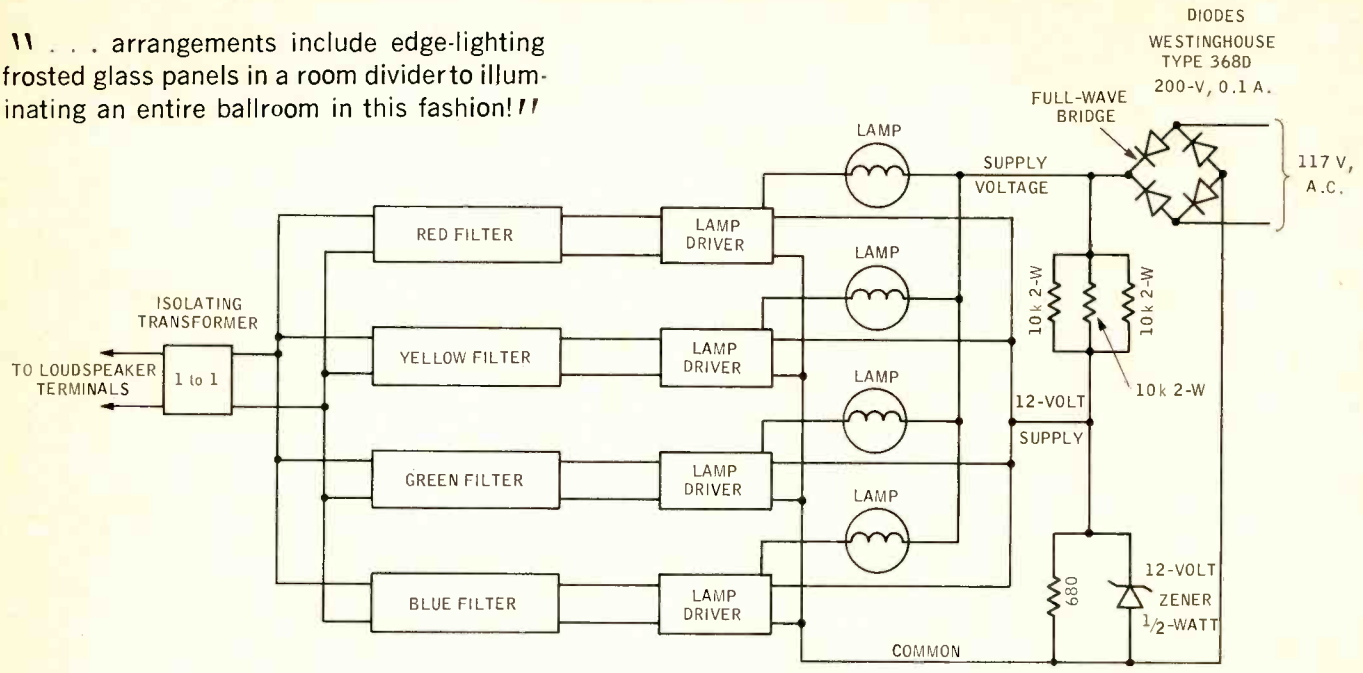

Fig. 2. Block diagram of the entire system, with circuit details for the power-supply section.

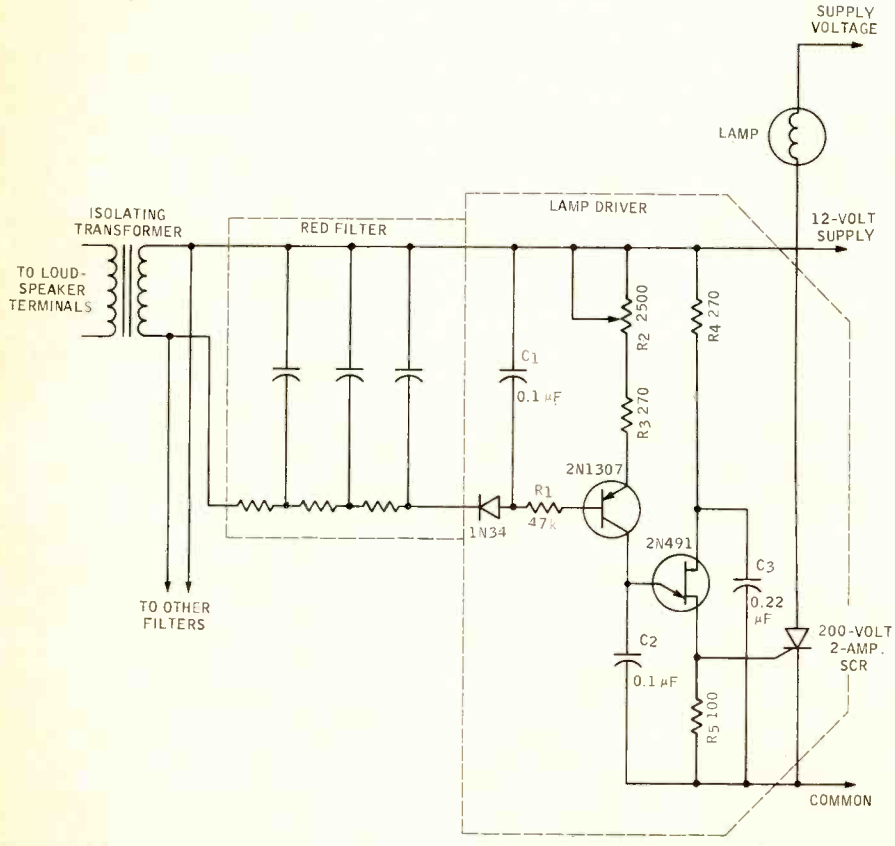

Fig. 3. Schematic for one of the four channels—in this case, the red, or low-frequency, one. Aside from the filter components, the circuits for all four channels are identical.

the four channels the system can be set for the best effect for any type of music.

The 2N1307 transistor is wired as an emitter follower and by varying its emitter resistor (R_2), the charging current to C_2 is varied. Since the 12-volt supply, which is unfiltered, falls to zero every half cycle of the 60-Hz voltage, capacitor C_2 starts at the beginning of every half cycle with zero volts across it. The time before the unijunction (2N491) is triggered will depend on the charging current supplied by the 2N1307, which is given by the combination of the setting of R_2 and the volume of the sound. The action of triggering the unijunction will fire the SCR which then conducts for the remainder of the half cycle. *Figure* 4 shows how, when the SCR is triggered early in the cycle, the lamp will be bright; if triggered late in the cycle, the lamp will be dim. Resistor R_4 and capacitor C_3 serve to isolate the unijunctions of the lamp drivers from each other. Without these major interaction occurs.

Filter Circuits

Details of the filter networks are shown separately in *Fig.* 5. The red filter configuration can be recognized as that of *Fig.* 3, with the values used shown in *Fig.* 5. For each of the four channels a different filter is required to select out just the band of frequencies for that channel In some cases it may be more practical to use electrolytic or polarized tantalum capacitors. If this is done, germanium diodes must be installed as shown in dotted lines and the capacitors connected with the polarity as shown. This will prevent the capacitors being subjected to a voltage reversal.

There are one or two minor changes which may be made to suit particular circumstances. The isolating transformer must have a 1 to 1 ratio and be of

Now instant movies in sound start at $695.

The new Sony Videocorder deck (model CV-2000D) is both compact and versatile. It's also quite reasonably priced, $695.

It's just like current Sony Videocorder models, but without the built-in TV monitor. Using a separate monitor or TV set, you can tape selected TV programs off-the-air. Add the optional Sony TV camera and you can tape "live" action in sight and sound. Play back your tape, and you'll see instant movies in sound.

This new deck is small enough to fit on a bookshelf, as a part of your hi-fi component system. Light enough (only 44 lbs.) to take wherever you want it to perform. Adaptable enough to use with any TV monitor, small or large screen (the new Sony 8*-inch and 22*-inch receiver/monitors are perfect mates). It can be adapted to work with most home TV sets. Handsome too, in walnut-finish cabinet.

Looking for a Videocorder with its own built-in monitor? Then meet the rest of the Sony Videocorder family. TCV-2010 complete in its own carrying case, $995. The TCV-2020, handsome oil-finish walnut cabinet and with built-in timer to automatically tape TV programs while you're away, $1150. For taping "live" action, there is the Video Camera Ensemble VCK-2000 (camera, elevator tripod microphone) at $350. For an unforgettable demonstration visit your Sony Videocorder dealer today. For free 16-page booklet write:

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*diagonal measurement. The Videocorder is not to be used to record copyrighted material. Sony and Videocorder are registered trademarks of the Sony Corp. All prices suggested list.

fairly low impedance—suitable for working at about 25 ohms. A more readily available type of transformer is an output transformer. A Hammond 125B universal output has been tried and found successful.[1] In this case the full primary winding of the transformer is connected in parallel with the primary winding of the existing output transformer of the audio amplifier, i.e., to the plate(s) of the output tube(s). If the amplifier is push-pull and has a balance adjustment for output tube currents, adjust the balance control to give zero volts drop, dc, across the output-transformer primary. With the selection of secondary voltages on such a transformer one can select the tap for best loudspeaker volume combined with best display operation. If no speaker is used, a dummy resistor across the normal speaker connections must be installed.[2]

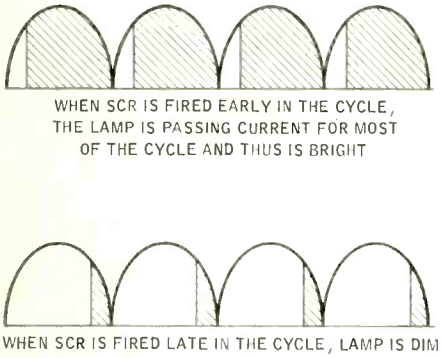


Fig. 4. Action of the SCR (silicon controlled rectifier) to vary the total amount of current flowing through its load.

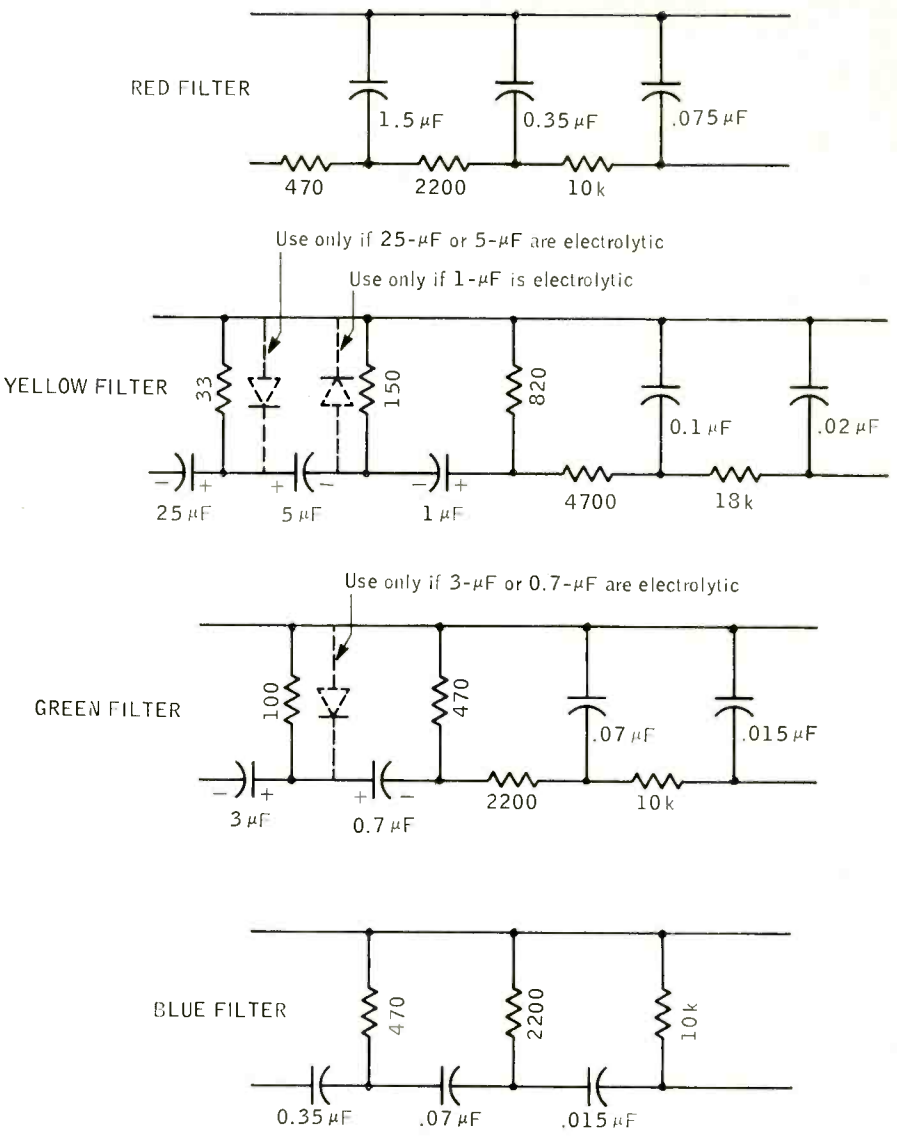


Fig. 5. Details of the four filters required for the color organ.

The full-wave rectifier bridge shown in *Fig.* 2 is not essential, but without it the lamps will not be quite as bright. If the bridge is not used, connect the 115 V. supply to the "supply voltage" and "common" lines.

It is possible that a low-voltage lamp display is preferred in which case a conventional automobile battery charger has been tried. The positive side is connected to the "supply voltage" and negative to the "common." Naturally, the full-wave rectifier bridge is omitted. The three 10-k resistors are replaced by a single 150-ohm ½-watt resistor and the 680-ohm resistor is omitted. Another advantage is that the isolating transformer may also be omitted, and connections made direct to the loudspeaker terminals.

A further modification is that the unijunction may be omitted together with R_4, R_5, and C_3. The junction of the 2N1307 and C_2 is connected to the gate of the SCR. This does not give such good triggering of the SCR, but provided the SCR is not passing its maximum rated current (derate by 25 per cent), satisfactory operation will be obtained.

The arrangement of the lamp display lends itself to endless experiment. Miniature displays using Christmas tree lamps have been tried as well as floodlighting a wall with coloured floodlamps. Generally speaking, the most pleasing effects have been obtained where the light from the lamps is diffused in such a way as to cause the colours to merge. Other arrangements include edge-lighting frosted glass panels in a room divider to illuminating an entire ballroom in this fashion! *Æ*

COMING NEXT MONTH:
The 1966 New York High Fidelity Music Show

[1] This transformer probably will not be readily available in the U.S. A suggested replacement for tube-type amplifier applications is a Knight 62Z022, which is also a universal output transformer. With a 1:1 transformer, it will be observed that the amplifier is almost completely loaded by the 25-ohm input of the filter system, leaving little power available for the loudspeakers. Hence a transformer of fairly high power capacity is suggested. Ed.

[2] For use with transistor amplifiers, the input isolation transformer might well be a 25-volt line-to-voice coil type, such as Chicago Stancor A-8097, or a Knight 64Z147. Ed.

The FM-Stereo Antenna Primer

WALTER G. WOHLEKING

In four parts—Part 3

Now that you know you need a good antenna system if you must have reliable, noise-free stereo reception, you are faced with the problem of selecting the best one for your particular requirements and location. In this installment the author tells you which type you will find best.

WE HAVE NOW COVERED the basic antenna patterns and have had a taste of actual performance data. Which antenna is the right one? Other treatments of this subject usually answer that question in the following manner:

1. "If all stations are located in one place, use an antenna with a unidirectional pattern. If the stations are far away, use a high-gain unidirectional antenna. This will be tougher to align because of its narrow beamwidth, but the added gain is necessary because of the great transmitter-to-receiver distance."
2. "If broadcasts originate from two directly opposite locations use a bidirectional antenna."
3. "And if stations are located in number of directions use an omnidirectional antenna."

This is fine, but it both over-complicates and over-simplifies things at the same time. For all but a very few of the FM-Stereo receiver installations anywhere, the antenna that should be used is *the antenna that provides the highest gain and highest front-to-back ratio* available and falls within whatever mechanical or budgetary constraints that might exist on roof or in pocket, respectively. Read this, remember this, and revere this. It is FM antennas in a nutshell. If a choice must be made between two antennas, one with higher gain and a lower front-to-back ratio and the other with lower gain and higher front-to-back ratio, (unless multipath is a very serious problem), choose the one with greater gain, for stereo reception is very unsympathetic to low received-signal levels.

Before discussing the reason for an equivocal stand on high-gain, highly directional antennas, let's deal with the disadvantages.

1. If we're faced with reception of a number of stereo stations all from different directions, it's evident that a high-gain, narrow-beamwidth antenna will have to compromise reception of the stations away from the direction in which its pointed. When this situation is encountered, its time to start looking at a rotator or else aim the antenna at preferred stations and accept what you can get on other stations. The alternative is to install an omnidirectional antenna and most probably suffer, because of the higher signal levels required for stereo reception, compromised stereo reception on *all* stations.

   An antenna with an omnidirectional pattern is also susceptible to multipath reception, a highly undesirable feature of any antenna system. Clearly the best solution is the use of a rotator.
2. In certain urban areas the use of a high-gain antenna in close proximity to the transmitting antenna might produce signal levels high enough to overload the front end of a receiver, causing—among other things—cross-modulation distortion. High signal level can be minimized with the use of an attenuator (available commercially from most electronic parts suppliers). The use of a low-gain omnidirectional antenna might serve to temper the overload situation but once again the multipath spectre raises its head but even higher than before, because the many high structures present in cities provide numerous surfaces for reflection and attendant multipath.

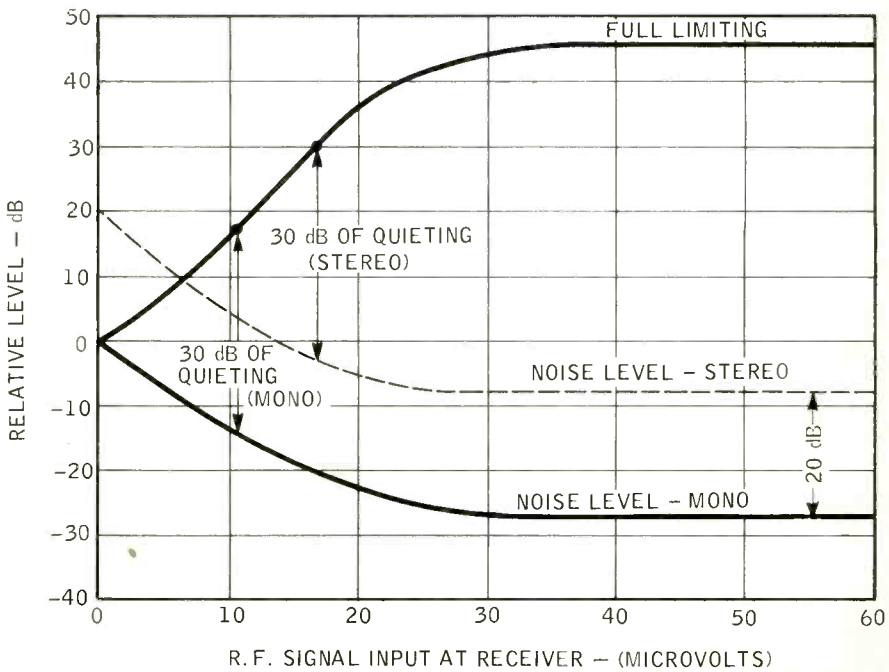


Fig. 17. Limiting and quieting conditions for a hypothetical FM tuner.

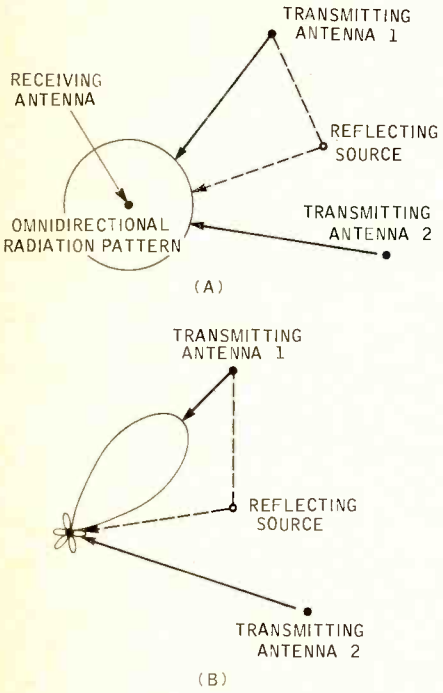


Fig. 18. (A) Receiving antenna with omnidirectional pattern provides no discrimination to reflections nor to adjacent- or co-channel transmitters. All signals are received at the same relative gain. (B) High-gain directional antenna can be aligned toward desired station, providing discrimination against unwanted signals.

These two problems (other than physical ones, such as size, weight, and so on,) are the only ones that are faced when a gauge is to be used for stereo reception. The first of the two is by far the more formidable and the requirements of stereo reception on the antenna-system gain are going to make rotators the rule rather than the exception in these cases.

With the disadvantages hopefully out of the way let's take a look at why the high-gain antenna is the only antenna for multiplex reception.

First there is gain. It is hard to emphasize how important to satisfactory stereo reception is a high signal level at the tuner imput. To get a better idea however, refer to *Fig.* 17, which represents some characteristics of what might be termed a typical, albeit a hypothetical FM tuner.

The top curve illustrates the limiting characteristics of the tuner. It is a plot of audio output as a function of r.f. signal level at the tuner input. The lower curves give the background noise level for the same r.f. signal level at the input for stereo and mono signals. The signal-to-noise ratio of an FM-Stereo signal is a little more than 20 dB worse than an equivalent monophonic signal, because the transmitted 38-KHz amplitude-modulated, suppressed subcarrier is 1/100 the power of the main or sum channel.

The difference between the upper and lower curves is a measure of the quieting of the tuner. 30 dB is the currently accepted satisfactory quieting figure for tuners and for our typical FM tuner; this quieting level is reached on a monophonic broadcast with about 10 microvolts at the tuner input. But this signal level only produces 10 dB of quieting for a stereo broadcast, and an additional 8 microvolts of signal is necessary to reach the 30 dB quieting point for stereo reception.

Obviously once a receiver reaches the point of full limiting, further antenna gain will be of no use and the determining factor for noise level is the signal-to-noise ratio of the tuner. Up to the point of limiting, it should be evident why as much gain as possible from the antenna is desirable. In addition, a couple of important receiver characteristics should also be evident. Particularly for stereo (but also good for mono) reception, a high signal-to-noise ratio and a steep limiting characteristic are desirable features in any tuner you might decide to buy.

Multipath

The second reason for using a high-gain antenna is connected with the shape of the beam. Remember, as gain is increased the antenna radiation-pattern beamwidth decreases and the antenna thus becomes more discriminatory. This particular facet improves the antenna's rejection of reflected signals, thus minimizing the possibilities of multipath distortion. Everyone talks, rather blithely on occasion, about multipath distortion, but few actually know exactly how it works to make stereo not work. Let's take a little space to investigate this problem so that we may better understand the importance of it and the way to minimize it.

We've all been witness to "ghosts" in a television picture. This phenomenon is the result of the appearance of the receiving antenna of the broadcast signal direct from the transmitting antenna and the same signal reflected from some object in the vicinity of the receiver. The direct signal is responsible for the desired picture on the TV screen. The reflected signal, which carries the same information as the direct signal, "paints" the same picture but a slight distance to the right because the path length of the signal is longer. It must travel further before reaching the antenna, and it therefore is delayed somewhat, due to this path-length difference between direct and reflected waves. Because it travels a greater distance and is often reflected inefficiently, the signal strength of the reflected wave is below that of the direct and the "ghost" is of lower intensity on the screen than is the primary picture.

In television when multipath is encountered it can be seen. No such nice visual aid exists with FM, with the exception of multipath indicators available on certain tuners. FM signals behave the same as do TV, falling as they do between the high and low VHF bands.

If no "ghosts," as such, exist in FM reception, then what does multipath do to the signal and the information it carries? Well, if the delayed demodulated information resulting from the reflection is added to the direct demodulated signal, an apparent phase difference results between the signal received at the tuner and that transmitted from the station. The effect is similar to the result obtained when two sine waves of the same frequency but different phase are added. The result is a wave of that frequency with its phase somewhere between the two, depending on amplitude and phase difference between the two original waves.

To reproduce accurately the stereo separation as transmitted, it is important to retain the phase relationships of the signals originating at the broadcast station. If, for example, the phase of the

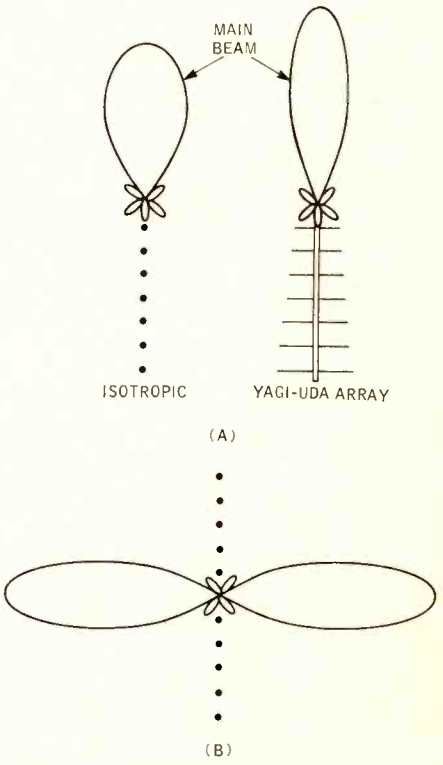


Fig. 19. (A) Endfire array of isotropic elements, and a practical Yagi equivalent, with representative patterns of each. (B) Broadside array of isotropic elements, and representative pattern.

audio relative to the subcarrier envelope should shift by 20 deg., the maximum separation that would be achievable with even the best tuner would be 16 dB. Add to this, phase shifts within the tuner itself, and you rapidly approach a severely degraded stereo signal, with regard to separation. In all fairness it is only proper to add that 20 deg. of audio phase shift relative to carrier is an extreme example. However, much less phase shift and separation loss is quite evident, particularly when the multipath varies as it often does and causes the separation to vary cyclically in intensity. It is a very annoying phenomenon[2].

