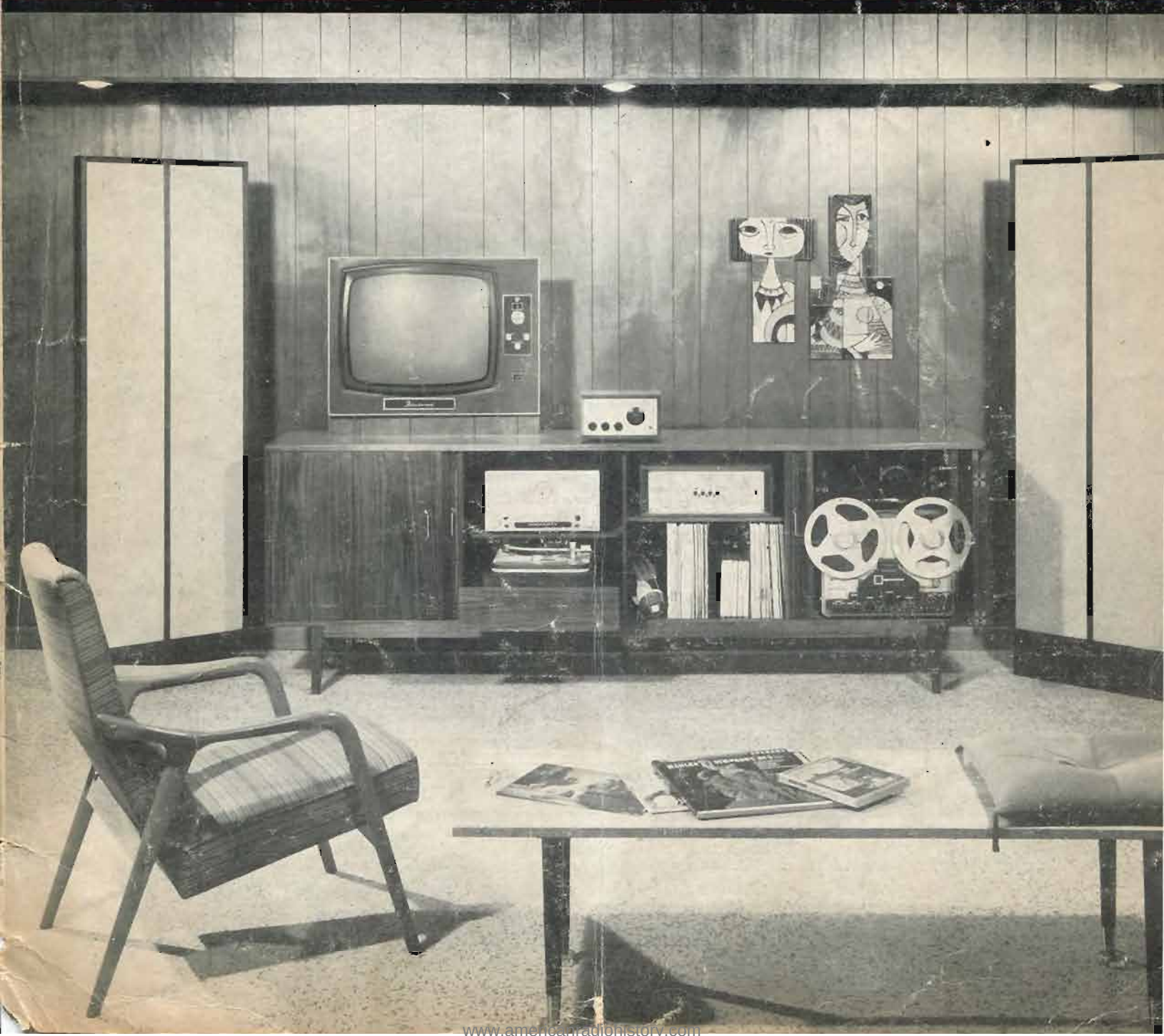
AUDIO

OCTOBER, 1960
50¢

...the original magazine about high fidelity!



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The tonal complexity of the trumpet is indicated in these power-frequency spectra, which show 12 perceptible overtones above a fundamental high-range note (698 cps), and 24 above a low-range note (175 cps). You capture the full dynamic range and tonal range with the RCA-7027-A in your audio output circuits.

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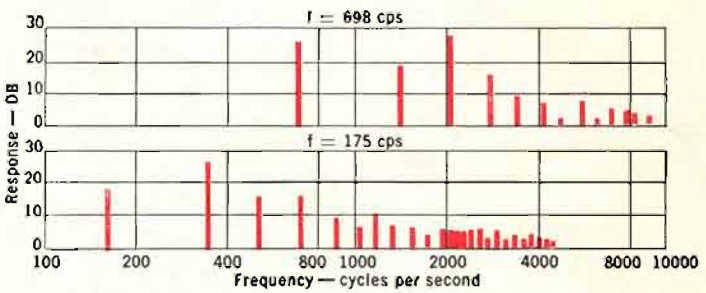

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OCTOBER, 1960 VOL. 44, No. 10

Successor to RADIO, Est. 1917.

AUDIO

ENGINEERING MUSIC SOUND REPRODUCTION

COVER PHOTO—Photographer Mort Weldon indulges in hi-fi as a hobby. This shot shows his equipment installed in an "Elegette" cabinet designed by Robert Fellner and Mark Furst—Marantz Model 9 70-watt amplifiers and Model 7 stereo preamp, Magnecord 728 tape recorder, EMI stereo integrated arm and cartridge mounted on a Thorens TD-124 turntable, Fleetwood 1000A TV, KLH Model Eight FM receiver, Koss stereo headphones. Flanking the cabinet are a pair of KLH Model Nine full-range electrostatic speakers. Ceramic wall plaques by Harris G. Strong.

