

# AUDIO

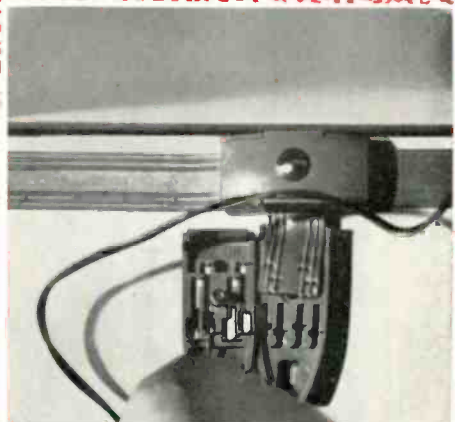
MAY/1965

60¢

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- 1 Wide Range Speaker Systems**, with separate woofers and tweeters and superb Scott cross-over networks, assures perfect reproduction, from thunderous bass to the highest shimmering overtones.
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- 5 Highly Compliant Magnetic Cartridge**, with precision diamond stylus, prolongs the life of treasured records, brings out every subtle musical detail.
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- 8 Full Complement of Controls** includes separate bass and treble controls for both channels, exclusive balancing controls, and switched headphone output for completely private stereo listening.
- 9 Handsome Styling . . . Superb Cabinetry** constructed of select oiled walnut, to please a wife, to grace a fine home.
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# AUDIO

May, 1965 Vol. 49, No. 5

Successor to RADIO, Est. 1917

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Number 21 in a series of discussions  
by Electro-Voice engineers



## TRANSISTORS COME OF AGE

JACK BURCHFIELD  
Chief Engineer  
Loudspeakers

Despite the relative newness of the technology, many design parameters for transistorized high fidelity amplifiers have become relatively stable and "standard." Unfortunately, these so-called standard circuits too often tend to represent the extremes in design philosophy without regard for the usable benefits to the consumer.

To follow proven techniques may well result in either a high-cost "ultimate" approach that vastly exceeds the needs of home music systems, or in a low-cost approach that performs significantly below the capabilities of present-day tube-type units.

In an effort to provide optimum quality—related to useful benefits to the user—Electro-Voice found it necessary and desirable to depart in several essential ways from "tried and true" circuit design in its new line of high-fidelity amplifiers and receivers.

For instance, a complementary emitter-follower driver stage is employed in the E-V 66 amplifier. Since resulting idling current is extremely low, and current is drawn only in proportion to the signal, heat generation is extremely low. Even more important to the non-technical user, however, is the reduced danger of burning out the power stages due to momentary shorts or overloads. This circuitry has made possible the use of slo-blo fuses which provide full protection, but reduce the need for frequent fuse changing when accidental overloads or shorts occur.

Another distinguishing characteristic of the driver circuit of these new amplifiers is its hexifilarwound transformer. The winding is carefully designed to reduce leakage inductance, and the extended high frequency response of these amplifiers is a direct result of the performance of this critical component.

A unique tone control circuit also distinguishes the E-V 66 amplifier. Variation in volume control settings change the source impedance feeding the tone control circuitry. No effect on response can be noted when the amplifier is set for "flat" operation. However, as tone controls are advanced and volume lowered, the permissible amount of tone control action is increased. Thus, advanced settings of the tone controls (often essential at low levels for realistic reproduction) are automatically reduced as volume is increased. Ease of maintaining uniform response at every level is increased, with automatic safeguards against excessive equalization at high levels. More than adequate tone compensation is available at every volume.

Innovation in design requires, as a corollary, a thorough testing program. The testing of the E-V 66 can only be described as abusive. Despite unusual extremes of heat, physical violence and excessive electrical demands on input and output circuits, the designs were proved exceptionally stable. This stability, in turn, benefits the high fidelity enthusiast directly, by assuring optimum performance despite less than perfect ambient conditions. It also serves to reduce the incidence of repairs and maintenance required to an absolute minimum.

For technical data on any E-V product, write:  
ELECTRO-VOICE, INC., Dept. 553A  
602 Cecil St., Buchanan, Michigan 49107



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# COMING

## ARTICLES

• **Calculus Made Difficult.**  
D. R. Butterly. Most engineers find calculus quite difficult, but this article illustrates a technique for making it impossible.

• **Are Tapes Long-Lived?**  
John T. Mullin. An expert and pioneer in the tape field takes direct aim at this controversial and difficult topic. Many misconceptions are thoroughly exploded.

**Reversible Speakers.**  
Abraham B. Cohen. Reversible sound systems require the speakers to be both speaker and microphone.

## PROFILES

- KLH Stereo Amplifier and Tuner, Models 16 and 18
- Altec 604E Speaker

In the June Issue

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

# AUDIO CLINIC

Joseph Giovanelli



Send questions to:

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

Include stamped, self-addressed envelope.

### Vertical and Lateral Cartridge Performance

*Q. All available arms and cartridges are intended for stereophonic use, yet many of us still use monophonic discs. In order to play both mono and stereo records, cartridge manufacturers recommend that the coils in the stereo cartridge be paralleled.*

*I wonder whether this arrangement is proper. I made up a unit, using a minibox, a SPDT slide switch, and three phono jacks wired as in Fig. 1. I wanted to be able to prove whether paralleling of the cartridge elements is proper.*

*Playing a mono record, with the slide switch in the "mono" position, one determines which of the two cables from the arm is "lateral" because the mono record is recorded laterally. There should be no vertical response.*

*For comparison's sake, with the determined lateral cable plugged into the lateral jack, one obtains an output of one volt. By reversing the cables and plugging the vertical cable into the lateral jack, no signal should be present except possibly for noise and the grit in the bottom of the record groove. However, the cartridge does respond laterally via the vertical coil, at about 40 per cent of the output from the lateral coil, with the lateral cable in the lateral jack. How come? The reproduction is not good, but yet it does respond. What happens to the sepa-*

*ration that manufacturers of cartridges talk about? Isn't the cartridge made so that the lateral modulations of a monophonic disc are only impressed on the lateral coil and not on the vertical?*

*It would appear that cartridge manufacturers have a big job cut out for them, for one cannot refute that playing a monophonic record, with the cartridge paralleled, the response should be only from and through the lateral coil. Any response from the vertical coil is in the form of noise and added distortion, which to my thinking should not be present.*

*Conversely, if one had a vertically recorded disc, would not the latter coil also respond?*

*I think this proves my contention that the playing of a monophonic disc demands that the vertical coil be grounded to provide clean reproduction, and disproves the paralleling theory of playing monophonic records. Adolph Hoefer, Clayton, Missouri.*

*A. Let us first examine the construction of a stereo record. Assume that a groove is being cut with no modulation. Now let us modulate the right channel. If you could observe this modulation with a microscope, you would note that the right-hand groove wall was being modulated 45 degrees from vertical while the left wall will contain little or no modulation. The degree to which the left wall is modulated is a measure of the separation of stereo channels in the particular cutting system used to make the record under discussion.*

*If, now, we modulate the left channel and omit modulation of the right channel, the pattern will reverse so that the lefthand groove wall will be modulated but not the righthand groove wall.*

*If we take the modulation and feed it simultaneously into both channels, making sure that the modulation is identical in character, one of two conditions would prevail. The output, or modulation of the groove, would be vertical or horizontal depending upon the phase relationship between the modulation applied to the two channels. (If the modulation is applied out of phase, the resulting modulation will*

*(Continued on page 49)*

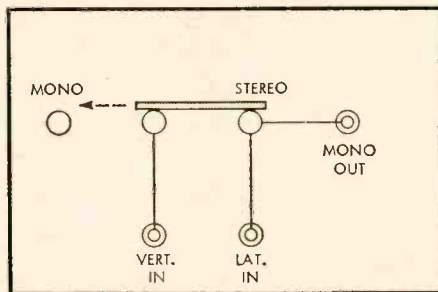


Fig. 1.

70 Larkspur Avenue

February 20, 1965

British Industries Corp.  
Harvard Division  
80 Shore Road  
Port Washington, New York

Gentlemen:

About 1 1/2 weeks ago I purchased a Harvard LAB 80 (I turned in an ~~in~~ ~~trade~~) and I wish to tell you I am so delighted with the unit that I am compelled to make periodic trips into the living room to reassure myself it is still there.

I consider the LAB 80 a remarkable achievement. The arm tracks perfectly at pressures 1/4 to 1/2 a gram lighter than the excellent ~~arm~~ ~~I~~ had before. In fact it will handle even my most difficult records flawlessly at one gram and the unit will trip with ease at 3/4 of a gram.

The cueing device is a delight to use. You score 100% on the appearance of your unit - it is a very handsome addition to our living room. The finger lift seems to be in the perfect spot - it makes manual handling of the arm a delight. What more can I say?

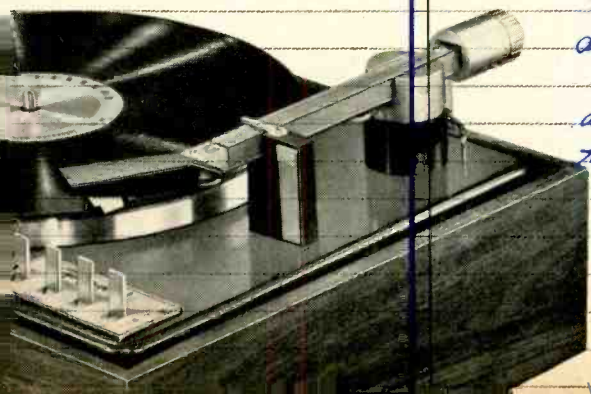
Upon opening my unit I found the instruction manual (which I also must compliment you on for its clearness and completeness) but included in the box there was no Warranty Card. The number of my unit according to the carton is #1293.

To complicate matters I have now lost or misplaced my instruction book. Would you please: 1. register my LAB 80 under Warranty if this is standard procedure and 2. send me another instruction Booklet and bill me for any cost involved.

May I again compliment you on an excellent and exciting automatic transcription turntable.

Sincerely,

Allan Goldfinger



## Famous for REVERBERATION...



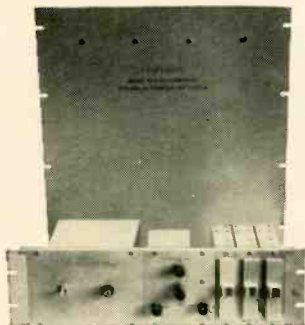
**LIEDERKRANZ HALL**  
in New York City

For years Liederkranz Hall was world renowned for its remarkable acoustic effects and consequently it was in constant demand for recording. But even Liederkranz Hall had its limitations! Engineers could not always control the reverberation quality and time. However if you wanted to record in Liederkranz Hall today it would be impossible because, as with most old landmarks, it's destined for destruction.

But . . . don't fret, don't worry! There's a much more practical, effective, and less expensive method to add controlled reverberation to your sound.

Now reverberation comes in a compact, portable attractive and rack mountable package 24½" high by 19" wide in . . .

## THE FAIRCHILD REVERBERTRON



### Unique Features of the FAIRCHILD REVERBERTRON

Variable reverb • Electronic time control • Solid state components • Rack mountable • Portable • Three time periods instantly and noiselessly selectable • Remote control without expensive servo mechanisms • Mixing network provided.

Used by studios throughout the world for its natural reverberation effects, the FAIRCHILD REVERBERTRON'S reasonable price now makes it possible for every studio to have the production plus of controlled, flexible and natural reverberation.

**Priced at only \$985**

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

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# LETTERS

## He's On Our Side SIR:

Your April 1965 issue response in "Editors Review" to Elliott Sanger's letter (page 4) in the same issue was greatly appreciated, much needed, and well done.

I have no doubt but that separate programming on AM and FM, for those commercial broadcast stations now duplicating programming, involves a significant investment in terms of equipment alone, let alone programming costs. However, although licensees have been allowed some latitude in terms of past duplication (which did stimulate development of an FM audience to some degree), there is now no reason why licensees should not be required to conform to requirements intended to bring about more effective use of the existing commercial broadcast spectrum. After all, the spectrum is extremely crowded. Surely there is no longer a public need for this duplication of AM and FM programming.

Licensees, such as Mr. Sanger's WQXR, have a right to complain and may be expected to desire continuation of a situation that is to their advantage, but we must bear in mind that the freedom which they were given was neither a right nor guaranteed to continue indefinitely, nor is it now in the listener's interest: most effective use of the spectrum allocated for commercial purposes. The F. C. C. proposals aren't flawless, but they should prove to be a practical approach to a problem of effective spectrum allocation. Let us see how this proposed solution works. Practice will point to refinement needed.

In his April issue letter, Mr. Sanger generalized regarding the characteristics of his listeners, citing these generalizations as one support for his argument against the F. C. C. proposals, and here I strongly disagree with him. Speaking as an authority in this particular field—I am a "WQXR listener"—I positively do *not* expect nor want the same programming on AM and FM, but rather the reverse. Since Mr. Sanger chose to cite WQXR as the good example, this listener must differ again: although WQXR is one of the *two* best (Mr. Sanger forgets the programming of WPAT at certain hours) commercial "good music" stations in the New York area on AM (but WQXR occupies this position only by default), it is one of the worst on FM (where it suffers by comparison because of relatively unimaginative programming, steadily increasing commercialization, and long-term heavy emphasis on the

"personality cult" in the announcing function).

To conclude my major argument, Mr. Sanger says "The announced purpose of the separation policy is to give greater variety of programming to the listener. There is no need for this in New York." Mr. Sanger would indeed seem to be saying that he can see no need for greater variety in programming to serve his own marketing area. This is surely a memorable, truly a remarkable, and an even astonishing statement to come from the pen of an AM-FM station executive vice president—and a very illuminating statement.

MICHAEL M. MEYERS  
25 NUTMAN PLACE  
WEST ORANGE, N. J. 07052

## Open Letter to a Crushed Box

(Last month Mr. Sutherland of Electro-Voice apologized for their having failed Mr. Canby's wastepaper carton test. Mr. Canby replies.)

SIR:

I have just gone into executive conference with myself and have voted you a vote of thanks for your letter and also a memorandum to the effect that I hope you do *not* send me your 473 different varieties of carton, and I must warn you, moreover, that if you do, there will be nobody at home. Permanently.

ED CANBY

P. S. The EV speakers arrived in perfect condition—and so did the cartons, but as you say, the cartons aren't much good without the stuff inside them.

## Addendum to "Sound at Fair"

SIR:

It is of special interest that some World's Fair exhibits used home-type rather than industrial equipment to provide high-quality sound. I only know about the exhibits for which we were asked to supply speakers, but I am sure there were others.

For example, the Crystal Palace fashion show used 16 AR-2a speakers and Dyna power amplifiers; the studios of station WTFM, broadcasting from the Fair, used 12 AR-3's; the Minnesota Pavilion used 12 AR-4's and 2 AR-3's; and a jazz group on 'Bourbon Street' used 8 AR-2a's.

There were also three exhibits devoted specifically to high fidelity: the silent IHF display, the H.H. Scott exhibit in the Belgian Village, and the AR Music Room in the Better Living Center. The latter demonstrated (and will again in 1965) the equipment of

(Continued on page 49)

# SOMEDAY, THERE MAY BE OTHER FULLY AUTOMATIC TAPE RECORDERS LIKE THE NEW CONCORD 994



## (WHY WAIT?)

*The 994 gives you automatic programming. Plays or records automatically three different ways. Stops by itself where you want it to. Threads itself automatically. And, the 994 is available now!*

With the transistorized 994, Concord introduces a new dimension to tape recording. Some might call it modernization, some might call it automation. We think of it as *convenience*—in playing, in recording, in starting and stopping, in threading, in hours of uninterrupted listening. You can't compare it to anything because the 994 is as different from the conventional stereo recorder as the old crank-type Gramophone is from the modern record changer.



**AUTOMATIC PROGRAMMING.** You can program the 994 to play or record one side of a tape from beginning to end and stop automatically. Or, to play/record first one side of the tape, reverse, play the other side, then stop automatically. Or, to play/record forward and back, forward and

back, continuously, as long as you like—an hour, six hours, or all day. You may change direction of tape any time you like by merely pressing the direction change buttons. These same lighted buttons automatically show you direction of tape travel.

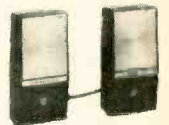
**PUSH-BUTTON KEYBOARD.** The operating controls are literally at your fingertips. This is the one recorder you can operate without arm waving, and with one hand! As far as threading, that's even simpler—the 994 threads itself automatically.



After all this, we didn't just stop in designing the 994. We kept going. As a result, the 994 offers superb performance and every conceivable feature required for your listening and recording pleasure. Here's a brief sample: three speeds with automatic equalization, four professional heads, two VU meters, digital tape counter, cue control, sound-on-sound, exclusive Concord Trans-A-Track recording, 15-watt stereo amplifier, professional record/monitoring system. The 994 may also be used as a portable PA system, with or without simultaneous taping.



**TWO-WAY STEREO SPEAKERS.** The split lid of the 994 houses a pair of true two-way speaker systems, each containing a tweeter, woofer, and crossover network. A pair of highly sensitive *dynamic* microphones is included.



The 994 is priced under \$450.\* An identical recorder, Model 990 comes without speakers or microphones and is priced under \$400.\* Both are at your dealer's now. So why wait? Drop in for a demonstration and find out for yourself what *fully automatic tape recording by Concord* is all about! Or, for complete information, write Dept. A-5.

For Connoisseurs of Sound

Other Concord models from \$50 to \$800.

# CONCORD 994

CONCORD ELECTRONICS CORPORATION, 1935 Armacost Avenue, Los Angeles, California 90025  
IN CANADA: Magnasonic Industries, Ltd., Toronto/Montreal

\*Prices slightly higher in Canada.

THE SIGNATURE OF QUALITY ■ Tape Recorders/Industrial Sound Equipment/Dictation Systems/Communications Devices/Closed Circuit Television

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**Announcing  
The New  
FAIRCHILD  
F-22  
Condenser  
Microphone**

**New  
advanced  
design with  
low-noise  
field effect  
transistor!**

The FAIRCHILD F-22 Condenser Microphone uses a field effect transistor as the microphone pre-amplifier. This field effect transistor has an extremely high input impedance that complements the high impedance characteristics of the condenser capsule for an outstanding improvement in signal-to-noise ratios. No complicated RF circuitry is used in an effort to improve signal-to-noise ratios. The absence of vacuum tubes eliminates the problem of noise, microphonics, and the expensive periodic replacement of the tube.

The FAIRCHILD F-22 provides the user with the most often needed pickup pattern—cardioid—with outstanding front to back cancellation characteristics thereby making it ideal for broadcast, TV, sound re-enforcement and recording. Extremely low hum susceptibility allows easy use in a variety of operating fields and the basic high sensitivity of the F-22 allows integration into a variety of circuits and a variety of studio and field operating conditions.

A new convenience... the F-22 is self-powered. The F-22 eliminates the bulky, heavy, cumbersome remote power supply associated with conventional condenser microphones. The F-22, as illustrated, is complete—just plug into a studio audio line and you have the smoothest, cleanest sound possible. This self-contained power supply allows new ease of operation in studio work and in field assignments. The use of a field effect transistor with its low noise and low current drain requirements allows the operation of the F-22 with long life mercury cells. The use of minimal parts and the use of missile-grade components throughout assure the user of continuous quality.

By breaking away from traditional condenser microphone design and using the latest in solid state-field effect transistor technology and micro-circuitry, FAIRCHILD is able to produce this quality condenser microphone at an astonishingly low and sensible price, thereby putting the ultimate microphone quality within the reach of every sound engineer. price **\$219**

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

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# LIGHT LISTENING

Chester Santon

**Maile Serenaders: Evening in the Islands**

Warner Bros. WS 1584

It would seem that the influence of this magazine is making itself felt even in a place as far off as Hawaii. Here is a stereo disc of exceptional technical competence recorded in Hawaii for Warner Brothers by a local firm called Hula Records. This Honolulu outfit can hardly be called a byword among record customers in the U.S. market yet the work it turns out puts to shame the efforts of some of our fanciest labels. The sound here has all the crystalline crispness of the best Warner releases, automatically placing it near the very top of the list of American labels still turning out a decent product. Hawaiian engineers were not the only free-lance artists involved in this project. The six native musicians who make up the Maile Serenaders appear under that name only on records. They have been drawn from the major performing groups on the islands. Ukulele, bass and three types of guitar—each instrumentalist featured here obviously deserves the top rating he enjoys in the island.

**Dinah Shore: Lower Basin Street Revisited**

Reprise RS 6150

The Lower Basin Street style of music making shows no sign of dying out while Dinah Shore remains within reach of a microphone. It doesn't seem possible that 25 years have gone by since Dinah hit last year's fame on the NBC radio series known as "The Chamber Music Society of Lower Basin Street." What is there in the distinctive Shore voice and style that time simply does not affect? She sounds as fresh and relaxed in this revisit to Lower Basin Street as she did when many of us listened to the original radio series on a weekly basis. The album points up a fact perhaps forgotten by devotees of the old radio show. In addition to the old Dixie standards, the program offered a fresh and nonchalant treatment of current songs of the day in a singularly appealing style. The same idea has been carried over to this find album. Interspersed with *Basin Street Blues*, *Chloe* and *Bye Bye Blues*, are relaxed arrangements of modern tidbits such as *More* and *Do-Re-Me* from "The Sound of Music." All returns should be as happy as this one.

**Bravo Jankowski**

Mercury SR 60993

Mercury's affiliation with the Philips label, one of Europe's largest, offers dual dividends in this release. Anyone seeking

an album of unassuming background music delivered in the current continental style will find it here as pianist Horst Jankowski, age 28, leads a choir and orchestra in his own novelty arrangements. The other dividend is the opportunity to hear what German recording engineers are doing with their latest gear. It's easy to make a judgment of contemporary German sound in this stereo recording because Mercury did not tamper with the original recording curve when it turned out the disc for American consumption. In playback I was able to indulge in the rare luxury of flat tone control settings without being driven out of the room by screaming highs and fake bass. This is a thoroughly clean job at level settings considerably higher than one can endure on some American (and European) discs of a pop nature. The odd mix of tunes—*Nola* rubbing shoulders with *Parlez Moi* and *Toselli's Serenade*—may give the record some difficulty in finding a specific audience but any true audiophile should be pleased with what he hears.

**I Had a Ball (Original Broadway Cast)**

Mercury OSC 6210

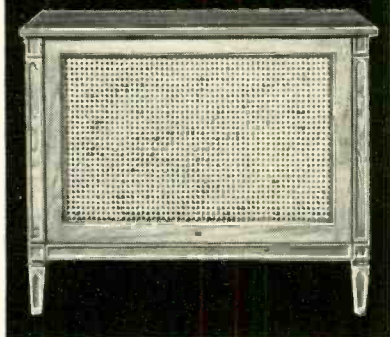
With good musicals as rare as they are these days, it doesn't take much persuasion to talk a large record company into backing a show in order to get release rights to the original cast album. If a show score or cast lineup displays any merit before rehearsals, the major disc firms are quick to put in their bids and the production appears in due time on one of three labels—RCA, Columbia or Capitol. For reasons that become plain when you hear this album, the three companies usually most interested in show casts passed up this Buddy Hackett musical comedy. Mercury Records, however, was willing to wager that comedian Hackett has a following large enough to justify release of his first major Broadway effort. In one sense, the label is performing a public service in gambling where the others showed no interest. Not having seen the show, I don't know how many numbers Buddy Hackett has in the stage presentation. On the record the listener is scarcely aware that Hackett is the star of the show. He appears in no more than three songs. Of these, only *Dr. Freud* offers any semblance of a vehicle for his visual comedy style. There are ballads aplenty (*Can It Be Possible?* and *Almost*) to keep romantic leads Richard Kiley and Karen Morrow busy but the score just doesn't have enough to sell a Hackett record with so little Hackett on it.

(Continued on page 14)



1965 -

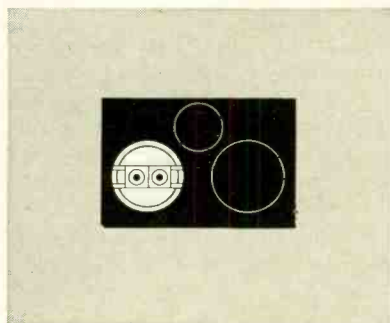
This is Bill Smith's New Bozak Speaker. It Cost \$251\*



Though young and just getting a start in the business world, Bill has an ear for music. He wants the very best loudspeaker he can afford now, without losing his investment later.

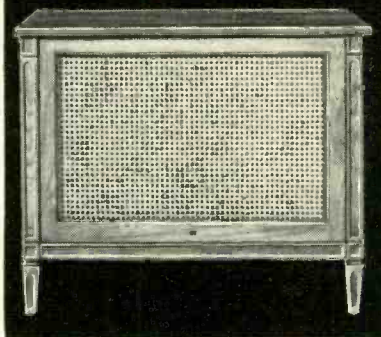
His wife, Mary, wants furniture of which she can be proud.

Wisely, they choose the tasteful Italian Provincial enclosure designed to house a full Bozak B-305 speaker system. In it they have mounted a single two-way Bozak coaxial B-207A speaker.



1967 -

This is Bill Smith's New Bozak Speaker. It Cost \$94.50\*

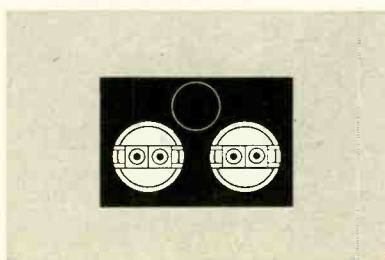


Things are going well. Bill and Mary just moved into a new house. Their living room is big enough to take advantage of a broadened sound source, with its increased realism.

While both secretly believe it to be difficult to improve the sound from their Bozak, they add a second B-207A coaxial speaker.

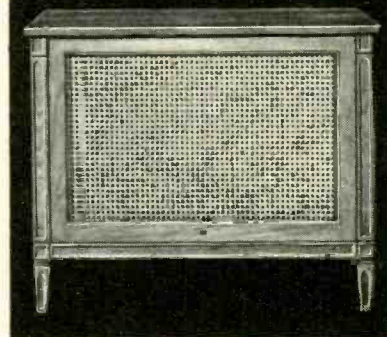
It's easy — just remove a pre-cut panel and insert the speaker. Total cost \$94.50.

To their surprise, they find a new measure of presence, of musical delight, in their Bozak.



1969 -

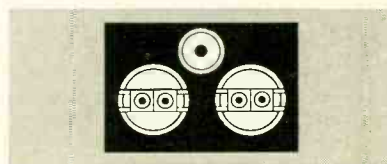
This is Bill Smith's New Bozak Speaker. It Cost \$82.00\*



Bill just had another raise. Mary completely refurnishes their home, but finds that the quiet dignity of the Bozak cabinet still adds charm to her living room.

They take the final step toward their dream of listening perfection. They convert their speakers to a three-way system by adding a Bozak B-209B mid-range speaker and a three-way crossover network. Again, they simply remove a panel and insert the speaker. Total cost, \$82.00.

Now they have achieved their goal. They have the complete Bozak B-305 speaker system which they couldn't afford when they were first married. Meanwhile, they've enjoyed years of musical pleasure.



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## ABOUT MUSIC

Harold Lawrence

Around 1678 a London charcoal hawker converted the loft above his coal house into a music room. He tuned up his Ruckers virginal and small five-stop organ, and put on a series of weekly public concerts. Coffee was served at a penny a cup, and customers who were "willing to take a hearty Sweat [had] the Pleasure of hearing many notable performers in the charming Science of Musick."

We have come a long way from those informal chamber music parties, which were among the earliest public concerts in history. Nowadays audiences file into concert halls ranging in size from small auditoriums like Judson Hall, to Philharmonic Hall at Lincoln Center, to hear pianists, string quartets, violinists, harpsichordists, and other soloists and chamber groups, play music originally composed for the more intimate atmosphere of an aristocratic salon or a charcoalmonger's loft. A critic recently compared the experience of attending a guitar recital at Philharmonic Hall with that of peering down at a fly in a Grand Canyon gorge.