The narrow beamwidth of the antenna also does much to eliminate interference from adjacent-channel and co-channel signals in areas of high FM station densities. On the north shore of Long Island, for example, listeners have a choice of thirty to forty stations from New Jersey, Connecticut, and metropolitan New York, as well as from Long Island itself. While this is a blessing because of the programming variety it brings, the close proximity in frequency of many stations plays havoc occasionally with satisfactory listening.

The degree to which a tuner can discriminate between two signals appearing at its input is denoted by its capture ratio. If the capture ratio of a tuner is 6 dB, two signals appearing at the input of the tuner will have to be 6 dB or more apart if the tuner is to reject completely the weaker of the two. Now if an omnidirectional antenna were used which employed no directional discrimination to incoming r.f. energy, any two stations on the same frequency (or close in frequency) whose signal strengths were within 6 dB of each other, would interfere and both stations would be heard.

Because of FCC regulations regarding frequency spacing and geographical location of stations in the same area, the interfering station will probably be arriving from a different direction than the station of interest. In this event a narrow-beam antenna aimed at the desired station will reject the interfering station depending on the pattern gain of the antenna in the direction of the interfering station. Thus the capture ratio of the receiver is apparently lowered, improving reception, because the objectionable station has been discriminated against effectively as shown in *Fig.* 18 by the selectivity of the high-gain antenna.

There are really very few instances when other than a high-gain unidirectional antenna is called for. If stations

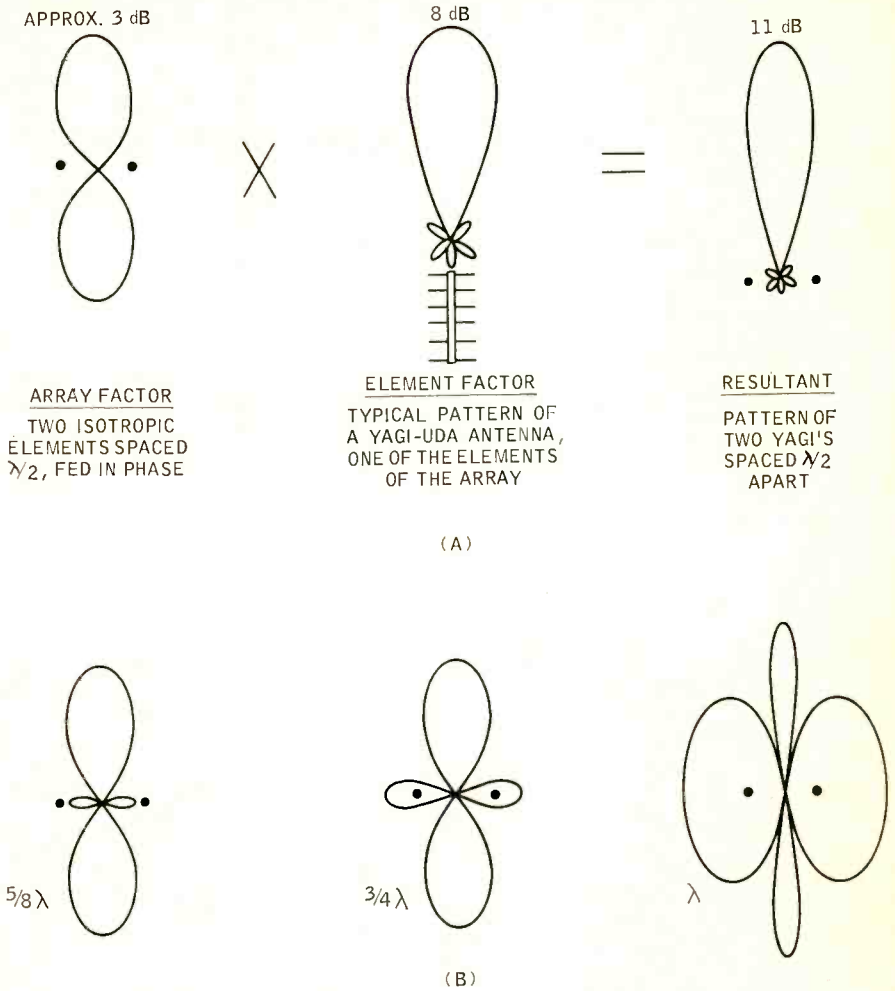


Fig. 20. (A) Combination of array factor and element factor add together to show pattern multiplication. (B) Typical array factors for various element spacings.

in a particular area are in opposite directions from one another, then there might be some justification in considering a bidirectional antenna. For stereo listening, however, few votes can be cast for the omni antenna, which, because of its low gain and lack of directivity, has characteristics in direct opposition to those required for optimum reception of multiplex broadcasts.

Arrays

Another question now presents itself. Suppose, after installing the highest gain antenna available on a rotational device and connecting this antenna with an optimum transmission line system (which will be discussed shortly) we haven't enough signal available at the receiver input to provide an adequate signal-to-noise ratio on stereo broadcasts. Assuming we don't wish to design an antenna of higher gain but intend to make use of commercially available equipment, is there a way to deliver even more signal to the receiver?

The answer, of course, is "yes." By utilizing another antenna in conjunction with the one already atop the domicile, an increase of 3 dB in delivered signal can be realized. A first look at "stacking," as this procedure is called, might seem to indicate the reason for this signal gain. If one antenna will do the job, then two ought to do it twice as well. While there is no denying that a 3-dB increase indicates the stacked combination is delivering twice the signal power of the single antenna, it is an oversimplification to say this is merely due to the addition of the other antenna. Addition of this antenna, it turns out, might well have caused a reduction of available signal. There are certain space and phase relationships which must be maintained if we are to stack antennas properly for increased gain.

First off, any grouping of individual antennas which are electrically connected or interrelated is termed an array. Stacking two or more antennas forms an array. In most cases the antennas that are being stacked are themselves arrays. The Yagi antenna, for example, consists of a driven element, to which we connect a transmission line, and a number of parasitic elements, the currents on which are derived from that on the driven element. Each parasitic element induces currents on an adjacent element

[2]Leonard Feldman, *"FM Multiplexing for Stereo."* Indianapolis: Howard W. Sams and Co., 1962.

and so on. Because the main beam of the Yagi is directed along the line on which the elements are positioned and emanates apparently from the last element in the line, the Yagi-Uda array and any other grouping of elements which has a similar beam-directional relationship is termed an "end-fire" array. Log periodic dipole arrays (lpda's) are also end-fire in nature, having a number of driven elements and, on occasion, directors.

If the main beam were directed perpendicular to the element lineup, the resultant group of elements would be termed a broadside array. *Figure* 19 illustrates the two array types with dots representing the radiating elements. The way the endfire or broadside condition is obtained is by phasing the voltage at each element of the array in a certain way. The patterns shown in *Fig.* 19, are for isotropic, or point-source antennas as the elements of the array. What this tells us is that completely omnidirectional antennas when combined in an array yield patterns with directivity depending upon the phase relationship with which they are combined.

How does this relate to directional antennas combined in an array? Very simply. The pattern formed by the combination of omnidirectional antennas is termed an "array factor." If this is multiplied by the pattern of one of the antennas actually used in the array (presuming every antenna in the array has the same pattern) the result will be the radiation pattern of the array. What is formed when we stack two high-gain antennas is a "broadside array of end-fire elements." We'll now pause a bit while that mouthful is digested. The Yagis or lpda's are elements of the broadside array. As has been said previously, the Yagi or lpda is itself an array of end-fire elements. Hence the nomenclature, broadside array of end-fire elements. Array and element factors enable us to determine easily the best spacing and phasing for arrays. *Figure* 20 illustrates this "pattern multiplication" principle.

Now this is all well and good when the array factors for various spacings and the element factor for the antennas to be stacked are available. What we're usually required to contend with however, is at best, beamwidth and gain. Another look at various array factors indicates that a bidirectional pattern results from an array spaced $\lambda/2$ or less. At spacings greater than this, significant minor lobes begin to appear in the array pattern. These are undesirable because they represent energy taken from the main lobes of the array factor. As a result, the point of decreasing return is reached at $\lambda/2$ spacings.

Secondly, simple mathematics gives the dimensions of a $\lambda/2$ stacked array at 100 MHz as 150 cm which is 59 inches or about 5 feet. Arrays any larger than these become physically unwieldy and are difficult to support, particularly when mounted on a rotator. We may, therefore, limit consideration of stacked arrays to those of $\lambda/2$ spacings with each element of the stacked array fed in phase.

Under these ground rules the beamwidth of a two-element array will be one-half that of one element in the plane in which the antennas are stacked, and the gain will be 3 dB greater than a single element. All we need know about one of the antennas that makes up the array are its beamwidth and gain.

As an example, consider a Yagi antenna with a gain of 8 dB and a beamwidth in the azimuth plane of 60 deg. and the elevation plane of 100 deg. If two such antennas are stacked, one above the other $\lambda/2$ apart, the array gain will be 11 dB, the azimuth beamwidth will be unchanged at 60 deg., but the elevation beamwidth will become 50 deg. If the antennas are arrayed horizontally, gain will be 11 dB, elevation beamwidth will remain unaffected at 100 deg. and azimuth beamwidth becomes 30 deg.

One word about impedances when antennas are stacked. If two antennas each having an impedance of 300 ohms are stacked or arrayed ,the combination presents a parallel impedance of 150 ohms when connected. Obviously, if a good match is to be maintained between the transmission line and the array, transformers must be used to change each antenna impedance from 300 ohms to 600 ohms so that the parallel combination now becomes 300 ohms and the array and line are matched as shown in *Fig.* 21.

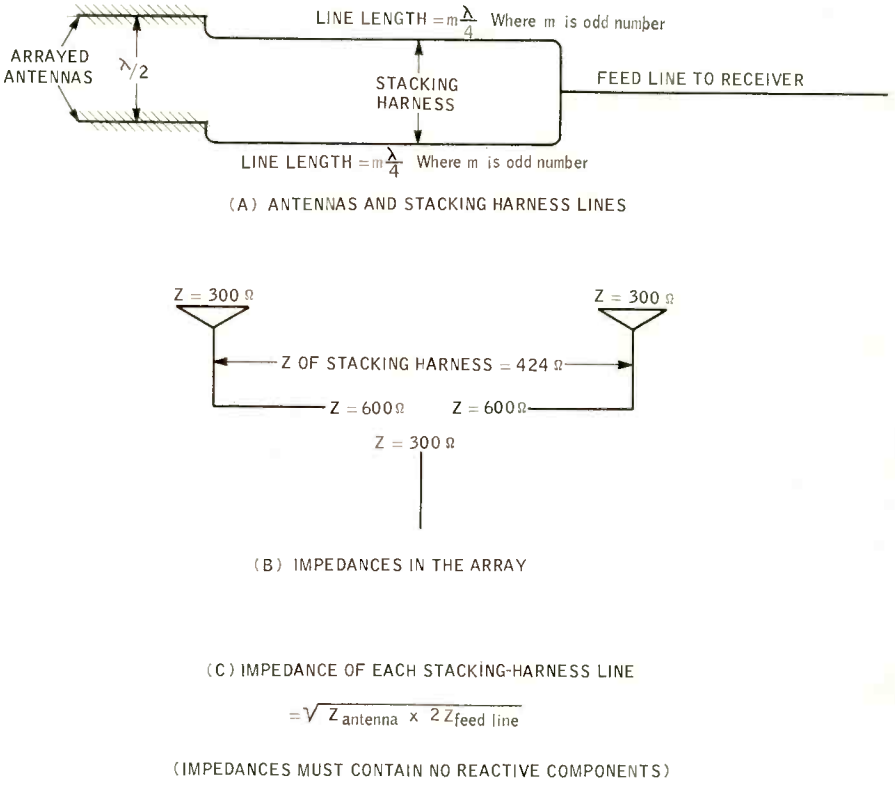


Fig. 21. Diagrams showing stacked-array relationships, together with the formula for determining the required impedance of the stacking-harness line.

The transformers used for this purpose are odd multiples of $\lambda/4$ lengths of transmission line of an impedance value between 300 and 600 ohms. The impedance value of the $\lambda/4$ line necessary to transform from one impedance, R_1, to another, R_2, is defined by the following equation:

$$Z = \sqrt{R_1 R_2}$$

(*Continued on page* 63)

Audio Measurements Course

Norman H. Crowhurst

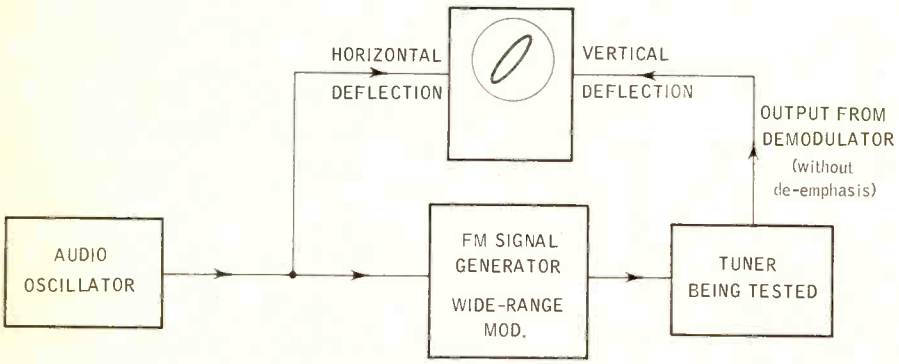


Fig. 8-1. The set-up for measuring response (particular phase) of a tuner intended for multiplex reception.

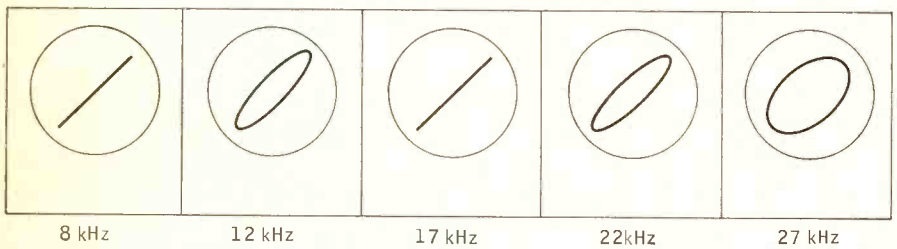


Fig. 8-2. Traces observed at the frequencies stated, in a tuner that has erratic phase response.

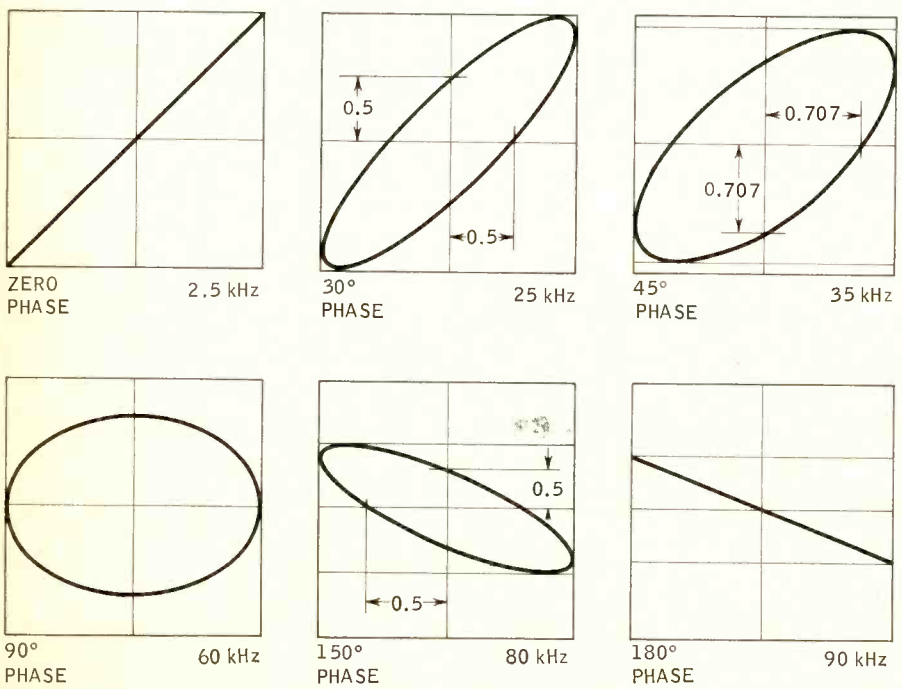


Fig. 8-3. Traces observed, representing specific phase shifts, identified under each, by the dimensions shown. The frequencies shown represent a sample measurement of this type.

STEREO MULTIPLEX TUNERS have five basic parts: the tuner, the demodulator or detector, the multiplex decoder, and two audio sections; the regular tuner has only the radio tuner, demodulator, and one audio section. The multiplex receiver includes a decoder between the tuner section (including demodulator) and the two audio sections, one for each channel, left and right.

Some multiplex receivers may also include provision for rejecting a third signal in the multiplex group (SCA) used for special (private) broadcast applications, such as store and business background music programs.

The Tuner

Where the regular, pre-multiplex tuner had to demodulate audio from a low frequency up to 15 or 20 kHz, the multiplex tuner and demodulator must handle "audio" frequencies up to about 75 kHz. And where phase shift in the older tuner's audio output was of little importance, that in the multiplex variety may prove quite disastrous.

So one form of test, to resolve the

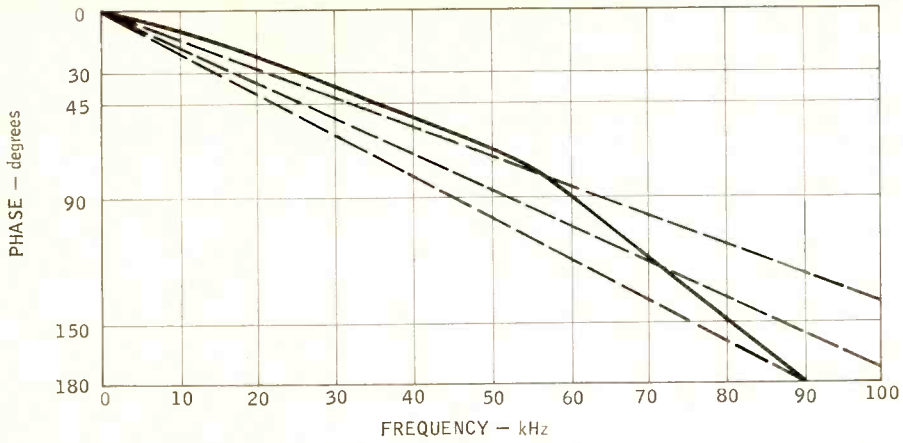


Fig. 8-4. Phase response. The solid line represents the response derived from the readings in Fig. 8-3. The dashed lines are various lineal phase (constant time delay) responses that are the theoretical ideal.

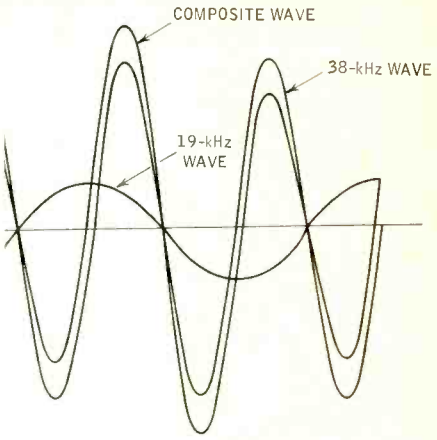


Fig. 8-5. Relationship between pilot and subcarrier phase, according to the FCC standard for stereo multiplex transmission.

problem of analyzing performance into sections, is to check the response of the tuner as far as its regular demodulator —the one that retrieves audio complete with multiplex attached. This test will follow the method adopted for taking the response of an ordinary tuner, except that performance out to 75 or 100 kHz will be checked, and phase as well as amplitude should be included.

Phase response can be checked by viewing output against input on a 'scope (Fig. 8-1). Zero phase shift results in a straight line (or a bent one, if there is distortion without phase shift), while phase shift opens the trace out to form a loop. A 90-deg. shift opens the trace out to a circle, or an ellipse with its axes vertical and horizontal.

A 30-deg. phase shift makes the ellipse cross the vertical and horizontal axes at half the maximum amplitudes in those directions, when the trace is centered correctly on the screen, and the ellipse is not distorted. A 45-deg. phase shift makes these intercepts at 0.7 of maximum amplitude.

If the angle goes over 90 deg., the ellipse slopes the opposite way from that when it begins to depart from the zero-shift straight line, and when the shift is 180 deg., the trace closes to a line again, sloping in the opposite direction from the original line. These phase values are enough to give a good indication as to where the phase-shift angles lie.

Phase shift cannot be avoided. Complete absence of phase shift would indicate zero time delay, which is impossible to achieve. So the important thing about phase shift is that it should represent, as closely as possible, constant time delay. This condition is called linear phase response.

Suppose, for example, that the shift is 30 deg. at 20 kHz. For constant time delay, or linear phase response, it should be 45 deg. at 30 kHz, 60 deg. (which is difficult to read on the 'scope with any accuracy) at 40 kHz, 90 deg.

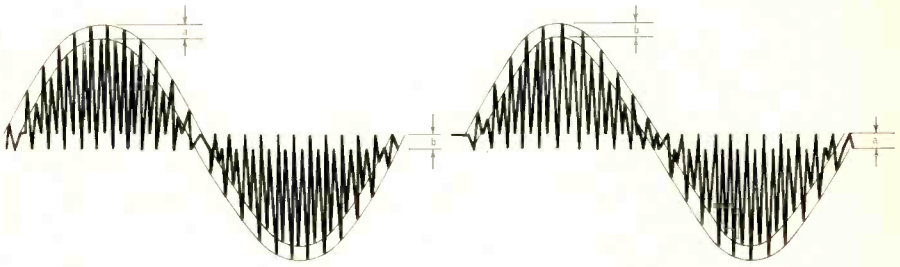


Fig. 8-6. Waveforms of composite stereo multiplex signal for left only and right only, complete with correctly phased pilot. Correct phasing is indicated in each case by dimension 'a' being equal to dimension 'b'.

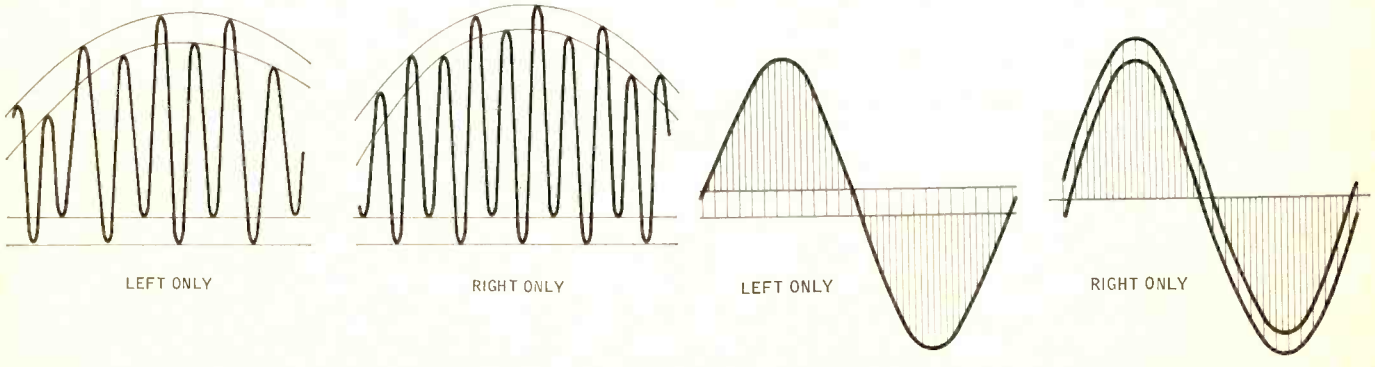


Fig. 8-7 (left). An enlarged segment of the traces at Fig. 8-6, to show the difference in peak sequences for left-only and right-only signals. Fig. 8-8 (right). If the pilot is shifted precisely 45 deg. from the FCC standard phasing, these signals result, which are characteristically different and easier to check for phasing.

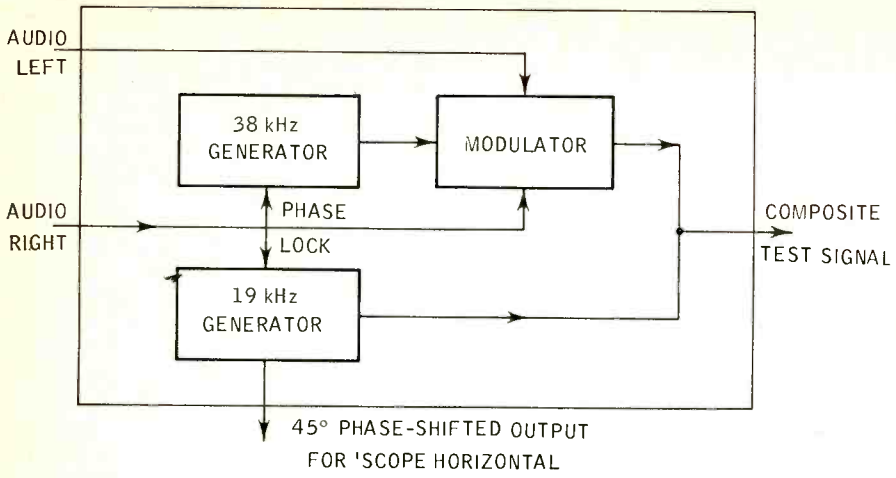


Fig. 8-9. Provision made on good multiplex generators, to help with phasing checks.

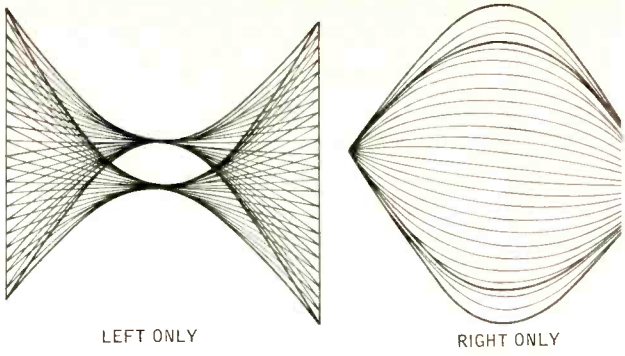


Fig. 8-10. Traces for correctly phased signals, using the generator provision of Fig. 8-9.

at 60 kHz, 135 deg. at 90 kHz (an ellipse like the one for 45 deg., but sloping the opposite way), 150 deg. (like the 30-deg. ellipse, opposite slope) at 100 kHz.