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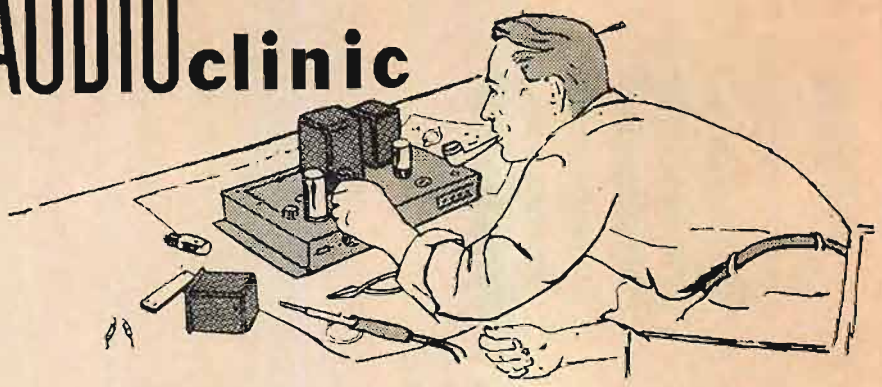
AUDIO clinic



JOSEPH GIOVANELLI*

Two Speakers and One Amplifier

Q. When connecting an 8-ohm loudspeaker and a 16-ohm loudspeaker to one monophonic amplifier (so that both loudspeakers will be operating at the same time), does a person connect them to the 4-ohm and the 8-ohm output taps?

If this connecting of the loudspeakers to the output taps which are 50 per cent lower than the loudspeaker's rated impedance is the proper procedure, please explain why this is true. Name withheld.

A. When you connect an 8-ohm and a 16-ohm speaker to your amplifier for simultaneous operation, connect the 8-ohm speaker to the 4-ohm tap and the 16-ohm speaker to the 8-ohm tap, with the other sides of the speakers brought to the common or ground as the case may be. If you have two 8-ohm speakers, you would connect them both between the 4-ohm tap and ground; two 16-ohm speakers would be connected between the 8-ohm tap and common. Two four-ohm speakers would have to be wired in series and connected between the 8-ohm tap and common. It is best to connect speakers in parallel, but, as in this latter instance, it is sometimes impossible to avoid the series hookup.

Why is this necessary? When two resistors are connected in series, the total resistance is equal to the arithmetical sum of the individual resistances. It is obvious, therefore, that the total of this combination must be greater than any of the individual resistances making up the network. The impedances can be treated as though they were pure resistances, so the two 4-ohm resistances when connected in series will be equal to 8-ohms and must be connected to the 8-ohm tap.

Two resistances in parallel are equal to the product of the resistances divided by their sum. This results in the value of the combination of the resistances in parallel being smaller than either of the resistanes. Resistances, whether in series or in parallel, act as a single unit having a different value from any of the individual units which make up the network. The need to match impedances between amplifier and speaker determines the tap to which the speaker or speakers shall be connected.

When the impedances of the two speakers are unequal, as in the case of your 8-ohm and 16-ohm speakers, you will achieve a better match by not connecting them directly in parallel, but by connecting each to its best tap on the amplifier. If the speakers are connected in parallel directly, there would be an unequal division of power between the two. Assuming that the speakers are of equal efficiency, connecting to different taps as has been discussed divides the power equally so that each speaker will deliver an equal and full share of the acoustical load.

The following questions were submitted by Robert F. McDonald, Oakland, California.

Rotation of Speakers

Q. I have heard from different sources that some speakers should be rotated 180 deg. on their mounts to compensate for the sagging of the cones. Is this true? If so, how often is it necessary? Do all types of speakers need this rotation?

A. When a speaker possesses low cone resonance and high compliance, it often means that the suspension material which centers and supports the cone has low elastic limits. After a considerable time, in such units, gravity exerts a downward pull sufficient to stretch the suspension. If this stretching process continues long enough, the voice coil will move far enough to rub against the pole pieces. To avoid this, it is a good idea to rotate the speaker 180 deg. so that the pull of gravity is then in a direction to re-center the cone. This rotation should be carried out once every year or two. The need for a speaker to be rotated does not indicate poor workmanship. I cannot say whether your speakers need this treatment. I can say, however, that most speakers do not need it. I suggest that if there is any doubt in your mind you write to the speaker manufacturer regarding this matter.

Distortion in Stereo Pickups

Q. Is there any simple way to check distortion in a stereo pickup? I would like a method of determining if the distortion is being caused by a worn stylus or by a defect in the pickup design. This distortion shows up particularly on trumpet passages. These same passages sound fine on another pickup which is part of another system. I have tried changing preamps, power amplifiers, and speaker channels. The distortion still persists and sounds as if the trumpets are breaking up on peaks.

A. In checking pickup distortion, the

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

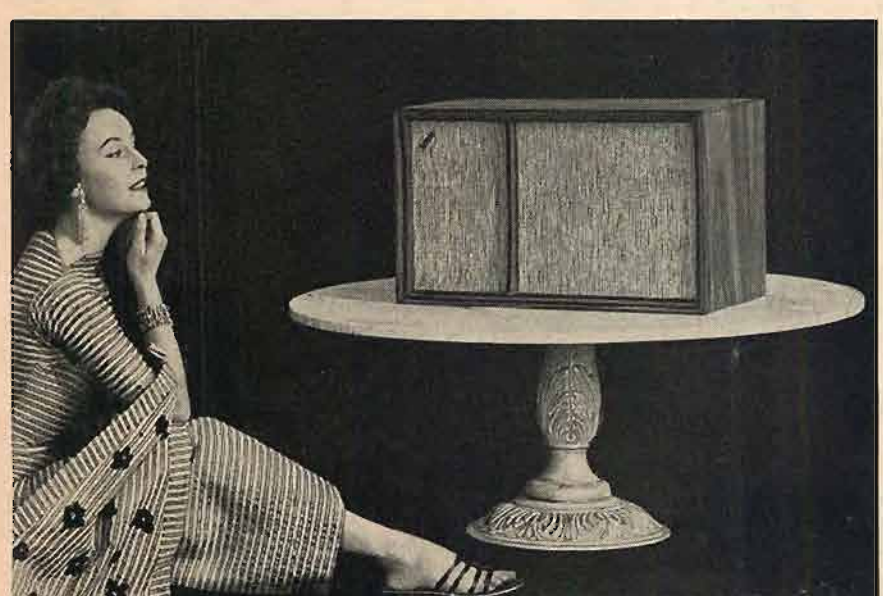
This is the only common sense when you buy a speaker system!