Chamber music concerts like these erect a barrier between audience and performer. Seen from the sunken orchestra seats or the distant balconies of most concert halls, the musicians on stage often appear remote and inaccessible, and the spectator cannot fail to

be affected by this separation. But place the music lover on the same level as the performer, and in the same room (most concert halls consist of two distinct 'rooms': stage and auditorium) and he is at once drawn into the sphere of the performance. A bassoonist and pianist recently played a short program of works by Mozart, Hindemith and Weber for some friends at a private studio. The audience was thrilled to hear the unlikely duo, but their excitement stemmed less from the performance than from the impact of hearing these instruments at close range and in an intimate setting.

To the average music lover, the words "chamber music" suggest austerity, monotony, and the esoteric. Concerned with this image, a pair of part-time impresarios set out to cultivate a wider public acceptance of what some have called "the music of friends." They noted with gratification the signs that the rigid patterns of concert-giving may be breaking up: at a Greenwich Village coffee house probably no larger than Britton's London loft, a pianist performed Mozart and Bach to a bearded and blue-jeaned audience; programs of experimental music are staged in cold-water flats in Lower New York; and, of course, there are the perennial series of chamber music at the Frick Museum. A year ago, Edgar S. Feldman, an insurance broker, and William S. Boal, an assistant manager at Time-Life enterprises, rented the Bowman Suite of New York's Biltmore Hotel to produce a subscription series of Friday evening concerts, or "concert-parties." In the mirrored ballroom, some 400 persons may sip drinks at tables arranged in horseshoe fashion around a small platform for the musicians. The living room lamps that provide light for the players' musical parts add to the intimate atmosphere the impresarios are trying to achieve. "We acquired the lamps first to compensate for the room's inadequate lighting," explained Mr. Feldman, "then we found to our delight that they enhanced the 'home' effect."

Each concert-party is conducted in three movements. The first is the Reception starting at 8:00 P.M., during

(Continued on page 48)



Fig. 1. Gotham Baroque Ensemble performs at a concert party in the Bowman Suite of the Hotel Biltmore. (Photo by L. B. Fink.)

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# AUDIO ETC.

Edward Tatnall Canby



## FOUR TRACKS UNDERGROUND

There are worlds within worlds, these days, even in audio. Merchandizers spend thousands, just like everybody else, trying to pin them down via marketing research—to get their itching fingers on a few more pulses and maybe sell a few more products.

And yet the unrehearsed, un-researched bits of info that we stumble onto, now and then, can sometimes show up more of those little worlds than we might have thought even existed. Take a letter between two friends that was passed on to me recently by a third friend. It's about tape, home tape, tape from the point of view of something called the Tape Underground.

The Underground, of course, is that vast unofficial exchange of taped sound that is now world-wide and which no tape manufacturer can admit to knowing about, since it involves the little matter of copyrights, *et al.* But this isn't the point I have in mind at the moment—let's take all *that* for granted. What interests me is the side-comment in this letter, concerning tape machines and the present state of 4-track.

I don't know either correspondent, the one who writes, apparently from some such place as Hawaii, and the one who gets the letter, who might be living anywhere in the world where Americans are found. But their mutual story unfolds immediately. They are both home tape amateurs, both music lovers, and both members of the world-wide Tape Underground.

*"Dear Bill, (Name falsified here, deliberately.) The tape arrived Saturday morning. Many thanks. I was able to reproduce it very well and enjoyed the Flagstad songs (Wesendonck). I've been wanting them for some time and it was a pleasure to get them. For some reason the St. Matthew Passion which, you say, is on LP repressed from 78 rpm—does not have the same quality but it certainly is a pleasure to have the voice of the immortal Ferrier in such a work. The Robert Frost poems I am not familiar with, but they were much appreciated—particularly by Dorothy."*

That sets the scene, doesn't it? These two boys are hep on classical music and many other things to be found in such

lovely quantity on LP records, all ripe for their larcenous recorders. No compunctions about that—not one bit! As most of us in the field are well aware, this little side-show is actually one of the biggest hobbies in the whole tape area and it accounts for a whale of a lot of our business—that is, the sale of tape recording equipment and of raw tape itself. (Though a vast amount of erased tape recirculates in these Underground circles, to the frustration of tape sellers.)

After a side-paragraph having to do with a tidal wave scare (thereby locating the source of the letter as Hawaii), our friend gets down to the real point of his letter, which is the interesting part for us. Seems the writer is an old hand in tape exchange, while the receiver of the letter must be fairly new at the game. He wants information, this Bill character. And so our writer, who shall be called John, proceeds to give it.

*"NOW, in choosing a type of tape-recorder, IT ALL DEPENDS ON WHAT YOU WANT TO DO WITH IT. If you want to have a fine one and go down town and buy 4-track professionally made tapes—or make your own recordings and play 'em back ON YOUR OWN MACHINE, then a 4-track machine is fine. ON THE OTHER HAND, if you are in the Tape Exchange Underground, 4-track is DYNAMITE."*

O-oh. I can see the hackles rising on some of our professional readers. Sorry, can't help it. That's what the guy says. (It was about here that I myself began thinking, hey, maybe somebody ought to print this letter.)

*"I would never use a 4-track machine—under present conditions (February 1965), with my English correspondent, the guy who sends me those marvelous Handel operas, etc., screaming his head off, and all the Old Pros swearing they'll never use 'em. They're justified, too, because 4-track on one fellow's machine might be 1000th of an inch off on some other fellow's and you have plenty of crosstalk. AS A MATTER OF ACTUAL FACT, there IS crosstalk on all 4-track tapes but it's below the normal "annoyance point" when played back on machines with IDENTICAL*

## ALIGNMENT, FACING and HEAD POSITIONING."

Well, there's the Underground viewpoint, as of this very year. It harks back only too familiarly to many an argument that raged among us in the professional field back when 4-track tape first appeared. Obviously, alignment in all its phases is much more crucial in 4-track taping than in the earlier formats, two-track and full-track. The guy is right in general terms.

But is this really an up-to-date observation, or does it reflect the usual tangle that is inevitable among consumers?

First, equipment-in-use always ranges back in time and *brand new equipment is always in the minority*. Second, there is the persistence of older ideas, perhaps already out-dated.

We need merely think back to every new development in this and similar areas where the standards of *precision* have been upped. Always, the older system allows more leeway, the newer one is more subject to troubles of misalignment, etc. etc. I'm thinking not only of tape but, of course, of the LP record itself—which suffered the same sort of criticism in its early years as compared to the then more "reliable" 78 system. Can't we all (us middle-aged people) remember it? The 33-rpm speed was almost impossible to stabilize short of big, expensive, bulky pro equipment. The microgroove was too delicate, the playing cartridges too gross—or else themselves too delicate—for home use. The needle skipped, the pitch wavered and I don't know what else.

But with the passing of years, we improved the LP system, with all its precision. We improved the 8-mm home movies system similarly. We improved 35-mm still pictures, until the blow-ups were plenty good enough for anybody, amateur or pro. Progress does progress, given time. Is it to be so much different with tape?

Is there any reason why 4-track tape shouldn't in the end be just as reliable as 2-track tape and, before it, full-track? I would assume, as I'm sure most pros in the field also assume, that 4-track for the home is today well on the way to reliability and to that illusive interchangeability so important to the Tape Underground. There's still room for a lot of healthy progress. Look at the newly exact parameters already on the home market in such devices as the Revere cartridge tape recorder with its tiny thin tape and 1½ ips speed. Also the demonstrated accomplishments of numerous 1965 recorders at similar slow speeds, as shown at the Hi Fi Shows this year. We'll see plenty more precision.

However—let's keep an eye on things as they are NOW, out in the field—

After two months of what **Popular Science** described as "the most extensive listening tests ever made by any magazine," a panel of experts chose components for stereo systems in several price categories. The components in the highest rated system were to be the best available no matter what the price.\* "Where there was a more expensive component that produced a detectable improvement in sound," stated **Popular Science** authors Gilmore and Lockett, "it was chosen."

AR-3 speakers and the AR turntable were the choices for **Popular Science's** top system.

The **Popular Science** panel was not alone in its findings. Two other magazines — **Bravo!** and **Hi-Fi Tape Systems** — selected components for the best possible stereo system; AR-3 speakers and

## THE AR-3's WERE CHOSEN AS BEST.

REPRINTED COURTESY OF POPULAR SCIENCE MONTHLY © 1963 BY POPULAR SCIENCE PUBLISHING COMPANY, INC.



Two of **Popular Science's** five-member panel check speakers.

the AR turntable were the choices in each case. **Gentlemen's Quarterly** chose the AR turntable for its top (\$3,824) system, but relegated AR-3's to its "medium-cost" (\$1,273) system. (The complete lists of selected components, as they appeared in these four magazines, are available on request.)

The AR turntable by itself has been reviewed by leading authorities as the best in the entire field regardless of price.

Yet you can spend many times the price of these AR components. AR-3 speakers are \$203 to \$225 each, depending on finish (other models from \$51), and the two-speed AR turntable is \$78 including arm, base, and dust cover.

\*Speakers limited to "compacts" for reasons of practicality in the home.

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with all that accumulated back-information going around, and all those older 4-track machines still at work. Our friend John goes on further. An interesting idea—he thinks that only younger people go for 4-track tape. His feeling is they don't know any better. Lack of experience. I'm not so sure. Couldn't it be that these younger kids keep up with the times a bit more enthusiastically, and so veer more quickly towards the newer systems as they improve with development?

"Now, for the purposes of economy that you mentioned—four different sets of material on one tape,—there are a bunch of younger fellows in the Underground who are using 4-track machines for this purpose—economy and space—BUT—note this—THEY ARE ALL WAY UNDER 30 years of age and I think that experience in EXCHANGE will ultimately force them back to 2-track. However they do good work, and they REVERE the quality of tape that I send to them."

Well, anyhow, now we know that John is over 30. He's one of those Experienced guys all right. He goes on about the problems of playback:

"Of course—they can play my tapes on their 4-track machines BUT WHEN THEY SEND TAPE TO ME, they have

to use VIRGIN TAPE and record on tracks 1 and 4, leaving the two center tracks blank. Now don't think that is ALL of the picture. Tape so recorded—and your Flagstad to me is so recorded—sound weak and fuzzy because I'm getting only half of what I normally would get. Have, therefore, to play them on a special transport where I can "position" the head to get the full effect of that ¼ track. . ."

Well now just a minute, John, hold on. You're going overboard a bit. Natch, if you're going to play 4-track on a 2-track machine you'll have to fix things up somehow; but why blame the system? To be sure, there's an incompatibility. It was, alas, necessary and inevitable if we were to have a new arrangement which would take advantage of tape progress to allow more sound on less tape—for useful commercial ends and a widening of home tape potential.

If you're going to play 4-track tapes, then for goodness sake play them on 4-track heads. There is no other way.

Well, now we know that this letter's recipient, Bill, uses 4-track. The cat is out of the bag! Bill is a 4-tracker, whereas older, wiser John, writing this letter, is an old-fashioned 2-tracker.

"(I can) generally get pretty good

effects from ¼-track tape recorded on tracks 1 and 4. BUT DON'T KID YOURSELF—two track is BETTER—and FULL TRACK is much better still. . . . If it's economy (you want) you can, like these young guys, put four different sets of material on one tape, but don't ever kid yourself that you won't get crosstalk (if you listen carefully in the quiet spots) and DON'T EVER KID YOURSELF THAT YOUR CORRESPONDENTS WON'T GET PLENTY OF CROSSTALK unless their machines are identical to the 1000th part of an inch."

OK, John, I get the message. I'm not even trying to kid myself. As a matter of fact, tape being reasonably cheap if you shop carefully, I do all my own tape exchanging at 7½ ips full-track and I write in big letters on each reel—"PLAY ON ANY MACHINE, 4-TRACK, 2-TRACK OR FULL-TRACK, AT 7½ ips." So you see I'm an old conservative, even more so than John. And yet I do not accept his reasoning as final, nor will you. Things are improving. They'll go on improving.

But what really makes me marvel, in all this fine discussion, is one huge, enormous, positively staggering omission. STEREO!

For Heaven's sake—hasn't the Under-



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## Mr. Saul Marantz discusses his revolutionary new model 10-B FM Stereo Tuner

**Q. Mr. Marantz, your new 10-B tuner is quite revolutionary. Do you feel it will obsolete all other tuners?**

**Mr. Marantz:** In one sense, yes. The performance of this tuner is so dramatically superior to conventional tuners that anyone who wants or needs perfect FM reception today has no choice but to use the model 10-B. Its superiority, however, does not necessarily *obsolete* conventional tuners. Rolls Royce, of course, makes superior cars, but they haven't obsoleted Chevrolets.

**Q. Is this superior performance discernible to the average listener?**

**Mr. Marantz:** Very much so. The difference is quite dramatic. As you know, conventional tuners have never been able to pick up and reproduce broadcasts which could match the quality of a fine disc or tape playback system. This has often been blamed on *broadcasting* quality. But the new 10-B disproves this theory. It reproduces the *broadcast* of a disc or a tape with the same clarity and separation as if played through a playback system — proving that broadcast quality is generally excellent.

**Q. Is this true with weak broadcast signals also?**

**Mr. Marantz:** Yes. In fact the model 10-B will reach 55 db quieting at only 3 microvolts! This is better than most conventional tuners will reach at 1000 microvolts. With a 25 microvolts station the Model 10-B reaches a phenomenal 70 db quieting which is about 20 db better than most conventional tuners can achieve at *any* signal strength. This means that with the Model 10-B there will be excellent reception even in fringe areas, particularly so because of the tuner's high sensitivity, its extremely sharp selectivity and reduced susceptibility to multipath effects, which on other tuners cause distortion.

**Q. How are such improvements accomplished?**

**Mr. Marantz:** The answer to that question is very complex, because the 10-B is far more than an improved tuning system; it is a completely new *design concept* with *many* technical innovations developed by Marantz engineers.

**Q. Can you give us some examples?**

**Mr. Marantz:** Yes. The RF section, for example, contains a balanced-bridge di-

ode mixer — a technique used in modern sensitive radar designs to eliminate a major source of noise, harmonic distortion and other spurious interference. The whole RF circuit is balanced-tuned, using a precision tuning capacitor with four double sections, for further reduction of spurious images.

For the critical IF strip, we've developed the first commercial application of the "Butterworth," or phase-linear filter. This new concept provides a number of distinct characteristics essential for good results. The passband, for example, is phase-linear for extremely low distortion — especially at high frequencies — and it remains essentially phase-linear at all signal levels.

Cutoff slopes beyond the passband are extremely steep, allowing unprecedented selectivity; it is much less subject to the effects of multipath, and it doesn't require realignment with tube changes or aging. The old standby coupled IF circuits currently in use do not have any of these characteristics.

**Q. Are there any innovations designed specifically for multiplex?**

**Mr. Marantz:** Yes. For multiplex reception we've developed our own unique

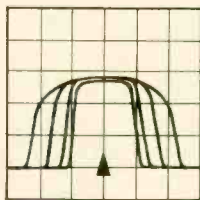
variation of stereo demodulator, which permits phase correction to maintain a very advanced order of stereo separation throughout the whole audio band.

**Q. What is the purpose of the tuning and multipath indicator?**

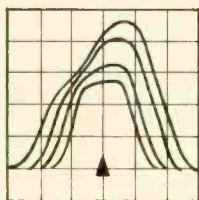
**Mr. Marantz:** This oscilloscope device is so versatile its single trace tells many easily understood stories. It shows when a station is tuned exactly to the center of the passband. The height of the pattern shows the signal strength. The indicator shows how much multipath is present, making it easy to adjust the antenna for best reception. It shows if the station is creating distortion by over-modulating. Also, technically informed users can check stereo separation of transmissions, discs and other sources.

**Q. And how soon will the model 10-B be available in quantities?**

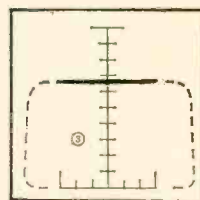
**Mr. Marantz:** The Model 10-B is a laboratory instrument of extremely high quality which will never be *mass* produced in the usual sense. However, production has been stepped up fourfold and all back-orders are now being filled by Marantz franchised dealers.



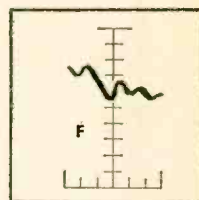
IF Passband retains phase linearity and sharp slopes at any signal strength for low distortion, sharp selectivity.



Conventional mutually-coupled IF circuits change characteristics drastically depending on signal strength.



MARANTZ MULTIPATH/TUNING INDICATOR  
Station tuning is simply and accurately adjusted by centering the trace.



Multipath (Ghosts) shows up as 'wiggles' on the tuning trace. Antenna is simply rotated until trace is smooth.



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**PREVIEW**

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### TK-80 SPECIFICATIONS

#### AMPLIFIER SECTION

Total Music Power: 80 watts (IHF Standard)  
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 Frequency Response: 20 - 60,000 cps  $\pm$  1 db  
 15 - 120,000 cps  $\pm$  3 db  
 Hum and Noise: Phono - 60 db, AUX - 72 db below rated output  
 Bass Control:  $\pm$  10 db (50 cps)  
 Treble Control:  $\pm$  10 db (10,000 cps)  
 Input Sensitivity: MAG 1.5 mV, Tape HD 1.5mV, AUX 100mV  
 Loudness Control: +10 db 50 cps, +5 db 10,000 cps (at Volume Control -30 db)

#### FM TUNER SECTION

Usable Sensitivity: 1.8 microvolts (IHF Standard)  
 Signal to Noise Ratio: 60 db (at 100% modulation 1mV input)  
 Image Rejection: 55 db  
 SCA Rejection: 50 db  
 Capture Ratio: 2 db  
 Stereo Separation: 38 db at 1Kc  
 Frequency Drift: 0.02% without AFC  
 Special Circuit: Automatic switching FM Stereo Tuner, Automatic Mono Stereo Indicator, Output Selector Switch, Silicon Power Transistor Main Amplifier, Tape Monitor, Muting Circuit.

Power Consumption: 50 - 60 cps, 110 - 120 volts  
 Dimensions: Width 17 $\frac{3}{4}$ ", Height 5 $\frac{1}{16}$ ", Depth 14"  
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**SMOOTH PRECISION TUNING:** KENWOOD's larger flywheel is designed for smoother, exact tuning of FM broadcasts.

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*the sound approach to quality*



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ground discovered stereo yet? Evidently not. Too soon. Don't these guys remember that the entire reason for the 4-track system in the first place was to make a workable *stereo* home tape possible? Two tracks in each direction, with stereo and reasonable economy too?

Don't they ever stop to think that nowadays there are literally dozens of thousands of stereo LP records (whoops -shouldn't be saying this. . .) on which is found every sort of sound and music imaginable? And may I say to them, sort of sidewise (for of course I can't possibly condone larceny. . .), that in my most seasoned and professional opinion, as a long-time listener and a trained musician, at *least 90 percent* of these records gain in their communicative power via the stereo transduction.

I'm astonished that there isn't as yet a Tape Underground in stereo—if there isn't. Anyhow, our writer John and his correspondent Bill obviously aren't involved. Maybe the answer is that all the guys who do STEREO 4-track corresponding are under 20 years of age. More power to them, I say. Off the record, of course. **Æ**

## LIGHT LISTENING

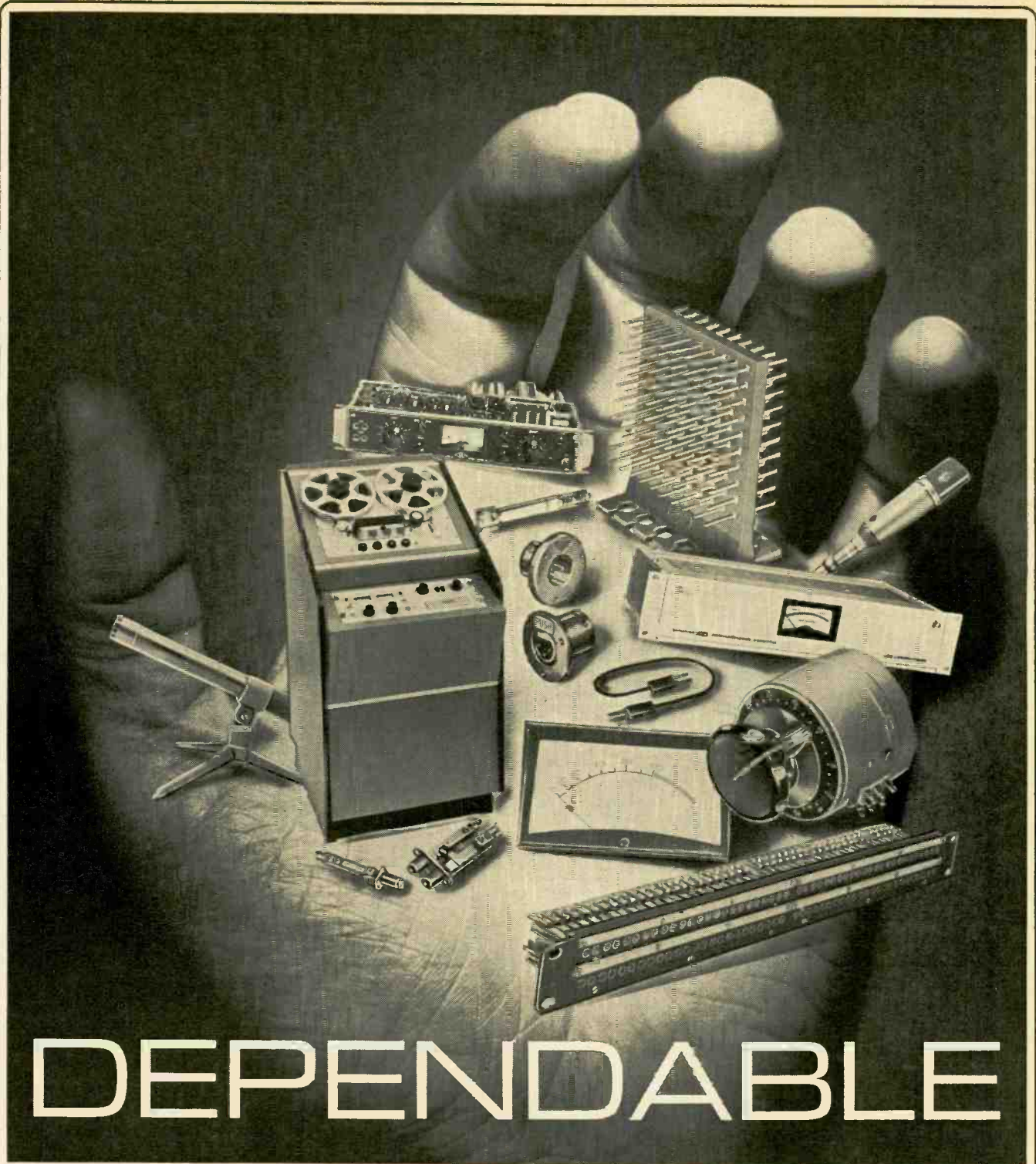
(from page 6)

### Fred Waring Pennsylvanians: In Concert

Reprise RS 6148

This album took me back about thirty years or so to a day when show business was not dominated by television. In his coast-to-coast tours, Fred Waring is still leading his Pennsylvanians in a theatre show similar to those many of us saw him give in the Thirties. Now, for the first time in his disc career, Waring had recording engineers on hand when he played a typical concert engagement. The locale happened to be Lake Charles, Louisiana but it could have been any one of 150 cities he appears in during the course of an annual tour. Observers who have argued that television has created a more sophisticated audience throughout the country will have a job explaining the enthusiastic reception Lake Charles gives even to the cornier routines in the concert. Waring's soloist, chorus and orchestra appear in a fast-paced omelet of entertainment that covers pop- folk, jazz-of-sorts, movie tunes, a smattering of the classics and a familiar hymn for the finale. The program may be theatrical in the extreme but the milking by Reprise is too close-in to convey a Waring stage perspective in the sound. The chorus sounds considerably smaller than it should while singing into its own mike. Each component of the large and diversified Waring ensemble is pinpointed at the expense of the aural sense of the whole. **Æ**





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Circle 118 on Reader Service Card

# EDITOR'S REVIEW

## AUDIO PIONEER PASSES AWAY

**A**N IMPORTANT ERA in the history of audio engineering is ended; C. J. LeBel, pioneer, Secretary of the Audio Engineering Society, and indefatigable worker for the audio engineering profession died on April 13. He was admired by all who knew him, and respected for his incisive and fearless voice. He will be missed.

Born Dec. 16, 1905 in New York City, C. J. LeBel attended the Mass. Inst. of Tech., and received a B.S. in 1926 and an M.S. in E.E. in 1927. From 1927-29 he was a research physicist with Raytheon, Inc. working on lamps and rectifiers. In 1929-1932 he was a research engineer with Sylvania Electric Products and worked on lamps, ozone tubes. From 1932-37 he worked as a consultant on sound recording problems. From 1937-1942 he was Chief Engineer, and from 1940-1965, Vice President, of Audio Devices, Inc. where he worked on lacquer recording blank discs and magnetic recording tape. From 1942-45 he was Chief Engineer of The Maico Company working on hearing aids, hearing test equipment, electronic stethoscope and a surgeon's metal locator. In 1945-46 he was a Project Engineer at Cambridge Instrument Co., working on hearing aids and electronic stethoscopes. In the years 1946-47 he worked as electronic consultant, Damage Control Project, at Steven's Institute in a study of ships' motion. Finally, from 1947-1965 he was Chief Engineer of Audio Instrument Co., Inc.

He was listed in "American Men of Science," "Who's Who in the East," "Who Knows—and What."

Mr. LeBel was a Fellow of the Audio Engineering Society; a Member of the Acoustical Society of America; an Active member of Society of Motion Pictures & Television Engineers; and a Fellow of the Radio Club of America.

Books he had authored are "Fundamentals of Magnetic Recording" and "How to Make Good Tape Recordings" both published by Audio Devices, Inc. and both best sellers.

At Raytheon his first patent turned out to be one of fundamental patents on the fluorescent lamp (the much litigated "LeBel Patent").

At Audio Devices LeBel was active in the first automatic machine production of lacquer recording



discs in America, and in American application of these discs. Audio Devices rose from "nothing" to the largest American maker of lacquer discs in one year and still is the largest. He supervised development of the first Audiotape magnetic recording tape. He also helped write many sound recording standards.

At the Maico Company LeBel applied psychoacoustics to hearing aid design. It was here, at Maico, that he helped write the first standard on methods of measuring performance of hearing aids and developed the Maico Stethetron, the first really successful electronic stethoscope.

At the Audio Instrument Co., Inc. LeBel developed an intermodulation meter with extremely low internal leakage, capable of reading very low values of IM. Subsequently he developed logarithmic amplifiers (loggers) which are used to convert linear recorders to a db scale. These utilize a highly developed and patented instant acting varsitor convertor. He also developed a magnetic tape time delay recorder using sliding heads to adjust delay time.



## Nine out of ten musical people prefer the sound of Pickering.

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Any of the new Pickering V-15 stereo cartridges will reproduce the groove, the whole groove and nothing but the groove. That's why a Pickering can't help sounding natural if the record and the rest of the reproducing equipment are of equally high quality.

To assure compatibility with your stereo equipment, there are four different Pickering V-15 pickups, each designed for a specific application. The V-15AC-1 is for conventional record changers, where high output and heavier tracking forces are

required. The V-15AT-1 is for lighter tracking in the newer automatic turntables. The even more compliant V-15AM-1 is ideal for professional-type manual turntables. And the V-15AME-1 with elliptical stylus is the choice of the technical sophisticate who demands the last word in tracking ability.

No other pickup design is quite like the Pickering V-15. The cartridge weighs next to nothing (5 grams) in order to take full advantage of low-mass tone arm systems. Pickering's exclusive Floating Stylus and patented replaceable V-Guard stylus assembly protect both the record and the diamond.

But the real payoff is in the sound. At least for those who can hear the difference.