As a final check, which may not mean much, because the roll-off may become rapid here, the shift would be 180 deg. (closing the loop to a line) at 120 kHz.

The easiest way to check phase shift is to run up the frequency scale with the audio generator. If the loop opens and closes at successive frequencies, phase shift could be an invalidating factor (Fig. 8-2). But if it is progressively in the same direction, note the frequencies at which known phase-angle shifts occur (Fig. 8-3). This can then be plotted on linear paper to see how linear the phase characteristic is (Fig. 8-4) up to the limit (usually 75 kHz) needed.

If the phase shift is reasonably linear up to 75 kHz, as far as can be judged, the performance should be good enough for good multiplex reception.

Multiplex Signal

When the tuner has been checked thus far, tests can be conducted with a multiplex generator, to see how it performs with an actual multiplex signal. For this purpose the generator provides an input, either with left or right only, or with different signals on each. To understand just what we are measuring, we need to look at the time relationships of the multiplex components, according to FCC specification.

The 19-kHz pilot frequency is phased to the subcarrier, or switching frequency, so its peaks are at 45 deg. to the 38-kHz wave peaks. (Fig. 8-5) With this phase relationship, a signal with left only looks very much like that for right only (Fig. 8-6).

Only by picking, very carefully, an audio frequency that is an exact submultiple of the 19-kHz pilot, so the trace stands still, can the peaks be closely examined for sequence (enlarged at Fig. 8-1) to see whether left and right are correctly identified. This is very difficult to hold and there is no way to 'sync' it without invalidating the test. Even if you hold it, the precise phase relationship is not easy to check, because it depends on the spacings in different parts of the audio waves being equal (Fig. 8-6).

Phase-shifting the pilot from the standard by 45 deg. will make the patterns readily identifiable and also make the precise phase angle easier to check (by the smoothness of the smooth edge) (Fig. 8-8). But this is not a practical test, because the tuner is operating on a non-standard signal, which may make it perform differently.

An acceptable alternative is for the generator to provide an accurately phase-shifted 19-kHz reference output to apply separately to the 'scope horizontal, spaced 45 deg. from that injected into the composite signal, which is phase locked to conform with the FCC standard (Fig. 8-9).

Now the correctly phased traces look like those shown at Fig. 8-10. Or by removing the 19-kHz signal from the composite input, the same traces look as at Fig. 8-11, which also shows incorrect phasing on both.

Removing the 19-kHz pilot signal may be a help in identifying correct phase response of the rest of the signal, when such direct connection from the generator to the 'scope is available as reference. Whether the presence of the pilot changes the phase should still be checked. Reception of a transmitted signal must have the 19kHz signal to establish phasing and to reconstitute the 38-kHz subcarrier in correct phase, which we have not reached in testing yet. But this is a good check on the

(*Continued on page* 58)

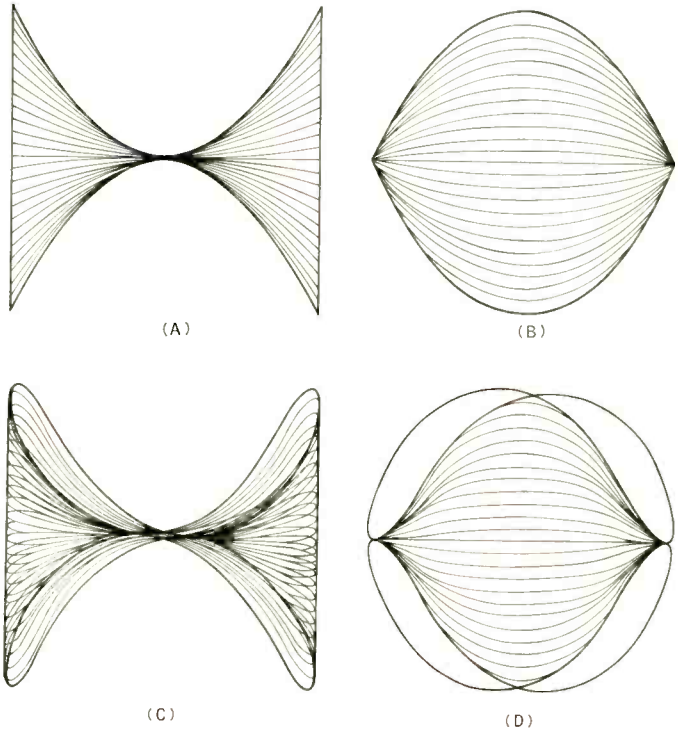


Fig. 8-11. Traces obtained in the same way as for Fig. 8-10, but when the pilot signal is removed from the composite. (A) and (B) show correctly phased left-only and right-only signals, respectively, while (C) and (D) show the effect of incorrect phasing of pilot and subcarrier.

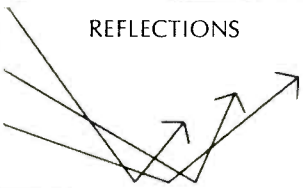
not all cardioid microphones are alike . . .

the

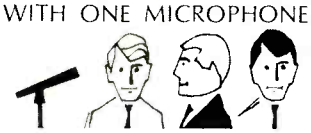
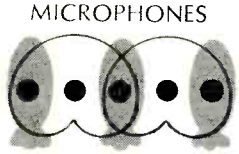
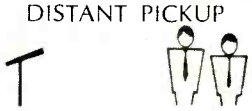
SHURE UNIDYNE® III

TRUE CARDIOID UNIDIRECTIONAL DYNAMIC MICROPHONE SOLVES ALL THESE COMMON MICROPHONE PROBLEMS!

PROBLEMS CAUSED BY INEFFICIENT REJECTION OF UNWANTED SOUNDS BY THE MICROPHONE

SITUATION	PROBLEM	CAUSES	SOLUTION
REFLECTIONS 	Feedback occurs where a so-called "cardioid" microphone is used and the speakers are placed to the rear of the microphone. A common occurrence in churches, auditoriums, and meeting rooms.	Sound bounces off hard surfaces on the walls, floor and ceiling, in and around the audience area and the microphone used is not effective in rejecting these sounds at all frequencies, and in all planes about its axis.	The Unidyne III rejects sound at the rear with uniformity at all frequencies. Sounds bouncing off floor or other surfaces are uniformly rejected.
COLUMN LOUDSPEAKERS 	Unexplained feedback. Column loudspeakers are used to distribute sound more evenly to the audience in churches and auditoriums.	Feedback occurs when rear and side sound lobes of column speakers coincide with rear and side lobes of so-called "cardioid" microphones.	The Unidyne III solves this problem because it has no rear or side lobes. Thus it rejects the side and rear lobes of the sound column speakers.
REVERBERANT BOOM!	A disturbing, echoing effect of low frequency sound often found in churches, large auditoriums, and arenas.	Low frequency reverberation and boominess occuring when microphone fails to retain unidirectional characteristics at low frequencies.	The Unidyne III maintains a uniform pattern of sound rejection at all frequencies, even as low as 70 cps. The response has a controlled roll-off of the low end—low frequency reverberation diminishes effect of boomy hall.

PROBLEMS CAUSED BY THE MICROPHONE'S INEFFECTIVENESS IN PICKING UP THE DESIRED SOUND

GROUP COVERAGE WITH ONE MICROPHONE 	A single microphone does not provide uniform coverage of a group. This is commonly experienced with choral groups, quartettes, instrumental combos, and speaker panels.	The particular "cardioid" microphone used lacks a uniform pickup pattern, so that persons in different positions within the general pickup area of the microphone are heard with varying tonal quality and volume.	The Unidyne III affords uniform pickup of the group with a resulting consistency in volume and sound quality among the members of the group.
USING MULTIPLE MICROPHONES 	Variation in the pickup level and tonal quality exists throughout the broad area to be covered. This may occur in stage pickup of musical and dramatic productions, panels and audience participation events.	The pickup pattern of the microphones used is too narrow, causing "holes" and "hot spots." The off-axis frequency response of the microphones also varies.	The Unidyne III permits smoothness in pickup as true cardioid pattern gives broad coverage with uniformity throughout coverage area. Eliminates "holes," "hot spots," and variations in sound quality, simplifies blending many microphones.
DISTANT PICKUP 	Too much background noise or feedback results when working with microphone at desired distance from sound source.	Long-range microphones are less directional with lower frequencies. Lobes or hot spots allow background noise or feedback.	Use the Unidyne III to gain relatively long range with effective rejection of sound at all frequencies at the rear of the microphone.

SHURE BROTHERS, INC., 222 HARTREY AVE., EVANSTON, ILL. 60204

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31st Convention

Audio Engineering Society

Following is a complete list of papers to be presented at the thirteen technical sessions.

9:00 A.M. Monday, Oct. 10, 1966
ANNUAL BUSINESS MEETING

9:30 A.M.
MICROPHONES AND EARPHONES
Chairman: Theodore Lindenberg, The Astatic Corp., Conneaut, O.

AN EARPHONE FOR AUDIOMETRY
Richard R. Howard, Instrument Systems Corporation, Telephonics Division, Huntington, New York

A PRACTICAL EAR ENCLOSURE WITH SELECTIVELY COUPLED VOLUMES
Alfred L. DiMattia, CBS Laboratories, Stamford, Connecticut

ELECTRO-THERMAL RESPONSE OF LEAD-ZIRCONATE-TITANATE
George C. Maling, Jr. and Uno Ingard, Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, Massachusetts

SEMICONDUCTOR MICROPHONE
M. E. Sikorski and C. K. Kuo, Engineering Experiment Station, Georgia Institute of Technology, Atlanta, Georgia

AN INTERFEROMETER MICROPHONE
Niels O. Young, Block Associates, Inc., Cambridge, Massachusetts

DIRECTIONAL MICROPHONES
Harry F. Olson, RCA Laboratories, Princeton, New Jersey

MINIATURE CONDENSER MICROPHONE FOR TRANSIENT MEASUREMENTS
Bob R. Beavers, LTV Research Center, Anaheim, California

A TWO-WIRE, LOW NOISE, CONDENSER MICROPHONE PREAMPLIFIER
Mead C. Killion, Industrial Research Products, Inc., Elk Grove Village, Illinois

1:30 P.M. Monday, Oct. 10, 1966
LOUDSPEAKERS
Chairman: Saul J. White, Dyna-Empire, Garden City, N.Y.

HIGH-FIDELITY LOUDSPEAKERS FOR UNDERWATER USE
Claude C. Sims, U.S. Navy Underwater Sound Reference Laboratory, Orlando, Florida

A HIGH-FIDELITY EFFICIENCY TRANSDUCER FOR USE AT HIGH PRESSURES
Frank Eisenhauer, Dyna-Empire, Inc., Garden City, New York

BLAST-PROOF SPEAKER-EVALUATION TECHNIQUES
Abraham B. Cohen, University Sound, Oklahoma City, Oklahoma

A MOBILE TWO-FREQUENCY ACOUSTIC SOURCE FOR UNDERWATER STUDIES AT GREAT DEPTH
R. J. Bulmer, O. P. Dickson, L. C. Maples, and R. H. Smith, U.S. Navy Underwater Sound Laboratory, Fort Trumbull, New London, Connecticut

A STUDIO MONITOR LOUDSPEAKER SYSTEM
Edward M. Long, CTS of Paducah, Inc., Paducah, Kentucky

5-IN. HIGH EFFICIENCY WIDE-RANGE LOUDSPEAKERS FOR SMALL ENCLOSURES
Edmond A. May, James B. Lansing Sound, Inc., Los Angeles, California

A NEW SUSPENSION SYSTEM FOR LARGE AMPLITUDE LOUDSPEAKERS
Saul J. White, Empire Scientific Co., Garden City, New York

THE USE OF THE COMPLEX-PLANE IMPEDANCE AND ADMITTANCE LOCUS IN ANALYZING ELECTRO-ACOUSTICAL TRANSDUCERS
Abraham I. Dranetz, Dranetz Engineering Laboratories Inc., Plainview, New Jersey

7:30 P.M. Monday, Oct. 10, 1966
AUDIO AMPLIFICATION
Chairman: F. L. Mergner, Fisher Radio Corp., Long Island City, N.Y.

MINIATURE AUDIO AMPLIFIERS
William H. Greenbaum, Zenith Radio Corporation, Chicago, Illinois

LINEAR MICROELECTRONICS AND THE IMPLEMENTATION OF AUDIO CONTROL FUNCTIONS
Basil T. Barber, Sperry Gyroscope Co., Great Neck, New York

INROADS OF INTEGRATED CIRCUITS IN AUDIO
H. R. Camenzind, P. R. Mallory & Co., Inc. Laboratory for Physical Science, Burlington, Massachusetts

THICK-FILM INTEGRATED CIRCUITS
George C. Haas, Motorola Semiconductor Products, Inc., Phoenix, Arizona

TRANSISTOR-POWER-AMPLIFIER DESIGN WITH HIGH-SPEED OVERLOAD-PROTECTION CIRCUIT
F. J. Krausser, Fisher Radio Corporation, Long Island City, New York

FET'S IN AUDIO CIRCUITS
Charles L. Farell, Texas Instruments, Inc., Dallas, Texas

A VOX SYSTEM FOR OPERATION AT HIGH AND VARIABLE AMBIENT LEVELS
Emil L. Torick and Richard G. Allen, CBS Laboratories, Stamford, Connecticut

AN IMPROVED HOME REVERBERATION SYSTEM
Arthur P. Davis (retired), New York, New York

9:30 A.M. Tuesday, Oct. 11, 1966
AUDIO INSTRUMENTATION
Chairman: Robert E. Owen, General Radio Co., West Concord, Mass.

A VOLTAGE-TUNED AUDIO WAVE ANALYZER
David Smoler, Electro-Metrics Corporation, Amsterdam, New York

COMPREHENSIVE SOUND MEASUREMENT CONSOLE DESIGN
Ervin E. Gross, General Radio Co., West Concord, Massachusetts

ALL ELECTRONIC AUDIO SWEEP GENERATOR AND DISPLAY FOR RESPONSE MEASUREMENTS
Allen E. Byers, Waveforms, Inc., New York, New York

ELECTRONIC DUMMY FOR ACOUSTICAL TESTING
E. Torick, A. DiMattia, A. Rosenheck, Louis Abbagnaro, B. Bauer, CBS Laboratories, Stamford, Connecticut

A HIGH-SPEED TRANSIENT ANALYZER
Gordon R. Partridge, General Radio Co., West Concord, Massachusetts

DESIGN OF A LOW-COST AC/DC VOLT OHMMETER
James M. Colwell, Hewlett-Packard Company, Loveland, Colorado

A NEW ACOUSTICAL REVERBERATION CHAMBER
G. L. Fuchs, Universidad Nacional de Cordoba, Argentina

TONE-BURST TRANSIENT-OVERLOAD TESTING
James K. Skilling, General Radio Co., West Concord, Massachusetts

1:30 P.M. Tuesday, Oct. 11, 1966
AUTOMOTIVE TAPE CARTRIDGE SYSTEMS
Chairman: Robert C. Moyer, RCA Victor Record Division, Indianapolis, Ind.

THE COMPACT-CASSETTE SYSTEM FOR AUDIO TAPE RECORDERS
L. F. Ottens, N. V. Philips' Gloeilampen Fabrieken, Philips Factory Hasselt, Belgium

DESIGN EVOLUTION OF THE 8-TRACK STEREO TAPE CARTRIDGE
Theodore Maimy, Lear Jet Corporation, Detroit, Michigan

DESIGN CONSIDERATIONS OF A NEW CONTINUOUS TAPE-CARTRIDGE SYSTEM
B. A. Cousino and R. E. Cousino, Orrtronics, Inc., Perrysburg, Ohio

SOME DESIGN CONSIDERATIONS OF THE 8-TRACK ENDLESS LOOP MAGNETIC TAPE CARTRIDGE AND PLAYER
H. E. Roys and L. C. Harlow, RCA Victor Record Division, Indianapolis, Indiana

ADAPTING STEREO TAPE TO THE AUTOMOTIVE ENVIRONMENT
John P. King, Ford Motor Company, Radio Engineering Department, Dearborn, Michigan

AUTOMOTIVE TAPE PLAYERS
Robert Wolf and Alfred Dusey, Motorola, Inc., Franklin Park, Illinois

MASTERING EIGHT TRACKS ON ½-IN. TAPE AT 7½ IPS WITH 62-dB + S/N RATIO
Keith O. Johnson and D. P. Gregg, Gauss Electrophysics, Inc., Los Angeles, California

DESIGN CONSIDERATIONS FOR MAGNETIC TAPE USED ON CONTINUOUS LOOP CARTRIDGES
Raymond C. Smith and Peter J. Vogelgesang, The 3M Company, St. Paul, Minnesota

HIGHER SPEED DUPLICATION OF EIGHT-TRACK TAPES WITH ENHANCED DYNAMIC RANGE
Keith O. Johnson, Gauss Electrophysics, Inc., Los Angeles, California and Carl S. Nelson, Capitol Records, Inc., Hollywood, California

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"...Completely Free from Harshness or Stridency... a very smooth easy-to-listen-to speaker" reported Julian Hirsch.

"...Superior Transient Response ...extreme clarity, will not break up under any normal or even super normal pushing", stated Larry Zide of American Record Guide.

"Optimum Stereo Performance... excellent dispersing It has a 'big sound' at any volume level", Gladden Houck of Electronics World.

The Empire Grenadiers represent the most talked about speaker systems in the world today. And why not. In sight and sound they have captured the imaginations of the audiophile, interior decorator and music enthusiast alike. Send for your free critics review pamphlet today and convince yourself. EMPIRE

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AES Convention Papers

7:30 P.M. Tuesday, Oct. 11, 1966
SPEECH PROCESSING

Chairman: Caldwell P. Smith, USAF Cambridge Research Laboratoris, Bedford, Mass.

A HYBRID ENCODING SCHEME FOR VOCODERS
Lawrence E. Cassel, Philco Corporation, Blue Bell, Pennsylvania

WORD RECOGNITION
Bernard Gold, Lincoln Laboratory, Massachusetts Institute of Technology, Lexington, Massachusetts

SOME GENERALIZED BANDWIDTH-COMPRESSION METHODS APPLIED TO VOCODER DATA
Charlton M. Walter, Air Force Cambridge Research Laboratories, L. G. Hanscom Field, Bedford, Massachusetts

A COMPARISON OF TWO TYPES OF DIGITIZED AUTO-CORRELATION VOCODERS
Calvin R. Howard, Harold J. Manley, and James C. Stoddard, Sylvania Electric Products, Inc., Waltham, Massachusetts

TECHNIQUES FOR THE MODIFICATION OF THE SPEECH SPECTRUM
Roger M. Golden, Bell Telephone Laboratories, Inc., Murray Hill, New Jersey

SOME PROBLEMS IN SUBJECTIVE TESTING
E. H. Rothauser and G. Urbanek, IBM Research Laboratory, Zurich; University of Technology, Vienna

CONFERENCING TECHNIQUES FOR CHANNEL VOCODERS
Stanley W. Helms, Texas Instruments Incorporated, Dallas, Texas

SURVEY OF METHODS FOR MEASURING SPEECH QUALITY
Michael H. L. Hecker, Bolt Beranek and Newman, Inc., Cambridge, Massachusetts

9:30 A.M. Wed., Oct. 12, 1966
DISC RECORDING AND REPRODUCTION

Chairman: John J. Bubbers, Pickering & Co., Inc., Plainview, N.Y.

THE DILEMMA FACING THE RECORD MASTERING ENGINEER
Sidney Feldman, Mastertone Recording Studios, Inc., New York, New York

DESIGN CONSIDERATIONS FOR A DEPTH-CONTROL UNIT FOR STEREO DISC MASTERING
Daniel Cronin, Bell Sound Studios, Inc., New York, New York

A NEW VERTICAL-STORAGE AUTOMATIC DISC PLAYBACK SYSTEM
W. E. Olliges and J. S. Shragal, The Seeburg Corporation, Chicago, Illinois

RUMBLE AND RUMBLE MEASUREMENT
Benjamin B. Bauer, CBS Laboratories, Stamford, Connecticut

HIGH-FREQUENCY INTERMODULATION TESTING OF STEREO PHONOGRAPH PICKUPS
J. G. Woodward and R. E. Werner, RCA Laboratories, Princeton, New Jersey

AN ANALYSIS OF PHONOGRAPH CARTRIDGE MISTRACKING
Ronald A. Knuebel, The Astatic Corporation, Conneaut, Ohio

1:30 P.M. Wed., Oct. 12, 1966
TAPE RECORDING AND REPRODUCTION

Chairman: Arthur E. Gruber, Consultant, East Rockaway, N.Y.

OPTICAL S-MM MOTION PICTURE SOUND
Marvin I. Mindell, Viewlex, Inc., Holbrook, New York

MULTIPLE-SPEED TAPE DUPLICATING
J. L. Ooms, Philips' Phonographic Industries, Baarn, The Netherlands

INTEGRATED CIRCUITS FOR AUDIO APPLICATIONS
John T. Heizer, RCA, Camden, New Jersey

VERSATILE HIGH-PERFORMANCE TAPE RECORDER
John T. Mullin, The 3M Company, St. Paul, Minnesota

A CONVENIENT MAGNETIC TAPE DEGAUSSER
Edward M. Long, CTS of Paducah, Inc., Paducah, Kentucky

DISTORTION REDUCTION IN TAPE RECORDING
John Curtis, Scully Recording Instruments Corp., Bridgeport, Connecticut

AUDIBILITY OF TAPE DROPOUTS
Benjamin B. Bauer, Edward J. Foster and Allan J. Rosenbeck, CBS Laboratories, Stamford, Connecticut

ABSOLUTE-LEVEL AND FREQUENCY-RESPONSE CHARACTERISTICS IN MAGNETIC SOUND RECORDING—DEFINITIONS AND STANDARDIZATION
John G. McKnight, Ampex CEPD, Los Gatos, California

ADJUSTMENT OF MAGNETIC RECORDER/REPRODUCERS WITH VARIOUS TEST TAPES
F. K. Harvey and P. J. MacLean, Bell Telephone Laboratories, Murray Hill, New Jersey

TAPE-REPRODUCER RESPONSE MEASUREMENTS WITH A REPRODUCER TEST TAPE
John G. McKnight, Ampex CEPD, Los Gatos California

REPRODUCER TEST TAPES, THEIR EVOLUTION AND MANUFACTURE
Robert K. Morrison, Ampex Corporation, Redwood City, California

7:30 P.M. Wed., Oct. 12, 1966
MUSIC AND ELECTRONICS

Chairman: Earle L. Kent, C. G. Conn Ltd., Elkhart, Ind.

A NEW CONCERT VIOLIN
Carleen M. Hutchins, Catgut Acoustical Society, Montclair, New Jersey

BOOM-BOXES, BEETLES, BAEZ, AND BOCCHERINI—THE ELECTRIC GUITAR AT THE CROSSROADS
Daniel Queen, Perma-Power Co., Chicago, Illinois

ELECTRONICS AND PIANO SOUND
Helmut Fuchs, Fachschule fur Musikinstrumentenbau, Ludwigsburg, Germany

TONE GENERATION WITH MULTIPLE SYNCHRONOUS AND NON-SYNCHRONOUS RC OSCILLATORS
R. E. Owen, General Radio Co., West Concord, Massachusetts

FIELD-EFFECT INTEGRATED CIRCUITS IN ELECTRONIC ORGANS
Fred B. Maynard and James F. Kane, Motorola Semiconductor Products, Inc., Phoenix, Arizona

ELECTRONIC-MUSIC PERFORMANCE INSTRUMENTS
Robert A. Moog, The R. A. Moog Company, Turmansburg, New York

TRANSIENT ANALYSIS OF MUSICAL TONES WITH DIGITAL FILTERS
James W. Besuchamp, University of Illinois, Urbana, Illinois

A COMPUTER SOUND-GENERATION PROGRAM ALLOWING USER-DEFINED SIGNAL PRODUCTION ALGORITHMS
Gary R. Grossman, University of Illinois, Urbana, Illinois

A GRAPHICAL LANGUAGE FOR COMPOSING AND PLAYING SOUNDS AND MUSIC
M. V. Mathews, Bell Telephone Laboratories, Inc., Murray Hill, New Jersey

"NEW SOUNDS" vs. MUSICAL ARTICULATION
J. K. Randall, Princeton University, Princeton, New Jersey

9:30 A.M. Thurs., Oct. 13, 1966
SOUND REINFORCEMENT I

Chairman: E. S. Seeley, Consultant in Acoustics, Ho-Ho-Kus, N.J.

AUDIO FACILITIES AT AES CONVENTIONS—THEIR DEVELOPMENT TO THE PRESENT
Irving Joel, Capitol Records, Inc., New York, New York, Hugh Russell, Colgate-Palmolive Co., Jersey City, New Jersey, and Keith Morris, Fairchild Recording Equipment Corp., Long Island City, New York

AN AUDIO CONSOLE FOR AES CONVENTIONS—ITS DESIGN AND FUNCTIONS
Keith Morris, Fairchild Recording Equipment Corp., Long Island City, New York, Irving Joel, Capitol Records, Inc., New York, New York, and Hugh Russell, Colgate-Palmolive Co., Jersey City, New Jersey

SOUND-REINFORCEMENT SYSTEMS FOR BROADWAY SHOWS
Saki Cura, Masque Sound & Recording Corp., New York, New York

SOUND-AMPLIFICATIONS SYSTEMS AND THE PERFORMING ARTS
David L. Klepper, Bolt Beranek and Newman, Inc., Cambridge, Massachusetts

SOUND REINFORCEMENT FOR STAGE PERFORMANCES
R. T. Bozak, the R. T. Bozak Manufacturing Co., Darien, Connecticut, and Christopher Jaffe, Stagecraft Corp., Norwalk, Connecticut

A DISTRIBUTED SYSTEM FOR CHURCH SOUND REINFORCEMENT
N. E. Rudback, N. J. Pappas & Associates, Montreal, Canada

A CONSIDERATION OF THE FUNDAMENTALS OF PASSIVE AND ACTIVE ACOUSTICS
Harry F. Olson, RCA Laboratories, Princeton, New Jersey

SOME EXAMPLES OF SOUND-SYSTEM CORRECTION OF ACOUSTICALLY-DIFFICULT ROOMS
C. R. Boner, C. P. Boner & Associates, Austin, Texas

1:30 P.M. Thurs., Oct. 13, 1966
SOUND REINFORCEMENT II

Chairman: Theodore Schultz, Bolt Beranek and Newman, N.Y.