THE KNOWLEDGEABLE audio-hobbyist demands that the components of *his* sound system achieve the reproduction of music which most closely represents *his* personal approach to perfection. He makes his choice of a speaker by one common sense—the sense of hearing—the one sensible way to evaluate the tonal qualities of a speaker. Yes, he buys by ear, by listening, by comparing to determine the sound of music which is most natural, most satisfying. His final selection is based upon a deeply personal judgment of the speaker which offers the greatest listening joy.

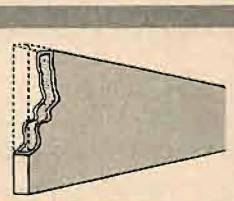
Because of its magnificent musical values the audio-hobbyist maintains an inflexible preference for Wharfedale. The name Wharfedale to him is synonymous with the world's finest speaker systems. When he purchases a new speaker system he does not desire, and cannot be sold, any speaker system except a Wharfedale. And, when the demand for Wharfedale speakers exceeds the supply, he will wait patiently, for months if necessary, for his Wharfedale speaker.

Now, for this man and for those who may profit by his special knowledge, sound judgment and good advice, England's G. A. Briggs has created the great new Wharfedale '60, the first full range shelf-size speaker system which incorporates the sand-filled principle. Its compactness has been achieved without a degree of compromise. The Wharfedale '60 brings you rich, non-strident high notes without electronic, mechanical or acoustical tonal coloration. The sand-filled panel, coupled with specifically designed speakers matched to each other and tuned to perform perfectly within the enclosure permits a full, rich, glowing bass completely free from any suggestion of false resonances. This is why, of all shelf-type speaker systems, the Wharfedale '60, in our sincere opinion, is the speaker system which achieves the closest approach to the perfect recreation of the live performance of music. Today, a great many people who enjoy the emotional experience of music are buying high fidelity components. It is unfortunate that competitive advertising claims—even though justified—far from being a helpful guide to selection, often offer a bewildering barrier to making an intelligent choice. But, of this you may be sure. The one way to buy a speaker system is to listen with your own ears. If the sound pleases you, it is the world's best for you.

And, no one can satisfactorily evaluate the characteristics of the speaker which will please you most by employing any visual device which purports to measure sound performance. We feel sure that your high fidelity dealer will advise you not to invest in any speaker system which may provide you with less listening pleasure until you have heard the sound of the Wharfedale '60. With the creation of the decorator designed Wharfedale '60 the commonplace look of ordinary stereo systems has been replaced by the perfect proportion of beauty.

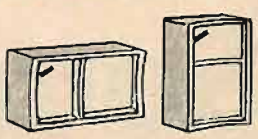


THE WHARFEDALE '60 IN GENUINE WALNUT, EITHER OILED OR POLISHED. GENUINE MAHOGANY AND GENUINE LIMED OAK, IS PRICED AT $109.50



The Wharfedale '60 exclusive sand-filled panel gives optimum results with bass frequencies. It consists of two layers of wood with a completely inert filler of dry sand between them to permit cleaner, truer bass down to 20 cycles.

The compact enclosure offers performance generally ascribed to an infinite baffle plus metered pre-balanced wave pressure release. Finished on four sides. Will perform excellently vertically or horizontally.



Note: A new Wharfedale "chairside" equipment cabinet has been coordinated in styling with the Wharfedale '60 Speaker System. The "chairside" cabinet holds your entire stereo system...your record changer, tuner, preamplifier and amplifier. Priced at $109.50.

Wharfedale '60

For illustrated brochure write Dept. WR10
Wharfedale Division, British Industries Corp., Port Washington, N. Y.

first point to consider is stylus wear as such wear will not only cause distortion but will also damage records. Your dealer probably has a microscope to check the condition of the stylus. There are also devices designed to keep an accurate record of the number of hours the stylus has been used. These can be attached to the turntable at the time of installation of a new cartridge or stylus.

Since some records are recorded at too high a level, distortion will result in most cases. The fact that some pickups play these same records without noticeable distortion, does not necessarily mean that these pickups are superior to the first one. The second pickup may have poor transient response which, in turn, makes it impossible to reproduce the distortion heard when using the original pickup. I am not saying that this is the case, but it can be.

I know of no easy way to measure the distortion of a pickup. What you need is a truly low-distortion test record, with enough material of a wide range to test the transient response of the pickup. How does one know that he has such a record? Even a recording which has little distortion when first played can deteriorate quite rapidly. Records for this purpose are checked out by means of special light sources which display groove geometry. If you know you have a record with a given amount of distortion you can then test the pickup. If the distortion in the pickup is less than that of the disc, the distortion on the disc will mask the pickup distortion. No distortion can be detected below the level of the piece of equipment in the test setup having the highest percentage of distortion.

It is also necessary to know whether the preamplifier and amplifier have low distortion. An oscilloscope and a distortion analyzer are virtually mandatory.

Distortion in a Mike-Tape Setup

Q. I would like a method of checking the source of distortion in a microphone-tape recorder setup. Recently I made my first pipe organ recording. Due to space limitations, the microphone had to be set midway between the chambers, about 12–15 feet from the pipes. Although gain was watched, distortion appeared on the playback on peaks. A subsequent test wherein a frequency test record was fed into the tape recorder at various levels did not produce a similar distortion even when deliberately over-recorded. Could this distortion be in the microphone or possibly in the acoustic characteristics of the room?