V-15

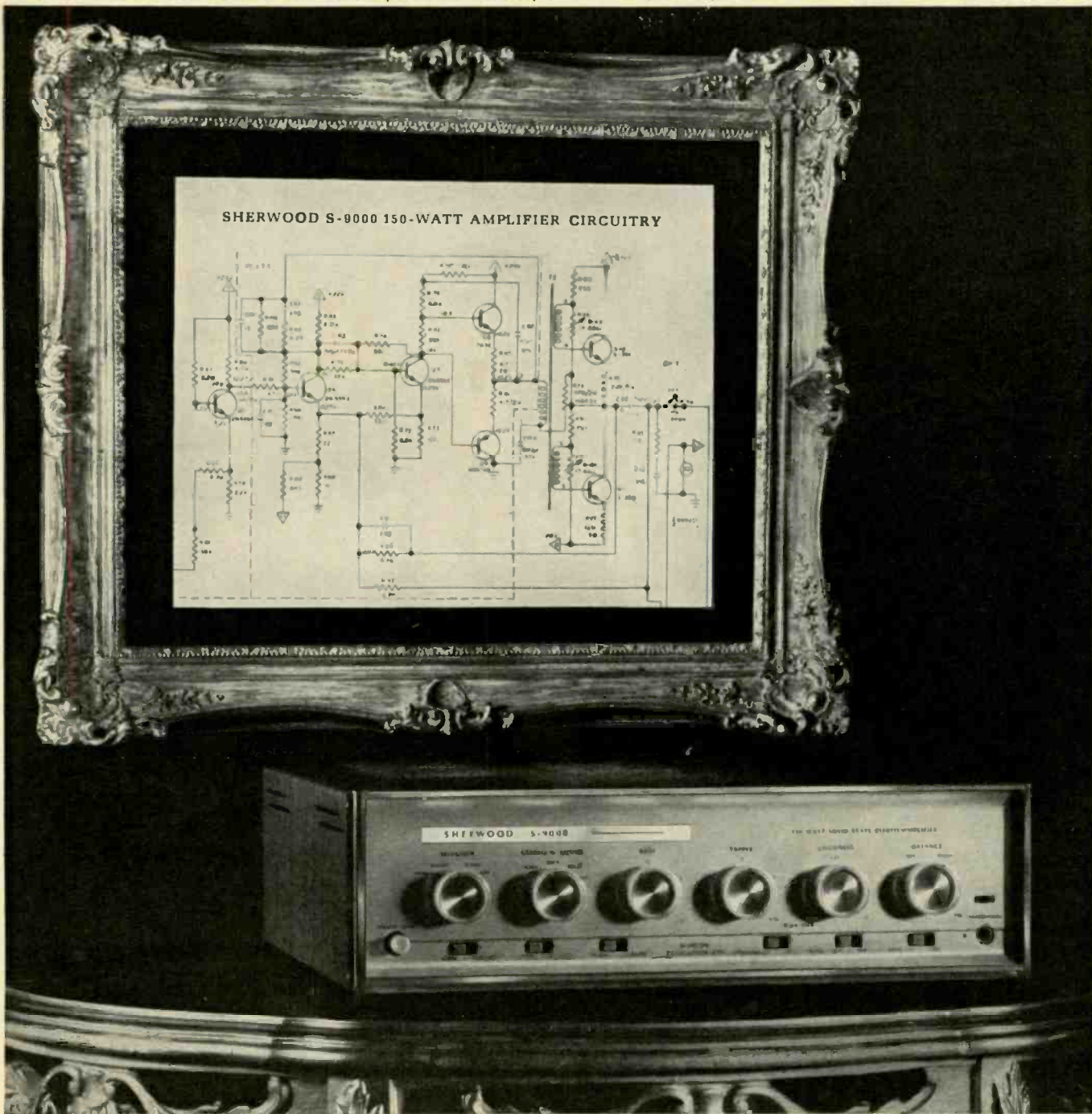
# Pickering

Plainview, L. L., N. Y.

For those who can **hear** the difference.

**WIN** a \$1000 stereo system or any of 125 other prizes! To become eligible, simply identify the musical people pictured above. See your hi-fi dealer for entry blanks and full details.

"Compare these S-9000 specs." Power output for both channels is 150 watts at 1% I.M. distortion. Continuous sine-wave power output (two channels) is 100 watts at 1% distortion. Power band-width: 12-25,000 cps. at 1% distortion. Hum and noise: Phono -70db, Tuner -80db. Sensitivity: Phono 1.8mv, Tuner 0.25-. Other Sherwood all-Silicon Solid-State amplifiers are the S-9900, 90-watts music power @ \$229.50 and the S-9500, 50 watts music power @ \$179.50.



Sherwood S-9000 Solid-State 150-watt amplifier \$299.50

## How dare we say Sherwood is the best?

The dictionary defines "dare" as "to challenge one to pass a test." The Sherwood S-9000 ALL-SILICON Solid-State 150-watt combination preamp-amplifier consistently passes tests against any competitors' products. These tests can involve either the accuracy of its 150-watt power rating, the design of its Baxendall type controls, the reliability and coolness of its All-Silicon circuitry, its lack of distortion (rated at less than 1/4%), the flatness of frequency response ( $\pm 1/2$ db), the elimination of hum and noise (-80db), or the sensitivity of its phono preampifier (1.8mv). How dare we say Sherwood is the best? We can because comparative specifications, together with the experts' opinions and listening tests confirm again-and-again that *Sherwood is the best!*

Dept. 5A

Sherwood Electronic Laboratories, Inc., 4300 North California Ave., Chicago, Illinois 60618

Circle 117 on Reader Service Card

*Sherwood*

# Portable Console

## for

# Broadcast or Discothèque



### JOHN WHITACRE\*

**A** dedicated engineer is constantly searching for ways to improve his equipment. He strives to make it more compact, lightweight, and attractive while retaining all the desirable features displayed in earlier models.

WILS engineers are no exception. They were intrigued with transistor circuits when the first CK-722's appeared on the market. Their experiments have uncovered many ways broadcast equipment can be improved using transistors instead of vacuum tubes.

The all-transistor console you see in Fig. 1 is one indication how successful their experiments have been turning out. The sponsor's reaction when the console is placed in his store or showroom is one of surprise at how attractive a broadcasting unit can be built. At the same time, our engineers testify how easy the console can be moved from place-to-place, set up, and taken down after a broadcast. Maintenance records over the past two years indicate a good history of reliability and low maintenance costs.

What about fidelity? Using the same equipment we employ in making "proof-of-performance" measurements on our broadcasting system, we recorded the following measurements: An over-all audio frequency response of

\*Chief Engineer, Station WILS, Lansing, Mich.

50 cps to 15,000 cps  $\pm 2$ db feeding the various tones into either the microphone channels or employing a CBS test record on each turntable channel. Harmonic distortion was no greater than 1.8 per cent from 50 cps to 15,000 cps, the low being 0.7 per cent at 1000 cps. Hum and other extraneous noise measured  $-52$  db below a zero db output level. All measurements were taken with channel controls and the master gain control set in their normal operating range, this range being from 10 o'clock to 3 o'clock on the master gain control and 9 o'clock to 5 o'clock on the channel control.

The microphone preamplifiers and the first stage of the program amplifier determined how much audio overloading could occur before distortion became objectionable. Components in these amplifiers have been selected to give us 12 db of overload protection.

So far we have considered beauty, mobility, and fidelity. What have we done to make it convenient for the operator? (See the operator's eye view at the beginning of the article.) A considerable amount of time was spent observing our operators in action. We talked with them and asked for their ideas. Their observations and suggestions were tempered with our past experience in designing audio consoles. The design formula became: "Fit the electronic and mechanical apparatus into the space remaining after the comforts and conveniences of the operator are satisfied."

### The Cabinet

Having read this far, may I assume you would like to build this console? Let's start by building the cabinet. Observing all the photos will be helpful. Those parts visible to an audience are cut from  $\frac{3}{4}$ -in. walnut plywood. The bottom is cut from  $\frac{3}{4}$ -in. fir plywood. All cabinet joints are mitred, blocked, and glued. Sometimes it was found helpful to nail the blocks into place after they were "battered" with glue and put in position. Two pieces of solid walnut were glued in place on the cabinet near each end of the operator's panel. Solid walnut was used instead of wood tape because it was reasoned these areas could be easily damaged. Don't forget to cut out the leg braces and round the ends of these pieces of plywood to follow the contour of the folding legs. Gerber folding legs are fastened to the underside of the cabinet with wood screws. Cut one set of folding legs  $\frac{3}{4}$ -in. shorter than the other set. Place  $\frac{3}{4}$ -in. blocks of wood between this set of legs and the cabinet bottom. Failing to do this, one set of legs will not fold over the other to a fully closed position. Use wood screws to fasten the plywood leg braces in place. I recommend some type of leg-leveling device be installed in the ends of the Gerber legs so the cabinet can be leveled if less than ideal conditions are encountered.

Three coats of Vitrolene are applied to the cabinet to give it a durable, handsome varnish-like finish. Use a fine grade of steel wool to smooth the surface before applying successive coats of Vitrolene. After the surface is completely dry, apply a good grade of furniture polish.

Because of its superior wearing qualities, anodized aluminum was selected for the operator's panel and the end panel. A piano hinge is now riveted to the bottom edge of the operator's panel. Secure this hinge to the leading edge of the cabinet with wood screws.

Both panels are now ready for you to install parts on them. When every-



Fig. 1. Portable broadcast console and discothèque.

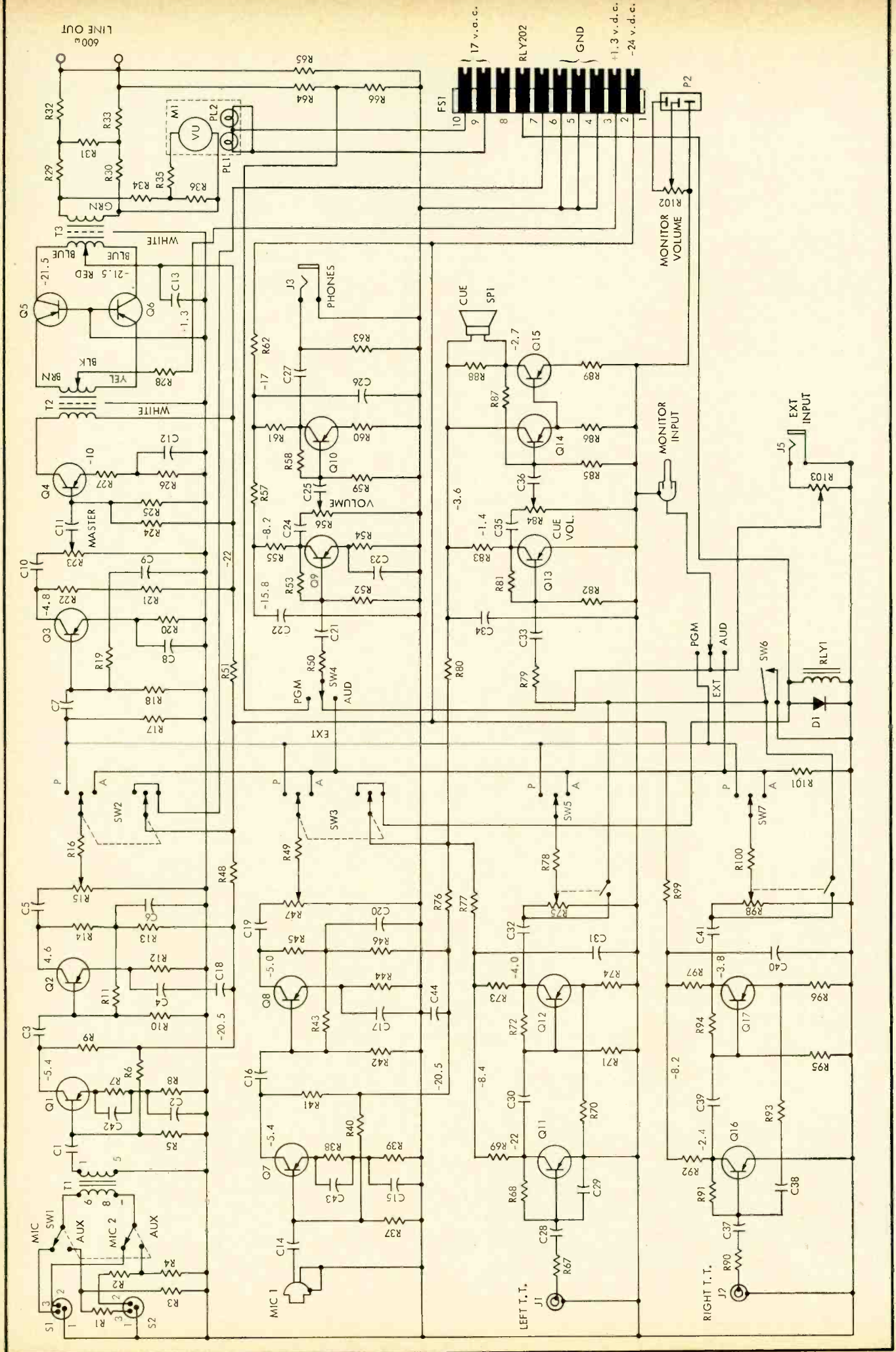


Fig. 2. Schematic of mixer section showing Vector-mounted amplifier circuits and connections.

PARTS LIST FOR FIG. 2

RESISTORS: 1/2w UNLESS OTHERWISE STATED						
R1: 150,000 $\omega$	R17: 100,000 $\omega$	R33: 68 $\omega$	R49: 27,000 $\omega$	R65: 8200 $\omega$ , 5%	R81: 100,000 $\omega$	R98: 100,000 $\omega$
R2: 150,000 $\omega$	R18: 12,000 $\omega$	R34: 4300 $\omega$ , 5%	R50: 27,000 $\omega$	R66: 510 $\omega$ , 5%	R82: 10,000 $\omega$	R99: 22,000 $\omega$
R3: 100 $\omega$	R19: 15,000 $\omega$	R35: 750 $\omega$ , 5%	R51: 470 $\omega$	R67: 6800 $\omega$	R83: 2200 $\omega$	R100: 27,000 $\omega$
R4: 100 $\omega$	R20: 7500 $\omega$ , 5%	R36: 10,000 $\omega$	R52: 47,000 $\omega$	R68: 270,000 $\omega$	R84: 10,000 $\omega$	R101: 3900 $\omega$
R5: 10,000 $\omega$	R21: 8200 $\omega$	R37: 10,000 $\omega$	R53: 470,000 $\omega$	R69: 15,000 $\omega$	R85: 6800 $\omega$	R102: 100,000 $\omega$
R6: 62,000 $\omega$ , 5%	R22: 4700 $\omega$	R38: 200 $\omega$ , 5%	R54: 1000 $\omega$	R70: 5600 $\omega$	R86: 220 $\omega$	R103: 5000 $\omega$
R7: 200 $\omega$ , 5%	R23: 100,000 $\omega$	R39: 7500 $\omega$ , 5%	R55: 10,000 $\omega$	R71: 15,000 $\omega$	R87: 39,000 $\omega$	(CENTRALAB, AUDIO TAPER)
R8: 7500 $\omega$ , 5%	(CA-1041 OHMITE POT.)	R40: 62,000 $\omega$ , 5%	R56: 10,000 $\omega$	R72: 270,000 $\omega$	R88: 560 $\omega$ , 1w	(CENTRALAB B-11)
R9: 43,000 $\omega$ , 5%	R24: 36,000 $\omega$ , 5%	R41: 43,000 $\omega$ , 5%	R57: 2200 $\omega$	R73: 15,000 $\omega$	R89: 1 $\omega$ , 2w	
R10: 12,000 $\omega$	R25: 36,000 $\omega$ , 5%	R42: 12,000 $\omega$ , 5%	R58: 47,000 $\omega$	R74: 270 $\omega$	R90: 6800 $\omega$	
R11: 15,000 $\omega$	R26: 10,000 $\omega$	R43: 15,000 $\omega$	R59: 4700 $\omega$	R75: 100,000 $\omega$	R91: 270,000 $\omega$	
R12: 7500 $\omega$ , 5%	R27: 240 $\omega$ , 5%	R44: 7500 $\omega$ , 5%	R60: 22 $\omega$ , 2w	R76: 2200 $\omega$	R92: 5600 $\omega$	
R13: 24,000 $\omega$ , 5%	R28: 110 $\omega$ , 5%	R45: 4700 $\omega$	R61: 3300 $\omega$	R77: 22,000 $\omega$	R93: 270000 $\omega$	
R14: 4700 $\omega$	R29: 68 $\omega$	R46: 24,000 $\omega$ , 5%	R62: 1200 $\omega$ , 1w	R78: 27,000 $\omega$	R94: 15,000 $\omega$	
R15: 100,000 $\omega$	R30: 68 $\omega$	R47: 100,000 $\omega$	R63: 15,000 $\omega$	R79: 27,000 $\omega$	R95: 270 $\omega$	
(CA-1041 OHMITE POT.)	R31: 1300 $\omega$ , 5%	(CA-1041 OHMITE POT.)	R64: 7500 $\omega$ , 5%	R80: 300 $\omega$ , 10w	R96: 15,000 $\omega$	
R16: 27,000 $\omega$	R32: 68 $\omega$	R48: 2200 $\omega$			R97: 15,000 $\omega$	

CAPACITORS	SP=SPRAGUE CL=CENTRALB	MISCELLANEOUS
C1: 25 $\mu$ f, 15v, SP TE-1157.1	C23: 150 $\mu$ f, 15v, SP TE-1163	D1: DIODE, INTERNATIONAL RECTIFIER 5A4
C2: 150 $\mu$ f, 15v, SP TE-1163	C24: 25 $\mu$ f, 15v, SP TE-1157.1	T1: TRANSFORMER, UTC OUNCER (0-12)
C3: 25 $\mu$ f, 15v, SP TE-1157.1	C25: 25 $\mu$ f, 15v, SP TE-1157.1	T2: TRANSFORMER, INTERSTAGE (GATES 478-0053-000)
C4: 100 $\mu$ f, 15v, SP TE-1162	C26: 100 $\mu$ f, 25v, SP TE-1211	T3: TRANSFORMER, OUTPUT (GATES 478-0122-000)
C5: 25 $\mu$ f, 15v, SP TE-1157.1	C27: 25 $\mu$ f, 15v, SP TE-1157.1	SPI: SPEAKER, QUAM 27A06Z17, 2 3/4"
C6: 25 $\mu$ f, 25v, SP TE-1207	C28: 2 $\mu$ f, 25v, SP TE-1201	SW1, 5, 7: SWITCHES, SWITCHCRAFT 3036-L
C7: 25 $\mu$ f, 15v, SP TE-1157.1	C29: 0.05 $\mu$ f, 10v, CL UK 10-503	SW2, 3, 4, 6: SWITCHES, SWITCHCRAFT 30312-L
C8: 150 $\mu$ f, 15v, SP TE-1163	C30: 2 $\mu$ f, 25v, SP TE-1201	S1, 2: CANNON MICROPHONE RECEPTACLE XLR-3-13N
C9: 25 $\mu$ f, 25v, SP TE-1207	C31: 100 $\mu$ f, 25v, SP TE-1211	J1, 2: PHONO JACK, SWITCHCRAFT 3501-FP
C10: 25 $\mu$ f, 15v, SP TE-1157.1	C32: 5 $\mu$ f, 15v, SP TE-1152	J3, 4: PHONO JACK, SWITCHCRAFT L-11
C11: 25 $\mu$ f, 15v, SP TE-1157.1	C33: 25 $\mu$ f, 15v, SP TE-1157.1	PL1, 2: METER LAMPS, #1829
C12: 100 $\mu$ f, 15v, SP TE-1162	C34: 100 $\mu$ f, 25v, SP TE-1211	M1: VU METER, SIMPSON #10470, MODEL 142, A SCALE
C13: 100 $\mu$ f, 25v, SP TE-1211	C35: 25 $\mu$ f, 15v, SP TE-1157.1	RLY1: RELAY, SPEAKER MUTING, POTTER-BRUMFIELD KM-11D
C14: 25 $\mu$ f, 15v, SP TE-1157.1	C36: 25 $\mu$ f, 15v, SP TE-1157.1	F51: FANNING STRIP, CINCH-JONES 10-160-R
C15: 150 $\mu$ f, 15v, SP TE-1163	C37: 2 $\mu$ f, 25v, SP TE-1201	
C16: 25 $\mu$ f, 15v, SP TE-1157.1	C38: 0.05 $\mu$ f, 10v, CL UK 10-503	
C17: 100 $\mu$ f, 15v, SP TE-1162	C39: 2 $\mu$ f, 25v, SP TE-1201	
C18: 100 $\mu$ f, 25v, SP TE-1211	C40: 100 $\mu$ f, 25v, SP TE-1211	
C19: 25 $\mu$ f, 15v, SP TE-1157.1	C41: 5 $\mu$ f, 25v, SP TE-1202	
C20: 25 $\mu$ f, 25v, SP TE-1207	C42: 0.1 $\mu$ f, 50v, CL CK-104	
C21: 10 $\mu$ f, 15v, SP TE-1155	C43: 0.1 $\mu$ f, 50v, CL CK-104	
C22: 25 $\mu$ f, 25v, SP TE-1207	C44: 100 $\mu$ f, 25v, SP TE-1211	

thing is installed on the end panel, use wood screws to fasten it to the inside of the cabinet opening provided for it. Install all parts on the operator's panel except the turntable potentiometers. Make a "U" shaped aluminum bracket and mount the two potentiometers and two microswitches on it. They are positioned so when a flat area is filed in the side of the potentiometer shaft, the microswitch is mounted so its lever rests in the flat area when the pot is turned off. This is called a "cue-pot". The completed assembly is fastened to the operator's panel with shaft bushings through the "U" bracket holding the sub-assembly to the front panel. The convenience provided lets the operator cue-up records anytime the turntable potentiometer is turned off without having to actuate another switch. The PROGRAM, AUDITION, and GROUND busses should be installed on tie-points screwed down to each switch, as shown in Fig. 5.

**The Electronics**

Lets make a quick tour of the schematic diagram (Fig. 2) before starting to build the Vector board amplifiers. Starting in the upper left-hand corner, we have the AUX/MIC-2 preamplifier. The frequency response, temperature stability, and low distortion exhibited by this amplifier are excellent. Its input is switched from the No. 2 microphone

position to the auxiliary input on the end-panel by SW<sub>1</sub>. This gives us two inputs for the price of one preamplifier. A 50 db fixed pad is inserted ahead of the preamplifier when it is used for a

tape recorder, remote line, or third turntable input. Transformer T-1 provides a 500-ohm to 2000-ohm impedance match and isolates the input from possible d.c. leakage across C<sub>1</sub>.

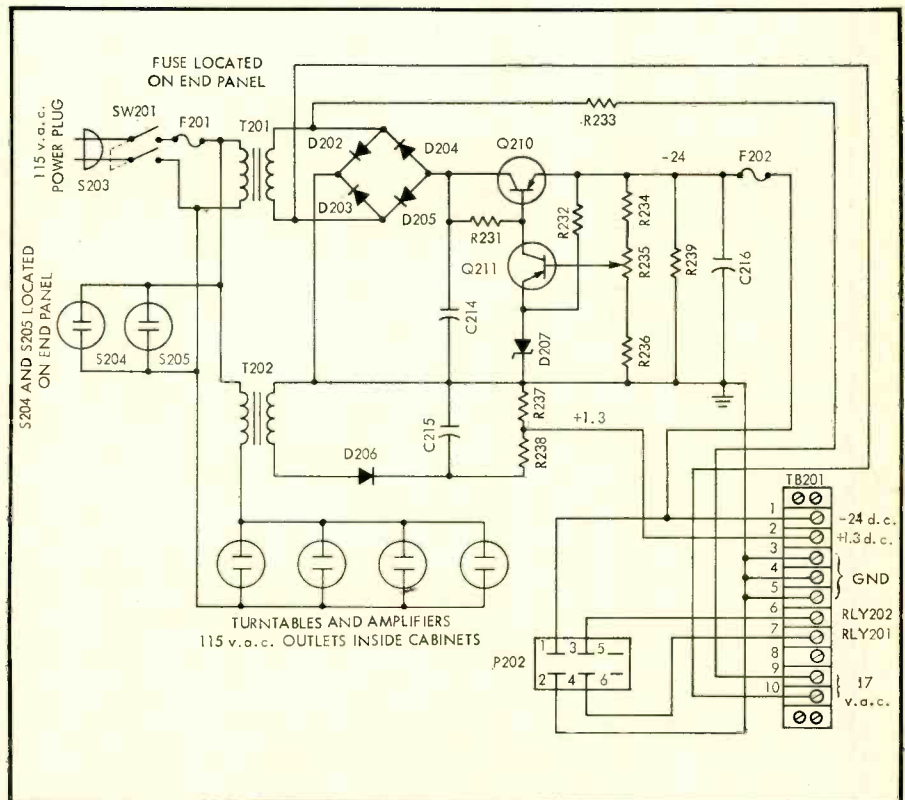


Fig. 3. Power supply schematic. (Parts List on Page 22)

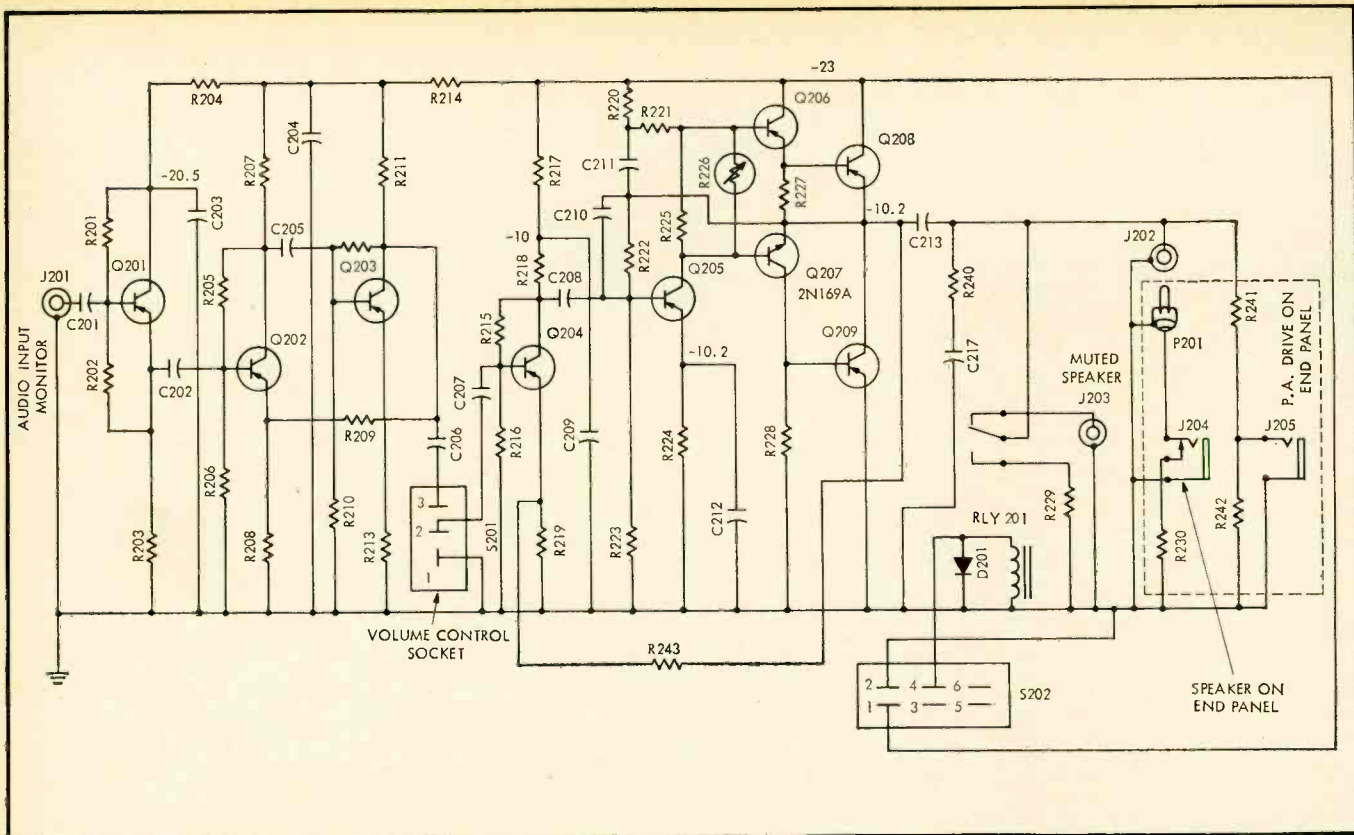


Fig. 4. Amplifier schematic.