MODERN ELECTRONICS IN COLONIAL WILLIAMSBURG
Charles C. Squires, Colonial Williamsburg, Inc., Williamsburg, Virginia

CIVIL DEFENSE AND DISASTER OUTDOOR WARNING SYSTEMS
William R. Truit and Edgard Burquez, Alabama Sound, Huntsville, Alabama

IMPROVING THE RELIABILITY OF SOUND SYSTEMS
Edward S. Seeley, Consultant, Ho-Ho-Kus, New Jersey

LANGUAGE LABORATORY WITHOUT EARPHONES
David H. Kaye, Bolt Beranek and Newman, Inc., Cambridge, Massachusetts

A NEW CONCEPT IN LANGUAGE LABORATORY EQUIPMENT
William R. Lewis, Audio Lab., Inc., Cambridge, Massachusetts

(*Continued on page* 61)

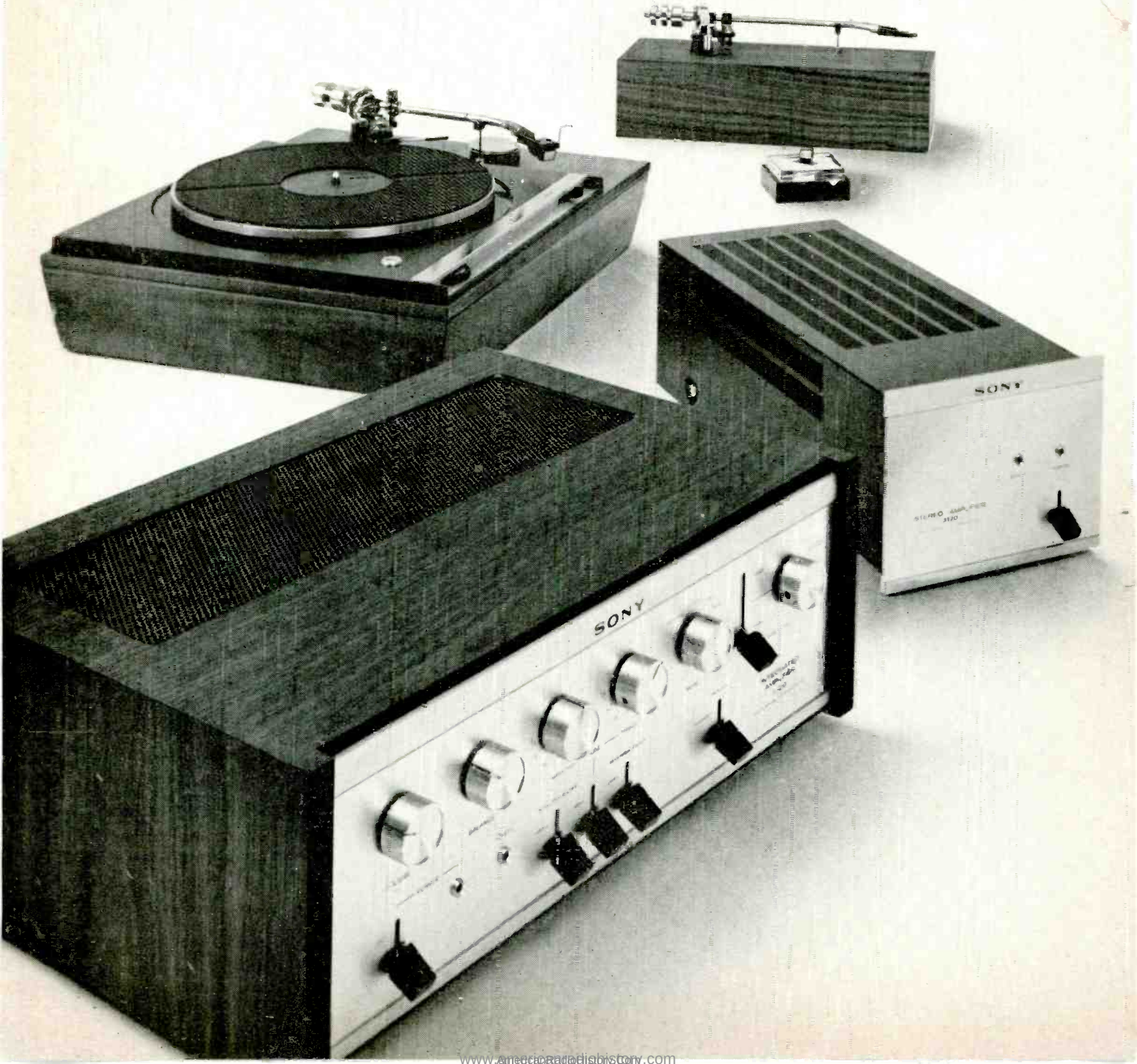
"They worked miracles
with transistors
in tiny TV and radios.

engineered today's most popular
tape recorders.

gave you the
home video tape recorder.

What is Sony up to now?"

Sony presents a new generation of stereo components



Whatever Sony has ever done, developed, designed or produced, has always resulted in something to heighten the enjoyment people derive through sight and sound. For Sony to have done less in stereo high fidelity would have been unexpected and unusual. So, Sony has done the expected with the unusual.

The first truly great solid-state stereo amplifiers. *The TA-1120 solid-state stereo amplifier/preamplifier* achieves the long-awaited breakthrough in solid-state power amplifier design. The result is a component whose performance capabilities surpass those of the most highly proclaimed units ever produced—vacuum tube and solid-state alike.

The power amplifier section has an IHF power rating of 120 watts at 8 ohms, both channels operating (200 watts at 4 ohms). Indicative of its quality is the extremely low distortion achieved at all power levels, from 0.05% at ½ watt to 0.1% at rated output. No less significant are these characteristics: high internal damping (140 at 16 ohms) and S/N ratio (better than 110db.); frequency response: (+ 0db/−1db from 10 to 100,000Hz). For safety's sake, a silicon-controlled rectifier (SCR) protects the transistors against damage due to accidental shorting of the output.

The control preamplifier section, fully worthy of the amplifier's performance, features the most functional arrangement of controls ever conceived. In metal enclosure with brushed aluminum panel, $399.50. An optional walnut enclosure is available.

The Sony TA-3120 solid-state stereo power amplifier features the same amplifier as employed in the TA-1120. It is the ideal choice in a high quality solid-state power amplifier to go with your solid-state preamp, for use with a professional 3-channel tape deck, or for 3-channel systems. $249.50.

First rumble-free turntable. *The Sony Servomatic* is the first turntable ever to employ a servo control amplifier. Rumble is virtually unmeasurable. Wow and flutter content exceed the most optimistic standards ever prescribed for professional equipment. Motor speed is monitored by a servo control amplifier which maintains rotation of the turntable at constant rpm. The Servomatic is powered by a low speed dc servo motor operating at *about 1/6th of the speed of conventional turntable motors.* This reduces rumble-producing mechanical vibration to an absolute minimum at its very source. A belt-drive coupling between the motor and the turntable absorbs all remaining mechanical vibration.

The Servomatic operates a 33⅓ and 45 rpm. A built-in illuminated strobe disc and speed control permit adjusting the turntable to the precise rpm desired. Model TTS-3000, $149.50.

First moving coil cartridge with high output. *The Sony VC-8E* is the first cartridge to realize the full quality capabilities of the moving coil, yet providing high enough output (4mv) to eliminate the need for transformer coupling. It is also the first moving coil design to permit simple stylus replacement. The VC-8E combines a low moving mass with unusually high compliance so that it can track in properly designed arms at as low as ½ gram. Performance is characterized by smooth, peak-free, balanced response over the entire audible spectrum and beyond (10 to 25,000Hz). Effective channel separation extends into the high frequencies. With elliptical diamond stylus, $65.

First truly professional arm designed for the non-professional. *The PUA-237, 12-inch tonearm* combines optimum geometry and mechanical responsiveness for flawless tracking accuracy with the highest compliance cartridges. Despite sensitivity, the PUA-237 exhibits amazing stability. Contributing to this is effective anti-skating compensation at every position on the record, and a lateral stabilizer which locates the center-of-mass in line with pivot and stylus. A built-in cueing device with a silicon-damped piston permits easy location of arm and gentle placement of the stylus in any selected record groove. It also provides a semi-automatic method for lowering the stylus into the lead-in grooves of 7-, 10- and 12-inch records. PUA-237 $85; PUA-286 (a 16-inch version). $99.50.

These new stereo components are now at Sony high fidelity dealers. Stop in and hear them today. For descriptive literature write:

SONY® Corporation of America, Dept. H.
580 Fifth Avenue, N.Y., N.Y. 10036

All prices suggested list

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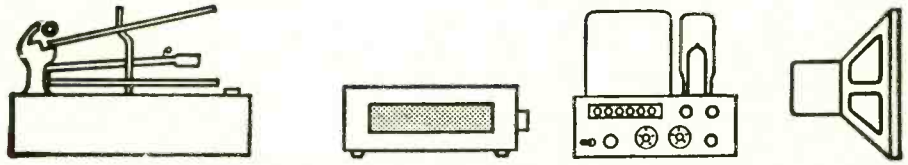
EQUIPMENT PROFILE



MARANTZ SLT-12 INTEGRATED TURNTABLE

Fig. 1. Marantz SLT-12 Integrated Turntable.

There have been arm designs before that used the principle of straight-line tracking. None of them worked particularly well. After all, the problems of moving a playback cartridge across a record are radically changed when you shift from the usual lever arm to a linearly travelling arm. There are, to be sure, all sorts of theoretical advantages to straight-line tracking and no (theoretical) disadvantages. Still. there is the history of the thing. So, it can be understandable that we approached this SLT-12 with a sort of prejudice.

We can forget it. It works.

And that means a lot, for when you say a Marantz works, you say something meaningful.

Not that Marantz has any secret spells to help him, but it seems to us that this company has had a distinguished history of turning out fine products.

So what have we here?

The SLT-12 is a two-speed (33-45) belt-driven turntable and base with a built-on arm and cartridge system. The cartridge itself is a modification (specially made) of the excellent Shure V-15. It is permanently mounted. The arm is like no other we have ever seen.

It comes out in a line from the box seen on the right in *Fig.* 1. Straight out. The knob below controls it. Press down on the knob and the cartridge lifts. Turn it and the cartridge head moves in or out. Release it and the stylus gently lowers into the groove.

There is always the question, when speaking of an integrated arm/cartridge of the problem of future obsolescence. After all, cartridge design is moving ahead at a breakneck pace. On the other hand consider the obvious design advantages of arm and cartridge as one piece. Each is made to extract the best from the other. There is no need to compromise cartridge compliance or arm mass to accommodate a variety. This marriage is certainly more than one of convenience. The Marantz system produces a quality of sound that is simply not excelled by any other. Will that soon become obsolete? We think not.

The turntable itself is a 12-pound platter of non-ferrous metal that is belt driven from an hysteresis-synchronous motor. This is not the usual type of inside-out synchronous motor. Rather, it is somewhat larger than is seen on most tables. More important though is the fact that it has excellent torque and nearly complete immunity from voltage variation effects. The sample we had would not change from its better-than-0.5 per cent speed accuracy at any test voltage from 130 down to 35 volts. Yes, 35 *volts*. At that voltage, (actually below about 50 volts) the table will not start, but if already spinning it will hold accurate speed and sufficient torque down to that 35-volt figure. Below that voltage, the motor simply stalls out.

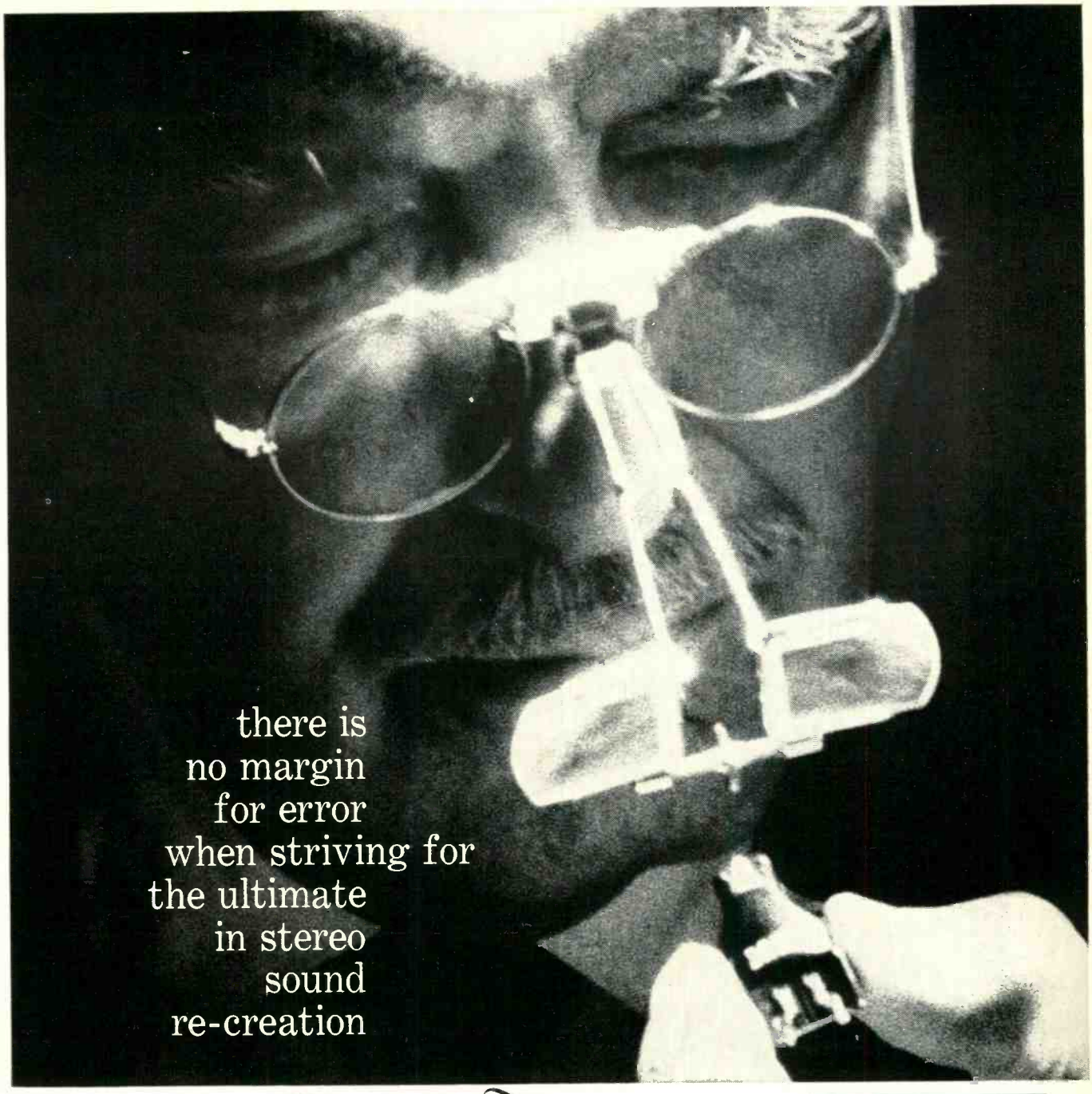
Rumble is totally inaudible. Measurements showed unweighted rumble to be 35 dB below 3.54 cm/sec recorded velocity. Most of this rumble is at 30 Hz and below; hence the inaudibility.

Total flutter was measured at 0.05 per cent. This figure represents the lower limit of our meter; we suspect this Marantz is even better.

One of the prejudices we had regarding straight-line arms is that resonance has to be high because of low mass. After all, the moving arm is only about six-inches long, although it is connected via a double partial-arc gear to the counterbalancing system below decks. The connection is not overtight.

Frequency sweeps down to 5 Hz did indeed reveal a resonant frequency. At 7-8 Hz. That is right where it ought to be for a first-rate arm so we have one more preconceived opinion shot down.

In fact, this Marantz has destroyed all of our prejudices. It is a lovely item. At $295 complete it can hardly be called inexpensive. Still, we feel that it is worth every penny. Sound is clean and completely without any fudgy qualities. The cartridge tracks most discs well. It has an 0.2- x 0.9-mil elliptical diamond. This is



incomparable Stereo Dynetic® . . . *by* SHURE

HI-FI PHONO CARTRIDGES

Tiny though it is, the cartridge can make or break a stereo system. For this breath-takingly precise miniaturized electric generator (that's really what it is) carries the full burden of translating the miles-long undulating stereo record groove into usable electrical impulses . . . without adding or subtracting a whit from what the recording engineer created. Knowing this keeps Shure quality standards inflexible.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill. 60204

select the unit equal to your music system from the premier family of stereo sound reproducers

M55E
15° tracking, elliptical stylus, ¾ to 1½ gram tracking. Professional performance—and a very special value at *$35.50*.

M80E
Bounce-proof, scratch-proof performance for Garrard Lab 80 and Model A70. *$38.00*.

M44-7
Economical trend-setter. 15° tracking. Low IM and harmonic distortion. 1½-3 gm. tracking. *$19.95*.

M3D
Extremely musical. Tracks at pressure to 6 gms., fits any changer. Only *$15.75*.

SHURE SME
"The best pick-up arm in the world." Provides features and quality unattainable in any other tone arm. *$100.50*. (For 12" records.)

SHURE PERFORMANCE depends on a SHURE replacement STYLUS / . . . *Look for* "Precision Manufactured by Shure"

Manufactured Under One or More of the Following U. S. Patents and Other Patents Pending. 2,983,516, 3,055,988, 3,077,521, 3,077,522, D 183,366, D 185,168, D 187,229, D 187,230, D 189,144 D 193,006, D 193,007, D 193,854, D 193,934.

Circle 117 on Reader Service Card

ideal for all stereo records but will not properly play all early monos. (There is *no* universal stylus.)

To sum up then, the Marantz SLT-12 is a truly fine product. It has been designed to be representative of state-of-the-art performance. It does not fall short of that goal.

CIRCLE 1

Fig. 2. The JBL SA 600 Integrated Amplifier.

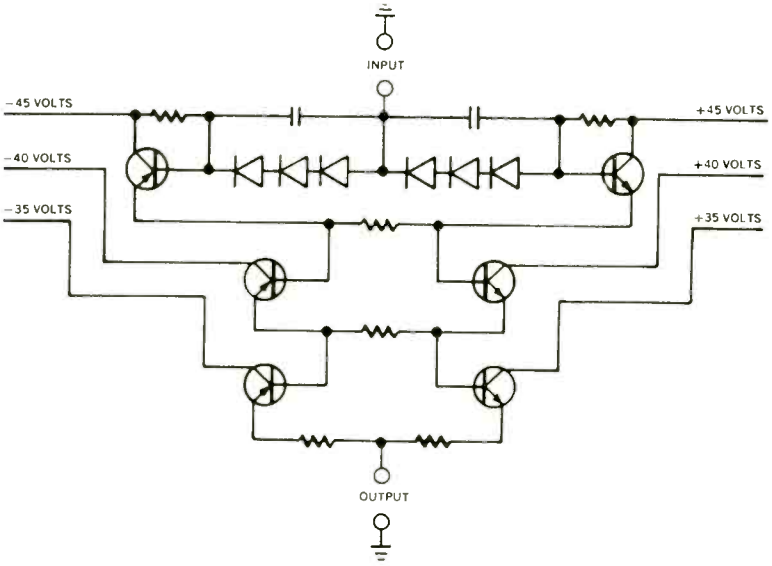


Fig. 3. The SA 600 output circuitry. The derivation of the term "T" circuit can readily be seen in this configuration. Note that coupling is direct. However, there is an extreme-bass attenuation capacitor in the first stage of amplification.

JBL SA 600 INTEGRATED AMPLIFIER

All-transistor stereo amplifiers are coming at us thick and fast. And these days they are pretty good. It is not correct to say that transistor products are inferior (in some respects, at least) to vacuum-tube products. Quite the contrary, we have seen several innovations in solid-state gear that would not have been readily possible an era ago. This JBL SA 600 is a case in point.

It is compact and not too heavy. It is a versatile integrated amplifier of high power output and excellent performance. Yet distortion, particularly IM distortion, was so low that it was straining the lower reaches of our instruments to measure it. To wit:

0.1 watt	0.07 per cent
1 watt	0.05
10 watts	0.05
20 watts	0.08
40 watts	0.23

These figures have been taken with an 8-ohm load and with both channels driven simultaneously. That is good performance by any standard.

The SA600 is not overburdened by a surfeit of knobs and controls. Still, nothing is really missing. Bass and treble control has been combined into two knobs each controlling both channels together. In this day of stereo via identical speaker sets we can not fault this elimination of separate channel control of tone function.

However, when versatility really counts, it is there in abundance. The tape-head input may be used as such, or, via a rear switch, it is convertible into a second RIAA phono input. The primary magnetic phono input offers considerable flexibility. JBL recognizes that many cartridges are not equal in output on the two channels. So they provide a rear-panel balance control just for phono. JBL also recognizes that cartridges of today offer outputs ranging from 2 mV to over ten times that amount. So the rear panel contains a three-position switch labelled LOW, MEDIUM, and HIGH. 4, 8, or 16-mV inputs will result in full output of the amplifiers. Overload is in excess of 250 mV at the HIGH settings; there will be no phono overload problem here.

There is a most interesting feature operated by the second-from-left toggle switch. In its normal position it does nothing. But swing it to TEST with a mono input source and adjust the front-panel balance control for the optimum null. This is electrical balance of the two channels.

But the true virtues of the SA 600 are to be found on the test bench and in the listening room. Power response of the unit is claimed at 40 watts per channel into 8 ohms. We measured 48 watts at mid frequencies, 45 watts at 20 kHz, and 47 watts at 20 Hz. (At 16 ohms the amplifier will deliver 25 watts per channel; at 4 ohms it is over 60 watts.)

All of these measurements have been made with both channels driven.

Frequency response may be drawn with a ruler between the usual 20-20,000 Hz limits. In fact, the ruler may be considerably extended. We found the –2-dB points to be at 8 Hz on the low end and 160 kHz at the upper end. Rise time was a fast 2.5 μsec. Noise was 81 dB below 40 watts at the high-level inputs. A check of RIAA accuracy showed it to be within a dB of ideal over the 30-15,000 Hz range. Cross talk at 20 kHz was better than –45 dB with the "worst case" measurement.

That we are dealing with an impressive product is proven when the unit is installed into a quality music system and subjected to the test of the ears. If there are any faults to be found, they will show here!

We should expect that this amplifier would sound satisfactory. In point of fact it does not sound satisfactory—it does not create sound at all. That cliche about hearing *through* amplifiers has never been more apt than here. The SA600 can truly be called an "undistinguished" product. And that is what a great amplifier should be.

CIRCLE 2

HEATHKIT LABORATORY OSCILLOSCOPE, MODEL 10-14

Every electronic technician and tinkerer knows (or should know) the value of a good oscilloscope. Most of the ones seen are quite adequate to observe a waveform

Don't just take our word for it...

READ WHAT THE EXPERTS HAVE TO SAY ABOUT THE NEW knight-kit® TAPE DECK

Knight-Kit 4-Track Stereo Tape Deck With Solid-State Stereo Record-Playback Preamp

Unmatched performance, quality and value! And so easy to build, too. You need only follow simple, illustrated, step-by-step instructions to assemble six solid-state plug-in modules. The Viking tape transport, built to Knight-Kit specs, is completely preassembled.

When you complete your Knight-Kit Tape Deck you'll enjoy stereo of unsurpassed realism, plus monophonic sound of highest fidelity . . . plus many features found only on professional quality decks: Separate monitor switch with monitor-level controls, mixing facilities, exclusive low impedance stereo headphone amplifier module, bias test oscillator, switch-selected sound-on-sound and echo, push-to-reset digital counter for quick indexing of recorded selection, easy-edit head cover, studio-type VU meters for accurate control of record and playback on each channel, and more.

Complete with all parts, instructions and 7" take-up reel (less base and tape) **$249.95**

Read the unique money-back guarantee below . . . exclusive in the industry . . . then rush the coupon at right for full details and Special Introductory Offer.

KNIGHT-KIT GUARANTEE

Build a Knight-Kit in accordance with our easy-to-follow instructions. When you have completely assembled the kit, you must be satisfied or we will return your money, less transportation charges, under the Allied guarantee of satisfaction.

ALLIED RADIO

Excerpts from Hirsch-Houck Laboratories Equipment Test Report in July, 1966

HI FI/STEREO REVIEW:

"Until quite recently, it was rare to find a tape recorder selling for less than $400 to $500 that could record and play back an FM radio broadcast with such fidelity that it could not be distinguished from the direct broadcast. The Knight-Kit KG-415 satisfies this requirement of a true hi-fi tape recorder, yet costs only $249.95.

Wow and flutter, 0.02 and 0.09 per cent, respectively, at 7½ ips, were negligible and significantly bettered the Knight rating of 0.2 per cent. The KG-415 worked flawlessly, producing recordings which at normal listening levels could not be distinguished from the original FM program. Other recorders can do this, too, but they generally cost $500 or more. The Knight KG-415 is, without a doubt, one of today's best values in tape recorders. It is made to order for the hobbyist on a budget who will not compromise his quality standards."