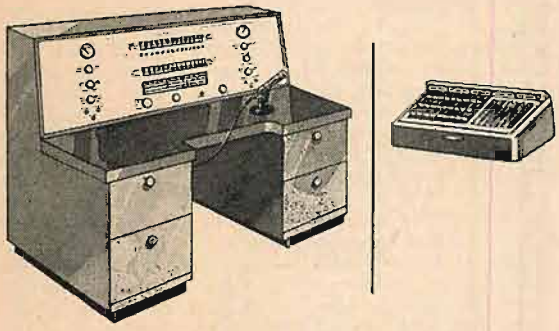
A. I rather doubt that this distortion has to do with room acoustics. If there were any rattles or undue resonances, you probably would have heard them while making the recording.

The distortion of your organ recording can be another tricky one to answer. If the organ was played at very high volume, it is possible that the microphone was overloaded. This overload would produce distortion. If the mike held up, perhaps the mike had sufficient output to overdrive the first or second stage of the tape recorder (ahead of the volume control). This would result in an overly high distortion level regardless of the setting of the gain control

(*Continued on page 79*)

Belden has it...

Every wire and cable you need for sound and intercom service and installation



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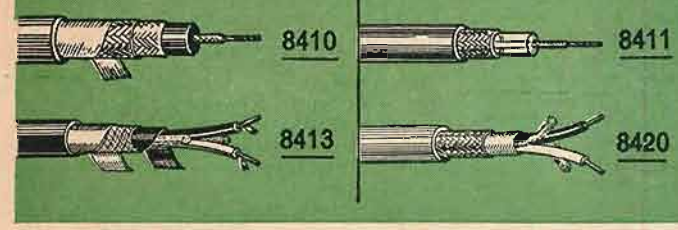

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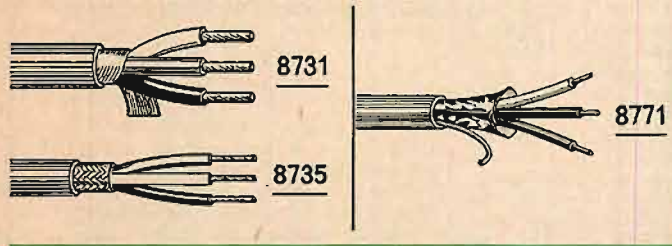
Three Conductor Shielded Cable



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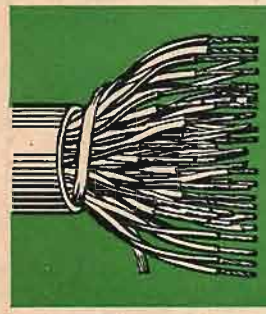

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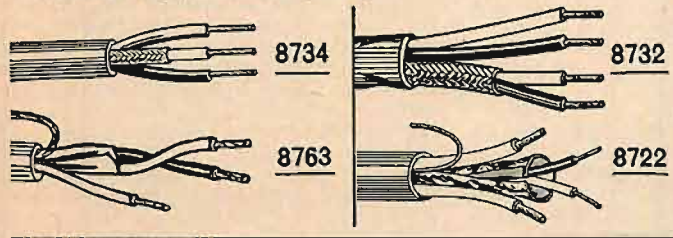

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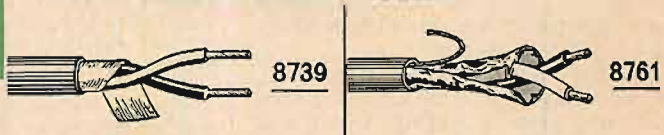

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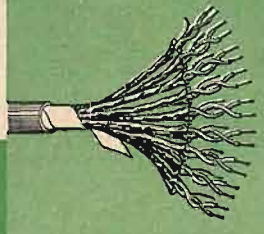

Belden Multiple Pair Individually Shielded Cables use Beldfoil*, a Belden development and a major breakthrough in the search for quiet cables.

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8-8-0

LETTERS

Tape Quality

SIR:

You are promoting the 4-track tape. That is the best thing you have ever done. Everyone is agreed. And the tapes are mostly simply wonderful. At last we can get good 4-track tapes.

But—just try and make a selection in the average retail music store or sound equipment store. *Just try it.* You are not permitted to test the tape. You are not permitted to have a portion of it played back to ascertain just what it is. You have no way of knowing whether it will appeal to you or not.

As you know, the end of the tape is sealed, and no one is permitted even to touch it. And I mean that. (I had one sales person take the carton from my hand and put it back in the rack.) You get the idea that they do not actually care to sell them! I'm serious. I mean it in all respect. I have tested this attitude in no less than fourteen different establishments. They frankly will not let you make the purchase.

Yet any one of these same stores will be happy to let you test their disc records as much as you like and to help make a desirable selection of either one record or a dozen. You may play them until you have made your selection in one of the cubicles they have for this purpose.

Not so with tape. They'll practically throw you out of the place. They say you'll spoil the tape, you'll break it, you are not supposed to, you can't break the seal.

This is asinine. Almost every day I play a tape or do something with a tape. Is tape so delicate, so forbidden, a thing that will literally crumble away at a touch? I have tapes that have been played *hundreds* of times and they are exactly the same now as when played for the first time.

My tongue is hanging out to buy about $200 to $250 of 4-track tape *right now*, including mostly the classics. They won't let me! But neither I nor any other sensible person wants to buy a "pig in the poke"—that day has passed. Music is a personal thing. What I like, you may not like, and *vice versa*. . . .

J. EMMETT CADE,
74 Woodfield Road,
Westwood, New Jersey

(This was excerpted from a much longer and much more vituperous letter, but it gets the idea over. We, too, wonder why tape—always touted as being basically indestructible as compared to discs—could not be played on demonstration machines for potential buyers. UST has demonstration machines for playback only, but even any tape recorder would be safe if the bias-erase oscillator tube(3) were removed. It seems to us that the dealers must demonstrate if they expect to sell recorded tapes. ED.)