RESISTORS 1/2w  
UNLESS LISTED  
OTHERWISE

- R201: 750,000  $\omega$ , 5%
- R202: 39,000  $\omega$
- R203: 6800  $\omega$
- R204: 2200  $\omega$
- R205: 750,000  $\omega$ , 5%
- R206: 10,000  $\omega$
- R207: 10,000  $\omega$
- R208: 100  $\omega$
- R209: 100,000  $\omega$
- R210: 10,000  $\omega$
- R211: 10,000  $\omega$
- R212: 750,000  $\omega$ , 5%
- R213: 100  $\omega$
- R214: 2000  $\omega$
- R215: 47,000  $\omega$
- R216: 10,000  $\omega$
- R217: 2700  $\omega$
- R218: 3300  $\omega$
- R219: 300  $\omega$ , 5%
- R220: 1000  $\omega$
- R221: 2700  $\omega$
- R222: 39,000  $\omega$
- R223: 2700  $\omega$
- R224: 150  $\omega$
- R225: 100  $\omega$
- R226: 100  $\omega$ , THERMISTOR, FENWAL KB21J1
- R227: 270  $\omega$
- R228: 270  $\omega$
- R229: 7.5  $\omega$ , FUSIBLE
- R230: 10  $\omega$ , 10w
- R231: 1000  $\omega$
- R232: 10,000  $\omega$
- R233: 50  $\omega$ , 10w
- R234: 3000  $\omega$ , 5%
- R235: 1000  $\omega$ , LINEAR POT.
- R236: 3000  $\omega$ , 5%
- R237: 10  $\omega$ , 2w
- R238: 56  $\omega$ , 2w
- R239: 250  $\omega$ , 10w
- R240: 22  $\omega$ , 2w
- R241: 20,000  $\omega$ , 5%
- R242: 470,000  $\omega$
- R243: 3300  $\omega$

CAPACITORS

- C201: 0.05  $\mu$ f, CENTRALAB TYPE DD503
- C202: 50  $\mu$ f, 25v, SPRAGUE TE-1290
- C203: 500  $\mu$ f, 25v, SPRAGUE TVA-1209
- C204: 100  $\mu$ f, 25v, SPRAGUE TE-1211
- C205: 0.47  $\mu$ f, 200v, SPRAGUE 2TM-P47
- C206: 0.22  $\mu$ f, 200v, SPRAGUE 2TM-P22
- C207: 2  $\mu$ f, 50v, SPRAGUE TE-1302
- C208: 5  $\mu$ f, 50v, SPRAGUE TE-1202
- C209: 50  $\mu$ f, 25v, SPRAGUE TE-1209
- C210: 1800pf, ARCO ELEMENCO DM-19-182J
- C211: 50  $\mu$ f, 25v, SPRAGUE TE-1209
- C212: 100  $\mu$ f, 15v, SPRAGUE TE-1162
- C213: 1600  $\mu$ f, 50v, MALLORY TYPE 068
- C214: 500  $\mu$ f, 25v, SPRAGUE TVA 1209
- C215: 500  $\mu$ f, 25v, SPRAGUE TVA 1209
- C216: 500  $\mu$ f, 25v, SPRAGUE TVA 1209
- C217: 0.22  $\mu$ f, 200v, SPRAGUE 2TM-P22

MISCELLANEOUS

- D201-206: DIODE, INTERNATIONAL RECTIFIER 5A4
- D207: ZENER DIODE, 1N3022-B
- T201: POWER TRANSFORMER, MERIT P-2963, 25.2v 3 A
- T202: BIAS TRANSFORMER, MERIT P-2944, 6.3v 1 A
- SW201: DPDT TOGGLE
- S201: VOLUME CONTROL SOCKET, CINCH-JONES S-303 AB
- S202: POWER SOCKET, CINCH-JONES S-306 AB
- S203: A.C. PLUG
- S204: A.C. SOCKET
- S205: A.C. SOCKET
- RLY:201: SPEAKER MUTING RELAY, POTTER-BRUMFIELD KM-11D
- F201: 0.5 AMP LINE FUSE
- F202: LAMP d.c. SUPPLY FUSE
- TB201: TERMINAL BOARD
- P201: UNMUTED SPEAKER PLUG, CINCH-JONES 13A
- P202: POWER PLUG, CINCH-JONES P-306
- P203: MUTED SPEAKER PLUG, CINCH-JONES 13A
- J201: AUDIO INPUT SOCKET, CINCH-JONES 81A
- J202: UNMUTED SPEAKER OUTLET, CINCH-JONES 81A
- J203: MUTED SPEAKER OUTLET, CINCH-JONES 81A
- J204: PHONE JACK (UNMUTED SPEAKER) ON SIDE PANEL, SWITCHCRAFT L11
- J205: PHONE JACK (PA DRIVE) ON SIDE PANEL, SWITCHCRAFT L11
- TRANSISTOR SOCKETS: CINCH-JONES 2H3
- Q201-206: RCA 2N109
- Q207: G. E. 2N169A
- Q208-211\*: CA-2D2
- \*THESE TRANSISTORS MAY BE OBTAINED FROM MINNEAPOLIS-HONEYWELL, BOX 161, UNION, NEW JERSEY AT \$1.50 EACH.

PARTS LIST FOR FIG. 3 and 4

The next preamplifier down on the left is used solely to amplify the audio voltage generated by the microphone mounted on top of the console. It is identical with the preamplifier just described, except it has no input transformer. Although the characteristic input impedance of the preamplifier is around 2000 ohms, little change in frequency response or loss in signal level is experienced using a 150-ohm microphone. The difference in signal level amounts to about 5 db.

Thanks to the many fine technical articles written about equalized phono preamplifiers, we had no difficulty designing the two appearing directly below the microphone preamplifiers. They have an excellent RIAA playback response when used with a Shure M3D cartridge. Parallel the outputs of this stereo cartridge for monophonic use. These amplifiers also have low distortion and excellent temperature stability.

Our program amplifier appears in the upper right hand corner of the schematic. The earphone amplifier is directly below the program amplifier. It is an intermediate-gain amplifier designed to amplify audio appearing on the PROGRAM, AUDITION, or EXTERNAL INPUT busses to earphone volume level. The busses operate at a level of -20 db. A level much too low for satisfactory earphone listening.



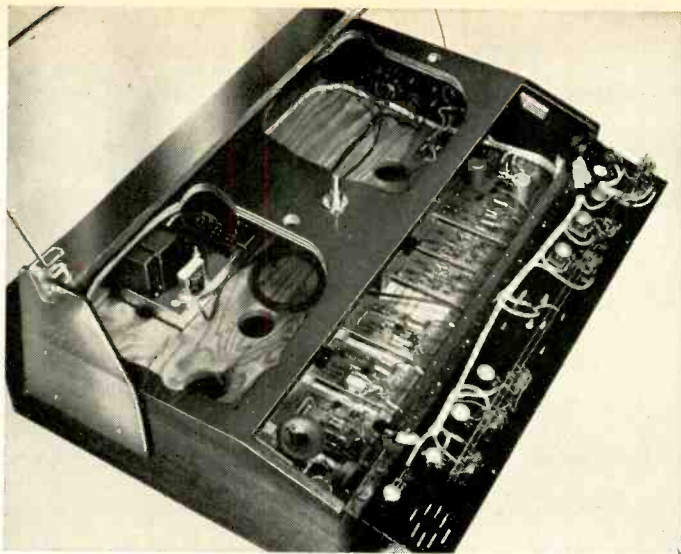


Fig. 5. Chassis before turntables are installed.

Last, in the bottom-right corner is the cue amplifier. An amplifier designed to raise the cue buss audio level to about 200 milliwatts and feed the small Quam speaker, it produces adequate volume for cueing even in noisy locations.

We are ready to build the Vector board amplifiers. Space does not permit me to show complete parts placement for these amplifiers, however it is not nearly as critical as in tube amplifiers. Although it consumes more area, it was found advantageous to put all parts on one side of the board and wire up interconnections on the opposite side.

Useco #2000-B terminals are swaged into place on each Vector board to provide tie-points and inter-connecting terminals. Those displayed across the front edge of the boards are used as terminals for the inputs, power leads, and outputs for the various amplifiers. However, there are two exceptions where this could not be done. On the turntable preamplifiers, the input is brought out to a pin jack near the rear edge of the board. Along the front edge of the program amplifier, from left-to-right, are the input, master volume control, and power terminals. Turning the corner and going up along the side of the cabinet, we have the meter pad, voltage drive for the earphone amplifier, and the program amplifier output terminals.

All Vector board amplifiers are mounted above the cabinet bottom on two wooden strips. They are directly below the operator's panel for convenient servicing, if necessary.

### The Amplifier and Power Supply

Our amplifier is rated at 10 watts. Heat sinks must be provided for power output and voltage regulating transistors. For this reason, the amplifier and power supply were built on two aluminum chassis and secured to a common

panel. Locations of the major parts are shown in Fig. 7.

Everything having been built and installed except the turntables, it becomes a relatively easy task interconnecting the amplifiers, power supply, end-panel, and operator's panel. Follow your schematic diagrams and the various illustrations carefully. Note how we have harnessed the audio cables leaving the operator's panel and laced them together so as to form just two large cables. You should use two-pair, stranded, shielded, audio cable for all audio runs. Power connection on the end panel were made using No. 20

solid hook-up wire. The turntables, power supply, and the a.c. distribution strip in the bottom of the console were wired with plastic lamp cord.

All wiring and interconnecting completed, install the turntables and tone arms, microphone, and copy rack.

When you apply power to the console for the first time, it is wise to monitor the  $-24$  volt supply. Be prepared to remove power from the console if the voltage doesn't come up to  $-20$  volts or more immediately. If this should happen, remove  $S_{202}$  from the power supply by unfastening the power amplifier chassis from the panel and pulling it away from the power supply. Also, remove the  $-24$  volt lead on  $TB_{201}$  that feeds voltage to the Vector amplifiers. If this doesn't clear the trouble, it is in the power supply and is most likely  $Q_{210}$ . After you have cleared the trouble, adjust  $R_{235}$  for a final voltage reading of  $-24$  volts.

### Operation

To check out the operation of the console under normal programming conditions, the MASTER gain control should be set to 3 o'clock, the MONITOR volume to 10 o'clock, TURNTABLE channels to 12 o'clock, MIC channels to 2 o'clock. The CUE volume control should be wide open and the PHONES volume to nearly wide open. Channel switches should all be placed in the

(Continued on page 52)

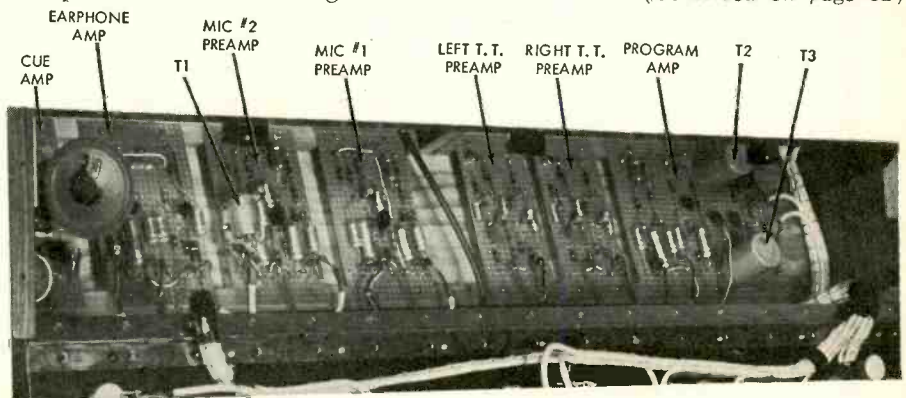


Fig. 6. Closeup of the Vector boards showing placement in cabinet.

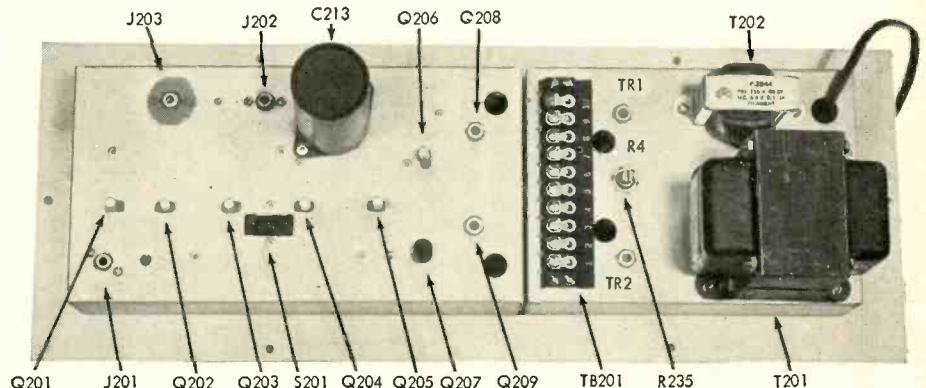


Fig. 7. Closeup of power amplifier and power supply chassis showing placement of major components. Fuses are on bottom to facilitate replacement.

# Recording Without Microphones

## ROBERT HAZELLEAF

Transducers on the instrument eliminate recording acoustics.

Lester M. Barcus and John Berry, of Long Beach, Calif., do not believe in microphones. The primary function of a disc or tape, they believe, is to provide a facsimile of a musical performance. To them, ambient studio sound, whether tolerated as a necessary evil or elevated by the term "concert hall presence," is nothing more than distortion.

They have devised a technique called the Barcus-Berry Direct Recording Process. Instead of microphones, it uses a transducing system that acquires its signal directly from the bridge of a stringed instrument, from the mouth-piece or reed of brass, from the vibrating element of percussion. By coaxial cable, the energy is transmitted to a mixing panel, then split between an Ampex 300 tape recorder and a monitoring section that employs a high-fidelity amplifier and loudspeaker systems.

For years Barcus worked with virtually every type of microphone, amplifier and loudspeaker produced, always reaching an almost-but-not-quite plateau.

John Berry was introduced to him through a mutual friend about five years ago, bringing to the partnership a well-developed talent as a concert violinist and a passionate interest in seeing his instrument reproduced to a musician's satisfaction.



Fig. 1. Violist Louis Kievman at recording session for Dvorak Quintet. Though instrument is completely redesigned, weight and dimensions of traditional viola are retained.



Fig. 2. John Berry and Marshall Sosson, violins; Roland Bundock, bass; Kurt Rener, cello; and Louis Kievman, violist.

They began anew. Microphones were tried again, using every conceivable technique. The men met the same problems that plague every record company, large or small. (Repeat records is their



Fig. 3. John Berry demonstrates "plugged-in" violin. Pickup element is concealed in bridge and body of instrument.

company.) Electric guitar pickups were tried and discarded, although persons introduced to the new system usually suspect them as the secret.

Contact microphones, too, came in for a share of attention, but they reproduced everything. A violin or cello was heard in its entirety, including every obnoxious scratching and scraping, the sound of the artist's chin rubbing on its rest and his fingers popping on the fingerboard.

Then came the concept that a vi-

brating string's energy can be captured at its source. Two tiny wires were placed in a violin bridge, an electronic unit was added to the circuit and *voilà!* Recording was direct. So were several phenomena of dubious benefit. Barcus and Berry spent days reliving some of the lesser contact microphone problems, along with the body noises inherent in close-heard fiddle.

For a violinist, John Berry took a drastic step, one that has lured musician, scientist and crackpot alike into an acoustic morass, when he became an accomplice to redesigning the instrument.

"Stripped of its glamour," Barry explains, "all the art in a *del Jesu* Guarnerius or a fine Stradivarius is confined to the chest, which serves as an acoustic amplifier, nothing more."

"Therefore," he continues, "a string of proper quality, tension, gauge and length can sound only like a violin string, provided it can be amplified sufficiently."

Proof is in Repeat's *Opus I*, an experimental rendition of standard melodies using two violins, viola, cello, bass, piano and guitar. The direct process captured all the sound normally heard by a concert-goer in about fourth row, center orchestra.

The new string family seeks to nullify all the false resonances, dead spots and notes that must be given special attention by a violinist. In redesigning, the partners built instruments of hardwood. Fingerboard, length and "feel" were retained—all serving merely as an anchor for strings.

The new instruments, looking much like something to be seen in a gallery of modern art, were first dubbed

"Violectras," a name later dropped at the suggestion of musicians who have worked with the new recording system. "They sound as they're supposed to," the artists said, "so why fool with the name?"

Repeat's second release, *Gentle Jazz*, uses redesigned violin, bass, piano and guitar, along with a new development, once called the "Baritone Violectra." The same size as a fiddle, but with much heavier strings, the baritone invades the register of the cello with the facility of execution of the smaller instrument. It has possibilities transcending mere novelty.

A brand new piano might be suggested for a brand new process, but pianist-arranger Fred Valdez furnished a 60-year-old Chickering grand in the interests of science. Here again, all the partners wanted were strings, a place to anchor them, and the transducing system.

First to go was the sounding board, unceremoniously ripped out and dumped. Tonal effect is unnoticed. The three-string unisons were reduced to two for simplicity with no deterioration in quality, except when unamplified. Without the monitoring system, the instrument is barely heard. The sustaining pedal mechanism was altered so that, when depressed, only those notes in use are sustained. Dampers remain on the others, eliminating unwanted sympathetic vibration. The muting pedal, which usually shifts hammers from three strings to two, now shifts to one, adding a slightly different sound to traditional piano tone. Naturally, the instrument is prepared to record in full stereo. The effect is not lost on pianists when they try their first arpeggio.

Reeds, brass and percussion caused fewer problems than strings. As mentioned, the pioneers decided on the mouthpiece as the pickup point on winds, except for the flute family, in which the end plug is used.

"If you blow a horn with a clarinet mouthpiece," Barcus suggests, "it will sound more like a horn than any reed instrument. Sound is made by the reed or lips, with the body of the instrument serving to change quality and pitch. There's nothing for us at the bell or in the body."

"The direct process calls for a little more push," recording artist Nash says. "The sax, for example, doesn't give the illusion of playing itself. But I'm well satisfied with the accuracy of the process and its quality."

After engineering the transfer from tape to disc of *Opus I* and *Gentle Jazz*, J. J. Ferree of United Recorders said, "I first thought it might be just another gimmick, but now I'm sure it's out of



Fig. 6. Reed man Ted Nash's alto saxophone mouthpiece is "transduced" from tiny wires directly under reed. Horn mouthpiece wiring begins immediately under lip. Notches are made, then re-filled after wire is added.

that category. We did find that only top equipment will do the job of making a good transfer. With an absolute lack of studio sound, you must be sure you don't add any mechanical noise in the mastering process."

Another facet of the system brought out in making discs is the energy contained on the original tape. While heavy bass tones will often cause groove jumping, it's seldom that mid-ranges exhibit the effect. On *Rural Rhythm*, the sharp tap of a wood block had to be tenderly handled.

With the earliest recordings, Barcus and Berry happily learned that most of the problems found in conventional methods were eliminated.

"We have absolute control," they declare "We can record from strength, capturing sounds never before reproduced. From there we must subtract. Our criterion is established by the musicians, our sole judges."

A recording session is informality itself. A listening room serves as the studio. On a warm day, doors remain open with no thought given jet aircraft in the Long Beach landing pattern, passing diesel trucks or tortured rubber as drivers miscalculate a traffic signal a few yards away.

Only the sounds of the instruments reach the tape recorder. Since the redesigned violin family produces little sound until amplified, musicians have had to adjust to hearing themselves on the monitoring loudspeakers several feet away. Naturally, with instant playback, retakes are cut to a minimum.

Kurt Reher, first cellist with the Los Angeles Philharmonic, recalls, "The adjustment was a problem, at first, since we're used to hearing an instrument as well as feeling it. But with an opportunity to practice beforehand, and the sound coming over the speakers just as we hear it, we managed to adapt. What surprised me was the way you can 'crank on' the volume without distortion."

Reher, who worked on *Opus I*, also appears on Dvorak's Quintet in G major, Op. 77, with John Berry and Marshall Sosson, violins; Louis Kievmen, viola, and Roland Bundock, bass.

"For the first time," Bundock says, "people can hear real fundamental tone from a bass fiddle. And it's wonderful doing the job yourself without an engineer 'riding gain'."

Marshall Sosson quickly reached a decision shared by everyone who has worked with direct recording: "There just isn't any place to hide. Nothing can be done to help a bad note or faulty execution."

The firm's partners are the first to admit that a premium is placed on musical competence. It just happens that that's exactly what they want, and one of the reasons all the artists to date have been symphony, motion-picture and/or recording studio men.

Engineering a direct-recorded session is accomplished by (1) pushing the (Continued on page 55)

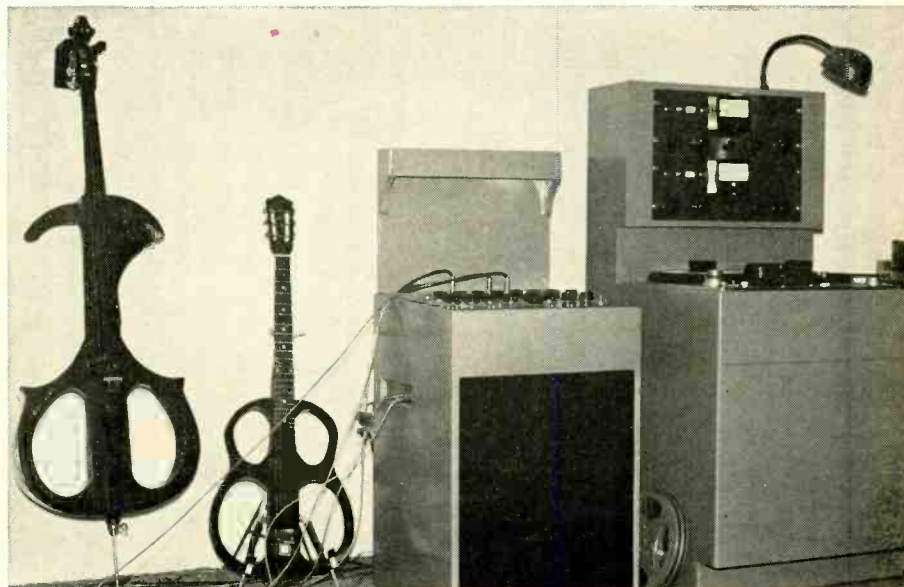


Fig. 3. Redesigned cello, guitar, mixing panel and Ampex 300 tape recorder. Cables lead to three-channel stereo piano.

# Calibrated Stereo Control Unit

RAPHAEL F. EHAT

## PART TWO

### The Hi-Fi Heart

What we are after now is a means for recording and reproducing high quality stereophonic signals in as quantitative a manner as to be within financial reason. This is clearly a high fidelity set-up, but with added requirements not presently available commercially. Since a tape recorder is required and never includes within its confines the complete circuit, its relation to the rest is the very first consideration. The author agrees with

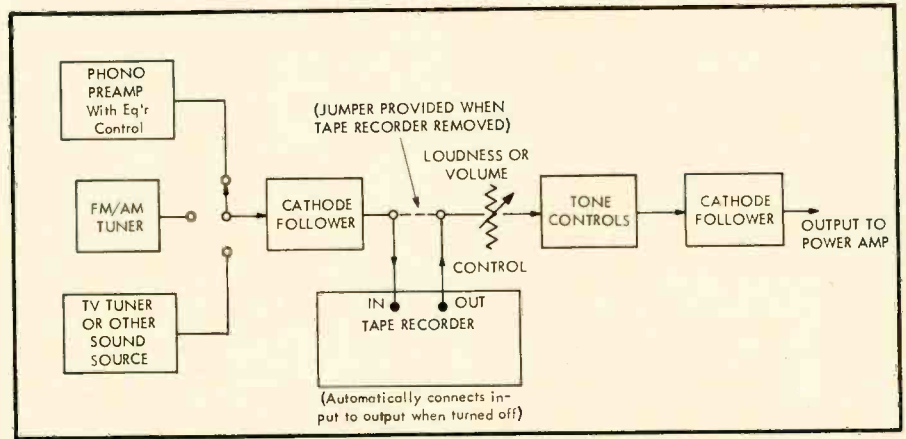


Fig. 1. Incorporating a tape recorder into music system.

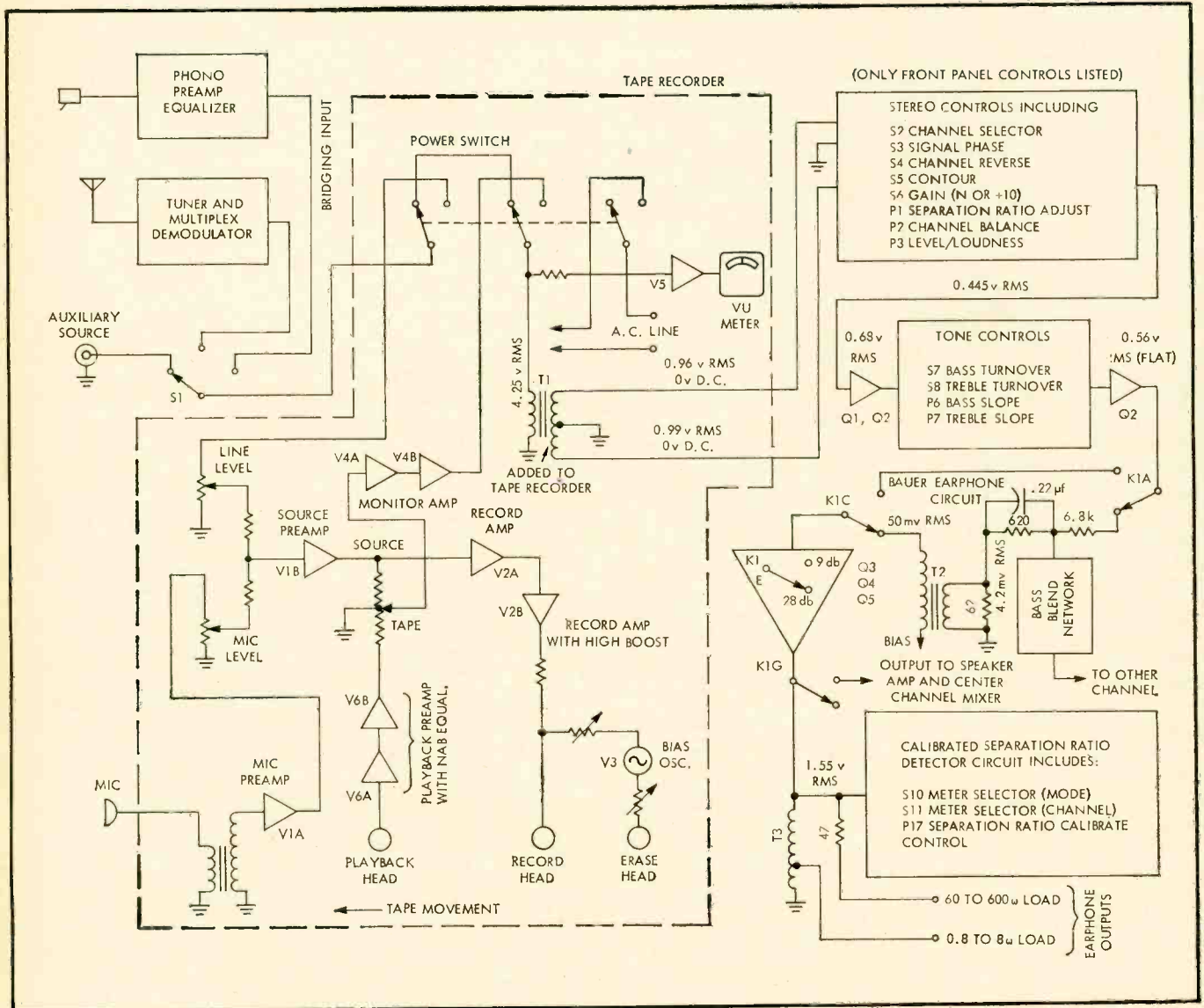


Fig. 2. Block diagram of system.