From April, 1966 AMERICAN RECORD GUIDE:

"At $249.95 FOB Allied Radio in Chicago, this recorder is not inexpensive. Still, I think it is remarkably cheap considering what it is and what it provides in the way of features and qualities.

It took me 14 leisurely hours to build the unit—start to finish . . .

Right off the bat, this kit performed right up to, or better than, all its specifications. I am jaded enough not to impress easily, but this got to me.

It all comes down to this in the end: the test bench indicates that this KG-415 should sound good. And it does."

From January, 1966 AUDIO:

"This is a kit which is a perfect delight to profile for two reasons—it was a pleasure to construct it, and it performed so well after it was completed.

At the relatively low price of $249.95 plus some 20 hours of pleasurable work, we think the KG-415 is an excellent buy."

From March, 1966 ELECTRONICS ILLUSTRATED:

"When the job is complete the builder has a deck of unquestioned high quality with all the functions and conveniences of a professional model. A comparable factory-wired deck would cost upwards of $400.

The instruction manual is well done, being logical and easy to follow.

Our KG-415 met or exceeded all Knight's specs."

From March, 1966 POPULAR SCIENCE:

"Judging by the almost flawless way it records and reproduces sound, the Knight-Kit KG-415 stereo tape deck costs a full third less than it's worth."

ALLIED RADIO, Knight-Kit Div.
Dept. 11-JJ, P. O. Box 4398
Chicago, Illinois 60680

Please rush Special Introductory Offer on the **Knight-Kit KG-415 Tape Deck.**

Name_____
PLEASE PRINT
Address_____
City_____ State_____ Zip_____

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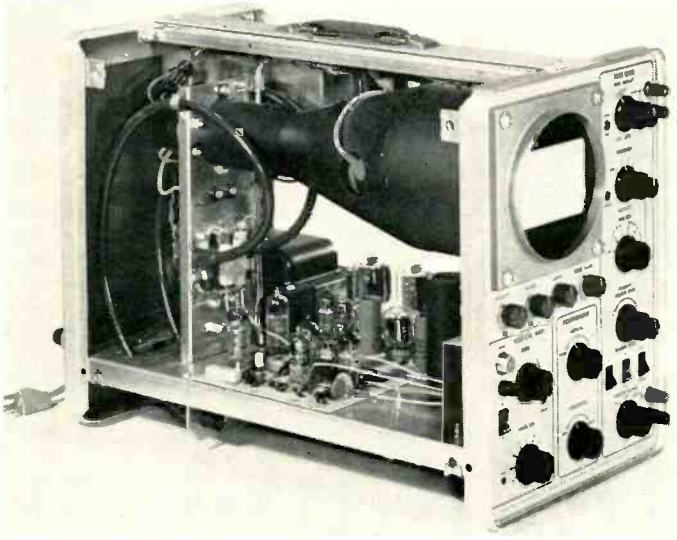


Fig. 4. With the two-piece cover removed, this is the way the 'scope looked when it was finished. The two looped cables visible toward the rear are the 0.25 microsecond delay lines.

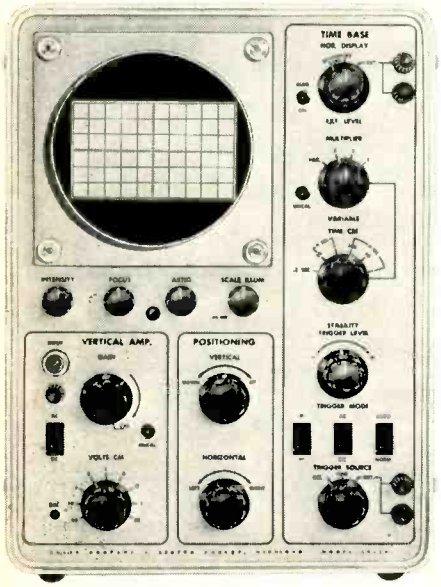


Fig. 5. A head-on view of the Heath IO-14 oscilloscope.

simply for shape. Most decent 'scopes are calibrated sufficiently so that they may be used as peak-to-peak voltmeters. Some have sufficient bandwidth to be usable in the region of several megahertz (for FM and TV servicing). Others feature direct coupling of vertical inputs for ultra-low-frequency viewing. There are even a few that offer a degree of automatic sync so they need not be reset everytime a frequency is changed slightly.

Professional laboratory scopes do all this and more. A primary virtue of theirs is a fully calibrated horizontal time base (sweep). With a CRT graticule marked in centimeter squares such a 'scope makes it possible to measure accurate rise times and identify unknown frequencies. Triggering is adjustable to start on any part of a waveform, and can be a.c. or d.c.

The Heath IO-14 is an attempt to offer such a 'scope (usually costing well over $1000) at a low price and in kit form. Our experiences with this unit (it sells for $299.95 kit, $399 wired) indicate that they have met with a high degree of success.

The IO-14 features a calibrated vertical input, through a 9-position switch, from 0.05 volts-per-centimeter upwards in a 1, 2, 5 sequence. Vertical frequency response is from d.c. to 8 MHz. At that upper extreme the 'scope is 3dB down.

The horizontal sweep is calibrated from 0.5 seconds-per-centimeter to 1 microsecond-per-centimeter. There are 18 steps on this switch, again in a 1, 2, 5 pattern. There is also an uncalibrated continuous adjustment. When this is used a neon reminder light is ignited. (A similar control for vertical gain also exists with another neon reminder light.)

The time base has a x5 magnifier; thus the fastest sweep is accelerated to 0.2 microseconds.

Heath has arranged all this into an attractive package. The cabinet is larger than most garden variety 'scopes. It contains a chassis with some 26 tubes including the 5-inch CRT, so a rear-blowing fan is in-built for cooling. The controls are all positive-feeling and substantial. The CRT is a standard flat-faced 5AD series; our sample came with a P31 phosphor.

The Kit.

Regular PROFILES readers will remember the report in these pages on the Heath GR-25 color TV receiver. This 'scope is hardly less complex. The manual is a formidable 139 pages plus many foldouts. It isn't until page 107 that the unit is fully finished. The remainder of the manual is Heath's usual fine service, operational, and theory manual. There is nothing terribly difficult about construction though a few corners are tighter than they need to be. All-in-all we rate the IO-14 as easy for the reasonably experienced kit builder. It is not the sort of kit for the neophyte to hit first, however.

One of the more impressive things about this unit is the substance of the component and chassis material. There is simply nothing second-rate here. The bulk of wiring is to be done on a total of five circuit boards. These are of heavy epoxy construction and represent high voltage, low voltage, vertical, horizontal, and trigger circuits.

Calibration is not complex but it properly requires an accurate 1000 and 100 kHz sine-and square-wave generator of fast rise time. A 2 per cent or better d.c. meter of up to 500 volts capability is also needed. Using less accurate instruments will result in a less accurately calibrated oscilloscope.

The manual is well illustrated. The tracings shown in the calibration section represent what you can expect to achieve during calibration.

One of the niceties of the completed IO-14 is the vertical-input connector. It is a standard coaxial connector with a banana-type inside lead. Heath has spaced an extra banana-post ground connector a ¾-inch away so that standard dual plugs may be used.

If you are used to a professional lab 'scope you will feel right at home with the operation and performance of the IO-14. How Heath manages to sell it at the low price (for service delivered) that they do is their secret. The fact is that this is not a 'scope for everyone's pocketbook or needs. It is for the serious experimenter who needs a unit of true laboratory capabilities. We expect that this sample will see long and useful service on our bench. It's that good.

CIRCLE 3

AUDIOCLINIC

(*From page 4*)

capable of stereophonic reproduction. Today it is virtually impossible to obtain a cartridge which is incapable of playing stereo records.

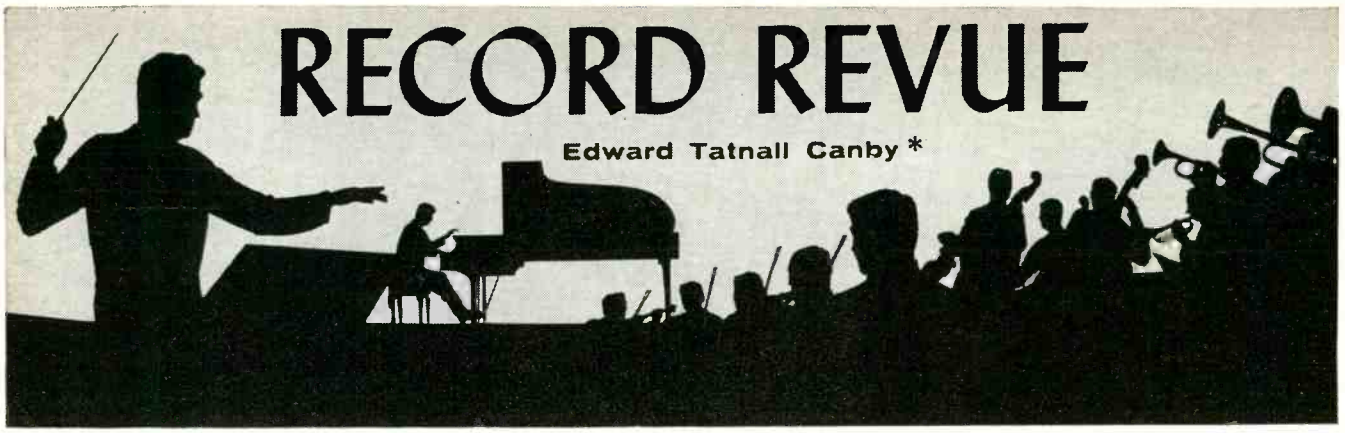
Before stereo came along most microgroove discs were played with styli having 1 mil tip radii. However, stereo has resulted in a decrease in the size of the tip. Many tips are 0.5 mil or less. However, you have a special problem; you want to continue playing monophonic records. If you use a very small tip radius on monophonic discs, especially some of the older ones, the stylus will come to rest at the bottom of the groove, which will increase the surface noise and add distortion. The 0.7-mil tip radius will play monophonic records very satisfactorily. In fact, it will improve the high frequency response on these records, especially near the inner diameters. The use of this stylus will not result in "bottoming" even with some of the older monophonic discs.

So far as distortion is concerned, this stylus should give you good performance on either stereo or monophonic discs. However, a smaller tip radius is likely to decrease the distortion somewhat when stereo discs are played.

Common sense tells us that if the size of the stylus decreases and the tracking force is held constant, more record wear will result than would be true if a stylus tip of larger radius were used. However, modern pickups exert a comparatively small force on record grooves as compared to the stylus forces which were common when you bought some of your older monophonic discs. It is very likely, therefore, that your discs will hold up better now than was possible a few years ago.

Today, stylus design has advanced to the point where it is possible to have the best of both worlds—small front-to-back tip radius for low distortion and good high frequency response, and wide lateral radius so as to avoid "bottoming" problems. In order that a tip can satisfy both of these objectives, its shape departs from spherical; it is elliptical in shape.

These styli do improve high-frequency response. However, if they are not mounted in a system which has a very minimal amount of tracking error, record damage will result. The design of the cartridge in which such a stylus is to be used must allow for a very small tracking force or again there will be damage to the grooves. Æ



RECORD REVUE

Edward Tatnall Canby *

WHICH IS THE TONI

A Two Organ Recital. Earl Ness, Wm. Whiteheard, organists. Allen organ, Möller organ.

Rittenhouse Records RS1003 stereo
(1932 Lombard St., Phila. Pa. 19146)

You've been waiting a long time for this record, though maybe you didn't know it. Two organs—and one of them is "real" (i.e. a pipe organ), the other an electronic organ! So casually is the recital presented that I played most of the way through before I even noticed and I wasn't at all sure at first which is the Toni—I mean the Allen.

The Allen electronic organ is no home living room model. It boasts 200 speakers (so it says here) and an impressive array of stops, couplers, mixtures. This one is even more than "just" an organ—it is oriented towards the newer "classic" organ sound, combining Baroque-style stops with more modern ones to accomodate various types of music. The Allen has a fine reputation among musicians; it is, indeed, an accepted substitute for the pipe sort of instrument in many demanding situations. There are even such subtleties on this one as "Chiff Off"—the chiff being the attack sound of the older un-nicked Baroque organ pipe, which the 19th-century eliminated as undesirable. The Allen also features something zanily described on this record as "Random Motion-Electronic Whind". Somebody needs a proof reader, maybe.

The Möller pipe organ, Opus 8128 (organs have Opus numbers, like works of music) is a good, solid, and slightly old fashioned instrument, judging by the sounds here, a fairly large 3-manual affair with 55 ranks of pipes. Good comparison.

When you finally get the two organs straight in the listening, you'll note that the Allen has a more highly colored "Baroque" sound to it, a bit more "authentic" than the Möller for the older music here, electronics or no. There is no audible compromise whatsover in the tonal quality that I can hear. Just shows what can be done.

The music ranges from some pleasant light-weight 18th century fare by Antonio Soler through an excellent piece by Cherubini (with unexpectedly good fugues) and on to a group of recent organists' organ music—Jongen, Purvis, Langlais—which left me cold. Excellent engineering, though, and fine for demo. *You* guess which is the Toni. (Are your channels reversed?)

Elgar; Violin Concerto (1910). Yehudi Menuhin; New Philharmonic, Boult.

Angel S 36330 stereo

A dozen years after the "Enigma" Variations, the aimable Sir Edward wrote this big, ingratiatingly Romantic violin concerto, in a style *very* slightly more modern and maybe only 40 years behind the continental composers in its outward sound. So what! It is basically honest British, late Victorian, and a glorious piece of the type—in case you love a nice, tear-jerker solo violin and an elegant lushness of orchestra, the whole on a very high level, of course.

The curiosity here is that Yehudi Menuhin made a celebrated recording of this music at the age of sixteen in 1932, with Elgar himself at the helm. Now, he does it again. Since by this time Menuhin has become a real, dyed-in-the-nylon Britisher, exactly "hep" to this music, the job is marvelous on all the counts that matter. What *you* need, you the listener, is merly a taste for this kind of concerto. Some have it, some don't.

By the way—Capitol Imports, Angel's sister branch in the E.M.I. family, is importing the original 1932 78-rpm Menuhin recording, transferred to LP. A nice comparison, if you are moved to acquire both versions.

Vaughan Williams: Symphony No. 8 (1958). Elgar: "Enigma" Variations (1898). Hallé Orch., Sir John Barbirolli.

Vanguard Everyman SRV 184SD stereo

Here is late British Romanticism in two big pieces—big, that is, in comparison to the now-stylish sort of Baroque music we hear so often—and it takes a very definite taste for this sort of music to enjoy both works on this forthright disc. The musical parameters, so to speak, are of a kind increasingly difficult to take for granted—above all, the huge, expertly managed symphony orchestra with its multitude of colors and its thickly layered textures, its hushed *pianissimi* and its great sonic *crescendi*. For Elgar and for Vaughan Williams, these things were taken for granted.

Yes—the British *are* slow to keep abreast! The 1898 Elgar music, lush and honeyed, ultra late-Victorian, could be middle Brahms of the 1860's, with much more sweetening and a lot of the stern fibre of Brahms removed. It is lovely, but icky. (The British have never quite understood our dislike for this ickiness—as, for instance, in the music of Delius, which is generally anathema to Americans in spite of some who worship it.) Sir John B. makes Elgar sound even more icky by a certain slightly apologetic approach here. OK, so it's Elgar; then let's play it like Elgar, all-out! The music is both completely honest and absolutely uninhibited, and should sound it.

The Vaughan Williams, composed no less than 60 years later when the composer was 84 (and one symphony still to go) is in a way the direct consequence of the Elgar high-level sweetness and light. Even in 1958 it is still basically a big Romantic piece, only mildly dissonant in a modal sort of way, immensely complex and thick in its very expert texture, an enormous orchestral fabric of a kind that for many ears today is nearly incomprehensible. Too many notes! It just goes on and on, louder and louder, thicker and thicker, sound piled on sound . . .

I can't myself listen to it with much response. But a lot of people call it a fine symphony. Matter of how your own ear is tuned, I guess.

Holst: A Choral Fantasia; Psalm 86. Finzi: Dies Natalis. Engl. Chamber Orch., Imogen Holst, Christopher Finzi; The Purcell Singers; Janet Baker, sop., Wilfred Brown, ten. R. Downes, organ.

Everest 3136 stereo

A known and an unknown British name, out of the early part of our own century, and of the two I liked Gerald Finzi's "unknown" music really the best, though Gustav Holst was a bigger, more versatile composer.

The Holst "Choral Fantasia" was a late work, 1930, composed in a big Romantic style that was trying dreadfully hard to be dissonant and modern. Holst just didn't have it in him and—though Holstophiles will disagree — I find his earlier and easier music, like the shorter "Psalm 86" (1912) much more digestible. All of this music is veddy British, of course, with lots of singable choral and vocal writing.

Finzi was one of those obscure composers who write and write without being much heard, and somehow manage to grow, nevertheless. There is a sweetness and honesty to this modest symphony for orchestra and solo tenor that wears very well, even if it is fragile music, shy, without much variety. I liked it a lot. (Holst's daughter conducts the Holst, Finzi's son conducts the Finzi.)

BRACE OF CLASSICS

The Guarneri Quartet—Mozart String Quartets K. 589 in B Flat. K. 590 in F.

RCA Victor LSC 2888 stereo.

The Guarneri Quartet—Smetana: String Quartet "From My Life"; Dvorak: String Quartet in A Flat, Op. 105.

RCA Victor LSC 2887 stereo

This is a new young string quartet of American-trained players, out of Curtis in Philadelphia and Rudolph Serkin's Marlboro in Vermont. RCA is plugging them hard and they are making quite a splash these days, too, in concert appearances. A fashionable debut, so to

speak, and they will be commanding increasing attention.

If you are quartet-minded, you'll find these young men curiously and typically American—as compared with the European younger quartets and even with the older generation hereabouts, often European-trained. First, there is a certain immediate hyper-intensity, a noticeably higher voltage in the sound than is common in European performance. That is *very* American. Second, as young players newly got together these are strong performers, all of them, who are neither very well blended yet into an ensemble nor very style-conscious, as, say, between Smetana, Dvorak and Mozart. Purely relative and on a very high plane, of course. They're good. Yet they are still individuals—who play, still, like four people closely cooperating, rather than as one poly-instrument. That takes years. And so does the higher style-sense that allows *more* communication with *less* energy and effort.

Not really any criticism, for why should a new, young quartet play like an old, seasoned one? Unlikely, whatever the publicity says. There's plenty of vigor and lots of finesse in these performances, already.

OLDE ENGLAND

Handel: Chandos Anthems. (O Praise the Lord; **Let God Arise**). Eliz. Vaughan, Alex. Young, Forbes Robinson; Choir of King's College, Cambridge, Academy of St Martin-in-the-Fields, Willcocks.

Argo ZRG 5490 stereo

The fine array of performing talent listed for these two big, early Handel works guarantees a sort of all-British authenticity. And the album, with enclosed complete texts and a fine color portrait of the Duke of Chandos (for whom the music was written) is quite a knockout, too. It is sad to have to report that, though the over-all sound and approach is, indeed, suitably magnificent, I am really quite shocked at the poundingly unmusical lack of rhythmic phrasing with which these good Britishers bang away at Handel, straight through all the big, magnificent chorus ensembles. It's what I call, in Bach-playing, "freight-train Bach"—here, it is freight-train Handel. Like a long string of loose, jangling freight cars banging over a switch, thumpety bump, thumpety bump.

Perhaps I'm over sentitive to this aspect of performance (being a choral man myself . . .) and so I can still recommend the record for its otherwise sumptuously got-up material.

Beethoven: Emperor Concerto (No. 5. Glenn Gould; American Symphony Orch., Stokowski.

Columbia MS 6888 Stereo

Paradoxically, the "Emperor" has been so much played that it is now really difficult to bring off on records. Here is a performance that comes off with a real bang—terrific! The old, old pro, Stokowski, and the young pro and eccentric, Gould, each with a flare for individuality and drama, here working astonishingly well together, so to speak hand in glove. I haven't enjoyed the "Emperor" so much in years. It really sounds *new*—fresh, enthusiastic, revealing, even in the most familiar old places, which so often tend to sound like "the same old effect," a story too often told and stale in the sheer repetition.

Not that this is a model of style—not at all. Part of its wide-awake charm comes from its relative eccentricity, in

tempo, in many a detail, as compared with now-standard performances by all the world's big pianists and conductors. Some regulars may not like it one little bit. I do. Because a freshness of eccentricity is always better than a staleness of regularity. (And who knows how Beethoven meant it to go?)

Beethoven: Symphony No. 3 "Eroica". N.Y. Philharmonic, Bernstein. Bonus 7" disc: "How a Great Symphony Was Written."

Columbia MS 6774 stereo

This is just to note that even without the extra "bonus" record this Bernstein version of the "Eroica" symphony would be very acceptable to my ear, since the great Lennie is at his best in the mid- and early-Romantic works. It neither drives too hard, nor languishes into neo-sentimentality, faults we often run into in other recordings. It is appropriately speedy, according to today's taste, but never so fast that the music is lost in the rush.

As for the bonus, it is one of those ineffable music-appreciation talks that Bernstein can provide so handily, what with a whole symphony orchestra at his disposal and a pair of very gifted pianistic hands as well. He uses both (though the "editing" technique of fade-outs is, to a Canby ear, pretty darned crude). Bernstein has the gift of gab, all right, but these little talks seem somehow to run to platitudes, and old fashioned ones, at that. Very inspirational.

Haydn: Keyboard Sonatas, Vol. II (13 Middle and Late Works). Rena Kyriakou, piano.

Vox SVBX 574 (3) stereo

Beethoven: Complete Chamber Music for Flute. Jean-Pierre Rampal, Alain Marion, Christian Larde, fl., P. Hongne, fg., Robert Veyron-Lacroix, piano.

Vox SVBX 577 (3) stereo

Vox's boxes continue to be both excellent bargains and unique collections. Here are two top-rank boxes, as well played, for the music, as you'll run into anywhere.

The fascinating Haydn piano sonatas, misleadingly "small," are now coming into their own both with listeners and pianists, including home pianists. The Kyriakou playing does them considerable justice, soberly, without any of the once-common down-grading of the music, with a somewhat nervous but very honest and expressive rapidity of execution that is never mere bravura showoff. ("Look how easy this silly stuff is for *me*!") The result is that the music itself is illuminated and made intelligible. What more can be asked?

Any recording that includes the superb flute of Jean-Pierre Rampal and the piano (or harpsichord) of his habitual side-kick, Robert Veyron-Lacroix, is bound to be superior in musical communication. This one most assuredly is. Say no more—just try these numerous small works of Beethoven and be pleased by them!

Italian Baroque Trumpet Concerti. (Manfredini, Vivaldi, Torelli, Albinoni). Soloists, Mainz Ch. Orch., Kehr, Wurttemberg Ch. Orch. Faerber.

Turnabout TV 34057 stereo

As Baroque trumpet records go—there are scads of them—this one is very good. Probably because the Italian music is played by Germans, who know how. No less than five trumpeters are involved, two pairs and a single, plus two similar orchestras and their conductors; but the record hangs together even so, both in the performances and in the sound. Both orchestras (and all the trumpeters) play with a brisk, crisp accuracy that makes listening a pleasure; the styling of the works is impeccable and very natural. (This is the sort of playing that is virtually never heard among our insulated, isolated American musicians.)

The record includes a pair of two-trumpet works, Manfredini and Vivaldi, a pair of one-trumpet concerti by the early (b. 1650) Torelli, very fine music, and another solo work by Albinoni, all relative near-neighbors in style and approach as well as in time and in Italian geography. That makes for variety with a purpose. Good.

WAY-OUT

Way-Out West. Mae West, with Somebody's Chyldren.

Tower T5028 mono

Here's a meeting of generations for you. Mae West began her business so long ago, only us grandpas can even remember when. She promoted her first stage play in 1927; it was called "Sex" and got banned. She entered ye flicks in 1932 and she's been singing and . . . well . . . panting, ever since. Her companions on this disc are "Chyldren" of the long-hair variety, little boys, average age of 15. They play quite excellent rock and Mae sings a very good roll.

That is, when she sings. Singing, she is really good—she even sounds Beatlish in the Lennon-McCartney "Day Tripper" and she has an informed background-sense of the various blues styles that have coalesced as part of today's rock music. Singing along with these kids (they sing too, occasionally) she is well worth a 33-rpm whirl.

Unfortunately, though, singing isn't Mae's trade mark. By now, everybody knows what *that* is. Minus the visual aspect, it boils down to two essentials—sexy talk and sexy groans and pants. When Mae talks sexy it's that same old wonderful feeling, even if it is repetitious, to put it mildly .When she groans and pants, it's very, very specific and she does enough of it here to account for a couple dozen willing men, not to mention fifteen year old chyldren. Pussonally, I find it a bit embarrassing, coming from a dame who might be Somebody's Chyldren's grandmother. But, just maybe (it occurs to me)—maybe they recorded the kids first and added Mae afterwards, over-dubbed electronically, groans, pants and all. I sort of hope so, anyhow. The kiddies tend to like it different, these days.

The Ballad of John Axon. (British railroad wreck, 1957). Ewan McColl, Charles Parker, dir. Peggy Seeger; assorted tape interviews. **Argo RC 474 mono**

This is a curious cross between a steam railroad documentary and a folk ballad. It is a radio drama in folk music, the first of its sort in England (followed by many more), concerning a 1957 wreck that killed the engineer of a runaway freight, one John Axon. The recording has no narrator—only the long series of folkish songs, some old, some newly composed, plus a few choruses, interspersed here and there with short, in-person taped interviews, people actually involved, such as Axon's wife, his co-workers on the doomed train, etc.

I found the music rather dull going. It is too self-consciously American, bluejeans style, and yet not *really* American. Except for a few items it is all in D minor, which would be fine if the musical ideas were more telling. Frankly, I was bored.