Record Quality

SIR:

I resent the fact that in order for me to buy my favorite stereo records I must take such a gamble in the quality of what I get for my money. I recently purchased some high-quality equipment and built two 60-watt amplifiers from an article in AUDIO. The overhang of the stylus and the stylus force are what the manufacturers specify, and I get less than 1 per cent IM distortion from the preamp input to either amplifier output terminal when driving them approximately 40 watts with an IM distortion test set. This is far more power than I ever use. But alas, when I play a new super-high-fidelity, complete-frequency-range stereophonic record I still must gamble on what kind of sound I will get.

I have records with some bands clear, some distorted; I have records with one side distortion-free and the other irritating to listen to; I have records with loud swishes as the stylus passes a part of each revolution and I also have records so crystal clear and distortion free that I can close my eyes and imagine the performers are right in my home. These defects are so audible and irritating that they must have been noticed during inspection after manufacture. I cannot blame my equipment as portions of the records sound good while other portions, recorded at the same level, do not. Neither were the bad portions either all near the outer or the inner portion of the record. The fact that these records *were* passed is, I feel, an indication of the contempt the record manufacturers have for the buying public.

You could do a valuable service for your readers, as well as for yourself and the record companies, by giving more emphasis to this obvious dereliction of responsibility on the part of record manufacturers. In the end they will hurt nobody but themselves. It is not right to pay $6.00 for a stereo record when there is no assurance that it will measure up to the technical specifications mentioned on the jacket. There is always the chiseled needle in the cheap phonograph in the record stores to test them on, but I don't think that is worth mentioning as a solution. Nor do I know of any dealers that will allow the return of records once they have been purchased and taken home.

CLYDE A. MCGOLDRICK,
FAIO-ACAN Facility,
APO 99, San Francisco, Calif.

(And that's the record side. Probably only about 5 per cent of those buying records have equipment of sufficient excellence to show up most defects—but that 5 per cent includes a high percentage of AUDIO *readers. We believe the factory should exchange faulty records—obviously not those damaged by playing on defective equipment, but those can be detected easily—at the dealer level, and any dealer wanting to build up a quality-conscious clientele should be willing to handle the extra work so long as the factory replaces the records to him.* ED.)

Tape Decks

SIR:

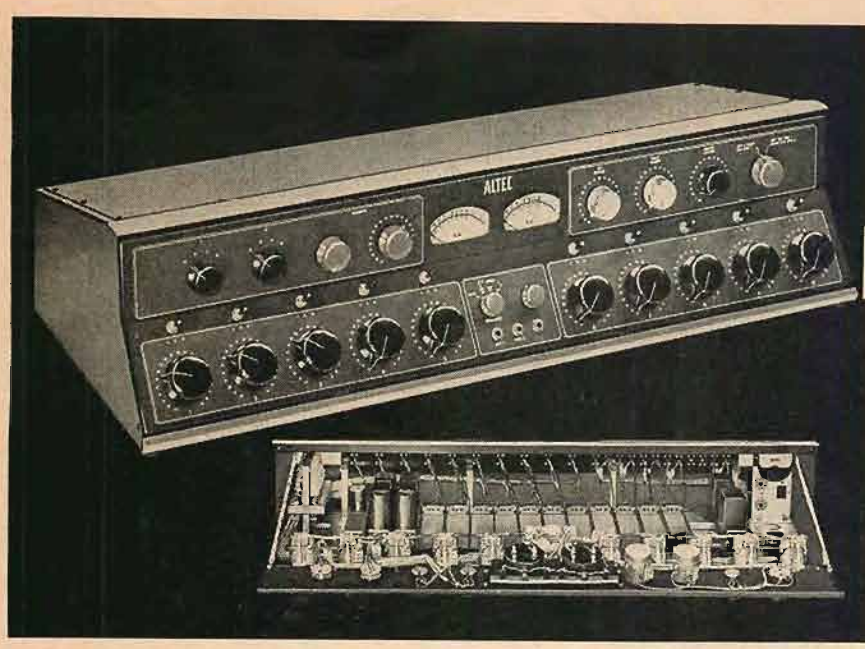
I am a hi-fi fan. I'm a bit of a tinker, too, capable of putting together a kit now and then, or building a cabinet. But my main objective is music—and quality.

I have friends who operate tape recorders. I believe they are a different breed of dog. They don't mind listening to good music, but they'd rather monkey with their machines. Music is only a vehicle. They seldom buy a disc and never a tape—except a blank. They record live music or dub from their hi-fi friends' discs, preferring to listen to second-rate reproduction of their own, rather than first-class store stuff.

The market for recorded tapes is among hi-fi fans like me. I'll buy recorded tapes when I can buy a reasonably priced tape deck. I want a first-class deck, to feed my preamp from the heads, for $150 or less.

I believe there are thousands like me

(Continued on page 86)



Plug-in reliability with ALTEC professional audio equipment

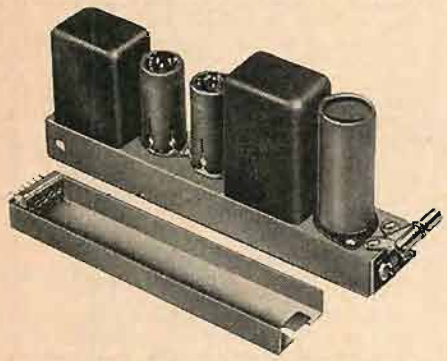
250 SU CONSOLE Combining compact simplicity with maximum flexibility through Altec advanced design, the new 250 SU Altec has proven to be the ultimate in control consoles for TV, AM, FM, recording studio or sound system use. Newly designed miniature plug-in preamplifiers, and utility input devices of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

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

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

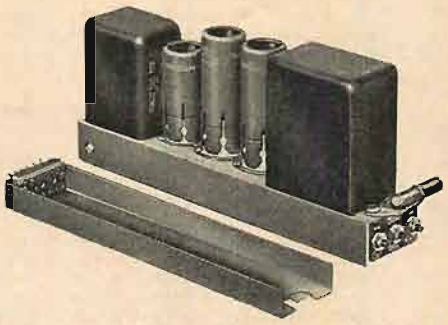
THE 250 SU FEATURES:

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



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

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



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

SPECIFICATIONS **GAIN:** 56 db unterminated input, 50 db terminated. **POWER OUTPUT:** +30 dbm at less than .5% THD 30 to 20,000 cps. +35 dbm at less than 1% THD at 1 KC. **FREQUENCY RESPONSE:** ±1 db. 20 to 20,000 cps. **SOURCE IMPEDANCE:** 150 or 600 ohms (centertap for 600 ohms). **LOAD IMPEDANCE:** 150 or 600 ohms (centertap for 600 ohms). **NOISE LEVEL:** Equivalent input noise: −126 dbm. **POWER SUPPLY:** 40ma at 275 vdc and 1.5a at 6.3vdc. **TUBES:** 1−6072/12AY7, 2−12BH7. **DIMENSIONS:** 1 3/4" W x 3 15/16" H x 9 11/16" L. **COLOR:** Cad plate, dichromate dip. **WEIGHT:** 3 1/2 lbs. (including tray). **SPECIAL FEATURES:** Push buttons for individual tube test. 40ma dc can be applied to center taps for simplexing. **ACCESSORIES:** 13225 Rack Mounting Assembly (for 9 units). 13401 Mounting Tray Assembly. 5981 Tube Test Meter. 535A Power Supply.

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

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

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CHESTER SANTON*

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

Marty Gold: Skin Tight
RCA Victor LSP 2230

Leading the sound parade this month is one of the hottest stereo disc recordings I've heard in what is still a specialized field—elaborate percussion playing pop tunes to a fare-ye-well. Until this item came along, RCA's recordings by Dick Schory's percussion ensemble had the field pretty much to itself. ("Music for Bang, Baa-room, and Harp," LSP 1866, and "Music To Break Any Mood," LSP 2125.) Those sessions owed much of their success to the exceptional acoustics of Chicago's Orchestra Hall, the scene of some of the most realistic classical stereo recordings. Webster Hall in New York, used by Marty Gold for his album, does not project instrumental sound with quite the flair of the Chicago hall but his strings, woodwinds, and brasses should help to bring his percussion ideas to a wider audience.

It's not easy to decide where to begin a description of some of the stunts pulled in this album. They use twelve timpani. Some are kettledrums of the chain-tuning variety figured out by Saul Goodman of the New York Philharmonic. Along with pedal-operated beasts, this collection of kettledrums delivers a range of almost two octaves, enabling the arranger to use them as melody instruments throughout the recording.

The music has been carefully selected for this particular project; *Hindustan, Jungle Drums, Perdido, Hawaiian War Chant,* and so on. Lest anyone miss the point, all the drums are grouped in front of the orchestra in what amounts to a sea of skins stretching in an unbroken line across the full width of the area being miked. At strategic intervals are placed more exotic items such as metal and wooden tabla from India, an Israeli clay drum, African log drum, and at least thirty-six tunable bongos. It all adds up to a demonstration recording capable of putting the finest sound system on its mettle and helping to keep it there in the months ahead.

More Drums On Fire
World Pacific ✪ WPTC 1005

Tape enthusiasts can no longer complain that they're not being taken care of in the drum department. The percentage of tape releases devoted to jazz is still somewhat limited but the situation is improving. United Stereo Tapes gained access to some unusual recordings when it added World Pacific to the growing list of disc firms now supplying material for tape releases. This is the second drum anthology to appear on this West Coast label. Like its companion recording "Drums On Fire," it offers a variety of talent within one release. The drummers featured are Ray Mosca and Armando Peraza of the George Shearing combo, Benny Barth of Mastersounds fame, Mel Lewis, and Count Basie's "Keeper of the Skins"—Sonny Payne. Added interest comes from occasional contributions by pianists Russ Freeman and Freddie Gambrell, tenor stylist Zoot Sims and guitarist Jim Hall. But drums hold the spotlight. In *Brushes* the mikes are worked at close range for fine detail in the Mel Lewis brushwork but the album's bigger moments come in the Stan Kenton original *Artistry in Rhythm* and the Basie favorite *Clap Hands Here Comes Charlie.* In the former, Ray Mosca provides the foundation for Peraza's Latin gymnastics and Sonny Payne ignited the fireworks in *Clap Hands.* Considerably more "master bass" may be found on this tape than is heard in the stereo disc of the same performance. Owners of recent-model tape machines should find this a novel and, at times, instructive reel.

Tchaikovsky: Swan Lake
L'Orchestre De La Suisse Romande, Ansermet
London ✪ LCK 80028

Ansermet's version of the complete ballet *Swan Lake* received more than average attention when it appeared on stereo discs some months ago. Listening to the same recording on tape doesn't prompt me to change my opinion of the performance. I still get the impression that even the lightest and most carefree dances in the score are considered pretty serious business by Ansermet. Other conductors (Monteux instantly comes to mind with Fistoulari a close second) seem to enjoy the sheer entertainment in Tchaikovsky's ballets a split second before the music reaches the listener.

This tape, ample in dynamic range, conforms to the standards of the stereo disc in cleanliness of sound. Since both recordings are products of London's "middle period," stereo spread is only moderate. Within the limitations of the miking theory used at the time, tape still has the more convincing orchestral panorama.

Oscar Peterson Plays the Duke Ellington Song Book
Verve ✪ VSTC 232

Oscar Peterson Trio: Fiorello
Verve ✪ VSTC 238

Music composed or made famous by Duke Ellington is never hard to take. One of its ever-engaging features is the way it maintains its identity in large and small instrumental combinations. This can be verified in a recent reel by the Oscar Peterson Trio. Peterson has not acquired his keyboard fame through recourse to introspection. His playing has never sounded heartier than it does in this closely-miked taping. The placement of the trio in the recording studio presents no complications. In playback, they toe an invisible line along one wall of the room. The bass in the hands of Ray Brown and Ed Thigpen's drums flank the piano at equal distance. With all three men "out front," the drums have a prominence not usually found in trio recordings. Most tape fans will welcome the richness in transients. In fact, the crisp niceties of brushwork on a modern tape may take away attention which normally would go to the piano.