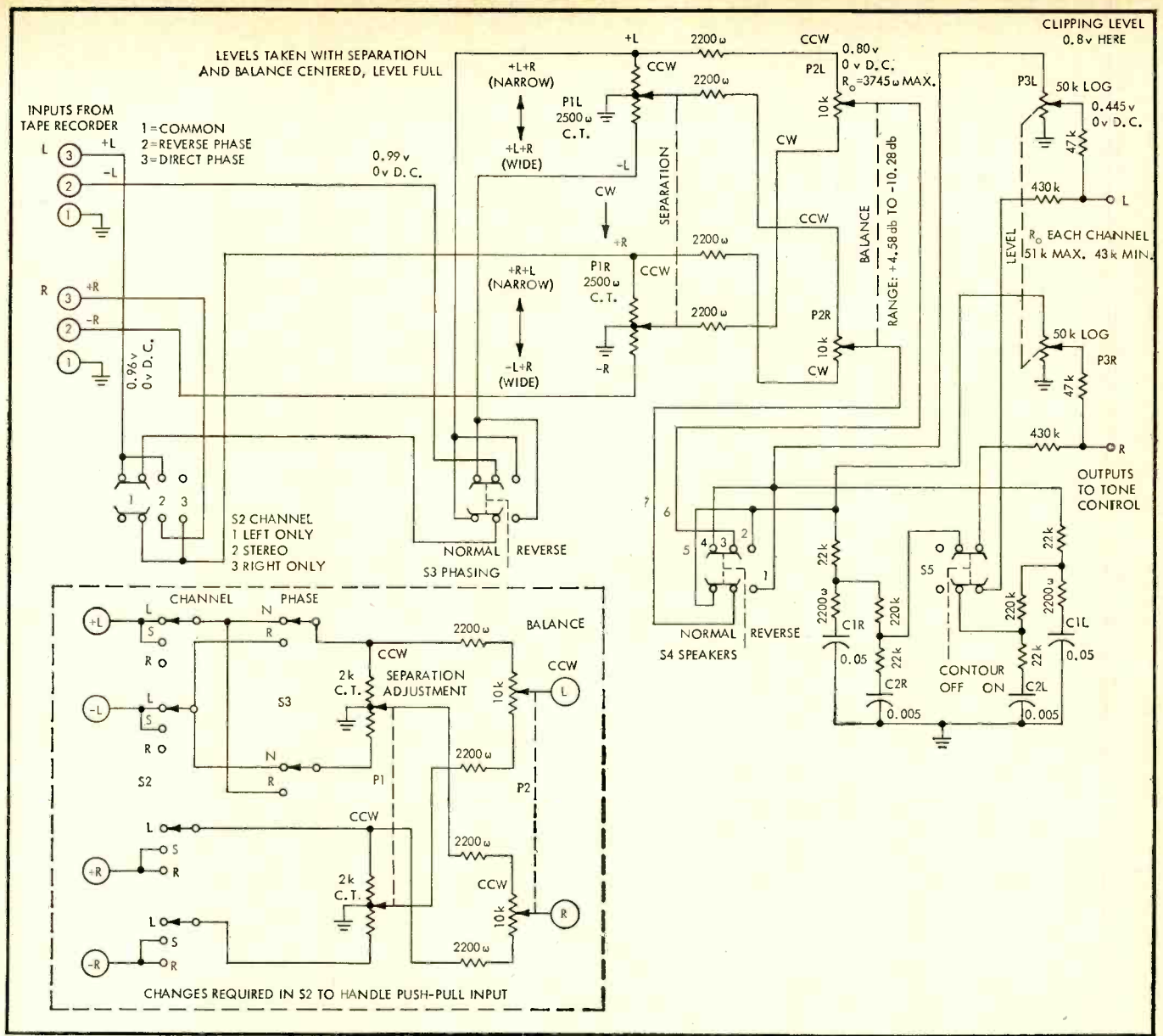


Fig. 3. Stereo controls.

Ampex's Ross Snyder<sup>7</sup> on how to integrate a tape recorder into a hi-fi system. His gospel, good as new after 10 years, is simple; install the tape recorder between the program selector and tone controls with optional bypass connection. Figure 1 (Fig. 8 of the original article) is our basic block diagram before the addition of requirements that prompt the present article. Note that the recorder is in series with the signal path, so feedback howl will never occur due to an inadvertent slip of a knob twiddler's fingers, yet when none of its functions are required it is simply shut off. Don't let the simplicity of this arrangement fool you. See how many control units you can name where this pattern is clearly stated in the instructions and unmistakably implied on the schematic.

<sup>7</sup> Ross H. Snyder "Building Simplicity into the Hi-Fi System," *AUDIO*, Oct. 1955, page 49.

### The Augmented Control Unit

Figure 2 shows Mr. Snyder's arrangement enlarged upon to include the author's present needs and also to show in outline form what he considers to be the best arrangement for internal tape recorder circuits. The tape/source pot is preferred to an A/B switch for convenience with the variable level signals one always has to contend with. With a semi-log taper on each side of center tap it is virtually as fast to use in practice as a switch. Following the recorder, the stereo controls (Fig. 3) work their way from a 1 kilohm input impedance up to 50 kilohms output into the tone control buffer (Fig. 4). They include a separation control<sup>8</sup> modified to operate at approximately 1 kilohm impedance level and integrated with a balance control at approximately 3750 ohms. The relatively low balance control impedance

<sup>8</sup> Ralph Glasgal, "A Dimension Control for Stereo," *Electronics World*, April 1961, page 56.

obviates the need of an impedance dropping amplifier into the contour network<sup>9</sup> and level control. This saves several transistors but requires an undistorted output from the tape recorder a few db higher than usual for a line level signal. Some tape recorder output stages may require "beefing up" to be compatible.

The tone control (Fig. 5) is an adaptation of the Baxandall feedback circuit along the lines of the modification described by Barhydt<sup>10</sup> in which he offers switched control of turnover frequencies and continuous adjustment of slopes between the asymptotes. The impedance level was reduced by a factor of 4.7 for compatibility with the active networks and different ranges of turnover selections were calculated (complete information on this is included in the reference).

<sup>9</sup> J. P. Wentworth, "An Improved Loudness Control," *AUDIO*, Jan. 1958, page 30.

<sup>10</sup> Hamilton Barhydt, "A Feedback Tone Control Circuit," *AUDIO*, Aug. 1956, page 18.



# HOBSON'S CHOICE? NEVER AGAIN!

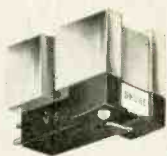
If, in 1631, you went to rent a horse from Thomas Hobson at Cambridge, England, you took the horse that stood next to the door. And no other. Period. Hence, Hobson's Choice means No Choice.

And, as recently as 1961, if you went to buy a true high fidelity stereo phono cartridge, you bought the Shure M3D Stereo Dynetic. Just as the critics and musicians did. It was acknowledged as the ONLY choice for the critical listener.

Since then, Shure has developed several models of their Stereo Dynetic cartridges—each designed for optimum performance in specific kinds of systems, each designed for a specific kind of *porte-monnaie*.

We trust this brief recitation of the significant features covering the various members of the Shure cartridge family will help guide you to the best choice for you.

## THE CARTRIDGE



V-15



M55E



M44



M7/N21D



M99



M3D

## ITS FUNCTION, ITS FEATURES . . .

The ultimate! 15° tracking and Bi-Radial Elliptical stylus reduces Tracing (pinch effect), IM and Harmonic Distortion to unprecedented lows. Scratch-proof. Extraordinary quality control throughout. Literally handmade and individually tested. In a class by itself for reproducing music from mono as well as stereo discs.

Designed to give professional performance! Elliptical diamond stylus and new 15° vertical tracking angle provide freedom from distortion. Low Mass. Scratch-proof. Similar to V-15, except that it is made under standard quality control conditions.

A premium quality cartridge at a modest price. 15° tracking angle conforms to the 15° RIAA and EIA proposed standard cutting angle recently adopted by most recording companies. IM and Harmonic distortion are remarkably low . . . cross-talk between channels is negated in critical low and mid-frequency ranges.

A top-rated cartridge featuring the highly compliant N21D tubular stylus. Noted for its sweet, "singing" quality throughout the audible spectrum and especially its singular recreation of clean mid-range sounds (where most of the music really "happens"). Budget-priced, too.

A unique Stereo-Dynetic cartridge head shell assembly for Garrard and Miracord automatic turntable owners. The cartridge "floats" on counterbalancing springs . . . makes the stylus scratch-proof . . . ends tone arm "bounce."

A best-seller with extremely musical and transparent sound at rock-bottom price. Tracks at pressures as high as 6 grams, as low as 3 grams. The original famous Shure Dynetic Cartridge.

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If your tone arm tracks at 1½ grams or less (either with manual or automatic turntable)—and if you want the very best, regardless of price, this is without question your cartridge. It is designed for the purist . . . the perfectionist whose entire system *must* be composed of the finest equipment in every category. Shure's finest cartridge. \$62.50.

If you seek outstanding performance and your tonearm will track at forces of ¾ to 1½ grams, the M55E will satisfy—beautifully. Will actually improve the sound from your high fidelity system! (Unless you're using the V-15, Shure's finest cartridge.) A special value at \$35.50.

If you track between ¾ and 1½ grams, the M44-5 with .0005" stylus represents a best-buy investment. If you track between 1½ and 3 grams, the M44-7 is for you . . . particularly if you have a great number of older records. Both have "scratch-proof" retractile stylus. Either model under \$25.00.

For 2 to 2½ gram tracking. Especially fine if your present set-up sounds "muddy." At less than \$20.00, it is truly an outstanding buy. (Also, if you own regular M7D, you can upgrade it for higher compliance and lighter tracking by installing an N21D stylus.)

If floor vibration is a problem. Saves your records. Models for Garrard Laboratory Type "A", AT-6, AT-60 and Model 50 automatic turntables and Miracord Model 10 or 10H turntables. Under \$25.00 including head shell, .0007" diamond stylus.

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Circle 120 on Reader Service Card

A new "Scotchflex" flat cable system, designed especially for custom stereo, hi-fi, intercom or background music systems has been introduced by 3M Company. Similar to a station wiring system currently used by many telephone companies, "Scotchflex" audio flat cable No. 800 is a 4-conductor, No. 22 AWG stranded wire, embedded in a flat vinyl strip, with an adhesive backing that will adhere to any clean, relatively smooth, firm surface.

"Scotchflex" No. 800 was designed for the sound engineer who needs a slightly heavier system to carry an extra load, or operate over extended distances. It is adaptable to nearly every type of music or intercom arrangement and to any room or building.

A series of accessories for termination, splicing and transition connections complete the package. Included are "Scotchflex" No. 728 terminals, 4-post transition devices for connecting amplifiers or speakers to the cable system; No. 729 splice units with which to splice flat cable when extending the main system; No. 730 plugs and receptacles, to connect amplifiers or speakers into the system; and No. 731 corner covers, to protect and secure corners made with the cable.

Although the No. 800 audio flat cable system is primarily a 4-conductor system, it may be modified for long run applications where resistance becomes too high through the use of shorting bars, which parallel connect adjacent wires to provide the equivalent of a 19-gauge, 2-conductor system. The shorting bars are provided with individual terminals or connectors.

With the use of the No. 729 splice unit accessory, any length of cable or cable layout is possible. By using the No. 728 terminal or the No. 730 receptacle, any number of speakers can be connected to an intercom or background music system. Greater use of a limited number of speakers can be made by prepositioning the No. 730 receptacle units about the room or office and then plugging in speakers as desired at one or several locations. No stripping of wires is necessary for installation. Splices in the cable and connections in the special terminal blocks are made with the "U-Element" connector, which makes an electrically efficient, mechanically strong connection simply by pressing in place.

The No. 800 audio flat cable system has a rated current capacity of 4.5 amperes per conductor, with a resistance of .016 ohms per conductor foot at 68 deg. F. The system is chemically inert to moisture and most common solvents, once applied to a dry surface. The insulation material is self extinguishing and may be painted over with any common house paint. Æ

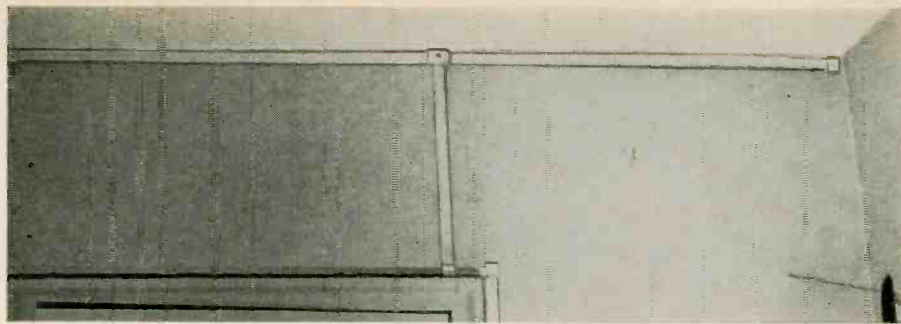


Fig. 1. FM dipole at ceiling.

# Flat Audio Cables

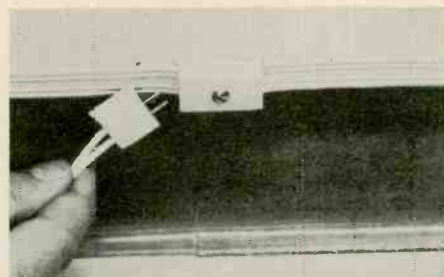
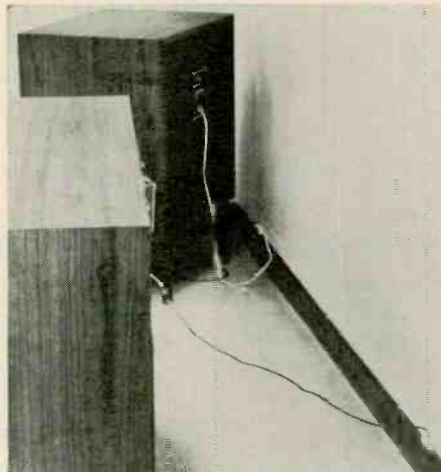


Fig. 2. & 3. Connecting high fidelity amplifier to speaker (left and above).

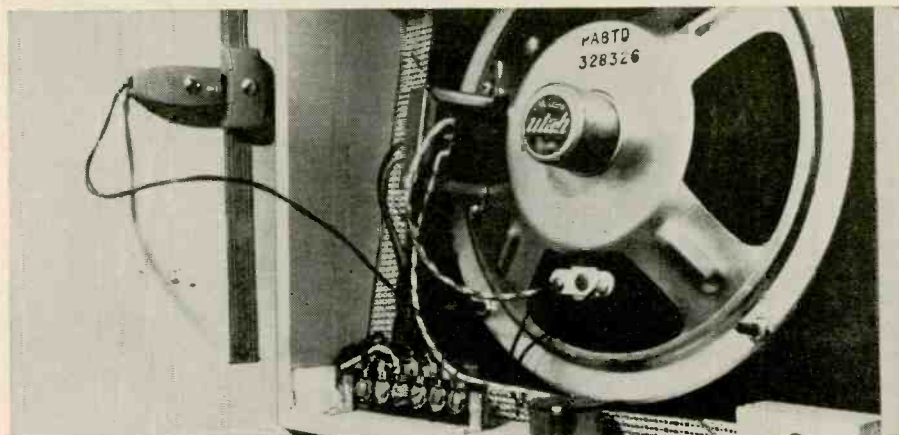
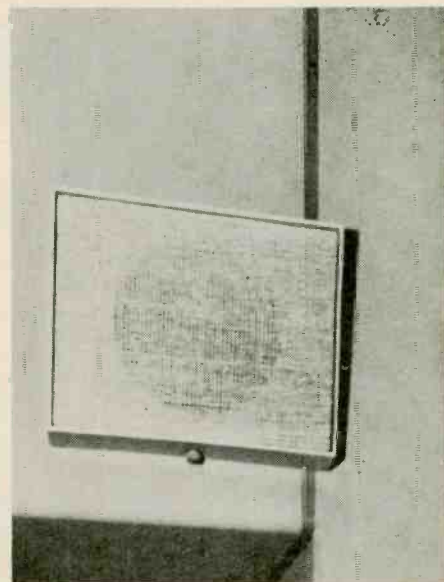
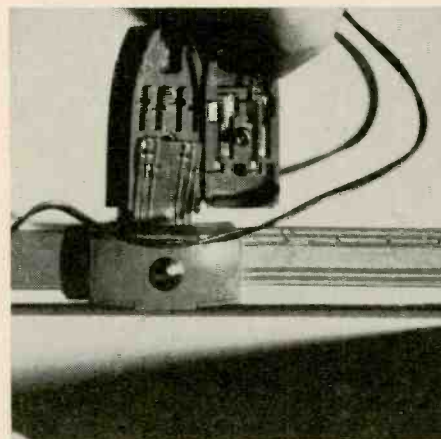
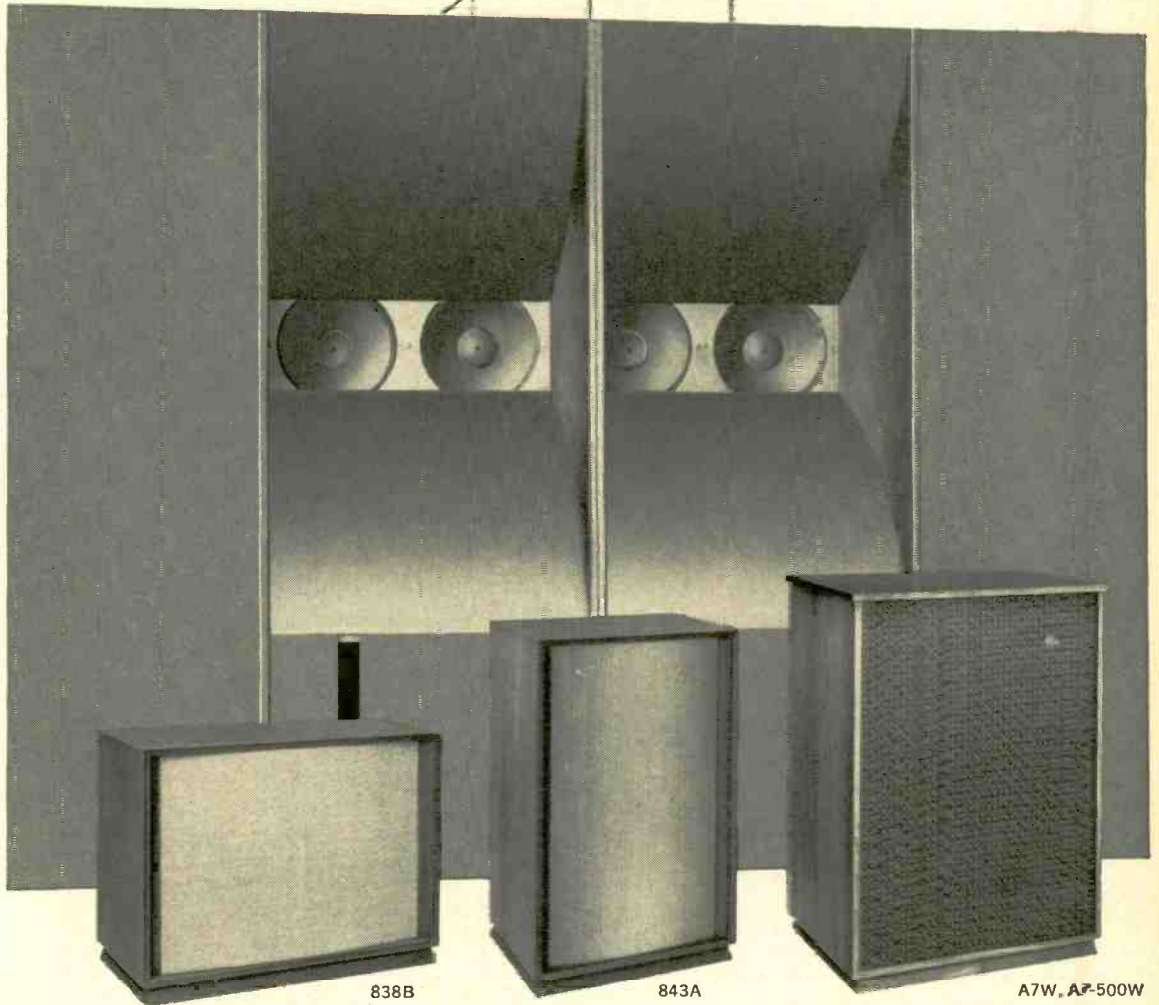


Fig. 4, 5, 6. Connecting P. A. speaker at Bethany Hospital in Kansas City, Kansas. (Installation by Tele-Music, Inc.)



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And maybe even these discriminating speaker buyers couldn't afford to help us amortize the research and development costs of developing **PLAYBACK** systems like our beautifully furniture-styled 843A "Malibu"; 838B "Carmel"; and A7W. Thank goodness they (and you) don't have to. Theatre owners the world over have done it already. Ever since 1945, when Altec introduced the first (and only) commercially-available speaker systems approved by the Research Council of the Academy of Motion Picture Arts and Sciences.

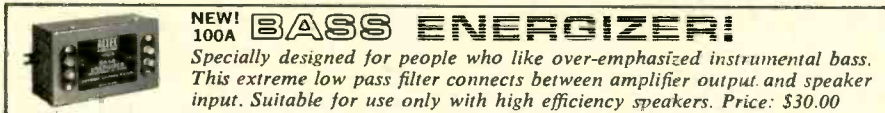
So unless you have room for two of our 1,400 lb. "Voice of the Theatre" Systems, we'd suggest you consider the only next best thing: **PLAYBACK** systems like the ones available to recording and broadcast studios *and you* at the same reasonable, R&D-prepaid prices.

For example, the new Altec 843A "Malibu" is a bargain at \$356.00 because it contains speaker components that are nearly identical to our giant two-way theatre models: two low frequency speakers, a horn-loaded high frequency driver with low crossover, and a two-section dividing network. The "Malibu" is first and foremost a beautifully hand-crafted furniture piece tailored into a space-saving upright walnut enclosure that will do credit to any living room. For a horizontal version of the same thing, try the 838B "Carmel" at \$346.50. Or, for \$384.00, you can own the new Altec A7W which is identical, in every way but looks, to our famous "baby" "Voice of the Theatre"; the

A7. The difference is that the A7W comes in walnut finish, while the A7 comes in a rather spartan utility cabinet (though at only \$288.00 who will complain!) for built-in installations. Other full-size Altec Speaker Systems available from \$214.50 for the space-saving 841B "Coronado" to \$411.00.

What more can we tell you? Just to "A-B" these **PLAYBACK** systems against anything and everything you can find at your nearby leading Altec Distributor's.

In the meantime, get your copy of *Hi-Fi Stereo Review's* Great Debate: "Is a good big speaker better than a good little speaker?" The affirmative, quite naturally, is presented by our own Chief Engineer of Acoustics/Transducers, Alexis Badmaieff. The negative is presented by a well-known manufacturer of little speakers. So find out for yourself why full-size speakers are now the rage. Merely write Dept. A-5.

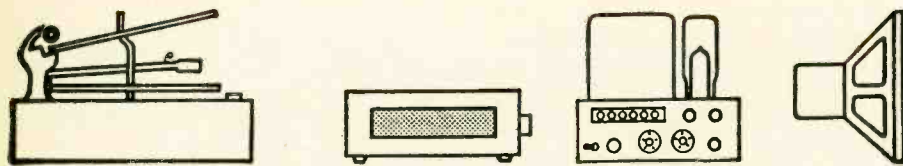




**ALTEC LANSING CORPORATION**  
LTV A Subsidiary of  
Ling-Temco-Vought, Inc.  
ANAHEIM, CALIFORNIA

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Circle 121 on Reader Service Card

# EQUIPMENT



# PROFILE

## H. H. SCOTT MODEL 260 SOLID-STATE AMPLIFIER

With the appearance of more and more transistorized amplifiers, it seems likely that descriptive literature may soon resort to the terminology employed in the automotive industry, for "cool" and "compact" are certain to be used. For whatever else transistors have offered in the amplifier category—and that is plenty—they can be compact, and they certainly run cool.

The new Scott 260 is also compact. Matching other Scott components in general appearance and size (most require the same panel cutout— $4\frac{1}{2}$  x 14 in.) it offers a full-size 80 watts (music power) as a fitting companion to the already well-accepted line of Scott tuners—and particularly the 312—and still runs cool enough as not to require any excessive precautions about ventilation. As a matter of fact, it dissipates only 25 watts of heat at standby, and radiates less heat than a 100-watt lamp under full power.

In appearance, the 260 could be a conventional tube amplifier except for its size. The panel is  $4\frac{1}{2}$  x 15 in. and it requires a depth of 13 in. from the front of the mounting panel. A dividing line separates four switches and a volume-control knob at the top from the less-used controls such as input, selector, bass, treble, balance, and the speaker and power switches in the lower half.

The upper switches are TAPE, RUMBLE, SCRATCH, and VOLUME/LOUDNESS. The INPUT switch has four positions—TAPE HEAD, PHONO, TUNER, and EXTRA, the latter being a welcome change from

the usual "AUX." The selector switch offers seven positions—BAL L, BAL R, MONO, STEREO, REVERSE STEREO, L INPUT, and R INPUT.

The "BAL" positions are a Scott feature which combines signals from both channels and feeds them only to either L or R speakers, permitting an accurate balance adjustment between them. The L and R inputs select the input from either channel and feeds it monophonically to both speakers. The other positions are self-explanatory.

Next in line across the bottom are the dual-concentric bass and treble tone controls providing separate control of the channels yet permitting easy control over both channels at once when desired. The last knob on the bottom section is the balance control. The remainder of the section is occupied with the speaker and power switches, a pilot lamp, and a stereo headphone jack—an especially desirable feature in these days of headphone popularity.

The rear panel mounts a power fuse and two speaker fuses, two convenience receptacles—one switched and the other not—a derived center-channel phono jack, tape recorder feed and output jacks, four pairs of inputs for TAPE HEAD, PHONO, TUNER, and "EXTRA." Also included are a grounding terminal, a slide switch for each channel to adjust for speaker impedance—either 8 and 16 ohms or 4 ohms, and a three-position slide switch to adjust phono input sensitivity. These last three switches are especially desirable, since the user may have two speakers with different impedances—or perhaps he wishes to parallel another speaker to feed a different

location, and thus requires a different output impedance—and not all phono cartridges are of the same output level, though many amplifiers make no provision for this condition. In the 260, the SENSITIVITY switch has three positions which adjust the amplifier (by a change in the preamp feedback circuit) to give rated output at 3-, 5-, or 9-mv inputs, respectively. In the least-sensitive position of the switch, preamp overload is satisfactorily high at 63 mv, while there is still adequate gain in the most-sensitive position for the lowest-level cartridges. The 9 mv position will be fine for most cartridges. This phono overload point has become the first parameter we measure, since we have encountered some units which have been disappointing in this figure. It is our opinion that the preamp overload signal should be at least 40 mv, since with average cartridges and records, this value is reached more than occasionally. This measurement is made at 1000 cps, and the overload point diminishes rapidly as frequency is lowered.