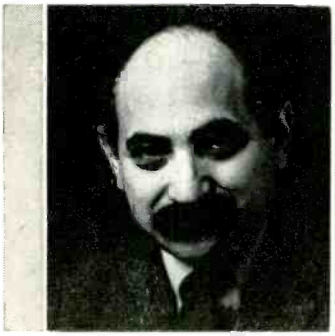
The booklet, though, is something else again—fascinating! First, it goes into immense detail concerning the wreck, with much technical info and helpful illustrations—even providing engineering diagrams of the steam fitting that burst and caused all the trouble. Now wouldn't it be nice to have "Casey Jones" with a similar technical account? I studied this one for hours, and well worth it.

But the strangest thing of all here—never mentioned anywhere in the booklet—is the incredible brake system on this freight train of 1957, with a quite new steam engine built after the war, which was the direct cause of the accident.

This freight, operating in hilly country, had *no air brakes at all.* The cars had only hand-set brakes. There was a heavier brake, also hand-set, on the rear caboose. The main brake was a *high pressure* steam brake on the engine! To go down a grade, you had to get off and individually set handbrakes on enough cars to supplement the steam brake up front. The accident happened when the steam pipe to the engine brake burst, filled the cab with steam while the engine was pulling forward against the set handbrakes; they couldn't turn the power off; the train roared down grade, dragging the cars with brakes on—and CRASH.

You'd think that after a century or so the British might have got the idea that vacuum, a la Westinghouse, prevents such accidents. If a line bursts, the brakes go on automatically. Yes?

(*Continued on page 52*)



JAZZ and all that

Bertram Stanleigh

Jabbo Smith, Volumes One and Two
Melodeon Mono MLP 7326 & 7

The very substantial merits of trumpeter Jabbo Smith have been largely overlooked because of his close resemblance to the style of Louis Armstrong. Without question, Smith sounds enough like Satchmo on these transfers from 78's of the twenties and early thirties to fool almost anyone other than Louis himself. But for all the similarity, this is not a case of slavish imitation of the master's manner. This is Smith's natural style, and he performs with spirit and abandon on a total of 27 of the 32 tunes in this valuable collection. The remaining five numbers had long been thought to include work by Smith; however, when Jabbo listened to these sides, he revealed that they were definitely the work of another trumpeter. Heard with Smith are a number of truly great musicians including Omer Simeon, Ikey Robinson, Lawson Buford, and Benny Carter who is heard in what are believed to be his two earliest recordings. Although Smith has been absent from the musical scene for many years, Melodeon plans to produce new recordings with him in the near future, as soon as some necessary dental work is completed. If he still retains the enthusiasm and imagination revealed on these valuable reissues, the projected recordings should be quite spectacular. Certainly these are.

Rod Levitt: Solid Gound
RCA Victor Stereo LSP 3448

In his third offering in as many years, Levitt again turns in a collection of original numbers that reveal him as one of the most vigorous and inventive of modern jazz composers. Great playing by one of the most thoroughly rehearsed and interrelated instrumental groups is matched to some of the most exciting stereo sound heard to date. When RCA really tries, the difference is quite noticeable. Separation is rather extreme, but it has been employed with the same effectiveness as Levitt's instrumentation. This is a rare item—a great example of jazz recording.

Phineas Newborn, Jr.: The Newborn Touch
Contemporary Stereo CRS 7615

The present performances were recorded in April, 1964, a few months after the release of the last great album by this exceptionally articulate pianist. It has waited a long time for release, but the results have been well worth waiting for. All of the compositions are by important performers. Works by Benny Carter, Ornette Coleman, Jimmy Woods, Hampton Hawes, Russ Freeman, and several others serve as a basis for a series of rambling improvisations in varying moods. Newborn's highly personal approach to all of this material serves as a unifying element that gives this collection the quality of single extended work.

Earl Hines: Once Upon a Time
Impulse Mono A 9108

The seven tunes that make up this fabulous collection are played by an almost legendary group of performers: Hines, Cat Anderson, Bill Berry, Clark Terry, Ray Nance, Lawrence Brown, Buster Cooper, Johnny Hodges, Russell Procope, Jimmy Hamilton, Paul Gonsalves, Harold Ashby, Richard Davis, Elvin Jones, Pee Wee Russell, Aaron Bell, and Sonny Greer. Only Hines appears on all seven numbers, but each of the groups is a highly interesting assemblage with plenty of solo room as these veterans romp through Ellington's *Black and Tan Fantasy* and *Cottontail*, *Hodges' Once Upon a Time* and *Hash Brown*, Hines' *You Can Depend On Me*. Hampton's *The Blues in My Flat*, and a less familiar item called *Fantastic, That's You*. This patter is simply one of the all-time-great recordings of some all-time-great music.

Joe Pass: A Sign of the Times
World Pacific Stereo WPS 21844

Guitarist Joe Pass further demonstrates his versatility by turning his attention to a group of pop hits that ranges from the Petula Clark favorite *A Sign of the Times* and Dionne Warwick's *Are You There* to the Beatles' *Nowhere Man* and Antonio Carlos Jobim's *Dindi*. Arrangements by Bob Florence feature an agreeably subdued vocal chorus and Chet Baker's trumpet and flugelhorn. It may not be jazz, and it's probably a bit too staid for the teenagers, but it nonetheless has the relaxed, always attractive style that Pass manages to impart to all of his recordings. This is lightweight but highly enjoyable material.

Mothers of Invention: Freak Out!
Verve Stereo V6-5005-2

While the Fugs have been raising their voices in protest on New York's lower east side, similar sounds have been emanating from the Los Angeles region. Source of these complaining noises is the Mothers of Invention whose new 2-platter album has just been made available for the price of a single disc. Musically, I suppose the sounds produced by the Mothers can best be described as percussive rock with unison vocal choruses. The five-man ensemble seems to have included every variety of beaten instrument. Good use of stereo does much to separate and clarify sounds that would otherwise be thick and turgid. It is particularly helpful in their highly inventive, side-long ballet *The Return of the Son of Monster Magnet*.

Corrie Folk Trio and Paddie Bell: The Promise of the Day
Elektra Stereo EKS 7304

Vigor, musicianship, and perfect balance make this new offering from these Scottish folksingers a true delight. In addition to traditional Highland melodies, they give us a couple of Christmas carols, and, with the courage that is common to the Scots, they dare to try their hands at *Roddy McCorly*, one of the Irish revolutionary ballads that's a mainstay of the Clancy Brothers' repertory. That they can be regarded as serious competitors on the Clancy's home territory is a clear indication of the high calibre of this group's performances. Good stereo separation and bright close sound.

Mance Lipscomb: Volume 3
Arhoolie Mono F 1026

Exceptional guitar work by this seventy-one year old Texas folksinger does much to enliven a rather varied group of songs that rambles all the way from spirituals, to blues, work songs, and such oddities as *Little Brown Jug* and *Shine on Harvest Moon*. Recorded live at a Berkeley, California, night spot, each number is introduced with a few words of description. An old man, with only slight vocal resources remaining, Lipscomb is nevertheless a stylish and assured performer who effectively documents an important style of folk performance.

The Party Blues
Melodeon Mono MLP 7324

The race records issued for the Negro market during the twenties and early thirties included a number of highly spiced items that would certainly have caught the censor's attention if they had been offered to a broader public. Melodeon has assembled fourteen of these bawdy blues ballads performed by Dennis McMillon, Blind Lemon Jefferson, Tampa Red's Hokum Jug Band, Red Nelson, Soldier Boy Houston, Bill Johnson's Louisiana Jug Band, the Memphis Jug Band ,Jim Hill and Eddie Anthony, Mississippi John Hurt, Bo Carter, and Blind Blake. In addition to transplanting these rare 78's to a long playing disc, they have transcribed the full texts on the album liner for those who find it hard to believe their ears.

Mark Spoelstra: State of Mind
Elektra Stereo EKL 7307

In his latest platter, Mark Spoelstra again offers a collection of original folk compositions that have a strong social message. In the course of his new recital, he speaks out on such matters as racial violence in the cities, war, and the special problems that affect the child as he learns about an adult world. An able performer, Spoelstra projects all of his offerings in a highly polished manner that is somewhat lacking in variety. One is also forced to the conclusion that his message is rather more contrived than heartfelt, and there is a woeful lack of imagery in most of his lyrics. But his tunes are neatly crafted, his guitar accompaniments are deft, and his recording has that superior sound quality that is so characteristic of Elektra stereo recording. Æ

LIGHT LISTENING

(*From page 8*)

doesn't matter whether the lyrics came from Johnny Mercer, E. Y. Harburg, Leo Robin or Dorothy Fields, the effect is one of taking the listener into the inner creative councils while the song was being put together. Barbra Streisand just "happened" to be on hand to join the composer for two songs on the album. It all adds up to instructive entertainment not exactly commonplace today. ÆE

Ted Nash: Made Wthout Microphones
Repeat Stereo 100-5

More exciting material from the interesting new label that produces its recordings by a new technique involving transducers directly attached to specially designed instruments. No microphones are employed, and the sound has a clean, distortion-free quality heretofore missing from all conventional recordings. The present waxing is substantially more than a demonstration disc for a new technique, it is an attractive collection of jazz performances by Ted Nash on flute, alto saxophone, alto flute and piccolo, Gene Di Novi, piano, Roland Bundock, bass, Alvin Stoller, drums, and Tony Rizzi, guitar. Together they swing through ten easy-paced selections that include six original numbers by Di Novi: *Nashville Blues*, *The Freeze*, *Your Face is Familiar*, *Meet'Cha at the Moat*, *Sweet Talk*, and *Act III*. Ted Nash, who has been heard regularly with Henry Mancini's group, is here given an opportunity to demonstrate a flawless technique on four instruments. He accomplishes this in fine fashion without overpowering the rest of the group, largely because the recording technique permits each instrumental voice to come through with complete clarity at all times. Stereo balance is excellent, and the recording introduces another innovation that I haven't previously encountered—"Polymax" dust repelling pressings. The record pressed by Research Craft Corporation in Los Angeles, has not only one of the quietest surfaces I have ever heard but doesn't collect dust in the manner of conventional vinyl pressings. As a result, this record sounded as quiet after a dozen playings as it did when it first arrived. There's no doubt about it, technical advances are still being made in the field of high-fidelity recording. Repeat Records' successes should act as a stimulus for all recording engineers to turn out a quieter product with lower distortion.

Riviera Orch: World's Greatest Torch Songs
Mercury Wing 16303

The Wing label is Mercury's current entry in the low-price field. It represents an encouraging departure from the usual problems found in the pressings of cheaper labels. I've often wondered how much of the increased surface noise of cheaper pressings was inevitable and how much of it was allowed to remain there in disregard of progress in order to distinguish such items from a label's first-line stuff. An immediate tipoff in surface quality usually comes in the dead grooves separating the bands because nothing is available to mask the poor materials used in the pressing. Dead grooves in this release are far quieter than those of average less-than-top-price discs. Strings form the backbone of Wing's Riviera orchestra with other instruments used as special attractions to glamorize dependable materials such as *Laura*, *Tenderly*, *Ruby* and *Deep Purple*. ÆE

Sound & Sight

HAROLD D. WEILER

A COMPLETELY NEW CONCEPT in television production systems was introduced at the recent Conference of the American Management Association in New York City.

Audio Video Industries, of Bridgeport, Connecticut, display its Min-Con* Television Production System. The heart of this system is the miniature control console, illustrated in *Fig.* 2, which contains all the components of a complete broadcast studio, normally housed in a large fixed console.

This concept was originally designed for the Olivetti Underwood Corporation for use in their training center, shown in *Fig.* 1. Olivetti was basically interested in a method of presenting their own as well as competitive equipment to their trainees, as quickly as possible and in the most effective manner. The concept, incorporating the recently introduced Ampex 7000 video recorder, appealed to Olivetti as the most effective and least expensive method of presenting a complete sales and technical training program.

Olivetti was quite enthusiastic about the video recorder concept for a number of reasons. Its simplicity of operation allowed the training personnel to concentrate on the job at hand—teaching. The video recorder is no more difficult to operate than the conventional home audio tape recorder. The Min-Con system permitted unskilled personnel to produce professional results. Unless a film production is made professionally the result usually lacks the sparkle and polish the average viewer has come to expect because of his familiarity with commercial television. The fades, wipes, dissolves, and other "special effects" which add interest to commercially produced films and television are extremely difficult and expensive for an amateur to create when employing film. Conversely, the synergistic combination of the video recorder and the Min-Con make it quite simple for anyone to create professional productions for use in industry and education.

When sound, an essential in any training program, is to be added to film the problems increase as does the cost. With video tape recording, sight and sound are recorded simultaneously and easily. The problem of synchronization, encountered with film, is non-existent.

The video recorder immediately increased the effectiveness of Olivetti's training program. The sales trainees were given simulated sales interviews with instructors, acting as purchasing agents, who deliberately resisted their sales talks. Each interview was recorded and replayed immediately on completion. The trainees could see instantly where the interview was weakest, how and where their approach could be improved, why the sale was lost, or how it could have resulted in a larger order. What more effective method of training a salesman could be conceived than one which allows him to see his errors immediately?

Other applications for the system suggested themselves! Other departments began to use it. It was employed by the engineering department for evaluation and analysis. The effectiveness of test runs was greatly increased since a video recording provided more accurate and detailed information than the memory of any observer. The video recording also could be played back as often as required by the engineering, or other, departments. Olivetti was now also in a position to record lectures and demonstrations by experts on any pertinent subject at any time they were available, for replay at any convenient time.

Olivetti's public relations department started to use the system to record tours of the company's facilities for replay at distant locations and field offices. It was quickly discovered that production costs were far below those of film. It was no longer necessary to hold equipment, personnel, and camera crews for possible "retakes" as with film. The results could be seen immediately while on "location" Video recording also eliminated the necessity for additional "takes" as insurance, another substantial saving in time and material. The presentation could now be polished easily, "special effects" could be added or subtracted immediately to increase the impact of the production. Corrections, if required, could be made at once; there was no delay in waiting for the day's "rushes."

In addition to its primary use as a training tool, Olivetti quickly discovered that the system was perfect for disseminating current audio-visual sales and technical information rapidly and economically to their one hundred and twenty field offices.

The obvious ease of production, the simplicity with which "special effects" could be added and the tremendous economy of video tape made this medium mandatory. However, the conveniences and advantages of film, particularly film cartridges, as a replay medium dictated that a marriage of the two media be accomplished to meet

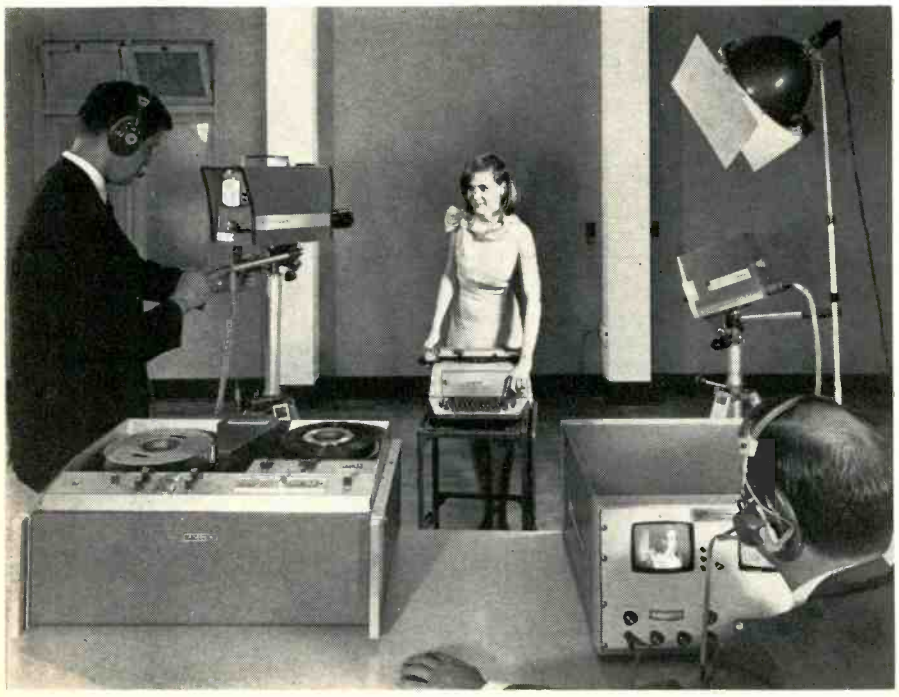


Fig. 1. The Olivetti-Underwood training center at Hartford, Conn.

*T.M. Reg.

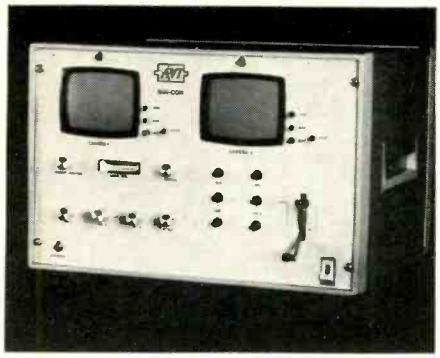


Fig. 2. The Audio-Video Industries Min-Con.

the requirements of this new application. AVI's concept was to capitalize on the advantages of video tape production techniques while utilizing the cartridge film techniques for inexpensive and convenient dissemination of the desired information at remote locations.

Kinescope recording (motion picture photography from the screen of a video monitor) is not new, it has been accomplished for many years with large broadcast recorders. However special consideration was required, in designing the Min-Con System to incorporate features which would allow high-quality Kinescopes to be produced from the new nonbroadcast recorders.

In the AVI concept the original video recordings are transferred to 8-mm film, and any additional editing or insertions from other existing films of charts, graphs, or maps is accomplished at this point. This method allows the best editing techniques of both media to be employed and combined to create inexpensive motion picture productions. The now completed edited product on film is then duplicated in the quantity required in the form of film cartridges. These cartridges can then be mailed, quickly, easily, and inexpensively, to any of the field offices.

The use of a rear screen cartridge projector, such as the Fairchild Mark IV, (illustrated in the September, 1965, SOUND AND SIGHT) at each of the field offices, makes replay of the desired information quite simple. The field salesman or technician merely inserts the cartridge into the projector and obtains the desired information. Since the film in the cartridge is in the form of an endless loop it is always ready for the next showing.

In the few short months the system has been in use at Olivetti, other advantages became apparent. One of the most desirable and least expected was the attitude of the training personnel and the trainees concerning the video recording of their courses. It was found that the average person who was shy or nervous when working before a motion picture camera became relaxed and had no fear of video recording due to the ease with which any errors

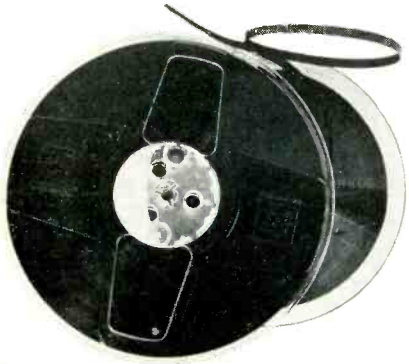
(*Continued on page 62*)

New Products

● **Sony's Components.** Here in one group is the Sony component line, newly introduced. All electronic units are solid-state throughout. In the foreground is

the Servomatic turntable (TTS-3000, priced at $149.50) with a 12-inch professional-type tonearm (PUA-237, priced at $85). In back of the table is the integrated stereo amplifier (TA-1120, priced at $399.50). The girl (no data supplied) is resting her hand on a walnut casing on which a 16-inch arm (PUA-286, priced at $99.50) is mounted. In front is the small, by comparison, moving-coil cartridge (VC-8E, priced at $65). On the right, in the foreground, is the TA-3120 solid-state stereo power amplifier (priced at $249.50). Not shown, but definitely in the works, is a comparable FM tuner. Clearly, Sony is aiming at the "high-end" market with this group of components. Circle 4

● **New Tape Reel.** Owners of recent model Magnecord recorders that can take advantage of a new 8-inch reel size may have wondered where such reels could be obtained. Magnecord has now made these reels available through their dealers at a cost of $1.20 per reel. The 8-inch reel can hold up to 50 per cent more tape than a conventional 7-inch reel, thus offering time advantages that are beyond the capability of the "regular" reels. Circle 5



● **New Receiver.** Latest in the handsomely redesigned product line of Lafayette Radio is this complete receiver. Featuring all-solid-state construction, the LR-900T has AM and FM (mono and stereo) radio. It is equipped with a "stereo search" system that will audibly signal when the tuner is adjusted to the presence of an FM Stereo broadcast. Important specifications include: four FM i.f. stages; stereo separation of 53 dB at 400 Hz; capture ratio of 2.5 dB; power output of 32.5 watts-per-channel IHF; frequency response is ±2 dB from 20-20,000 Hz; harmonic distortion is given as less than 0.6 per cent; hum and noise is 72 dB down; and IHF FM sensitivity is 2 μV. Operating controls include: Power on/off; tuning; volume; balance; dual bass and treble; mode; 6-position input selector; rocker switches for loudness, multiplex noise filter, tape monitor, and stereo search. An electronic circuit breaker protects against accidental speaker shorts. There is a built-in ferrite-bar AM antenna and screw terminals for attachment of an FM antenna lead. Price of the receiver, stock number 99-0157WX, is $199.95. Circle 6

● **Cassette Recorder.** Concord has just announced a portable, instant-loading recorder that is built around the Philips reel-to-reel cassette. The compact, battery-powered F-100 offers solid-state electronics and high recording and playback quality. The cassette itself will snap into place instantly and records or plays for a full hour. Stop at the tape conclusion is automatic. The F-100 comes complete with a dynamic microphone with a

remote start stop control. The combination of compact size (3 x 5 x 8 inches, light weight (3 lbs.) and rugged construction makes it ideal for use anywhere a portable can go. Controls include fast forward and rewind, and separate control for record and playback volume. A meter indicates recording level and battery condition. Included accessories are the remote-control microphone, mike stand and pouch, recording patch cord, playback patch cord, one Concord C-60 tape cassette, and a carrying strap.

Optional equipment includes a carrying case, a.c. adapter, telephone pickup, foot control for dictation, earphone, and additional C-60 tape cassettes. Important specifications given are that battery life is up to 10 hours of play (dependent on type of battery), tape speed is 1⅞ ips, frequency response is 60-10,000 Hz and flutter is 0.25% max. Price is under $100. Circle 7

● **Outdoor Microphone.** Two new microphones that provide built-in protection against explosive breath sounds and wind-noise, as well as against unwanted audience noise and feedback have been announced by Shure Bros. These are the Model 565 Unisphere I, illustrated left, and the Model 585 Unisphere A, right. Each has a strong, wire-mesh spherical front which contains two filters. These filters enable the microphones to be used outdoors without additional need for windscreening. Both units protect against objectionable background noise because they are designed to accept sound mainly from the front and to supress sound from other directions. The Unisphere I is a premium microphone ideal for use in high-quality theater-stage sound systems. List price is $95.00. The Model 585 Unisphere A is a lower-cost unit ideal for budget systems. Its list price is $65.00. Circle 8

● **The Tarzan Fan.** In this case we are not referring to admirers of Edgar Rice Burroughs' tree-swinging super-simian but rather to a compact air moving device measuring less than 7-inches square. This is the Rotron Tarzan fan, claimed

capable of delivering an air flow equal to much larger units. The new fan, which is the subject of several aerodynamic patents, now pending, is designed to cool micro-electronic modules, printed-circuit-card chassis, computers, and communications transmitter sections. Cost is less than $25.00 Circle 9

● **Antenna Lead-In Kit.** The Finco-Axial FM Stereo kit, model 7512B is a set for conversion from standard 300-ohm input and output to 75-ohm down lead. The claim is that coaxial lead will eliminate much of the outside and inside interference that normally occurs with FM-Stereo sets. The results of such interference can be noise or other multipath phenomena. This kit, which includes a waterproof balun for the antenna with mounting hardware, a second balun at the set, and coax connectors is all you will need, except for cable, to do the job. Most manufacturers of 75-ohm cable (Finco is one) offer 25, 50, 75 and 100 foot lengths with fittings already attached at both ends. If additional or shorter lengths are desired it is an easy thing to add fittings to the standard cables. This kit sells for about $8.95. Circle 10

● **Sine-Square Wave Generator.** This new model 636 from Precise Electronics is a complete source of sine- and square-wave signals from 20 Hz to 200 kHz. The instrument is designed with a one-scale frequency dial to simplify settings. There is also a dual-function output control. Operation is from a Schmitt trigger multivibrator and buffer for isolated optimum-waveform square-wave output to 100 kHz. Output is 0-10 volts is flat ± 1.5 dB over the instrument's range. Accuracy is ± 5 per cent. Distortion is less than 0.25 per cent at full output to 100 kHz. Output is 0-10 volts rms across a 600-ohm load. On square waves, the 636 has a 0.15-microsecond rise time with a 0-10 volt peak-to-peak output into 600 ohms. Output impedance is a nominal 30 ohms, the maximum is 1250 ohms. Weight of the unit is 15 lbs. Circle 11

RECORDS

(*From page 45*)

Soap Symphony. Classic Themes fom the Golden Age of Radio. Hollywood Bowl/Capitol Symphony Orch., assorted conductors, performers. **Capitol SP 8633 stereo**

Ho-hum. Here you have a brace of soap-opera (and other radio) themes, more or less in their original guise. More or less, because sometimes it is less than the whole original piece, necessarily. It begins with the *finale,* the last portion, of the famed (Lone Ranger) Wm. Tell Overture, then goes on to the Sibelius *Valse Triste* and the inevitable Flight of the inevitable Bumble Bee; then *Claire de lune* of Debussy, on the piano and so on and so forth. There's even a zither solo and an organ item. All played by a brace of "great classical artists," like, for instance, Carmen Dragon.

Very nice, but I find it a bit sad that the once-exalted Capitol Classics label has been so degraded by Angel's takeover of the heavy stuff that it can't rise higher than this sort of . . . well, I won't say what I was about to; for actually, the performances are perfectly good here, as far as they go. That's not very far.

Salve Regina. Choral Music of the Spanish New World, 1550-1750. Roger Wagner Chorale. **Angel 36008 stereo**

If you like European choral music, late-Renaissance and Baroque—anything from Palestrina to Schutz to Bach—you will be astonished at this music, composed 'way back in various Latin American spots when the Spaniards were solidly in control of those regions and the English to the North were mostly just a bunch of pilgrims. Much has been made of our own "early American" music—usually of the late 18th century—and of the only slightly earlier Moravian music, transplanted German music out of Pennsylvania. This Spanish music not only goes much further back, but most of it is more sophisticated, better polished, more meaningful than any New-World music I've run into so far in the North.