The roster of tunes includes Billy Strayhorn's *Take the A Train,* invariably linked with Ellington's compositions in a collection such as this.

The selections from *Fiorello,* although diverting enough in trio treatment, still lack the substance that an orchestra can give to a show score. Admirers of Peterson's past recordings of show tunes by Gershwin, Berlin, Rodgers, and Porter will not find fault with his loose-jointed and liquid approach in this folio. If forced to pick between the two tapes, I'd take the Ellington album.

Flamenco Spectacular
Columbia WS 319

Sevilla, Cuna Del Cante Flamenco
London OS 25107

A few stereo discs of Flamenco song and dance have managed to stand out above the average in terms of sound quality. Any one who has devoted any time and effort to the search for optimum playback of Flamenco in the relatively easy days of mono can appreciate the challenge presented to the stereo disc by the castanet and guitar transients; not to mention the thud of dancers' heels.

This test was met in earlier stereo records issued under the Montilla, Audio Fidelity, Elektra, and Riverside labels. These latest examples of the most sultry form of folk music should serve as a tonic to those demanding top sound and performances that could have occurred only in Spain. Columbia's Spanish affiliate, Hispavox, obviously believes in the very closest miking under the informal conditions of a "Juerga Flamenca" or Flamenco Jamboree. These contests have been held for centuries by Gypsy singers, dancers, and instrumentalists. The brand of stereo featured in this disc takes one into the crowd that surrounds the performers, making it easier to hear the coaching from the sidelines which continues even during the pauses between selections.

London's native cast, concentrating on the music of Seville, is heard in far different perspective. Although the chanting has the same smoky intensity of true Flamenco, the listener now finds himself on an imaginary balcony overlooking the performers—so distant is the miking in comparison with the Columbia technique. While I prefer the "guttier" quality of the closeup guitar, there is something to be said for a vantage point at some distance from the torrid tonsils of "cantaores" in full cry. A novel feature of the London program is the refreshing sound of a group of bell ringers from Andalucia. You don't go wrong with either release but I lean toward the Columbia.

Esquivel: Infinity in Sound
RCA Victor LSP 2225

Arranger-conductor Esquivel is on the loose again in RCA's Hollywood studios with exotic stylings for orchestra and echo chamber. Maximum directionality is applied with a lavish hand and every square foot of studio air shakes and quivers with tunes that used to identify the great bands of the past. Don't expect conventional updated versions of Harry James' *Music Makers* or Tommy Dorsey's *Marie.* Esquivel's Latin temperament takes these old favorites as a mere point of departure for flights of fancy that are unique in a violently competitive industry.

Ralph Hunter Choirs: Two's Company
RCA Victor LSP 2115

Stereo has encouraged considerable experiment in the handling of choral music. This is the first project I've heard that attempts to cover on one disc all the pop stereo technique up to the present time. Ralph Hunter, whose Wild Wild West RCA album (LSP-1968) was one of the first wide-range choral stereo discs, starts out with a large stock pile of voices, male and female, which he molds into different combinations for each standard tune in the album. All the usual devices, without recourse to ping-pong effects, are presented here. The neatest stunt occurs in the treatment of Richard Rodger's *Funny Valentine.* The female voices furnish a wordless curtain of sound that serves as a stage-

(*Continued on page 74*)

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

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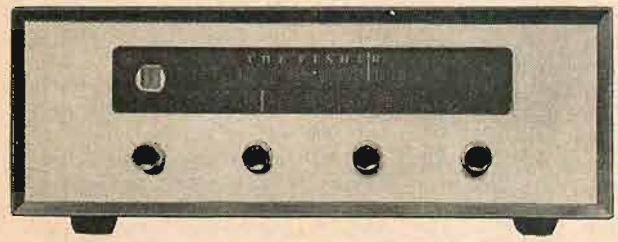

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AUDIO ETC.

Edward Tatnall Canby

Just Like Life

I SPENT A LIVELY DAY of vacation and instruction, this last August 31, attending an outdoor recording session that was of special interest to me. It was to produce an absolute recording, that being my own term of many years for a recording, with no liveness, no room sound.

On various occasions I've gone into the peculiar properties of the absolute recording, so unlike the "normal" or reverberant recording, but this was the first time that I had been present at an intentionally "absolute" recording session. And this was a full-dress occasion, with four top-ranking musicians, an engineering crew, stereo Ampex, Sony mikes, and so on.

Who would be putting solid cash into such an absolute recording, utterly useless for the normal purposes of home listening? If you know the properties of recorded sound, you'll understand why this particular job had to be of the absolute variety. This was the master tape for a "live *vs.* recorded" demonstration, the one that took place in connection with the autumn New York High Fidelity Show and will no doubt be put on elsewhere as well. The recorded sound of four pieces of music for string quartet was to be compared directly with the sound of the same four musicians playing "live," the two intermixed, back and forth, as the music continued unbroken. The type of demonstration is now familiar, but this one, it seemed to me, tackled the basic acoustic and engineering problems with a great deal of know-how, both musical and technical.

It was taken for granted (as it has not always been) that the pre-recorded sound *must* be of the absolute variety, with as little liveness as possible. It was understood from the beginning, here, that no matter how fancy the hi-fi quality, the sounds of recorded and live music by the same musicians can never match unless there is only *one* liveness to deal with—that of the listening room.

Three ways present themselves for the making of an absolute recording. A really 100 per cent job requires an anechoic chamber—but no musician worth his music could play sensible music in one of those chambers-of-horror, let alone play ensemble music with other musicians. (In an anechoic chamber, if you haven't stuck your head in one, your own voice sounds as though it were coming out of your ears and all other sounds, including other voices, seem to emanate from inside your own head. No sense of space or distance. Uncanny and unnerving, too.)