### Circuit Description

The two channels of the 260 are, of course, identical, and each employs 11 transistors, mostly silicons. The preamp section uses three—two 2N2926's and one 2N2613 or 2N508A. Equalization is provided in the feedback circuit, as is also the sensitivity change previously described. This is followed by one section of the input switch and the tone-control amplifier, which uses two more 2N2926's. The tone control circuit is similar to the Baxandall in that the frequency discrimination is provided by feedback. The scratch and rumble filters are also incorporated in this section. The driver section comes next, and employs three selected 2N3053's and one 2N398B, the latter a PNP unit used as a phase reverser. This section feeds the single-ended push-pull output stage using a matched pair of 2N3055's or 2N3235's mounted on a large heat sink. Bias and balance adjustments for the output section are provided in the driver amplifier. No transformers are employed in the audio circuits, and though this somewhat complicates the design, it does result in a fine amplifier with a minimum of phase shift throughout. The accommodation for differing speaker impedances is a switchable network in the feedback circuit from output to the base of the first transistor in the driver section. Coupling to the speaker from the common point of the output pair is by means of a 2000- $\mu$ f capacitor to give good low-frequency response. The derived center channel has an impedance of 4700 ohms, the value of a resistor to ground from this point, which is fed by an 82,000-ohm

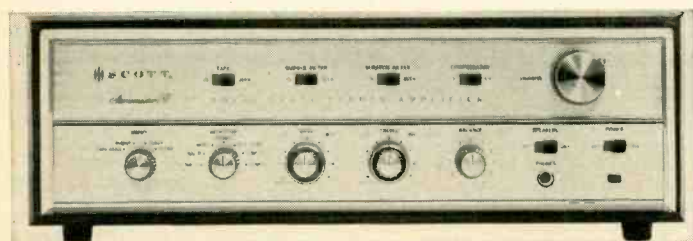
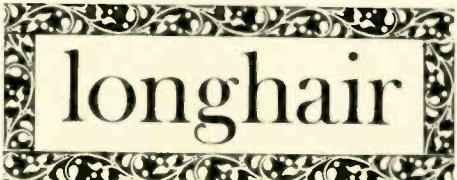


Fig. 1. H. H. Scott Model 260 solid-state amplifier.

Wait till you play your  
*Gesualdo madrigals*  
and your  
FRESCO BALDI TOCCATAS  
with the world's only true  
 **longhair** cartridge.

And if you can't wait—

Stanton Magnetics, Inc.  
Plainview, L. I., N. Y.

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I give up. What is a longhair cartridge?

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

A

Stanton

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resistor from the two speaker lines. The speaker terminals are fused to prevent any damage to the output stages in case of a short in the leads—an open circuit makes no difference, apparently, since the speaker switch simply opens the circuit without substituting a dummy load. The headphone jack is fed through a 220-ohm resistor from each speaker lead.

The power supply uses two silicon rectifiers, 2250  $\mu$ f of capacitive filtering, and one 27-volt Zener diode to stabilize the low-level stages.

### Performance

As we have learned to expect with Scott equipment, the 260 lives up to its specifications—even exceeding them in places. We measured 0.8 per cent total harmonic distortion at 45 watts (sine-wave) output, while the specifications claim only 30 watts. With both channels operating simultaneously, we measured 40 watts per channel at 0.8 per cent THD. At the more usual output level of around one watt—adequate with efficient speakers—we measured a THD of only 0.15 per cent, which is certainly exceptionally good. IM was less than 1 per cent at rated power (60 and 7000 cps, 4:1).

A signal of approximately 0.5 volts is available to feed a tape recorder, and rated output from the amplifier is achieved with only 2 mv input from a tape head. 3, 5, and 9 mv, respectively, will provide rated output from the phono input at three settings of the sensitivity switch, while the high level inputs require approximately 0.5 volts for the same output. The scratch filter is down about 7 db at 10,000 cps, commencing to roll off at 3500 cps. The rumble filter is down 11 db at 50 cps, with the effect commencing at about 125 cps. Loudness compensation measured 8.7 db at 50 cps, and the tone controls provide a boost and cut of 10.5 db at 10,000 cps, and 13.3 db boost and cut at 30 cps.

These symmetrical figures betoken considerable care in the selection of values in the tone-control circuits, and the over-all design appears to be conservatively done—both electrically and mechanically.

### Listening and Operation

Until someone finds out how to derive adequate aesthetic pleasure from meters or an oscilloscope, the ultimate proof of a hi-fi component is in the listening. Second to this is how it handles. If an amplifier sounds good but is poorly arranged or the switches are difficult to operate or the volume and tone controls have the wrong taper, the user is likely to become disenchanted after a few hours of even delightful listening.

The 260 has “nice manners” in operation and we certainly could find no fault whatever in its handling. We were pleased at the solid bass, resulting largely from the high damping factor that seems to be the reason for the so-called “transistor sound,” which might be described as a “tightness” or “dryness.” This type of sound results from a complete elimination of loudspeaker hangover. High-frequencies from such instruments as violins and oboes have a silky smoothness which is pure joy to hear in any reproduction.

Now may be the time for all good audiophiles to convert to solid-state amplifiers—and if you are thinking of buying any amplifier, the 260 is bound to be a most satisfactory choice. Circle 208.

### BOGEN B-62 TURNTABLE

The Bogen B-62 is not a new turntable; rather it is a significant updating of a well established system. Its direct ancestor was the B-61, a unit that established a good reputation for itself at a very modest price.

The differences between the B-61 and B-62 are not obviously visible: The arm has been redesigned so that it can accommodate a wider range of cartridge weights at the lowest stylus forces; the stylus force adjustment has been altered; the cartridge shell is metal instead of plastic. Otherwise, this is much the same unit as before.

The B-62 is an integrated unit. That is, the arm and turntable are irrevocably married to each other. The arm is of a static balance type, stylus force comes from unbalancing the arm for the required downward force. The on-off switch is linked to an arm lift device that is completely disconnected when the arm is in play position.

The turntable is really unique. It consists of a 7 $\frac{1}{2}$ -lb. non-ferrous platter that is driven by a four-pole motor. The motor is linked to the platter by a puck drive on the underside of the platter (not its rim). Accordingly the underside of the platter is accurately machined and polished. Of major interest is the shaft from the motor that drives the puck. Instead of the usual step diameters for the various speeds, this shaft is a tapered shaft with three steps,

each step tapered (there are actually four speeds—33 and 45 are on one step). The result is *continuously* variable speeds. Steps are provided for practical purposes, the shaft would have to be too long without them. Continuous speed change is provided from just below 33 to a bit over 80 rpm.

The value of this speed control is obvious to the music lover. Particularly, if he plays along or has a collection of older non-standard speed discs. Precise pitch control is his. At the same time, Bogen recognizes that fishing for an exact speed is not everyone's cup of tea, so they provide four click-in stops for the four popular speeds.

### The Tests

As received, the Bogen B-62 was right on speed at 120 volts: at 130 v it became 1.5 per cent fast; at 100 volts it was only 0.5 per cent slow; at 85 volts it became 2.0 per cent slow. These are very satisfactory speed regulation-versus-voltage figures indeed. And remember that the table can be adjusted to *exact* accuracy regardless of voltage.

Flutter measured 0.09 per cent while wow was 0.40 per cent.

Rumble measured 25 db based on 3.54 cm/sec recorded velocity at 1 kc. However, oscilloscope checks showed that the rumble was all well below 20 cps (centered around 15 cps).

Arm tracking error was moderately low. With an Empire 880P cartridge, we measured 1 degree per inch as the arm moved inward. Maximum error at a 6 in. diameter was just under 3 degrees. Arm resonance was very low in frequency (10 cps) and was +5 db. This places it well below the range of recorded music and should cause no performance problems at all.

Listening tests were made to find how far the ear could confirm these measurements. Rumble is inaudible, mono or stereo. Piano tones were pure without audible flutter or wow. The arm tracked well at the lowest recommended forces.

This table sells for a mere \$64.95. It is solidly built, and appears extremely reliable. And, it performs quite well indeed. Circle 209 on Reader Service Card

(Continued on page 44)



Fig. 2. Bogen B-62 Turntable

# WHEN KOSS & REK-O-KUT PLEDGE THEMSELVES TO QUALITY, HERE'S WHAT THEY MEAN

When John C. Koss purchased control of Rek-O-Kut, he discussed "quality" with Sid Simonson (Rek-O-Kut Manufacturing Vice-President) and Hal Dennis (Rek-O-Kut Sales Vice President). "There's a reason why everyone thinks of Rek-O-Kut as the very finest in single-play turntables. There's a reason why every audio engineer in the business knows and respects Rek-O-Kut equipment," said Koss.

"The reason," Simonson explained, "is that for over 25 years, we paid particular attention to purchase of parts and raw materials. Then we tooled for absolute precision in machining and assembly. If something wasn't perfect, we scrapped it!"

"Good," said Koss, "that's what I do with our headphones and that's what I want continued with our turntables." And that's what is now being done at the Milwaukee plant.



**KOSS PRO-4 STEREOPHONES**

**\$45.00**

Truly a professional instrument. Frequency response: 30-20,000 cps. Impedance: 50 ohms to be used with 4, 8, or 16 ohm outputs. Fluid-filled ear cushions for positive seal and comfort over long listening periods. Highest quality drivers mounted in acoustically designed chambers provide unusually smooth frequency response. Equipped for boom mike attachment.



**REK-O-KUT B-12H TURNTABLE**

**\$165.00**

Three speed. Noise level: -59 db below average recording level. Wow and flutter: 0.085% RMS. Custom-built, heavy duty Hysteresis Synchronous motor for constant speed and "hush" performance. On-off signal indicator.

Write for complete details and specifications on all Koss and Rek-O-Kut products.

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# The Tape Guide

HERMAN BURSTEIN

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

Herman Burstein  
280 Twin Lane E., Wantagh, N.Y.

## Neither Eye nor VU Says He

*Q. I cannot seem to understand why there should be any argument for either the VU meter or the magic eye tube as a record level indicator. It seems to me that if the tape recorder is correctly adjusted, there should be available a gain control setting, consistent with the "average" volume of the material being recorded, which will safely record any momentary peaks that come along. A lot of material being taped cannot be monitored for peaks before recording, so it seems only reasonable that most recording is done with the level indicator set for "normal" when "average" volume is being fed to the recorder. Is there anything wrong with this reasoning? If not, what is the continuing fuss about?*

A. In a tape recorder of good quality and employing a VU meter to indicate recording level, this meter is adjusted so that 0 VU corresponds to about 1 per cent harmonic distortion (at 400 cycles). This leaves about 6 to 8 db safety margin for signal peaks that the meter, being a mechanical device, cannot follow. In fact, however, signal peaks may be as much as 20 db above the average or indicated value. How are you to know? The answer is: experience. The experienced recordist, knowing what is apt to occur with different kinds of music and perhaps different recording sites, will alter his recording level accordingly. That is, in one situation he may adjust recording gain so that the meter never or hardly ever goes above 0 VU; in another situation he might keep below -3 VU; in still another he might allow the meter to hit +3 VU.

Furthermore, using a professional or semi-professional tape recorder, one can monitor the signal that has just been put on the tape. Thus one can use the evidence of his ears as to how high the recording gain control may be set. Lacking sufficient experience or the monitoring facility (which requires separate record and playback heads and tape amplifiers), one can turn to a magic eye to indicate whether peaks are being recorded at too high a level.

Let me describe a recent experience to

illustrate the point. I was at the home of a friend who owns a tape recorder equipped with a VU meter. However, this machine cannot record and play simultaneously. The owner had recorded an hour program of classical music, taken from phono discs and interspersed with his comments. There were many passages in one of his selections which contained distressing distortion, yet the operator had been careful to keep the VU meter below 0. A check of the phono disc which had been copied revealed no comparable distortion on the disc. The simple fact was that the VU meter had not been an adequate guide in setting record level for the program material in question.

You state that "a lot of material being taped cannot be monitored for maximum peaks before recording." I doubt this. If you are recording from microphone or phono disc, certainly you can experiment in advance in order to set recording level properly. If you are recording from radio, you can preset your recording level on the basis of the program material preceding that which you want to record; it is unlikely that the station will change its peak levels from one program to the next by a serious amount; in fact, stations generally guard carefully against doing so.

## Head Matching

*Q. In your article in Audio in July 1958 you describe the use of a Brush BK1090 low-impedance head (550 millihenries) for both record and playback. Why isn't a transformer for matching the tube input necessary during playback? The Brush BK1091 is a high-impedance head. Wouldn't that work as well? What circuit changes would be necessary if this were used instead of the BK1090?*

A. The Brush BK1090 is a high-impedance head, while the BK1091 can be described as extra-high impedance. Use of a step-up transformer between the BK1090 and a tube grid would entail serious danger of treble loss due to winding capacitance of the transformer. Use of a BK1091 for playback would have the advantage of presenting a higher signal to the tube and resulting in a better signal-to-noise ratio. On the other hand, the BK1091 has too high an impedance to be used satisfactorily for recording, where relatively substantial audio current and bias current are required. In playback, no circuit changes would be required in substituting a BK1091 for a BK1090, if the following

grid resistance is over 250,000 ohms. In view of the high impedance of the BK1091, you would have to make extra sure that stray capacitance (of the cable, and such) between the head and the following tube is kept to a minimum.

## Plastic-Coated Tape

*Q. Is magnetic tape with microthin plastic coating over the oxide more satisfactory than the uncoated type?*

A. I have had no personal experience with the microthin plastic coating. My guess is that there may be some loss of treble response, particularly at lower tape speeds, owing to the separation between the tape and the heads due to the plastic coating.

## Unusual Specs

*Q. One review of a particular machine puzzles me. After giving an over-all excellent report on this machine it concludes with (what I consider) a very poor IM distortion figure, stated as 5 per cent at -10 VU and 18 to 30 per cent at 0 VU. The review said that this figure is normal for this type of equipment. I have been a hi-fi fan for some time now, and distortion figures over 1 or 2 per cent tend to alarm me.*

Also, I don't understand this -10 VU as a normal recording level. On my present machine I would have considerable tape hiss if I attempted to record at such a low level. Could you please elucidate these specifications for me.

A. I believe that this particular machine's 0 VU reading corresponds to 3 per cent harmonic distortion (at 400 cps), in which case IM distortion of 18 to 30 per cent seems only moderately excessive; a figure of 5 to 10 per cent would be more in line with what can be expected of a high quality tape recorder. On the other hand, if I am wrong and this machine's 0 VU reading corresponds to 1 per cent harmonic distortion (which is the proper way of calibrating a VU meter for tape recording), then 18 to 30 percent IM is quite excessive.

The reference to -10 VU as a normal recording level assumes that most of the material recorded will be about 10 db below the peaks. Ordinarily you would set recording level so that the peaks cause the meter to read 0 VU.

It comes as a harsh surprise to most audio fans that IM reaches much greater heights in the case of a tape recorder than in any other electronic component. But this is a fact. Whereas we seldom encounter IM greater 1 or 2 per cent in preamps, power amplifiers, tuners, and so on, IM percentages frequently reach 5, 10, 20, and even more on tape. Great care must be exercised in setting record level low enough to avoid excessive IM, yet high enough to maintain a good signal-to-noise ratio. One of the reasons that commercially recorded tapes have not gained a more favorable reputation is because of the high amount of distortion on them due to the effort to maintain a high signal-to-noise ratio. It should be clear that the distortion is essentially due to the tape rather than to the electronics of the tape machine.  $\text{\AA}$

## NEW LITERATURE

● **Electronic Projects Catalog.** Henry Francis Parks Laboratory offers a free catalog of the many electronic projects that they offer. Complete plans for a wide range of items, such as amplifiers, spot welders, a theremin, moisture meter, impedance meter and ultra sonic power generator are offered. The catalog lists the item, gives a brief description and suggests the ease or difficulty of the project. Circle 220

● **Tape Manufacture and Use.** This free booklet from Eastman Kodak treats such subjects as the sound recording process, frequency response, bias, sensitivity, sound brilliance, print-through, output, signal-to-noise ratios, base materials and other mechanical properties of tape for audio use. Although primarily aimed at the advanced amateur sound recordist, the 24-page booklet is written in explanatory language designed to help the casual tape user to better understand the magnetic processes, thereby achieving better recordings. Title of the publication is "Some Plain Talk From Kodak about Sound Recording Tape." Circle 221

● **Viking of Minneapolis, Two New Publications.** "High Fidelity Decorating with an 88 Stereo Compact" is the title of a new brochure that includes general recommendations for component placement and photographs of stylish home installations. It is available at no cost. Owners of 88 series Viking machines can now receive, for \$1.00, a complete service manual. Theory of operation, installation, trouble shooting and complete mechanical and electronic service information is covered in detail. Diagrams and a complete parts list extend the usefulness of the manual.

● **Record Review Index.** The Polart Index to Record Reviews (including tape) has just been released for the year 1964. This is a comprehensive listing of all record and recorded tape reviews published during the past year in twelve of the leading review magazines (including AUNIO). Listings are by composer or category, whichever is obviously appropriate. Popular recordings judged to have a short life are not included on the basis of having no reference value. However, extensive reference listings are given to categories entitled "Pop and Jazz," "Foreign," and "Shows." In all cases, the listing for a particular subject will give the magazine(s), issue(s) and page number(s). Cost of this 48-page booklet is \$1.50.

● **TV Distribution System Handbook.** Jervold Corporation is offering a 50-page manual that provides 150 easy-to-understand sample layouts of typical TV distribution systems used in relatively small installations. The book is designed for the serviceman who would like to enter, or expand his activities, in this lucrative field. Complete information on antennas, cabling, division and tap-off are provided. Ample graphs and tables are provided to allow calculation of cable loss, db conversion and other parameters of distribution system operation. This revised and updated edition of a manual, originally published in 1959, is available for \$1.00.

● **Tape Recording Books.** "Tape Recording the Sounds of Your Life" is the title of a 128-page book that describes in depth typical home indoor and outdoor recording techniques. Vacations, weddings, zoos, holidays, parties, creative sound are some of the subjects covered. List price is \$1.35.

"How to Get the Most Out of Your Tape Recorder" is a second 128-page book, also with a \$1.35 list. It covers dubbing, radio recording, slide and film synchronization, sound effects, hobby-tape clubs, and the legalities of certain types of record copying. Both books are products of Robins Industries.

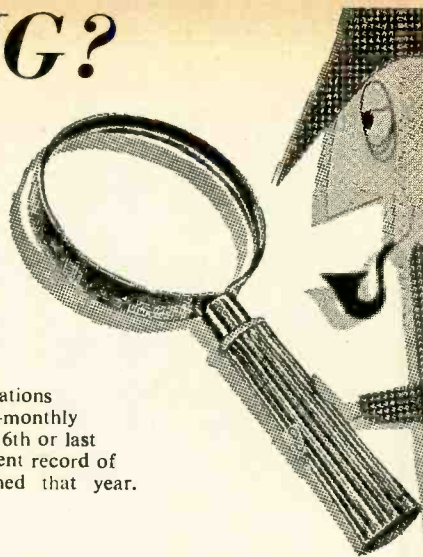
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rived systems and equipment specifications. Complete procedures are given for: Planning, assembling, and testing sound control installations—Articulating sound control with other elements of production—Rehearsals and performances—Operation and maintenance of sound control equipment.

### THE AUTHORS

During the past thirty years, the authors have developed the techniques of sound control in opera, open-air amphitheatres, theatres on Broadway, theatres on-the-road and off-Broadway, in concert halls and night clubs, in Hollywood and in the laboratory. Some of their techniques are used in broadcast and recording as well as in performances where an audience is present. From their laboratory have come notably successful applications of sound control to psychological warfare and psychological screening.

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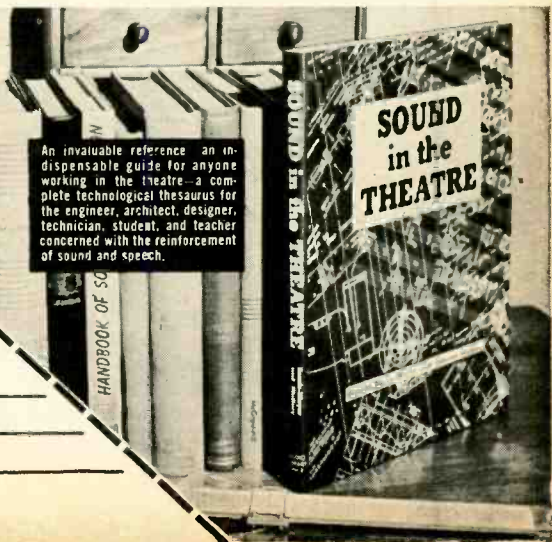
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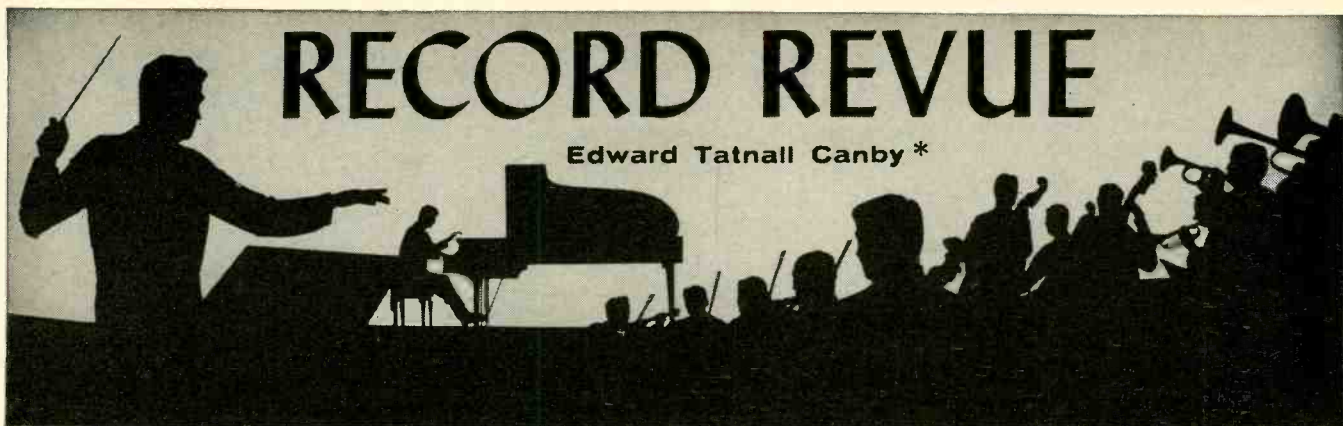
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# RECORD REVUE

Edward Tatnall Canby \*



## POTPOURRI

### Mexico: A Columbia Records Legacy Album.

Columbia LS 1016 stereo

This enormous book-album, with some 66 big pages of color and print, in both English and Spanish throughout, comes with a single slim record to keep it technically in the recording area—it's practically in the art-picture-book format. Plushy production: Goddard Lieberman is the producer and that slightly pompous word "Legacy" is attached to the project.

I've scarcely had time to do more than look admiringly through the big book, with its pictures in color and black and white and its decorative text layout. Like all these projects, the quantity of material is enormous and the detail-work is formidable. The book is called "Mexico: Its Cultural Life in Music and Art." The music?

Well, whaddya know. It's that old Columbia album of Mexican orchestra-chorus arrangements, engineered by Carlos Chavez, which first appeared in 1940 in connection with the Museum of Modern Art exhibit "Twenty Centuries of Mexican Art" in New York. If I'm right, the 78 album reappeared on an early LP. Now it has been done all over in stereo with the indefatigable Chavez still at the helm.

The stuff is pretty dated nowadays—a mixture of 1930s-modern and hepped-up popular music, with some intriguingly unimportant imaginary Aztec music (on real Aztec instruments) concocted by Chavez. I always liked the sentimental "La Paloma Azul" in its lush chorus arrangement by Chavez. I still do. But some of the other items are overly pretentious high-brow stuff; I suspect that the Mexicans themselves have gone much further than this now and may be just a bit embarrassed by it all, in spite of Columbia's best intentions, and Chavez's. How about 1965, Columbia? It's later than 1940.

### Valle del Locomotora de Vapor. Mobile Fidelity MF 14 (2) stereo

Darn it, I do like a bit of railroad now and then. But these RR buffs, you can't stop them. Now they've had to move to Mexico to find steam—and they come back with *two* full LPs of the stuff, in one album!

Let's face it. To a non-buff like me,

steam is steam, Mexican or otherwise. (In fact, these engines are U.S.-made, most or all.) The Mexicans do blow their whistles a'plenty, though. (Was it 'specially for the tape recorder, I always ask myself?) And they talk Mexican, i.e. Spanish, every now and then. Beyond that, I'd have to let the experts describe this big album, which seems as if it might be what the doctor ordered.

### 800th Anniversary Album Notre-Dame de Paris, 1163-1963. (Music by Campra, Desvignes, Vierne, Cocherneau.) Choir of Notre-Dame, soloists, Lamoureux Orch., P. Cocherneau, organ. Philips PHS 900-039 stereo

What an astonishing record! Two tons of stereo equipment, miles of cables, intercom TV and phone, 20 mikes—but what really counts is the 800-year-old cathedral itself, the heroine of it all. Four works are heard, all composed for the cathedral itself, the oldest (*very* young in terms of the building's age) being a Psalm by Campra, of the French-Baroque eighteenth century. Then there's a Napoleonic celebration-piece by Desvignes, right out of the Beethoven "Eroica" Symphony in its style (1809), a neo-Romantic bit by Vierne and, finally, a piece by the present organist, M. Cocherneau, all immersed in the darnest 20-second reverberation (well, almost) you ever heard! In stereo it's appalling, but you can't stop listening.

Musically, I regret to say, the two oldest works are all that matter very much. (But what will they say in another 800 years?) The Campra is first-rate of its newly-popular sort, with solos, choir boys, tutti, the bass continuo pounded out in giant elephant tones by fifty double bases and the organ pedals, 32-foot. So it sounds anyhow. But very musical, in spite of the drastic means taken to make musical sense in the big echo. The Desvignes is unimportant but a real period piece; sounds sort of like the Arche de Triomphe with Napoleon himself striding beneath it, crowned in laurel! The less said about the rest, the better, except that some listeners will like the big noise, both Vierne and Cocherneau.

### Organist at Play. John Ledwon. Alpha M7700 mono (also stereo) (5965 West Blvd., Los Angeles 43)

Wow! I somehow missed this in passing—the music isn't my dish but this kid, who

started on the Mighty Wurltizers at eleven and is around fourteen here, is the most finished past master at this stuff I ever heard. Whew! Sounds like he'd been at it for thirty years.

All sorts of weird noises in this Mighty W., including a remote-control piano, played off the organ keyboard. (Also honky tonk, harpsichord, mandolin.) Not to mention sleighbells, cow bells, Boat Whistle, Fire Gong, Surf, Trolley Bell, Bird Whistles and Horse's Hooves. What an antique.

*Electronic age P.S.* All sounds were recorded on the organ itself except for two notes. They came—ugh—from a Hammond. Taped in, I presume. Coupla dead pipes?

### Auscultation of the Heart.

J. B. Barlow and W. A. Pocock.  
S. O'Reilly, commentator.

London X 5873

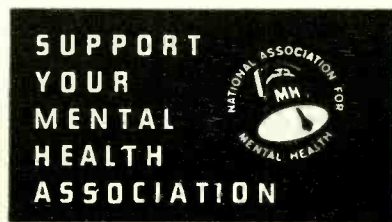
*Thump-thump. Slrrrp. Thump-thump. Slrrrp.* Somebody's heart is about to give way.

This amazing record just goes to show how far the LP in all its majesty has gone these days.

A *very* professional sounding young Britisher speaks here, analyzing (with plenty of medical terminology) just what is going on in the numerous and appallingly loud pumpings of these damaged hearts and normal ones, all beating furiously at the business of keeping somebody alive from minute to precious minute. Rather a terrifying sound for the uninitiated.

All sorts of heart troubles and actions are heard and discussed. Most is utterly beyond anyone but an M.D. though a few light moments intrude themselves timidly, like the sound billed as "Cooing dove". Not a bit funny, really.

If you want to listen for yourself, London has copies. No stereo. Æ





# Guts.

It took *guts* to even think of making a *low-cost* speaker line to University's *high quality standards*. But—the challenge paid off!