Imagine it—here, in the era when we think of the Spanish as grinding their heels into the local yokels, this saintly music was produced for local churches not merely for Spaniards but for the people who "belonged" there. Thus, for instance, a Peruvian, Juan Pérez Bocanegra, who published a whole set of works in 1631 with texts in Quechua, the language of the Incas!

As always, very good performance from the Roger Wagner people, who sing both musically and with intelligence.

MISCELLANY

Bernstein Conducts Shostakovitch: Leningrad Symphony No. 7. New York Philharmonic. **Columbia M2S 733 stereo**

(You'll pardon me if I quote the exact cover title of this record.)

They fought over it for a first U.S. performance in 1942, the big conductors. Toscanini won. In the next year, sixty-odd performances were given, just in the

U.S.—for this was the symphony about the siege of Leningrad, written on the spot and airlifted out. It became a patriotic world-symbol and, to be sure, it is full of an immensely serious expression and an appallingly effective wartime spirit of implacable hostility (the Germans) and high patriotism (the Russians). The sound still can make your flesh creep. But is it music?

It's music all right—too much. Like so much Shostakovitch, it goes on and on; but unlike Wagner, Shostakovitch won't let you go to sleep. Not a chance! Shostakovitch never relents.

In his "Concerto for Orchestra" of a year or so later, Bartok makes acid fun of a rather sappy tune (much blown up) from this symphony No. 7. It is now far more famous there than in the original here. Rather interesting to hear it in its original shape.

No—it's not "great" music nor even lasting music. But it makes an impressive show, and you'll never hear it more effectively set forth than in Bernstein's and Columbia's big-fi version.

Bartok: Concerto for Orchestra. Philadelphia Orch., Ormandy.

Columbia MS 6626 stereo

While we're at it—here's that very Concerto for Orchestra, in which Bartok satirizes the Shostakovitch Seventh (in the fourth movement, the "interrupted intermezzo"—the interruption is the Shostakovitch tune). This recording, out last all, is an interesting example of modern U.S.-style recording technique, applied to a piece that is full of solo and group-solo passagework within the larger orchestral sound and hence especially adaptable to the new "accent" close-up stereo miking within a big-space liveness. It works out very effectively, here, transmitting more sheer *musical information* to the ear than any conservative one-mike-per-channel stereo can do.

Ormandy's performance is too derivitive for me. It sounds like the famous Fritz Reiner versions, but with paler colors and less conviction. Not bad—just too slickly polished.

Bach: Brandenburg Concerti, Violin Concerti. Susanne Lautenbaher, Dieter Varholz, vls., asst. other soloists, Mainz Chamber Orch., Kehr.

Vox SVBX 567 (3) stereo

Phew! First time I got to know the Brandenburg Concerti, I bought *one* movement, of *one* concerto, on an expensive 78-rpm disc. Now here are all six works, plus two violin concerti, E major and A major, and the famous D minor for Two Violins, on three very well-filled LP records. Good performances, too.

You'll find these typical modern German performances brisk and authoritative, with the right instruments, the right ornaments, the right style, accurately played with nary a mistake nor ever a clumsiness—in fact, some of the solo playing is top-notch virtuoso stuff. And yet there is a prevailing gentleness of approach too, an unself-consciousness as though this music were as comfortable for all the players as an old slipper. All in all a really first-rate Bach recording. You won't find better, nor more communicative.

Really excellent soloists in the various groupings. A whirlwind trumpeter for No. 2, good recorder in No. 4, good horns in No. 1, a splendidly accurate harpsichord for No. 5 with its big solo cadenza, and very competent violins for the violin concerti. Excellent stereo balance in all the works, except that the solo violins are, for my taste, too close. Æ

Popular Science Magazine June 1966 Review of New ACOUSTECH ADD-A-KIT

PERSONAL-USE REPORT:

Kit Makes Super Hi-Fi Solid-State Amplifier

By RONALD M. BENREY

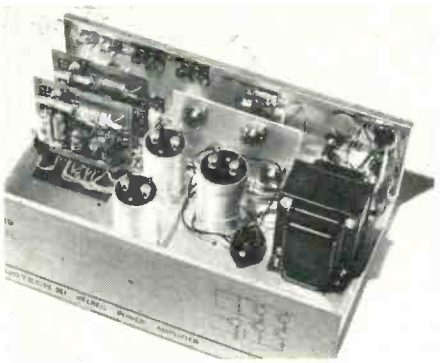
The Acoustech XI is a kit-built all-transistor amplifier that will outperform most factory-assembled rigs you can buy today. Its frequency response extends well past the upper and lower measuring limits of my test instruments. Distortion, even at the maximum power output of 35 watts per channel, is virtually inaudible.

I listened to the amplifier drive both low-efficiency AR-3 acoustic-suspension speakers and high-efficiency Jensen 600-XLs. The sound from both types of speakers was remarkably clear and brilliant, an indication of excellent transient response.

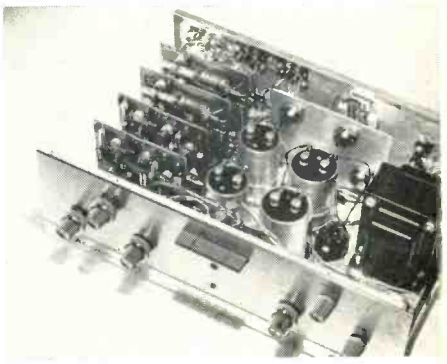
The basic power-amplifier kit costs $130; the add-on preamp module $90. They are made by Acoustech, Inc., 139 Main St., Cambridge, Mass.

Components and hardware are packaged in numbered plastic bags (like one shown above) that are stapled to a fuzzy-surfaced, solder-resistant cloth. You open one bag at a time to carry out a group of instructions.

The cloth makes an excellent work surface since small bits of hardware and tiny electronic parts won't roll or slide off it. Tricky-to-wire parts of the circuitry come preassembled on plug-in printed-circuit boards.



Step 1. Kit is designed so you can stop after wiring the easy-to-assemble power-amplifier stages, if you already own a hi-fi preamplifier. Construction time: about five hours.



Step 2. You can add on the preamplifier and control circuitry when you build the power amplifier, or do it at a later date. The conversion takes about 12 hours, most of it spent in wiring the complex selector switches.

HERMAN BURSTEIN

*Q. Just recently I taped a live choral concert and was quite disappointed with the results. The most annoying thing was a continuous, high-pitched buzzing sound. In playing back through my audio system I was able to eliminate this with the "high filter," but this also attenuated the treble response. I also encountered a low hum or rumble. The "low filter" had no effect on this. The equipment consisted of a **** tape machine, **** microphone, and **** microphone transformer. There was no electrical equipment in the area other than a bank of footlights to which the microphone cable ran parallel. Although I have made excellent tapes off my FM tuner, the audio quality of the live recording was far from as good. The highs had a shrillness and were often distorted even though I had the recording gain reduced so that the vu meter never hit the zero mark.*

A. The buzzing and hum may be due to inadequate grounding of the microphone case and/or the transformer case. Check that the shield of the microphone cable makes a secure connection to these. Check that the center-tap of the input side of the microphone transformer is connected to ground, if you use a balanced connection. You may have picked up electrical interference from the bank of footlights. The hum or rumble may be due to mechanical noise of the tape recorder being picked up by the microphone through the air or through floor vibration. The combination of shrill highs and distortion usually points to insufficient bias current. Possibly there is an appreciable difference in line voltage between your home and the site of the choral concert, resulting in a significant drop in bias current. With respect to the distortion, you may be recording at too high a level even though the meter doesn't indicate so. When you tape off the air, the material has usually been compressed a good deal, so that distortion-producing peaks are gone. But when you tape live material, you have to contend with a full dynamic range and with peaks that can soar as much as 20 dB above the average level. Futhermore, to my knowledge the meter of your particular tape recorder is calibrated to read 0 vu at too high a recording level (namely one that produces 3 per cent instead of 1 per cent harmonic distortion at 400 Hz).

Pops

*Q. I have a **** tape recorder and am very happy with it except for the very loud "pop" I get through my speakers whenever I press the stop button after rewinding. Turning the gain down on the tape machine or my audio preamp doesn't help much if at all. Have you any suggestions?*

A. I have queried the manufacturer of your machine about your problem and have been told that your situation is not uncommon, being due to a "spark" (RF impulse) picked up by your audio system when the button in question is pushed. The manufacturer suggests that careful grounding of your components to each other and to earth may alleviate the problem. If the button in question has electrical contacts, you might try placing a capacitor of about 0.1μf, 500 volts, across these contacts. Or you may try a similar capacitor across the leads to the transport motor(s).

Noise

Q. When playing recorded stereo tapes, the right channel has louder, harsher, and more obtrusive hiss than the left when the audio volume is the same on both channels. Your suggestions would be appreciated.

A. The greater hiss on your right channel may be due to a noisier tube, to a noisier plate-load or cathode-load resistor, or to a difference in equalization that results in greater treble emphasis (and therefore hiss emphasis) in the right channel. The first thing to do is to check the tubes of the first and second playback stages; do this by substitution. Checking the other possibilities will require the services of a technician.

Solo Instrument Stereo

Q. Is there anything to be gained musically by going to stereo if I only play recordings of solo instruments such as piano and organ?

A. I think that stereo does add something, particularly on organ, which is a broader sound source than piano. Whether the source is narrow or broad, stereo helps impart a fuller, less constricted sound. Even if the program material is mono rather than stereo, reproduction through two, or more speaker systems tends to increase listening pleasure.

Impedance Connections

Q. Would you please differentiate for me the two types of low-impedance microphone, namely those having one "hot" lead and those having two. I have a microphone transformer which accepts two hot leads, but my microphone has only one hot lead. How should this microphone be connected to the transformer? I have been contemplating the purchase of a tape machine which has provision for a one-hot-conductor low-impedance microphone. How may I connect my two-hot-line microphones to this input?

A. In the case of the 3-conductor, or balanced, connection, the two hot leads carry the signal, while the shield serves as a ground for the microphone case, the case of the transformer, and the chassis of the tape recorder. The balanced connection is particularly desirable for very long cable runs in order to cancel hum, static, and other interference picked up by the cable. If your microphone has only one hot lead, while the microphone transformer is designed for two (balanced connection), connect the hot lead of the mike to one of the transformer's hot leads, and connect the ground lead of the mike to the transformer's second hot lead, provided that this second lead can be grounded to the transformer case. Otherwise, try connecting the mike's hot lead to either of the transformer's two hot leads, and the mike's ground lead to the transformer ground. However, the latter connection may result in a serious mismatch, with adverse effects on the signal level, frequency response, and distortion. I suggest that you discuss the problem with the manufacturers of your microphone and transformer.

If you are referring to the problem of connecting a single microphone with two hot leads (balanced connection) to an input which accommodates only one hot lead, you can connect one of the microphone hot leads to the input's hot terminal and connect the microphone's second hot lead, along with the microphone ground lead, to the input ground.

Impedance Matching

Q. I have a tape recorder with a recommended source impedance of 10,000 ohms for the microphone input. My microphone can provide either 6,000 ohms impedance or 40,000 ohms impedance. Which should I use?

A. Use the 6,000 ohm setting. In general, the impedance of the source should be lower than that of the input if there is to be a mismatch.

Figure Eight

Q. What does a "figure-8" pattern of a microphone do for you?

A. A figure-8 pattern enables you to substantially eliminate noise arriving from the sides, and to pick up mainly sound coming from the front and rear of the microphone. Often you can get better pickup of a group of instrumentalists or vocalists by putting some in front of the microphone and some behind, instead of trying to crowd them all in front of the microphone.

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AUDIO ETC

(*from page 12*)

Veery? Or Veerio? As I say, we haven't formally met. I just know the sound of his voice.

Cat Birds are easy. (Another dull gray affair, with a longish tail that twitches—I've seen *him*. That's because he tends to come right up to you and sass you when he's bothered.) He just makes like a cat in distress, except when he's in a good mood—then he gives out a marvelous succession of endlessly sweet burbles and gargles, all apparently in one long breath. How does he do it? What an audio generator! Don't tell me bird songs aren't interesting.

° ° °

How Do They Do It?

I do, indeed, wonder how they do it, for this is an area of scientific know-how that is utterly blank to me. They *do* open their mouths, or beaks. Sound *does* come out of them. It must be generated mainly by air. But how much is on the intake and how much the outblow? And how, HOW do they manage to make (a) such LOUD sounds and (b) such an astonishing variety? Unbelievable. It would take more than RCA's Big Mark II computerized Sound Synthesizer to think up all the varieties of waveform and rhythm and pitch sprayed out by these little noisemakers.

I almost forgot my ubiquitous friends, the Drink-Your-Teas. That's what they're supposed to be saying, and that's what some of them do say. They also—when alarmed—say something like "Too-wee." And hence their official name, Towhee. (I dunno how to spell these official names since I rarely use them.) I like "Drink-Your Tea" much better. After all, these genial bird-brains are seldom alarmed. They're much less hysterical than the Phoebes.

The Tea Drinkers

The place is populated with tea drinkers. Each has his little territory (they are undoubtedly inbred, children and parents galore, fighting for a place in my sun). Each one let's loose every few minutes with his cheery command, "Drink your TEA!" and what amuses me (and distracts me from work) is that each individual bird has his own special version of the Official Song.

One of them, off to my South, has the hiccups. He says "*Tk* . . . vou-tea." Another lisps broadly. "DuWINK yo' TEEE!" And there's a Midwestern type, with that nasal R,—"Drnk yrrr Tzee." (*That "Tzee" sounds like Japanese.* Ed.)

But the best thing about this species is that, definitely, it has TWO songs. I've finally pinned them down. When they get tired of Drink Your Tea they just change the word order and it comes out like this, more or less: "Churrr-ti-Drrnk." (I.e., Your Tea Drink.) With variations. Sometimes there are supreme flights of fancy—"Churr-ti GURBLEGURBLEGURBLE."

In later summer, nest-building chores over, the Drink-Your-Teas economize on song. First it's just "Drink-your . . .," over and over. Then, in late August, the song is reduced to no more than one loud peep. "DRING . . . . DRINK." (*"Student Prince" candidates, no doubt.* Ed.) If I didn't know them so well, I'd hardly recognize it. Gets over the essential message, at least.

But back to the Quonset Bird and his friends. He is one of the birds I can't pin down to a proper name.

You see, I get to know a lot of birds quite intimately (that is, by their songs) who are wholly unidentifiable in terms of their right names, or even by visible looks. Yep, they hop around in the trees and bushes. But when I see them they aren't singing. And when they sing I can't see them.

The silly thing is, I really have tried out the bird experts on these; but without the smallest success. Those people know hundreds of Official birds, by name of course, and by plumage, habitat, nesting, type of flight and everything else—except their songs. They stop, look, and NEVER listen.

I say to them, "Now what's *that* one? And they say, "Where?" And I say, "Not the bird—the *song*!" And they say, "Well, I can't tell you unless I see him. . . ." And then they're off into the brambles, binoculars in hand. An hour later they return in triumph. "I saw a warble-sided chestnut! Did you know you had one on the place?" And I say, "What's he sound like?" And their faces fall. They don't know. We never seem to be able to get together, and it's too bad.

Bird Sounds Filing System

So I have to resort to my own devices and make up my private Filing System for birds—singular or plural (I never really know for sure). I listen, then I try to put the gist of the thing into words, or letters, just as I do with my deeper thoughts on audio equipment. I fill out cards and cards with my translations—bird-calls into typing.

Some of them, like the Robin, defy my best efforts. Just impossible. To be heard but not written down, like a genyooine folk song. But others, I fancy, I've got into print fairly well after a fashion—as a poet gets down a sunset in words.

Then, natch, I have to find names for them. If a Phoebe is a bird that says phoebe, and a Chickadee says chickadee, why obviously a bird hereabouts that says loudly, fifty times a day, "Quonset, Quonset . . ." is to be known as a Quonset Bird.

I've complete mystified one of my bird-watcher friends with this Quonset Bird. She is entirely unable to pin him down in her terminology, on the basis of my mere audio description. (I've never seen him, natch.) She sat outside for hours, one day, hopefully waiting for him to show—to sing *and* to be seen. He played dead. Next day he was all around, and now he sits outside jeering at me as I write this:

"Quonset, Quonset, DI-DI-DI-DI-DI phi*zee*, phi*zee* burp." That's his whole name, in my lexicon, and his whole song. He's been singing it at me for weeks.

Then there's a bouncy little devil, very sure of himself, who goes off occasionally, like an alarm clock:

"Zipzipzipper tree-*tweet*-you!"

I decided he should be called the Zippered Tree Tweecher.

The TV Bird

And there's the TV Bird. Maybe I'd best call him the tV bird, with the accent on the second syllable. He starts like an old-fashioned seltzer bottle overflowing:

"Swzzzzzzzzz *t'vee, t'vee, t'wee,* chortlewordledrp." Loud and clear, and it makes you jump when he lets go fifty feet or so away, up in the leafage.

Now there's another bird whose call is decidedly similar to that, though by no means identical, and I have an uneasy suspicion that he just might be the tV bird in a higher energy state. This one is altogether more agitated and eloquent. He bursts into exultant hysterics in the middle, chortling convulsively. Such animation! Such clarity of diction! Such nervous energy! Such volume! He also starts with the seltzer bottle fizz (or maybe a couple of Alka-Seltzers dropped into hot water) but it's more convulsive and his latter part is a kind of violent glottal oscillation:

"Whrzzzz-eezzzzzz-ti-WUR ti-WUR ti-WUR ti!"

Now *if* he's a separate bird, then I'll be darned if I can think what to call him. But if he's the TV Bird super-energized, then I can just call him TV Bird, Phase 2. Not a very adequate title for such a potent bird personality. But, then, I really have given up hope of further identifications for these characters. Somebody, for instance (I mean, some bird) said "Tchew!" at me several times this afternoon from a bit into the woods. Who was it? The Quonset Bird at rest? Or that big nocturnal visitor who made my flesh creep a week ago, suddenly yelling, out of the pitch dark and a dead silence, "Querp-querp querp *QUUMP quirk-quirk,*" only a few feet away from me. Then some animal must have tried to grab him, for he went into a wild, panic-stricken "Querp-querp *QUONK QUEEE-QUEEEE-querk*! and vanished. I was quite shaken by it. Nothing in audio to match *that* sort of sound track. I tell you.

P.S. I've gotta run. There's an Unidentified Stranger carolling outside my window in the grape vine and I can actually see him. Yep. One of those grayish affairs again. With a sickly greenish look underneath. But he sings like a bubbling brook. I like it. (*Obviously this was written at Mr. Canby's Mountain Hideout in northwest Connecticut.—not in Greenwich Village, N.Y.* Ed.) Æ

MEASUREMENTS

(*from page 28*)

performance of the tuner in handling the composite multiplex signal, before it is decoded.

Decoding

Regardless of the method of decoding employed, stereo balance depends on two things: reinjection of the 38 kHz in correct phase, as determined by control taken from the 19-kHz pilot; and correct matrixing, or the equivalent, of the composite signal to retrieve the original left and right signals.

The circuits that use the switching concept simplify this process somewhat, by retrieving left and right from the top and bottom of the resulting 38-kHz modulated wave, using oppositely polarized diodes as demodulators (Fig. 8-12).

The more sophisticated matrixing approach involves demodulation of the subcarrier to obtain a "difference" signal, then combining the filtered "sum" with this difference in the correct magnitudes by matrixing to obtain pure left and right, with proper separation (Fig. 8-13).

To check separation on the over-all performance, signal on left and right only should be used, in turn, checking for breakthrough on the other in each case, when the various controls are optimally set. Circuits using the switching concept use only one subcarrier phase adjustment to achieve separation.

In the matrixed circuit, there are more things that can be wrong and therefore need checking. It includes low- and high- or band-pass filters to separate the "sum" from the "difference" suppressed-carrier modulation. Incorrect or inadequate linearity of phase response in any of these filters will destroy the separation on a frequency-selective basis (when maximum at some audio frequencies, there will be breakthrough at others).

Checking the response of such filters can be achieved in the same way outlined for the tuner phase response. Incorrect amplitude response can cause the same thing. Both outputs ("sum" and "difference") should have as near identical audio response as possible.

Assuming the filtering and subcarrier reinsertion (which must be in correct phase—incorrect phase will produce a false waveform for the "difference" output that no subsequent adjustment can correct) and subcarrier demodulation are performed perfectly—which they never can be, completely, the separation then depends on correct matrixing: exactly equal parts of sum and difference being combined (at the respective outputs) in exact in-phase and anti-phase relationship.

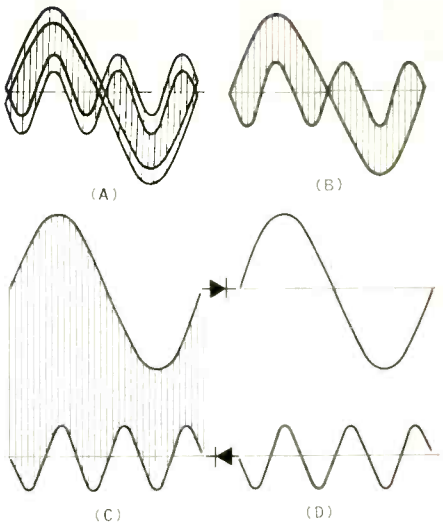


Fig. 8-12. Waveforms associated with reception on a multiplex decoder using the switching concept. Signals are on both left and right, with the latter three times the frequency of the former. (A) is the composite signal, used to modulate the FM carrier, and which should be retrieved by the tuner demodulator; (B) is the same with the pilot removed; (C) shows the waveform after subcarrier has been reinjected in correct phase; (D shows signals retrieved by oppositely polarized diode detectors.

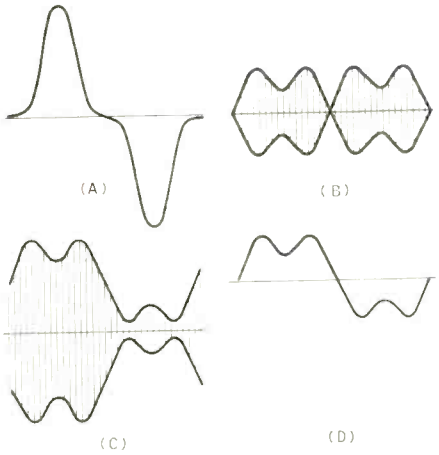


Fig. 8-13. Some of the waveforms associated with reception on a decoder using the matrixing method. The signal used is (A) of Fig. 8-12. (A) here is the output of the low-pass filter and should be pure sum of left and right; (B) is the output from the high- or band-pass filter; (C) is the same with the subcarrier reinserted in correct phase; (D) is the demodulated difference signal. If (A) and (D) are both correct in amplitude and timing, correct matrixing should retrieve the left and right of Fig. 8-12 (D).

Poor separation can only be tracked down in this kind of circuit by successive testing of each of these functions.

Even the switching-concept circuits may not yield optimum separation of left from right and of right from left at precisely the same setting. In any circuit, this should be checked. If the 38 kHz-circuits are reasonably linear, minimum breakthrough of left on right and of right on left will coincide. But if the 38-kHz wave is appreciably non-sinusoidal, due to non-linearity, the two conditions will not coincide, and the degree of separation either way will be deteriorated, and variable with signal level changes, in all probability.

With the matrixing circuits all the adjustments (on subcarrier phase and matrixing accuracy) need to be made, working alternately until an over-all minimum breakthrough is achieved, like balancing on a.c. bridge, both ways (left to right and right to left). If settings are different, for minimum one way as compared with the other, the resulting separation is difficult to evaluate, because an over-all maximum separation is difficult to find. This is another reason for preferring circuits using the switching concept.

Response and Distribution

Separation is relatively easy to check on a multiplex receiver. Frequency response on each channel is not too difficult, and distortion can also be measured. But the same questions of optimum setting are likely to recur.

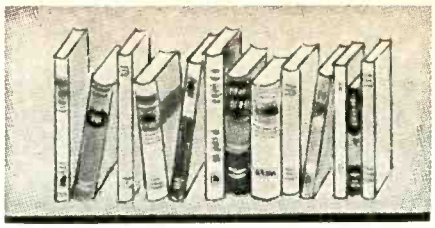
The only way to give a reliable figure of both is to check back and forth and find the setting that gives the best performance on both channels, in all respects, and then measure the whole performance at this setting without changing any settings.

In a good multiplex tuner, this procedure may sound unnecessarily involved, because everything happens to line up so nicely, you'd never know there could be such trouble! But if you are measuring the performance of a poor unit, trying to get it adjusted so you can get some measurements that are reliable will drive you out of your mind.

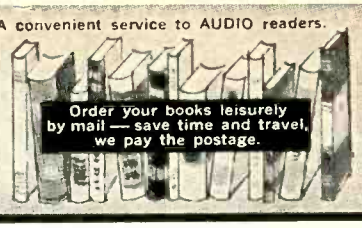
Of course, such a unit is not to be recommended anyway, because adjustment on actual reception will be even more difficult. If you cannot achieve a good setting when the generator is sitting on your bench, staying put, how can you do so when you are receiving a carrier that subject to fading, and that transmits a continuously changing program context?

The next installment will start on phonograph measurements. As in all audio measurements, what first look like simple measurements can become more involved than you expect. While waiting for next month's copy to arrive, how about trying to tabulate the things you should measure about phonograph performance? *Æ*

THE AUDIO BOOKSHELF



A convenient service to AUDIO readers.



Maintaining Hi-Fi Equipment
Joseph Marshall

A valuable reference for anyone whose living or hobby is servicing hi-fi equipment. Outlines the professional approach for servicing all types of hi-fi components. Covers trouble-shooting of electronic, mechanical and acoustic problems. 224 pages.

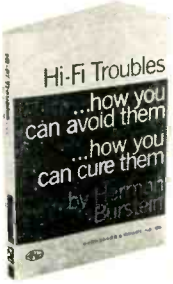
No. 58 Paperback $2.90*

Designing and Building Hi-Fi Furniture
Jeff Markel

Written by a professional hi-fi furniture designer who has taught furniture design at leading colleges, this book is an authentic reference of value to the hi-fi fan and professional custom builder. Covers everything from types of woods to furniture finishing for the mechanically adept; design principles, styles and arrangements for the decor minded. 224 pages.

No. 79 Paperback $2.90*

HI-FI TROUBLES
By Herman Burstein



HOW YOU CAN AVOID THEM
HOW YOU CAN CURE THEM

Just published! At last, a book which deals directly with the problems you face in maintaining your audio system in peak condition. Tells you how to locate troubles, what to do about them and how to do it—and, just as important: what NOT to do. Helps you to achieve the best in listening pleasure from your equipment.

No. 120 $3.95

"The AUDIO Cyclopedia"
Howard M. Tremaine

- 1280 pages
- 3400 topics
- 1600 illustrations

Here is one single volume with the most comprehensive coverage of every phase of audio. Concise, accurate explanations of all audio and hi-fi subjects. More than 7 years in preparation—the most authoritative encyclopedic work with a unique quick reference system for instant answers to any question. A vital complete reference book for every audio engineer, technician, and serious audiophile.

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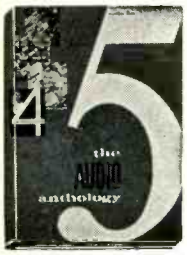
The 5th AUDIO Anthology



Edited by C. G. McProud, publisher of AUDIO. An anthology of the most significant articles covering: stereo recording and reproduction; stereo multiplex; measurements; stereo technology, construction and theory — which appeared in AUDIO during 1958 and 1959. The 5th is truly a collectors' item and a valuable reference for the professional engineer, teacher, student, hobbyist and hi-fi fan. 144 pages.

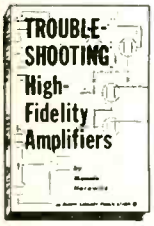
No. 125 $3.50

The 6th AUDIO Anthology

Edited by C. G. McProud, publisher of AUDIO. Includes articles on the two most significant milestones in the field of high fidelity: FM STEREO and TRANSISTORS IN AUDIO EQUIPMENT. A meaningful reference for everyone in the fields of audio engineering, recording, broadcasting, manufacturing and servicing of components and equipment. A necessary book for the high fidelity enthusiast. 144 pages.

No. 130 $3.95

TROUBLESHOOTING High Fidelity Amplifiers
Mannie Horowitz



Written specifically for the serviceman and audio hobbyist who wants to get into the profitable field of stereo hi-fi service. 12 fact-filled chapters with a plain and simple approach to troubleshooting all types of stereo and mona amplifiers—a direct text on curing both, vacuum tube and transistorized amplifier ills. Easy to read—includes data on test instruments and procedures. 128 pages.

No. 128 $2.95

McProud High Fidelity Omnibook

Prepared and edited by C. G. McProud, publisher of Audio and noted authority 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.

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SOUND in the THEATRE

First book of its kind . . . nothing like it has ever been published before! It is an authoritative text on electronic sound control for theatres, auditoriums, concert halls and other large enclosed areas where the source and the audience are present together. Contains complete procedures: For planning, assembling and testing sound control installations — Articulating sound control with other elements of production — Operation and maintenance of sound control equipment. Describes and illustrates 32 specific problems.

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SAVE • MONTHLY SPECIAL • SAVE

Save over 35% with this collection of AUDIO books
5th AUDIO ANTHOLOGY ($3.50) — 6th AUDIO ANTHOLOGY ($3.95)
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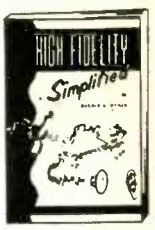
Harold D. Weiler

3rd Edition



The complete hi-fi story — answers all questions about tuners, changers, amplifiers, tape recorders, speakers, record players, etc. Lots of ideas for custom installations. Tells how to achieve concert hall reception in your home. 216 pages.

No. 142 $3.30

Getting The Most Out Of Your Tape Recorder
Herman Burstein

Written in "plain talk" for the man who has, or wishes to buy, a tape recorder. It answers the myriad questions raised by tape recording enthusiasts. Its chapters cover every phase of operation and maintenance—from adding a tape recorder to the hi-fi system, to a thorough dissertation on microphones. Lots of practical information on how to buy. 176 pages.

No. 251 $4.25

AUDIO Bookshelf—RADIO MAGAZINES, INC.
134 N. 13th Street, Phila., Pa. 19107

*All U.S.A. and Canadian orders shipped postpaid.

Please send me the books I have circled below. I am enclosing the full remittance of $..... (No C.O.D. or billing.)

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AES PAPERS (*from page 32*)

2:50 P.M. Thurs., Oct. 13, 1966

ACOUSTICS OF HALLS FOR RECORDING

Chairman: Theodore Schultz, Bolt Beranek and Newman, N.Y.

REVERBERATION REINFORCEMENT BY DELAYED ELECTROACOUSTIC FEEDBACK-AMBIOPHONY
G. F. Dutton, EMI, Ltd., Hayes Middlesex, England

HALL ACOUSTICS AND RECORDINGS
Leo L. Beranek, Bolt Beranek and Newman, Inc., Cambridge, Massachusetts

RECORDING PRACTICES AND STUDIOS FOR POPS RECORDINGS
Al Weintraub, Bell Sound Studios, New York, New York

9:30 A.M. Friday, Oct. 14, 1966

STEREO BROADCASTING AND RECEPTION

Chairman: R. W. Burden, Burden Associates, Mount Kisco, N.Y.

THE RELAY OF STEREOPHONIC PROGRAMS BY A SPACE SATELLITE
Harold L. Kassens, Federal Communications Commission, Washington, District of Columbia

FM-STEREO MONITORING
Arno M. Meyer, Belar Electronica Laboratory, Drexel Hill, Pennsylvania

MEASUREMENTS OF THE PHASE OF THE STEREOPHONIC SUBCARRIER IN FM-STEREOPHONIC TRANSMISSION
Lawrence C. Middlekamp, Federal Communications Commission, Laboratory Division, O. X. W., Laurel, Maryland

THE EFFECTS OF ANTENNA SYSTEM VSWR ON STEREO
Peter Onnigian, Jampro Antenna Company, Sacramento, California

RECENT DEVELOPMENTS IN FM RECEIVING ANTENNAS AND MULTIPLEX RECEIVERS
William S. Halstead, Multiplex Development Corporation, New York, New York, and Richard W. Burden, Richard W. Burden Associates, Mount Kisco, New York

THE GERMANIUM PLANAR FET—A NEW DEVICE FOR RADIO APPLICATIONS
David N. Leonard, Steve T. Ou, and Jack H. Abernathy, Texas Instruments, Inc., Dallas, Texas

1:30 P.M. Friday, Oct. 14, 1966

STUDIO AND CONTROL SYSTEMS

Chairman: A. C. Angus, General Electric Co., Syracuse, N.Y.

AUDIO IN A VIDEO WORLD
Oliver Berliner, Soundesign Engineers, Beverly Hills, California

AMPLITUDE LIMITING IN SYSTEMS WITH FREQUENCY-DEPENDENT OVERLOAD CHARACTERISTICS
E. Torick and R. Allen, CBS Laboratories, Stamford, Connecticut

A PORTABLE AUDIO CONTROL CONSOLE
William G. Dilley, Spectra Sonics, Ogden, Utah

AUTOMATIC AUDIO LEVEL CONTROL
Dale C. Connor, RCA, Meadow Lands, Pennsylvania

STUDIO FACILITIES WITH REMOTE CONTROL
Bruce H. Ratts, Westinghouse Broadcasting Co., Inc., Radio Station WINS, New York, New York

FILM MIXING WITH CONVENTIONAL TAPES
Robert Landers, Sound Studios of Landco Labs, Inc., New York, New York

SOUND & SIGHT

(*From page 49*)

could be instantly seen, erased, and the "take" re-recorded until the production was perfect. The smoother, less stilted, and more natural productions were an unexpected dividend.

The portable miniature control center, the heart of Olivetti's system measures 19¾" x 18" x 13" and weighs only 60 lbs. While it was designed for use by the non-professional, in combination with a high-quality video recorder, it will produce "better than broadcast" video productions for industry and education. The control center provides complete control of both audio and video functions for a two-camera recording or closed-circuit television system.

The Min-Con incorporates two high-resolution 5-inch monitors which permit the operator to see at all times the images being picked up by each of the cameras employed in Olivetti's system.

The switcher section provides instant selection of the image to be recorded or transmitted from either camera. The fader section provides complete control of the image brightness from each camera, thereby allowing the operator to achieve the various transitions so effectively employed in commercial television and motion pictures.

The image from either camera may be slowly "faded-in" to provide the ultimate viewer with the impression that he is gradually approaching the scene, thus paralleling the impression provided by his sense of sight in real life. As we approach a scene in real life all objects, in view, grow progressively brighter and more distinct. Conversely, the image from either camera may be faded out to parallel the mental impression received when leaving a scene in real life, where all objects gradually grow dimmer and less distinct.

The images from one camera may be slowly "faded-out" and the other then "faded-in." A technique employed commercially to mark the termination of an incident or a defined period of time, to indicate a change in location, or to denote a lapse of time and a simultaneous change of scene. The degree of time lapse is indicated by varying the duration of the transition. A quick fade-out and in, indicates a short time lapse or distance and a longer one a greater time lapse or distance.

The Min-Con also includes a four-position audio mixer which permits the operator to mix and fade three microphones and one auxiliary input. The auxiliary input may be a turntable or a tape recorder for "dubbing" sound effects. The built-in VU meter and Master Gain Control permit the operator to set the combined audio level accurately.

A broadcast-type EIA sync generator was included in the Min-Con unit to ensure high-quality video tapes from a multi-camera system when it is used with portable video tape recorders. Æ

CLASSIFIED

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

HI-FI SPEAKERS EXPERTLY REPAIRED
USED SPEAKERS BOUGHT
AUDIO SPEAKERS TECHNICS
22 Astor Place, New York, N. Y. 10003
AL 4-2140

PRESSINGS FROM YOUR TAPES. WHOLESALE PRICES. SPECIALIZING IN SMALL QUANTITIES. DUBLE DUBLYU RECORDINGS COMPANY, 221 Carton Avenue, Neptune, N. J. 07753.

FREE! Send for money saving stereo catalog AM and lowest quotations on your individual component, tape recorder, or system requirements. Electronic Values, Inc., 200 West 20th St., New York, N. Y. 10011.

HP. 300A Wave Analyser—$100.; 500A Frequency Meter $40.00; 205AG Audio Oscillator $125.00. RCA 77W—$25.; 76A—$40. (VTVM's); Custom AC VTVM $40.00; Distortion Meter $50.00. Write; Curt Guckert, P.O. Box 1882, Dallas, Tex. 75221.

M. RETTINGER Consultant on Acoustics Analysis. Room Design. Noise Reduction. 5007 Haskell Ave., Encino, Calif. Tel: (213) 784-3985.

PROTECT YOUR LPs. Heavy poly sleeves for jackets, 5 cents. Round bottom for records, 3 cents. Minimum 100. May Assort. Poly Co., Hillburn, New York Post Office.

WRITE FOR LOW QUOTES, fast service, everything in audio. Special Dynaco kits or custom wired plus walnut cases for complete Dynaco line. Kitcraft, 738A Washington Ave., Brooklyn 11238.

SALE: Fairchild Model 740 variable pitch three-speed suction chuck master disk recording lathe with hot stylus meter, playback arm and pedestal stand added. Value $4,000. Excellent condition S.N. 23 $2,900. Grampian "D" feedback cutter head with new 200-watt drive system $900. Westrex 2B feedback cutter head, factory rebuilt, unused $1,250 with saddle/holder. Westrex 1574B and 1574C drive systems available. Wiegand, 221 Carton Ave., Neptune, N. J. 07753.

AUDIO ENGINEER needed for new recording facility. Must be able to maintain and repair professional equipment. Excellent salary and fringe benefits. Call or write: John W. Kneller, Provost, Oberlin College, Oberlin, Ohio (216) 774-1221 Ext. 2257.

WANTED: USED SCULLY LATHE. Age and condition not important. Peter J. Helffrich, 419 W. 4th St., Bethlehem, Pa. 18015.

HARWALD AUTOMATIC FILM INSPECTOR AND CLEANER 35mm, automatic defect detector, spice counter, footage counter with spliceofilm auto. splicer. Call or write: Associate of American Medical Colleges, 2530 Ridge Avenue, Evanston, Illinois 60201, Attn: Mr. Harold Gordon, Phone 312/328/9505.

TWO UNIVERSITY C15W Woofers $25 each, $40 pair; two Wharfedale 3-way networks, 800 & 5000 cps: $15 each. E.V. X-600 network, $10. Prices plus shipping, all in excellent condition. John Haner, 683 Locust, Galesburg, Ill.

FM ANTENNA PRIMER

(From page 24)

For the case of two 300-ohm antennas arrayed, the impedance of the connecting line is equal to:

$Z_0 = \sqrt{300 \times 600} = 424$ ohms

Stacking kits are available from most antenna suppliers which yield both a match and correct housing of the two antennas in the array. We've pretty thoroughly covered the types of antennas available for FM reception and the methods of arraying them for increased gain. Little was said about the horizontal array mainly because of the relative difficulty of mechanically arranging two antennas this way and because of the lack of readily available feed-line assemblies for this type of array. The horizontal array finds greatest use in instances where adjacent or co-channel interference is a considerable problem. In these cases the phasing of the horizontal array can be adjusted to place the peak of the main beam (array main beam) in the direction of the desired station and a pattern null or minimum in the direction of the interfering station. For a good analysis of the horizontal array used in this manner, see "Antenna Method Minimizes Co-Channel Interference" by Robert Leitner in the June, 1963, issue of *Electrical Design News*.

Before we leave arrays it is important to place them in the proper perspective. Physically and mechanically they complicate the antenna installation sometimes far in excess of their relative worth to the system. The least an array can cost extra is the price of a second antenna. It can also include the cost of a larger mast, guying facilities, electrical stacking networks, and heavier mast and antenna support bracketry. For all this you are getting 3 dB more gain or 1.4 microvolts at the receiver input where 1.0 was available previously. If an antenna is currently in use which does not provide enough signal to the tuner input, rather than arraying this antenna with another of similar design, the better solution might be to replace the existing antenna with one of greater gain. Often the 3 dB that is picked up by stacking two antennas is available from a larger, single antenna without the attendant installation and support problems an array brings with it.

Our next installment will cover the problem of selecting practical and efficient transmission lines—equally important to good reception as the antenna or array itself. Æ

Advertising Index

TO OUR READERS

A new post office directive requires publisher to pre-sort magazine mailings by 5-digit zip codes. In order to ensure the same prompt delivery of your copy of Audio, please check the address label from this issue. If it does not contain the 5-digit zip code, please write it in and mail it back to Audio, 134 N. 13th St., Philadelphia, Pa. 19107.

READER INQUIRY CARD

Use this FREE Post Paid Card for more facts on the products described and advertised in this issue. CARD EXPIRES NOV. 30, 1966

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- ☐ Home Recordist
- ☐ Professional Recordist
- ☐ Broadcast Engineer/Manager
- ☐ Audio Service Technician
- ☐ Dealer or Manufacturer of Audio Equipment
- ☐ Other _____

I have purchased the following equipment after seeing it advertised in AUDIO Magazine. _____

I am planning to purchase the following equipment in the next year. _____

CHECK BOX A, B beside each coupon number

A to help me make an immediate decision to purchase.

B to explore a new method or to keep my files on the subject up to date.

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13			28			43			58			73			88			103			118			133			148		
14			29			44			59			74			89			104			119			134			149		
15			30			45			60			75			90			105			120			135			150		

My Comments On This Issue _____

CLASSIFIED ORDER CARD

DETACH HERE AND MAIL

Want to buy, trade or sell components? Looking for a rare piece of equipment? Want to offer or buy a service? Want a job in the audio field? If your answer is "yes" to any of these questions, your ad belongs in Audio Classified. Rates are comfortably low —readership is astoundingly high. Use this handy order form to include your message in the next issue.

PLEASE CHECK ONE:

- ☐ For Sale
- ☐ Wanted to Buy or Trade
- ☐ Situation Wanted
- ☐ Help Wanted
- ☐ Services
- ☐ Insert in next issue
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- ☐ Insert in next 6 issues
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- ☐ Assign box number (additional cost $1)

RATES: Commercial, 25c per word; situation wanted or non-commercial, 10c per word. We reserve the right to determine classification as commercial or non-commercial.

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DETACH HERE AND MAIL

Don't wait until your subscription runs out. Renew now and insure uninterrupted service. The remaining issues on your current subscription will be added.

GENTLEMEN:

PLEASE ENTER MY SUBSCRIPTION TO **AUDIO**

Name _____

Firm _____

Firm Address _____ City _____ State _____ Zip _____

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Send subscription to	Firm ☐	Home ☐
Send invoice to	☐	☐

☐ New Subscription

☐ Renewal

1 YEAR—$5 ☐ (Foreign - $6)	2 YEARS—$9 ☐ (Foreign - $11)	3 YEARS—$12 ☐ (Foreign - $15)	BILL ME ☐ PAYMENT ENCLOSED ☐

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STEREO LOG PERIODIC ANTENNA

NATIONALLY ACCLAIMED for:

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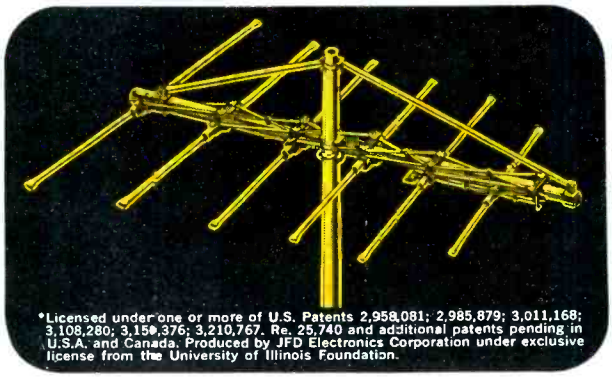

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NATIONALLY ACCLAIMED by:

- FM station engineers.
- Hi-fi publications.
- Tuner designers.
- Independent testing labs.

For the first time, JFD engineers have harnessed the amazing frequency independent telemetry log periodic antenna design to FM stereo. The result is a spectacular advance in the state-of-the-FM antenna art—the patented* JFD LPL-FM Log Periodic.

Your tuner's multiplex circuits require higher signal levels than monophonic tuner circuits. JFD full-wavelength L-dipole design gives your tuner up to 41 percent more signal voltage than today's best 10-element FM Yagi.

Your tuner's multiplex circuits also need pure, distortion-free signal. JFD frequency independent log periodic antenna design feeds your tuner studio-quality signals . . . maintains 300 ohm impedance match that prevents signal-sapping standing waves—on every station.

Whether you are seeking **more** FM stations, **better** separated FM stereo, **elimination** of distortion and interference . . . demand the antenna that is the expert's choice—the JFD LPL-FM Log Periodic.

Developed from research performed at the University of Illinois Research Laboratories.

MAKE JFD YOUR SINGLE SOURCE OF RELIABLE TV & FM ANTENNAS AND ACCESSORIES FOR THE HOME!

■ FM antenna signal amplifiers. ■ FM signal splitters that operate your FM and TV receivers off one TV/FM antenna (such as the JFD LPV Log Periodic). Or combine separate TV & FM antennas into one system using one down-lead. ■ Bandpass filters to eliminate interference. ■ AccuRotor rotators to pinpoint distant stations. Write for brochures 834 and 919.

4 LPL-FM ANTENNAS TO CHOOSE FROM

LPL-FM10	LPL-FM8	LPL-FM6	LPL-FM4
to 175 miles	to 150 miles	to 125 miles	to 75 miles
List $49.95	List $39.95	List $29.95	List $19.95

"With it we get the effective signal into the receiver which we formerly had using a yagi beam and transistor preamplifier. In addition to better limiting in the pickup receiver, we believe that we now enjoy a better noise figure in the overall system. We would recommend the use of this antenna to other broadcast stations."
Philip Whitney, Manager
FM STATION WRFL WINCHESTER, VA.

"My experience with this antenna will make me confident to recommend it to anyone who consults us from a difficult reception area."
Lawrence Gahagan, Chief Engineer
FM STATION WPRB PRINCETON, N.J.

"One particularly difficult pick-up is KTHO across 46 miles of rugged mountain range. Your antenna solved all of the difficulties."
Jerry Cobb
FM STATION KNEV RENO, NEV.

"We receive a perfect signal with the LPL-FM antenna, where it was impossible to use the signal heretofore for rebroadcast without a great amount of fading or atmospheric noise."
Cary H. Simpson
FM STATION WTRN TYRONE, PA.

JFD ELECTRONICS CORPORATION

15 Avenue at 62 Street, Brooklyn, N.Y. 11219

JFD International, 64-14 Woodside Ave., Woodside, N.Y. 11377 JFD Canada, Ltd., Canada

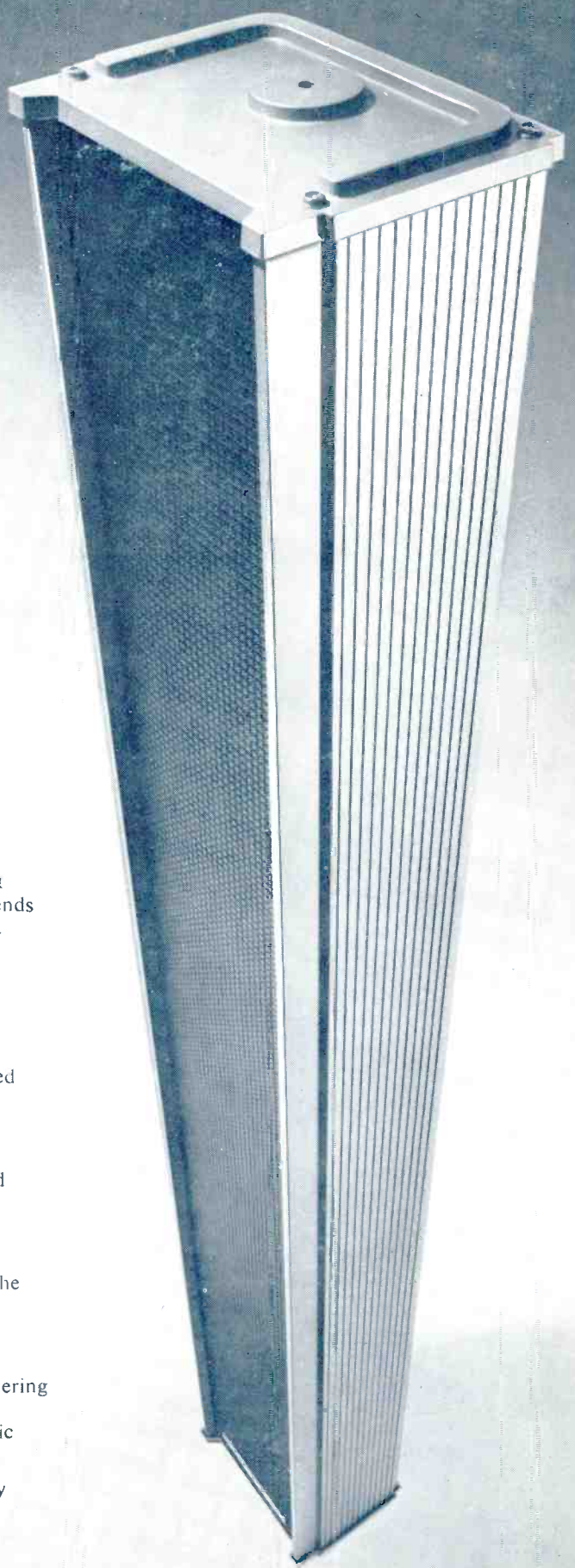
Circle 10 on reader service card

Anyone can build a column speaker.

We've built something better.

A new Line Radiator.

The LR4SA.



Column speakers look simple. Do it yourself? Why not!

Just hammer up a long box, grab a handful of radio-set speakers and a few feet of wire, and hook them up. Now cover the face with a couple of yards of hi-fi grille cloth and you're done. And it may even work.

Of course it won't be perfect.

It will be very heavy.

It won't be weatherproof.

Its polar pattern will be irregular — high frequency output lobes may appear almost anywhere (with at least one off the ends or back, right where you need a quiet spot for a microphone).

And finally, it may sound like nothing more than a long, narrow table radio. Or worse.

The new LR4SA Line Radiator* was designed to combat the many ills of hit-or-miss column speaker construction.

Start with the housing. We use a single channel of extruded aluminum, plus cast end caps. Very light. Weatherproof. Much stronger pound-for-pound than wood or steel. With no maintenance needed — indoors or out.

The grille is equally unusual. Acoustifoam®. We developed this foam plastic to be completely transparent to sound — yet act as a solid barrier to water!

And the LR4SA sounds better. You get solid coverage of a wide area with flat response. Unwanted lobes of energy at the backs and sides are sharply suppressed. It's quite a trick — and very useful to you.

It's accomplished in the LR4SA with very special 3″x 5″ speakers, chosen for rising response, teamed with electrical filtering that progressively rolls off highs at the ends of the column. This "contouring" of the response of every speaker is the basic difference between column speakers and a Line Radiator.

The next time you face a job that calls for a column — try the LR4SA Line Radiator instead. It can make your day!

*T.M.

Specifications: Frequency Response 200 to 10,000 Hz; 80 Watts Peak Power; Dispersion 160° Horiz. 30° Vert.; Net Weight 25 lbs.; Size 48-3/8″ L x 6-5/8″ W x 4-7/8″ D; $150.00 List (less normal trade discounts).

high fidelity systems and speakers • tuners, amplifiers, receivers • public address loudspeakers microphones • phonograph needles and cartridges • organs • space and defense electronics

Electro-Voice®

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