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2" long-throw voice coil

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Shallow depth styling

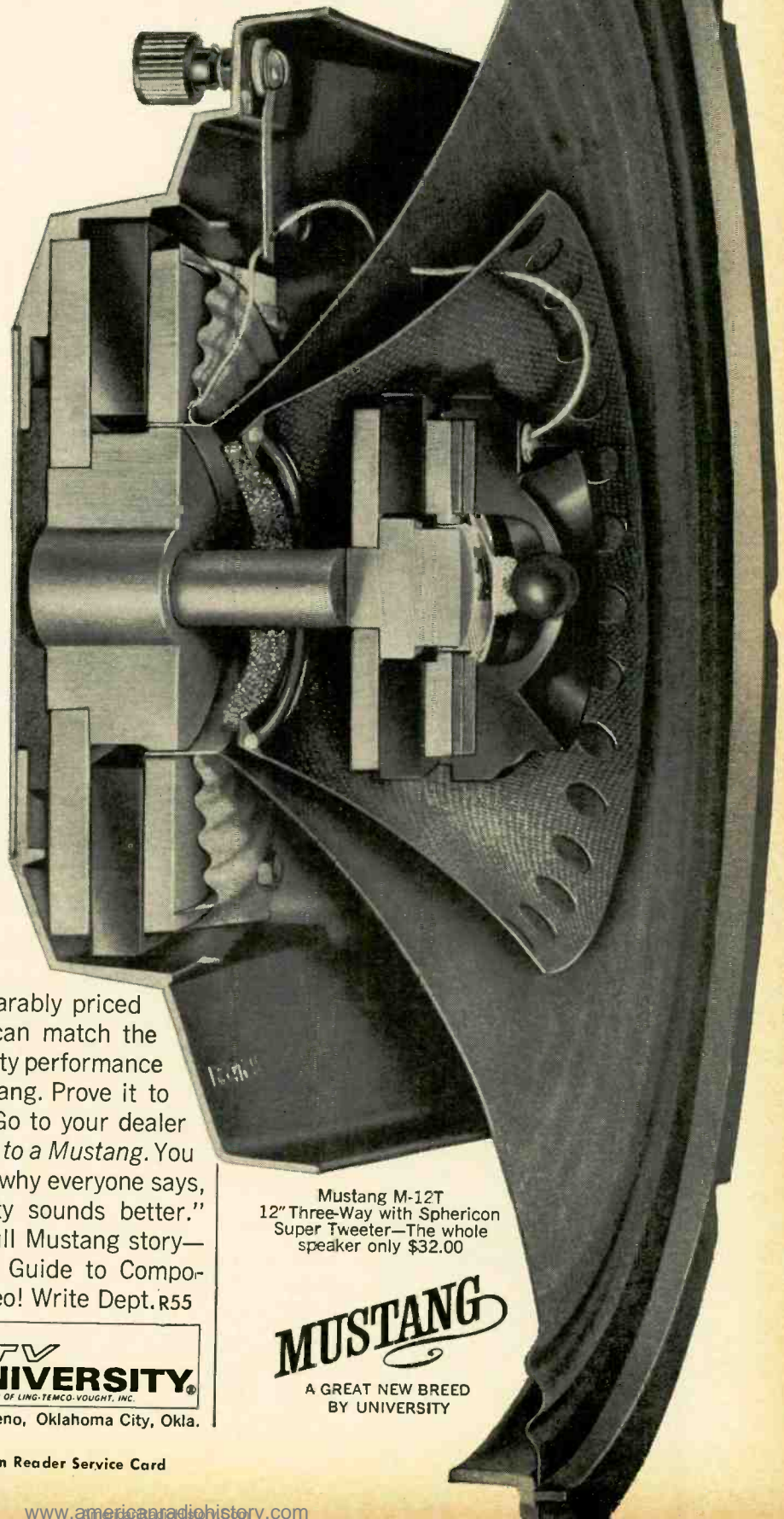
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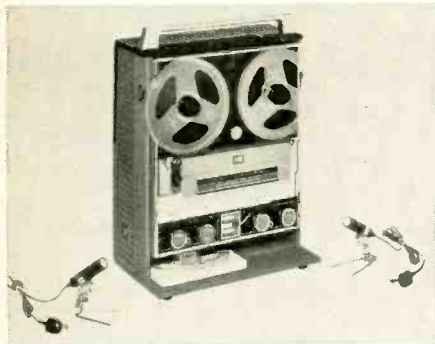
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BY UNIVERSITY

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# NEW PRODUCTS

• **Automatic Two-Way Tape Stereo.** The latest in Concertone's series of "Reverse-o-Matic" tape recorders is the Model 801. This is a  $\frac{1}{4}$ -track stereo recorder with three-motor drive. Automatic reversal play and record is provided through six heads, three for each direction, plus a symmetrical center-capstan drive. Record and playback preamplifiers are solid state. Operation



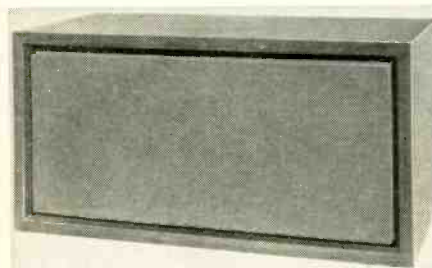
is by pushbutton and remote control is available as an optional extra. The recorder is built into a portable carrying case containing a stereo amplifier and stereo speakers. Two microphones are also included. Available as a deck (Model 802) for \$379.95. The 801 lists for \$449.95. Circle 200.

• **Deluxe Stereo Receiver.** The Kenwood KW-55A is an AM/FM/MX receiver with a host of interesting features. The FM tuner features 1.8  $\mu$ v sensitivity and nuvistor front end. Colored lights on the front panel indicate the mode of operation. A stereo indicator lamp glows when the set "senses" a multiplex broadcast. Silent, automatic, electronic switching changes the set from mono to stereo mode. The amplifier portion



provides a total of 17 watts per channel rms power at 1 per cent THD. The preamp section will accommodate magnetic inputs from phono or tape heads, with a sensitivity of 1.5 mv. Full tone control is provided ( $\pm 10$  db at 50 and 10,000 cps), as well as rumble and scratch filters, loudness compensation, AFC defeat, and a separate power on-off. 23 tubes and 8 diodes are used. Power consumption is 200 watts, weight is 30 pounds and dimensions are 17 $\frac{3}{4}$ " x 5 13/16" x 14". Price is \$239.95. Circle 201.

• **Decorator Speaker System.** Accent colors are only part of the modern styling built into the new Utah PRO speaker system. The grille cloth can be changed in seconds by snapping in alternate pre-covered boards. Blue, orange, persimmon, beige tweed, and cane panels are offered.



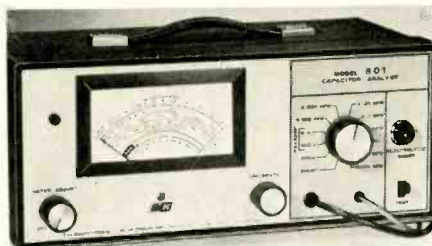
As for the speakers themselves, the cabinets (12" x 12" x 24") contain a 10" high-compliance woofer in a sealed enclosure. The 8" mid-range and 3 $\frac{1}{2}$ " tweeter are separately sealed to prevent interaction with the other drivers. The complete system (with one grille cloth) sells for about \$100.00. Circle 202.

• **Compact Phone Jacks.** Switchcraft has announced a new series of compact,  $\frac{1}{4}$ " jacks designed for use in applications requiring complete insulation between jack sleeve and metal mounting board. Called the Insulated HI-D Jax Series 110, the new units are only  $\frac{5}{8}$ " square and utilize a molded, threaded nylon bushing for



insulation between sleeve and panel. By integrally moulding this nylon bushing with a brass insert, a continuous sleeve contact is achieved between the phone jack's sieve and the mating sleeve of the plug. Five standard models are available. These include two- and three-conductor types in open, closed and double closed circuits. Eighteen other types are available on special order. Circle 203.

• **Capacitor Tester.** Designed to make measurements on a practical basis, this new B & K Model 801 checks all capacitors, including electrolytics, picking up defects that will affect circuit performance. A special balanced-bridge circuit tests electrolytics up to 2000  $\mu$ f. It can detect marginal electrolytics that should be replaced and predicts the life expectancy of any



electrolytic rated at 3 volts or more. An in-circuit leakage test eliminates the need to remove a capacitor to make actual leakage resistance measurements. Tests are made on low-voltage circuits so that transistor units may be read directly. Higher voltages can also be used. Size is 5" x 8" x 12 $\frac{1}{2}$ ". Net price is \$99.95. Circle 204.

• **Speaker Placement Aid.** The Jensen Manufacturing Company announces the availability of a valuable new design tool for the professional sound system layout engineer. Large 14" x 20" transparent plastic templates known as Isonomic Contour Charts show the sound coverage of the Jensen CALSTAR TM Column Speakers Model 55 and Model 1010. These transparent templates can be placed directly over the architect's elevation drawing regardless of scale to indicate the correct location and tilt angle for these column speakers to attain any desired audience coverage. Jensen Technical Bulletin No. 45, free upon request, "Speaker System Layout is Easy with Jensen Isonomic Contour Charts" describes these templates and how to use them. This bulletin includes small size reproductions of the isonomic contour charts for these two column speakers which can be used for speaker system layout although not as conveniently as with the large transparent templates. The set of two transparent templates with instructions are available in a mailing tube for \$1.00 Post-paid. Jensen Mfg. Co., 6601 S. Laramie Ave., Chicago 38, Ill.

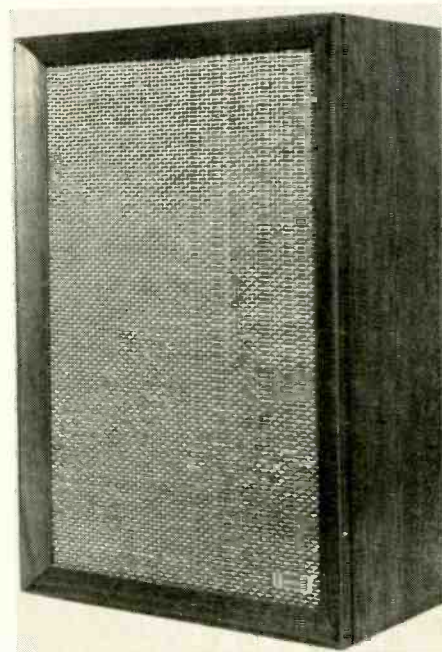
• **Bulk Tape Eraser.** This is actually a re-release of an old standby among tape recordists, the Model 150-A Magneraser Junior Bulk Tape Eraser. The unit will bulk erase a full reel of recorded tape in seconds, providing a noise

level lower than virgin tape. The 150-A will also demagnetize tape heads, guide posts, bearings and other tape recorder parts that could



alter a tape recording if they were to be magnetized. The unit also can be used to demagnetize watches, tools, and any small magnetized metal parts. Designed for easy, hand-held operation and housed in a plastic case, the 150-A is provided with an eight-foot gray-vinyl line cord. List is \$18.95. Circle 206.

• **New Speakers.** A new series of low-cost high-fidelity speaker components has been dubbed, by University, "Mustang" (for the small, hardy, half-wild horse indigenous to Texas, New Mexico and Oklahoma). In line with this they are described as a new breed of spirited components. They range in price from \$19.00 to \$32.00 in size from 8" to a 12" full three-way system.



Among other new speaker products released by LTV University is a new professional 3-way speaker system here illustrated. Measuring 23 9/16" x 15 $\frac{3}{4}$ " x 12 $\frac{1}{4}$ ", it is designed for bookshelf or floor placement. Response is claimed at 28-22,000 cps with crossovers at 600 and 4000 cps and power handling capability is 40 watts. Consumer price is \$129.00. Circle 207.

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### HIGH FIDELITY SYSTEMS—

A User's Guide by Roy F. Allison

AR Library Vol. 1 70 pp., illus., paper \$1.00

A layman's practical guide to high fidelity installation. We think that it will become a classic work for novices (and perhaps be consulted secretly by professionals). From the Bergen Evening Record: "completely basic . . . If this doesn't give you a roadmap into the field of hi-fi, nothing will." From The American Record Guide: "really expert guidance . . . I would strongly urge this book as prerequisite reading for anyone contemplating hi-fi purchases." From High Fidelity: "welcome addition to the small but growing body of serious literature on home music systems." From Electronics Illustrated: "To my mind, this is the best basic book now available on high fidelity."

### REPRODUCTION OF SOUND

by Edgar Villchur

AR Library Vol. 2 93 pp., illus., paper \$2.00

Vol. 2 explains how components work rather than how to use them, but it presupposes no technical or mathematical background. Martin Mayer writes in Esquire: "far and away the best introduction to the subject ever written—literate, intelligent and, of course, immensely knowledgeable." From HiFi/Stereo Review: "just the books to satisfy that intellectual itch for deeper understanding."

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Previously, we have written about some aspects of the complex relationship between the audio industry and its ultimate master, the customer. The connecting link in this relationship is the retailer. After all, the dealer is the one who *sells* the product.

As audio has grown, so have the number of dealerships. There are many small establishments, to be sure, but it is the retailing giants (and there are only a few) who dominate the industry. Now, most manufacturers offer better prices to the quantity buyer. This puts the small independent at an immediate price disadvantage since he cannot possibly purchase products by the hundred to get the best price. So, he must either sell at a higher price or take a reduced profit if he is to stay alive against the chain store.

#### Another Choice

He has one other choice. He can become a franchise store. This is something new in audio but it is certainly not a new idea. Howard Johnson, Carvel and others have been doing just that all along. Many of their establishments throughout the country are not centrally owned, they are the *private* property of a local individual. They are a small business that is given the advantage of a big dealer through the device of a *franchise*. This has come to retail audio.

My interest in this subject was recently aroused by an announcement that a New York retailer who had several stores of his own in the area was starting a franchise program. This dealer is the Audio Exchange. His specialty is, as the name implies, the trade-in. Audio Exchange has an enviable reputation as a source for used audio equipment and as a dealer in new merchandise as well. His reputation was built by careful, natural demonstration of components under simulated living room conditions and a thoroughly competent and extensive service facility.

I spent part of an afternoon recently with William Colbert, energetic President of the Audio Exchanges, discussing his approach to expansion via the franchise route.

It must be established that Audio Exchange is a newcomer to franchise having begun with their first non-owned store in November 1964. We talked, then, mostly about future plans, particularly what they held for the consumer. Bill Colbert feels very enthusiastic about the future of franchising. He sees it as a benefit for all. I am inclined to agree.

Audio Exchange is, by necessity, con-

finned to the Greater Metropolitan Area of New York City. Beyond this area their reputation decreases, as does the desirability of their franchise.

If a local retailer on Long Island wanted to enlarge his business he might investigate becoming an Audio Exchange franchisee. If he sought this out, he would find out the following:

That he must be a substantial and reliable business, or risk (if a new firm), before he will receive a franchise. His competence will be investigated. If he passes muster he can hang that Audio Exchange logo outside.

What does he get?

He can buy all his merchandise from a central source. Since the central source buys in quantity, it gets the best price. This is passed onto the franchisee. He thus gets the bulk price even though he may only purchase one piece. And, in the case of limited-distribution fair-trade lines, he has direct access. But, he must be authorized by the manufacturer for these special lines. It's easy to understand that a finicky manufacturer would tend to approve an Audio Exchange outlet where he might not otherwise want to open up a particular area.

The franchisee does not *have* to buy from Audio Exchange. If he prefers, he can buy directly from the manufacturer. Wherever he gets the best price.

The franchisee also participates in regional advertising by Audio Exchange without actually paying for it. And, the local store will directly benefit from any advantage that central buying can accrue. If Audio Exchange can buy a special deal, all the stores will have it.

Last, and most important, the Audio Exchange house label components are available to the local dealer. This question of house labels is a big one. You will hear more about this. Suffice it to say that a house label offers the dealer an item that is non-competitive. Only an Audio Exchange store can sell a Colbert speaker. And, house brands offer the consumer a good value since they are often sold as leader items, or because of mass purchase and low advertising cost, can actually be sold for less than standard brands.

The consumer, our long suffering friend, who visits an Audio Exchange franchisee is, for all practical purposes, at an Audio Exchange store. That dealer's trade-in and trade-back policies are open to him. And, Audio Exchange service is open to him. The local franchisee may, or may not, have service of his own, but central service is avail-

able. Many outlying stores cannot afford (or get) a high-priced technician/audio specialist. The local man, stumped, just picks up the phone and he is talking to the chief serviceman in New York.

#### Another Plan

From Audio Exchange, I went to Lafayette Radio in Syosset, New York. Lafayette is one of the giants, long established as a major mail order house and direct retailer. Their catalog has made them a national dealer so it was no surprise to find that their involvement with franchising was on a national scale. Lafayette now has been at it for four years. They have 167 franchise stores, spread all over the country. Their *modus operandi* is quite similar to Audio Exchange. The dealer gets his merchandise at a good price from Lafayette, though not always at the maximum discounts.

This brings up the question of what does the franchisee pay Lafayette or Audio Exchange for the privilege of using their name. A percentage of gross sales.

A Lafayette franchisee has the availability of the entire catalog at their disposal. This goes far beyond high-fidelity components, and gets into the electronic parts business as well. And Lafayette has an *extensive* house label system, again well beyond the component business alone.

It was pointed out to me at Lafayette that franchising makes it possible for a locality to have a Lafayette store that otherwise would not have been. It would not pay for a major distributor/retailer to go into a small town in, say, Kentucky. But a local business man can make a go of it. We have already pointed out the advantages of the franchise to the dealer. For the consumer, in that Kentucky town, he has the Lafayette catalog on display in his town. Lafayette requires of its franchisees that they maintain equipped service shops and in general adhere to minimum care standards beyond the mere sale of a component.

I've looked for the loopholes in this franchise gimmick. I can't find them. It may cost the local dealer personal identity. Joe's Audio Shoppe now becomes Audio Exchange or Lafayette Radio (and only in small letters, "owned and operated by etc"). But the dealer does benefit. The consumer benefits by greater choice and often lower price. The manufacturer benefits by selling more amplifiers. No wonder Lafayette could franchise so many stores in only four years. I would not be surprised if Audio Exchange, on its own scale, does as well. In fact, I would not be surprised indeed, if more companies climbed on the franchise bandwagon. It's a sure winner. **Æ**

## MORE NEW STUDIO EQUIPMENT FROM ALTEC

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#### A LITTLE ABOUT A LOT OF IMPORTANT IMPROVEMENTS

You might like to know how some of these improved attenuators were engineered. For instance, "coin" silver, which is normally used to make brushes, contains copper and is subject to oxidation—reducing conductivity and raising noise level, among other things. So we've made our brushes of "fine" (pure) silver because it doesn't oxidize—it sulfides. Silver sulfide does not reduce conductivity; in fact, it actually has a helpful lubricity. We use dual brushes on all our attenuators—both rotary and straight-line models. They are independently sprung and so guided as to eliminate "stumble" from contact to contact.

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#### DON'T FORGET THE CATALOG

The new Altec Attenuator Catalog we mentioned above has all the technical characteristics and other relevant data on the new line. We'll be delighted to send it to you. So write today, Dept.. AB5.



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ANAHEIM, CALIFORNIA

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# EQUIPMENT PROFILE

(from page 34)

## EICO SOLID STATE FM-STEREO RECEIVER, MODEL 3566

The EICO Model 3566 is completely solid state FM-stereo receiver, designed as a kit but available factory assembled, which has successfully tackled many of the problems which had plagued early solid-state designs. Thus we find that the 3566 *decreases* in distortion as power decreases; at normal listening levels distortion is as low as any unit we have encountered, and far lower than most. Also the ability

to handle a wide dynamic range in low-level stages is surprisingly good. For example the phono input, with a sensitivity of 4 mv, does not start clipping until the signal becomes 78 mv. With a sensitivity of 12 mv clipping doesn't start until 240 mv. (The 3566 can be set for either sensitivity by removing or replacing a jumper.)

Some of the conveniences provided by the EICO 3566 are: Automatic,

silent switching between FM stereo and mono; automatic indication of stereo transmission by means of a light; adjustable and defeatable muting; defeatable afc; loudness compensation; tape monitor; and a front panel headphone jack. In addition, the tuning dial is extremely well laid out and lit.

### Circuit Description

**Tuner:** The FM front end and i.f. section are separate assemblies which are apparently supplied as a unit and the transistors are not identified. However, from the schematic we note three transistors in the front end, the r.f. input stage being in the common base configuration. The converter is straightforward. Following the front end assembly is the i.f. assembly which consists of four stages and the ratio detector, with taps for afc, tuning indicator and muting. The multiplex assembly contains ten transistors, all of them 2N2672's except for a single 2N1304 in the indicator circuit. The multiplex is classified as a time division type.

**Amplifier:** The power amplifier is a good example of the RCA output circuit which has become the most common circuit available. The output transistors are 2147's, two per channel, driven by a transformer, which in turn is driven by a 2N2613. The driver transformer is driven by the emitter of the transistor (low impedance) so that the transformation ratio can be 1:1 and permit a much wider bandwidth transformer. Tone controls are Baxandall type, utilizing a feedback network for boost or cut. The phono input stage is quite straightforward, incorporating a DTG110 transistor for the input stage and a 2N2613 for the second stage, with a feedback network from the output of the second to the emitter of the first, the network incorporating the required equalization. High level inputs such as tape, or auxiliary, or the integral tuner bypass the phono preamp. There is no tape equalization provided, so that the tape input must be from a recorder with a built-in preamp.

**Power Supply:** The power supply of the 3566 provides electronically regulated voltage to the entire set except for the amplifier power output stage, which really doesn't require regulation. Transistors (three) are used to regulate the various supply sections, apparently quite successfully to judge by performance.

### The Kit

The kit version of the 3566 is designed to require absolutely no adjust-



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सादर से सुन्दरी आवाज़ पैदा करता है।

IN JEDER SPRACHE, NUR **Tandberg** BIETET  
BESSEREN, KLAREREN UND NATURTREUEN TON!

भाषा कोई हो, “अच्छी, साफ और स्वाभाविक  
आवाज़ के लिये” — टैन्डबर्ग

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ment. This is achieved by having the front end, i.f., and multiplex sections factory assembled and adjusted, each on its own circuit board. The amplifier section, and preamplifier are also uncomplicated, in spite of the switching. The transistors are safeguarded, and assembly eased, by the use of sockets for the transistors instead of having to solder to them directly.

The manual is quite clear and detailed, with a good deal of space given to oversized illustrations. We were particularly happy to note that the operation and service sections were completely removed from the assembly section; two separate manuals are provided. In fact, the operation manual is precisely the same as provided for factory assembled units. And rightly so.

### Performance

**Amplifier:** The amplifier provided 25 watts per channel rms with an 8-ohm load and both channels driven; with a 4-ohm load it put out 29 watts rms, with only one channel driven; at 16 ohms it provided 27 watts rms, both channels driven. Distortion measured 0.4 per cent at 25 watts rms, 8 ohms, from 20-12,000 cps; at 12.5 watts it measured 0.33 per cent; at 1 watt 0.13

Fig. 3. EICO solid - state FM - stereo receiver



per cent, 20-18,000 cps. Intermodulation was 1 per cent at 25 watts (60-7000, 4:1), 0.25 per cent at 1 watt. Frequency response was within 1 db from 10 to 63,000 cps. Hum and noise measured 69 db below 10 mv on phono. At the most sensitive position of the phono jumper, sensitivity was 4 mv. At other inputs sensitivity was 190 mv.

With an 8-ohm speaker connected to the speaker terminals, we swept from 20-20,000 cps and observed the waveform on an oscilloscope in order to determine whether the amplifier reacted well with a reactive load such as it would normally encounter. Results were quite excellent. We did not attempt a capacitive load, but experience with this type of circuit leads us to believe there would not be any difficulty.

**Tuner:** Sensitivity, IHF, is 2.2  $\mu$ v; channel separation was 39 db; capture ratio was 4.5 db; harmonic distortion 0.45 per cent; audio response within 1 db from 20-15,000 cps; AM rejection 43 db; crossmodulation index, 61 db.

Listening tests reveal that the 3566 is a fine performer and an extremely good buy at its kit price of about \$230 (factory assembled at \$350). Its handling of music is most enjoyable, delivering a firm but full bottom end and smooth response throughout the rest of the range. As a tuner, we were quite impressed with its ability to handle a strong signal, an ability which early all solid-state tuners didn't share. We were also impressed with its generally good handling and low noise level. A very satisfactory product at a very attractive price.

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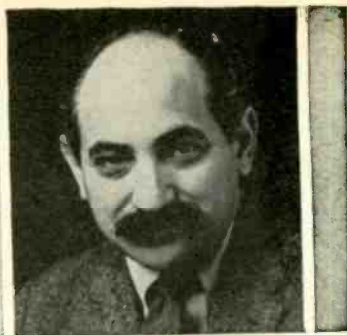
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## JAZZ and all that

Bertram Stanleigh



One of the most stimulating jazz labels is Impulse—the cool division of ABC Paramount. Under the aegis of Bob Thiele, a veteran record executive and jazz enthusiast, Impulse has contributed a number of very important albums featuring musicians from mainstream to way out. And their performances have usually been on that consistently high level that is only achieved under ideal studio conditions, when a group of first rate professionals who respect one another can play for each other in an atmosphere of serious music making without the distractions and influences of a noisy concert or night club audience.

Together with this sympathetic atmosphere, Impulse exercises the kind of care in recording and pressing that results in the utmost fidelity to the live performance in the finished product. Most of their sessions are engineered by Rudy van Gelder, a man whom I know only from his discs and his reputation as a cutter of superior lacquers, but a man whom I admire more with each Impulse waxing I hear. At a time when most engineers have ceased to care about the quality of their mono tapings, van Gelder continues to make progress in this area, and I find myself in the rather surprising position of having to admit that I find greater clarity and separation in most of his mono recordings than I can hear in the stereo sound of some of the mass production labels.

For its latest release, Impulse has inundated record enthusiasts with an even dozen of discs. Most of them are up to the very highest standard that the artists involved have achieved to date, and in one very important instance—the new Coltrane album—one of the very greatest achievements of the jazz recording industry.

### John Coltrane: A Love Supreme Impulse Mono A 77

The deep sincerity of John Coltrane is manifest in the impact of his performances. That his sincerity is grounded in deeply felt religious belief had not crossed my mind until I encountered this new release to which Coltrane not only contributes profoundly moving performances but also a set of devotional album notes that are just as deeply motivated even though the pen is not his effective medium of expression. The simple faith that Coltrane reveals in

his notes is impressive and uncomplicated. Johann Sebastian Bach was another great musician with simple devotional concepts and complex musical ideas. Coltrane's music on this record consists of a four part setting titled: *Part I—Acknowledgement, Part II—Resolution, Part III—Pursuance and Part IV—Psalms*. McCoy Tyner, piano, Jimmy Garrison, bass, and Elvin Jones, drums, work effectively with Coltrane throughout. My one reservation concerning this deeply moving performance is the chanted repetition of the set's title at the end of *Part I*, but this is a minor detail. This record is one of the most eloquent performances ever committed to wax.

### Archie Shepp: Four for Trane Impulse Mono A 71

In spite of the title and a credit on the album indicating that John Coltrane is co-producer with Bob Thiele, Archie Shepp emerges from this platter as a highly individual tenor saxophonist, rather than as a carbon copy of Coltrane. The four tunes referred to in the title are *Niema, Syyeeda's Song Flute, Cousin Mary and Mr. Syms*. Each receives a vigorous workout in a flippant, extrovert style that is very much Shepp's. But nothing matches Shepp's tune *Rufus (Swing his face at last to the wind, then his neck snapped)*, a number that demands—and receives—a high keyed, intense performance. John Tchicai, alto, Roswell Rudd, trombone, and Charles Moffett, drums, all work tightly with Shepp, but the album belongs to Archie and to bassist Reggie Workman who provides a pensive, supple counter pattern to Archie's spirited exposition. Leroi Jones' liner notes are as sensitive and evocative as these notable performances. "This album," says the back cover, "will be a milestone in the history of jazz music." It is not an overstatement.

### The Russian Jazz Quartet: Happiness Impulse Mono A 80

On August 15, 1964 two Russian musicians on tour in Japan with a Soviet vaudeville troupe presented themselves at the U. S. Embassy in Tokyo with a request for asylum. It was their desire to come to the United States so that they could perform the kind of jazz that they were not permitted to play in the Soviet Union. Following two months of debriefing in Frankfurt, Germany, the pair arrived in New York late in October, and within two weeks of their arrival, they had not only met a sizable number of the jazz greats of



today, but they had formed the group with which they are now heard in their first recording. In addition to the two young Russians, Boris Midney, alto and clarinet, and Igor Berukshits, bass, the quartet consists of Grady Tate, drums, and Roger Kellaway, piano. On three of their first six recorded numbers, George Ricci, 'cello, augments these forces. If not staggeringly original, these young men are at least sufficiently good to justify genuine interest in their work as musicians, instead of being classified as mere political curiosities. Midney swings freely in a relaxed, somewhat impressionistic manner, and Tate and Kellaway turn in the same sort of reliably sensitive performances that they generally deliver. With the exception of a very low introduction on *Remember*, the 'cello is either difficult to hear or is heard in mere doubling of the solo line in a manner that does nothing to enhance the music's message. Possibly the stereo version brings out the 'cello sound more effectively. All of the important solos are contributed by Midney who is also the composer of four of the six tunes on this set. He sounds like an earnest, inventive performer from whom we are likely to hear rather a bit in the near future.

**Johnny Hartman: The Voice That Is!**  
**Impulse Mono A 74**

Hartman's rich, robust voice is coupled with superb instrumental accompaniments on his second great album for Impulse. The arrangements by Bob Hammer make effective use of guitar and percussion, and Hartman uses his flexible voice to turn each number into an expression of a very personal experience. One of his great virtues is his ability to make his points without impairing the musical line or the meaning of the lyrics. To find so much latitude for individual statement without distorting the basic material is a very rare thing these days. But, then, singers of Hartman's stature are, indeed, rarities. The collection covers a wide range of interesting but not overly familiar music. Among the more interesting numbers are *My Ship*, by Riego and Mortimer, and Rogers and Hart's *It Never Entered My Mind*.

**Yusef Lateef: Live at Pep's**  
**Impulse Mono A 69**

Here is the exception to the usual studio recording that we have come to expect from Impulse. The recording was made at Pep's Musical Lounge in Philadelphia, and it has many of the objectionable characteristics that plague all "live" jazz discs—spoken introductions to the music, applause at the end of solos within the number, audience noise, etc. But it must be admitted (grudgingly) that this disc does offer exciting, alive performances that go a long way toward justifying this technique of insinuating a microphone into an evening's entertainment. In the course of his performances, Mr. Lateef plays tenor sax, oboe, argol and shannas—the last two instruments are a twin reed instrument from Syria and another twin reed, oboe-like instrument from India. He is also heard playing a bamboo flute of his own construc-

tion. Assisting Lateef on conventional instruments are Richard Williams, trumpet, Mike Nock, piano, Ernie Farrow, bass, and James Black, drums. Together, they make up a remarkably well coordinated team that displays not only exceptional precision but also the kind of closeness in style and anticipation of one another's ideas that make for great ensemble playing.

**Milt Jackson: Jazz 'n Samba**  
**Impulse Mono A 70**

With the assistance of Jimmy Heath, tenor, Connie Kay, drums, Richard Davis, bass, and further help from some miscellaneous instrumentalists and singer Lillian Clark on several tracks, Vibraphonist Milt Jackson turns in some rhythmically tantalizing numbers that are sure to delight those cool characters who don't object to music with a pronounced dance beat. This is simply lively dance music played by jazz oriented musicians, but they swing superbly, and the Lillian Clark vocals on *Jazz 'n Samba* and *Kiss and Run* are a perfect amalgam of warmth and rhythmic agility. Joe E. Ross, known to television admirers as Gunther Tootie of "Car 54 Where Are You?," is vocalist in an amusing novelty called the *Oo Oo Bossa Nova*, a witticism that will doubtless be lost on future generations of TV audiences.

**J. J. Johnson: Proof Positive**  
**Impulse Mono A 68**

Here are six trombone solos in as many moods by the greatest living exponent of that instrument. Never has Jay sounded better on discs or received such clean, accurate recording. Harold Mabern, Jr., piano, Arthur Harper, Jr., bass, and Frank Gant, drums, provide a brisk but self effacing accompaniment on *Neo*, *Stella by Starlight*, *Minor Blues*, *My Funny Valentine* and *Blues Waltz*. McCoy Tyner, piano, Richard Davis, bass, Elvin Jones, drums, and Toots Thielemans, guitar, speak out more individually on *Lullaby of Jazzland*, but none of these men rises to the exalted heights of Johnson, and their attempts merely constitute an intrusion of mediocrity into great music making. Happily this group is heard on only one tune. The rest of the platter is sheer magic.

**Lionel Hampton: You Better Know It!!!**  
**Impulse Mono A 78**

The perennially welcome Mr. Hampton turns up with a quintet of grand old veterans: Clark Terry, trumpet, Ben Webster, tenor, Hank Jones, piano, Milt Hinton, bass, and Osie Johnson, drums. Together they romp through a delightful collection that includes such splendid old numbers as Ellington's *Ring Dem Bells*, *Sweethearts On Parade* and the Goodman-Hampton *Pick-A-Rib*. Bobby Scott's *Taste of Honey*, a trio of Hampton tunes: *Vibraphone Blues*, *Tempo's Birthday*, and *Swingle Jingle*, Manny Albam's *Trick or Treat* and *Cute* by Neal Hefti and Stanley Styne fill out the set. The results are a set of easy, relaxed music delivered with mellow good spirits. It isn't very modern, but it's lots of fun. Æ

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## ABOUT MUSIC

(from page 8)

which the guests get settled, order their drinks, and mingle. The second movement is the Concert itself: 8:45-10:45. The evening concludes with the Party, which gives the audience an opportunity to meet the artists, and to discuss the concert with fellow guests. Mr. Boal says there is absolutely no coughing during the second movement: "All one can hear, and seldom at all, is a faint tinkling of an ice cube in a highball glass." Having attended a concert-party last February, I can vouch for the claim; the audience was noticeably quieter than its concert-hall counterpart. Probably the informality of the event (drinking and smoking permitted during the concert unless singers object to the former) engenders a feeling of relaxation along with a deeper concentration on the music.

The first concert-party took place on April 9, 1964 and featured the Lenox String Quartet; the second was on June 17 and included works for wind instruments by Mozart and Beethoven. Both concerts were sold out. Following this, a subscription series of eight concert-parties was scheduled, the last of which will be given on May 21.

The acoustics of the Bowman Suite are ideal for chamber music: resonant, well-blended, yet detailed sound, with a remarkably smooth frequency response. The room measures 71-feet long and 42-feet wide, with a 20-foot ceiling. A horseshoe terrace frames the lower ballroom floor on three sides, both areas accommodating 26 tables.

So far, the concert-party entrepreneurs find that audiences enjoy the mixture of conviviality and chamber music. Has it paid off? The first concert-party, Mr. Feldman said, "cost about \$1,200, including artistic and rental fees and other costs." The hotel gets the proceeds from the bar. Individual tickets cost \$4.00 (or \$3.75 in advance).

Messrs. Feldman and Boal, who made a profit of \$30.00 on the first concert-party, were afraid that their series might appeal mostly to classical Lonely Hearts. It turned out otherwise; doctors are among their heaviest subscribers. But romance was in the air at the first concert-party. Peter Marsh, first violinist of the Lenox Quartet, met a young woman there and married her a week later. Commented Mr. Feldman: "We expected this sort of thing to happen to our guests, but *not* to the performers." Æ

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## LETTERS

(from page 4)

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### El Cheapo Power Supply

SIR:

In the El Cheapo 2-30, the use of three diodes in the series string D1-D2-D3 may cause excessive zero signal current flow in a few cases. The use of only two diodes provides excellent temperature compensation, but unfortunately results in serious crossover distortion. My suggestions are as follows:

Check the zero signal current flow to the amplifier, one channel at a time, with a milliammeter. If the zero signal current is less than 75 mils or so with three diodes, leave well enough alone. If much greater than 75 mils, replace one of the diodes with a 50-ohm pot set for minimum resistance. Adjust the pot for a zero signal current through the amp of about 50 mils, or until no crossover distortion is visible on a low level sine wave. Either adjustment works fine. Once the value of the pot is determined, it may be replaced with a fixed resistor of equal value.

I've worked with silicon transistors so long, that my approach to temperature problems is rather casual. Usually I just spit on the case, and if it doesn't sizzle, I don't worry about it. Actually, the output transistors can run a couple of hundred mils without any trouble; the dissipation is only a couple of watts. But conceptually, why waste power?

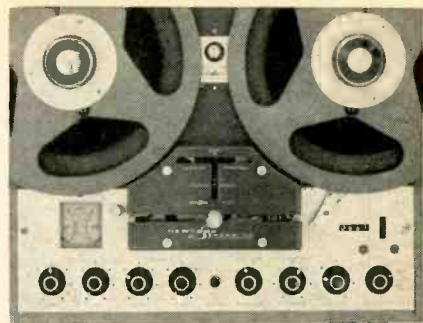
Richard R. Moore

## AUDIOCLINIC

(from page 2)

be lateral; if the signals are in phase, the modulation will be vertical.) It may be difficult to visualize this but it is worth trying because it bears on your problem.

Notice that on a stereo record we do not have a vertical and a lateral channel. We have two channels, equidistant from the vertical or the lateral plane. The conventional cartridge has a similar arrangement of coils or elements. Each pickup channel is constructed to

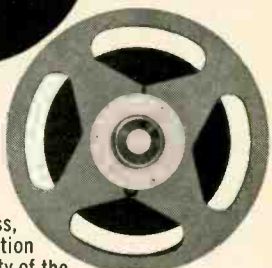


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work best when the signal is applied to it 45 degrees from the vertical or lateral plane. One coil will not produce electromotive force; the other coil will when we play our groove just described. If we play a laterally recorded groove, both coils will produce output, but not quite as much output as they would if the playback stylus moved at a 45 degree angle. The same holds true of vertically recorded grooves.

Remember the way our cutting stylus acted when we reversed the phase of identical modulation of the two channels? Well, the same thing will happen when we change the phase of

one coil with respect to the other in a playback system. When a highly modulated lateral recording is played, there is a tendency for the stylus to be pushed upward from the grooves at high frequencies. Thus, there is some vertical stylus motion on even a purely lateral record. This is part of the reason you hear some program level when you have the channels phased for vertical when playing a lateral disc.

If you want to see this experiment work out a little better, try to find a stereo disc which contains some vertical rumble or find a playback table which has it. Using either channel alone, you

will hear the rumble. Play the disc laterally and the rumble is greatly reduced. (Certain kinds of record scratch can be reduced by this same approach.)

Obtain a good stereo test disc and note the separation between the channels. It probably will run about 20 db or more at 1 kc. This is not perfect separation, partly because of the recording process and partly because of the playback process, as well as the manner in which the tonearm is mounted. Even with this seemingly poor separation, we obtain rather dramatic stereophonic sound on some discs. The degree of the stereophonic effect depends on the men behind the recording rather than upon the performance of the equipment. Some experts say that if separation was no better than 12 db, stereo would be just as apparent as would be the case if much greater separation was achieved. You'd be surprised how little separation is required in order to make a sound appear to be located on one side of a room or the other.

To repeat, the pickup is constructed with two orthogonal coils rather than a vertical and lateral coil. If there was a vertical and a lateral coil, there would be no need to parallel them to obtain the desired cancellation of unwanted signals. All that would be needed is to use the lateral coil or the vertical coil as the case may be. It is only when these channels are combined properly that the cartridge as a whole can discriminate between lateral and vertical modulation.

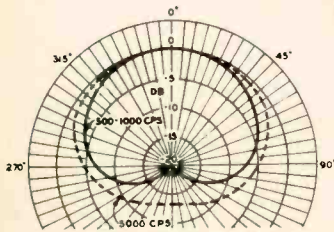
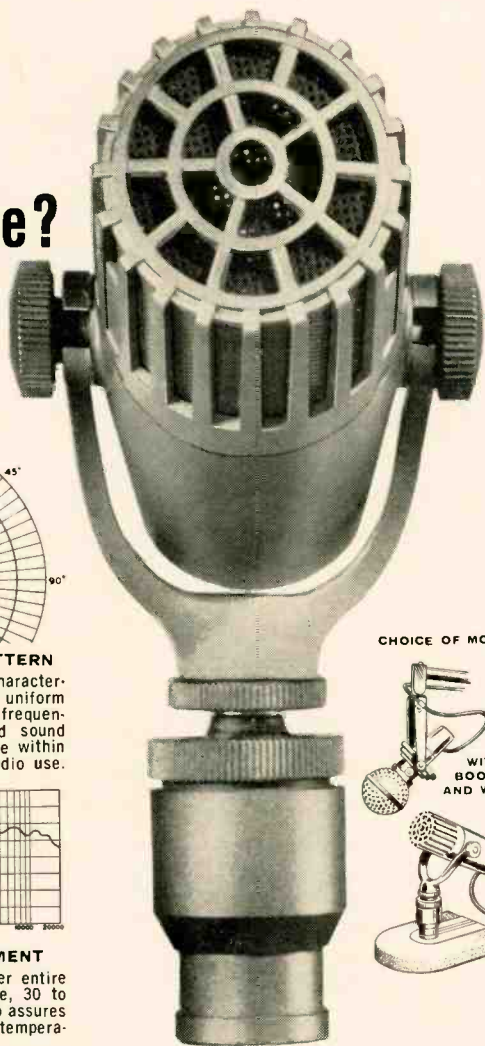
There is still one point which may be troubling you. When you used a monophonic disc to determine which channel was the vertical channel and which was the horizontal channel, you were obtaining a definite difference in output between them. From what I have said already, there should not be a difference in output of one channel over the other because of the angular relationships between the coils and the modulation of the disc. The difference in output can be accounted for in one of two ways. Either the cartridge is defective or the tonearm is not truly vertical. If the tonearm is tilted to one side or the other, the cartridge will tend to be oriented in a vertical-lateral arrangement rather than the 45-45 degree manner intended. Check this and try some other cartridges.

#### Coupling Two Power Amplifiers

*Q. In setting up a disc recording, because of cost considerations and such, I have chosen not to buy a new disc recording amplifier. However, I have a disc recording amplifier rated at 13.5 watts and a much older PA amplifier which is quite linear and still in very good condition. The PA amplifier is*

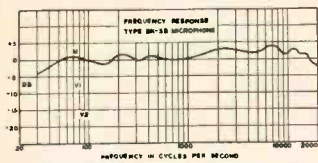
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AUDIO • MAY, 1965

rated at 30 watts; it has been a good disc-cutting amplifier.

I want to couple the two amplifiers so that I have a usable power of 40 watts or a little more to drive the cutter. Because both units have controls for mikes, phono, and such, how would I use these controls?

How do I couple the output of the 13.5-watt unit to the input of the 30-watt unit?

Should I use the mike or phono input on the 30-watt unit?

Do I leave the volume control of the 30-watt unit wide open, and use only the controls of the 13.5-watt unit? Both units are rated 20 to 20,000 cps. What can I expect in the way of response and distortion if both units are coupled together?

Both units have output taps of 8 and 16 ohms. The 30-watt unit has a 70-volt tap.

I am interested in clean, wide-range sound. What are your recommendations? Name and address withheld.

A. You cannot couple the input of one amplifier to the output of the other to obtain more power. Let us see why this is true.

Amplifiers are rated as producing their full power when X voltage is fed into the input. Increasing the X voltage will not materially increase the power output of the amplifier but will materially increase the amount of distortion produced by the amplifier. Even if the device feeding this input is producing power, this power is not taken by the input. The input only uses the voltage developed across the power amplifier. All the power from the driver amplifier is being wasted. Thus, it is not in any way added to the power of the driven amplifier.

The way amplifiers are usually connected to provide additional power is to connect speaker taps together and drive both amplifier inputs from a common source. This is impractical, however, in your case because the amplifiers are not matched. This means that the phase relationship between them will not be zero degrees as is required for such an arrangement. Because of this, the power produced by these amplifiers will not add up to form the sum of the powers of the two amplifiers. It is actually possible that the total amount of power will be less than that supplied by your 30-watt unit.

Fortunately, this is not important because you would not gain very much even if the two amplifiers could have been used as intended. The improvement in power output is considerably less than 3 db. This improvement is not a sufficient amount to warrant experimenting further with combining your two amplifiers.

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## DISCOTHEQUE

(from 23)

PROGRAM position with the exception of MIC-2 and MIC-1. They should be left in the neutral position.

Plug a speaker into the MUTED SPKR jack on the end panel. Start a record playing on one of the turntables. Adjust its volume until its peaks at 100 per cent on the vu meter. Momentarily actuate MIC-1 switch to the PROGRAM or AUDITION position. This should mute the speaker. Plug in a pair of earphones and adjust the volume to please you. Turn the TURNTABLE channel potentiometer all the way down to off. You should hear the record playing over the cue speaker unless your control room MIC-1 is turned on. Go through your AUDITION side of the operation just like we have with the PROGRAM side.

Although I haven't included *Rly* in my power amplifier, connections are available all the way from MIC-2 switch to the power amplifier chassis so you could install it to mute a speaker in an adjacent studio where you might station MIC-2.

May I take this opportunity to point out some of the bonus features we've given you in this all-transistor audio console that are not immediately apparent? Something you can't appreciate from black and white photos is that different colored knobs were used to identify the channels. Yellow was used for the MONITOR control, black for both MIC-1 and MIC-2 controls, blue for both TURNTABLES, and red for the MASTER gain control.

We remembered to leave three feet of extra microphone cable on the console-mounted microphone so the announcer can remove the microphone from its stand and interview nearby guests.

Transistors were not soldered into the circuits except where it was necessary to use a heat sink. The servicing engineer appreciates this.

Few, if any, commercial, portable, audio consoles feature auditioning provisions. With this feature, announcers can check out a microphone, turntable, or even feed a separate public address system without interrupting the regular program.


Little has been said about the copy rack idea. But ask any announcer if he




Fig. 8. Closeup of end panel.




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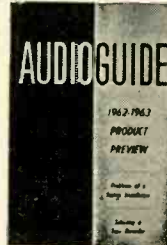
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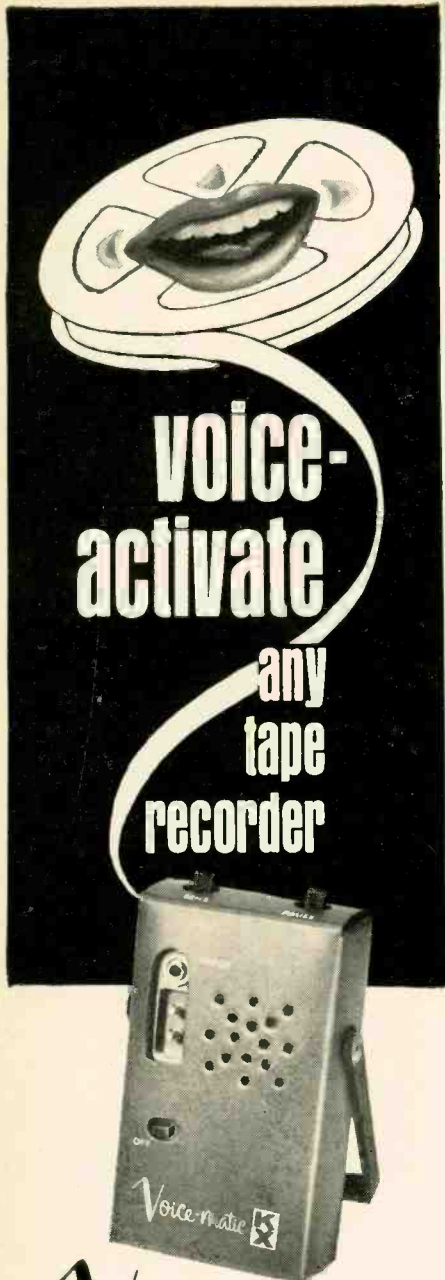
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## STEREO CONTROL

(from page 28)

crowding unless transistors are used. The Baxandall circuit utilizes an anode follower for the negative voltage feedback used for distortion reduction, a desirable feature for the transistorized version. The first active stage in the control unit reduces the 50 kilohm output of the level control to approximately 900 ohms to feed the Baxandall network. At the same time a gain of approximately 1.5 is realized at low distortion to make up part of the 8 db loss suffered through the stereo controls preceding it. Another transistor "collector follower" (Fig. 6) is used to isolate the network from the output stage. Unfortunately the 600 ohms output impedance desired here cuts the gain to approximately 0.8, so the output stage must regain most of the passive circuit loss. An emitter follower was not resorted to here as to do that would destroy the Baxandall network by removing the virtual ground at the active element input terminal ( $Q_2$  base). Measurements showed that the net unequalized gain of  $1.5 \times 0.8$  or 1.2 was satisfactory and gave the minimum transistor count up to the special output stage, six transistors being used (two channels).

Design information for transistor anode followers is glaringly absent. Many design equations were found, but they numbered almost as many as their originators. None of them gave a confident prediction of a circuit using the kind of transistor parameter data available to the average user. After discussing this matter with another designer having previous experience in this area, we suspect the algebra of matrices for this lack. All transistor design equations, if not in matrix form, are approximations of that form, and the theory of matrices has not, as yet, been completely adapted for universal and easily applied transistor design. There is also a lag in the parameter measurement field for best expressing parameter variations so that a matrix can handle them accurately.

The transistor anode followers used in this control unit were consequently designed by the old compromise method plus some published information.<sup>11</sup>

TO BE CONTINUED

<sup>11</sup> Wm. E. Owen, "Shunt Feedback Video Amplifier Design," *Solid State Journal* Vol. 1, No. 1—1960. Equations 9, 12, 15 and 22.

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(from page 25)

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Fig. 4. Pianist-arranger Fred Valdez at 60-year-old piano. The instrument has no sounding board, but three cables lead to mixing panel and monitoring loudspeaker system.

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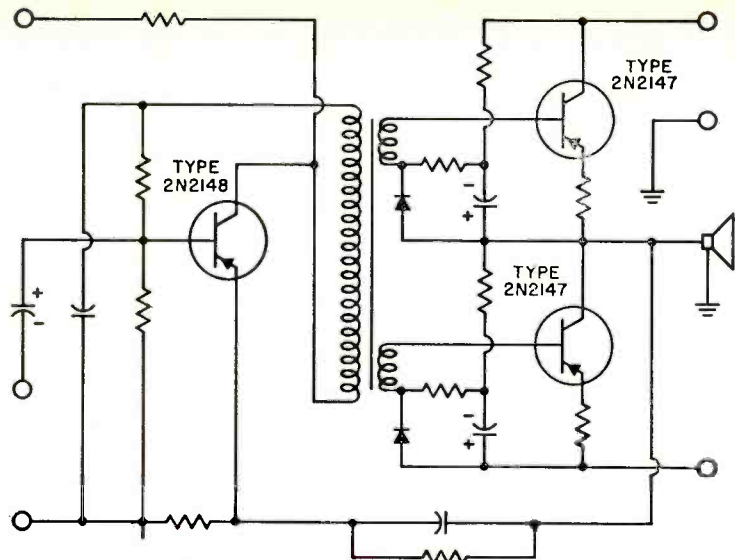


**EMPIRE**

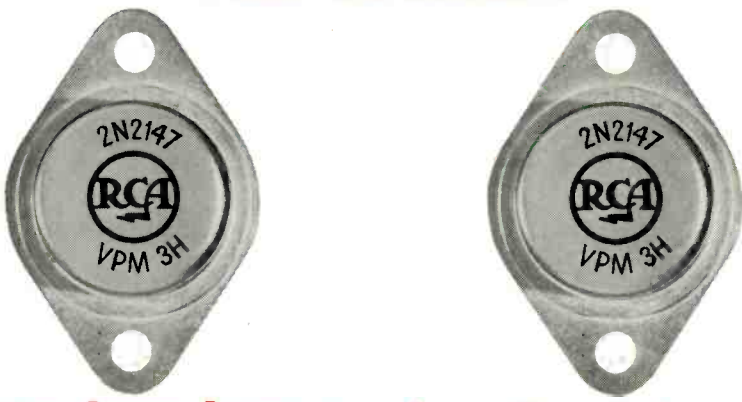
Empire Scientific Corp. • 845 Stewart Ave., Garden City, L. I., N. Y.

Circle 108 on Reader Service Card

**AUDIO • MAY, 1965**

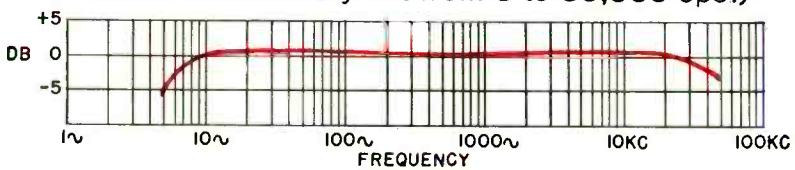


**This circuit...**



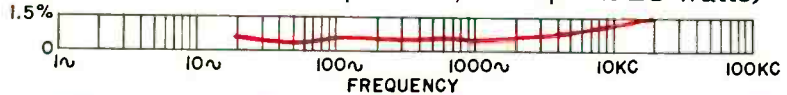
**with these two low-cost output transistors gives you audio power output like this**

(25 watts—virtually flat from 8 to 30,000 cps!)



**with total harmonic distortion like this**

(less than 1% from 11 cps to 15,000 cps at 25 watts)



**...plus the magic of "Transistor Sound"**

Hard to believe...but true! RCA Drift-Field High-Power Audio Transistors can put the difference of "transistor sound" into your high-fidelity amplifiers—at low, low cost! Two RCA 2N2147 Drift-Field germanium P-N-P transistors can deliver 25 watts audio output with less than 1% inter-modulation distortion and with essentially flat frequency response from 8 cps to 30 Kc.

Low cost is only part of the story. Additional benefits—as in all RCA germanium audio transistors—include exceptional uniformity, high linearity, excellent stability, broad frequency response and high beta. Positive proof: most of the originators of quality solid-state hi-fi units use RCA audio transistors. And the "new generation" of RCA audio transistors now available deliver still better performance at lower cost.

RCA Top Value transistors and silicon rectifiers include all the solid-state devices you need to design virtually anything from a 1.0-watt-per-channel commercial phonograph to a 35-watt-per-channel professional stereo amplifier. For information on specific types or the complete line, see your RCA Field Representative. Or write: Commercial Engineering, Dept. E2C-5 RCA Electronic Components and Devices, Harrison, N. J.


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**The Most Trusted Name in Electronics**

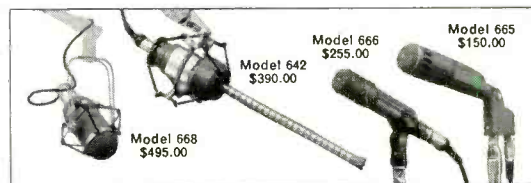
# How does this 7 FOOT MONSTER help solve your sound problems?

 The giant microphone shown here is the biggest microphone in captivity! The Model 643 is also the most directional microphone sold today. It helped E-V win the first Academy Award for microphone design in 22 years.

But beyond this, the 643 has been one of our most effective field research tools, offering a far-reaching insight into the nature of directional microphones, and their applications.

An obvious result of 643 research is our unique Model 642. Same E-V Cardiline™ principle\*, but only 18 inches long. It reaches up to twice as far as any other broadcast unidirectional microphone to give you better long distance pickups than were dreamed possible a few years ago.

And this same basic research stimulated the development of our new Model 668 cardioid microphone. It uses the Continuously Variable-D® cardioid principle (a creative development from our exclusive Variable-D patent\*) to provide smoother cardioid action—plus more versatility—than any other boom microphone you can use.



But let's not ignore the most popular professional cardioid microphone of all, the Model 666. Here's where the Variable-D principle got its start. And since the introduction of our seven foot laboratory, the 666—and its companion, the 665—has been further refined to offer better performance and value than ever before.

From such startling microphones as the 643, come continuing basic improvements—and the tools you need to solve your most difficult sound problems. Only E-V provides this kind of design leadership. E-V microphones in your studio will give you a big head start toward better sound. After all, we're at least seven feet ahead of everybody!

**ELECTRO-VOICE, INC.**

Dept. 551A, Buchanan, Michigan 49107

**Electro-Voice®**  
SETTING NEW STANDARDS IN SOUND

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