Second, you can find yourself a "dead" studio and proceed to drape every wall with blankets and the floor with two-inch carpet; but you still won't get more than 80 per cent or so of what you need. It'll do in a pinch. The third way is better. Outdoors.

Outdoors

Microphones and speakers are tested out of doors, because if you have room enough, there is no reverberation—only crickets, wind noises, autos, jet planes, kids playing baseball, blue jays, crows, chipping sparrows, and kibitzers. In speaker testing these extraneous noises are of no great moment. In an absolute recording session they are, to put it mildly, annoying, but even so, the great outdoors is the place for *any* good absolute recording of a sane musical performance. So outdoors it was, for our string quartet.

The place was coyly described in the (later) accompanying literature as the "testing field" of the well-known speaker company which put on the show. The "field" was the spacious front lawn of the Boss's country home in the mountains, at Woodstock, New York. In front was a grand view over the valley below and the blue ranges beyond. On each side were enormous maple trees (their leaves made noises, and—believe it or not—there was a perceptible liveness reflected from the foliage, though not enough to spoil the recording). The ground sloped up a hundred feet or so to the house, out of which spewed recording cables from the Ampex indoors. (Weather insurance.) Just on the far side of the musicians, under the big trees, was a stone wall dropping down five or six feet. Our listening spot was down below this wall, in the underbrush and the poison ivy.

(Note—you can listen to an absolute recording anywhere at all. It takes on the coloration of the place in which it is played, just as does the sound of live music. The live-*vs.*-recorded comparison could be made right there on location, out of doors, as well as in a show room or living room.)

We had luck—I include myself as a kibitzer and enthusiast. The people kept quiet and the autos stayed away. It threatened rain all day, but didn't. The wind started to make high-level white noise in the maple leaves, but obligingly died down again. It was warm, but not too warm for violin playing, and there was shade, when needed. Bug bombs were sprayed on everybody (avoiding the fiddles and mikes).

The house dog sneezed only once, the house cat jumped into the first fiddle's lap only once, the crickets along the garden wall were mostly silenced by one Roy Allison, well known as an engineer-writer and here immortalized as the man with the flit gun. He sprayed and sprayed, dousing hundreds of crickets and silencing quite a few. Mrs. Boss served Danish beer and coffee, plus an absolutely absolute lunch in the single hour's break during some eight hours of steady work. It was wonderful—and out of the eight hours, plus editing until well after midnight, we got some twenty-odd minutes of first-rate quartet music, fit for absolutely nothing but the special experiment for which it was intended. Good work—the timing, after all, was normal for a serious recording session and the experiment itself was, after all, what the whole thing was about.

Fine Arts

The music itself is worth mentioning, because it was wholly uncompromised in musical quality, and the performances were superb. The players were the Fine Arts Quartet, a group of men who are one of the better quartets in the music business and, in addition, have between them an astonishingly alive interest in the mutual problems and satisfactions that come where music and reproduced sound meet. They're so good at this that they get paid for it, which is just fine. They seem to understand what is needed to bring constructive harmony between intelligent engineers (who often have good amateur musical ears) and professional musicians—a thing that cannot be said of most practicing musicians. It's gratifying to work with them, on either side of the audio-music fence. Since I am more or less on both sides, it was doubly gratifying for me.

They played, for the demonstration, a part of the Ravel Quartet, the well known *Andante cantabile* from the Tchaikowsky Quartet, the fiendishly difficult, twangy, buzzy scherzo from Bartok's Fourth Quartet—one of the wonders of the quartet literature—and as a grand finale, the last movement of the Mendelssohn Octet for Strings.

Yes—Octet. They recorded one half of it, on their four instruments, then in the demonstration played the other half to their own accompaniment. Musically this was a feat of extraordinary difficulty. Not the playing of the finished whole, which was easy in spite of the half-taped sound, but the playing of the recorded skeleton half, minus the second four instruments. The music is very fast, full of fugal counterpoint, themes against themes, syncopated tossings-around of quick ideas; when half the instruments are missing, the rhythmic and thematic cues are lost, the thing staggers on four out of eight cylinders, or like a spoken dialog with one speaker missing (to combine metaphors.) Very tough playing.

The recording of that truncated Octet was one of the most impressive technical demonstrations of sheer concentration I've seen for a long while in the musical field. It was the more so because it came after eight hours of work, in twilight and finger-numbing chill, with dew beginning to form and actually dampening the finger boards of the $100,000 or more worth of stringed instruments the quartet was using.

And, for that matter, the playback of the octet, complete and on the spot, was for me the most impressive part of the entire show. I stood directly in front of the quartet (I had two mikes in my hands) and was really entranced at the strange effect of seeing four players before me and hearing eight, perfectly balanced and in the most convincing musical ensemble. One cello, to my right, would play a phrase, then the other cello, sounding practically the same but invisible, would take it up; half the players I heard made motions that matched their sound, the other half played without moving, so to speak. An eerie effect—and it worked, of course, because the recording was absolute and therefore the recorded-live match was acoustically near-perfect.

Cue Music

Some interesting points were raised by the method that this demonstration used for putting together the music in the recorded-*vs.*-live demonstration. This, of course, is always a tricky business. Musical cues must be worked out and practiced for many hours, to ensure a perfect transition from live to recorded sound or recorded to live. Coordination between engineers and musicians is part of the deal—and is often a major problem, with the best will in the world. Even in such matters as the simple location of a given cue in the music. The musicians have their professional terminology and printed music to match. "Two before H," says the first violin, or "on the A major chord," and the players start, exactly together. But the non-score-reading engineer may be at a loss to express himself, though he hears the music perfectly well. "How about that rushing place there—you know, where the music comes up loud sort of, twice?" Needless to say, there may be a dozen "rushing places" that fill that bill, and an agonizing amount of paid time can be lost merely in coming to a factual understanding as to where the musical cues are located, without fail.

It was with this in mind, I suspect, that the demonstration this year was done by a method which has evoked some criticism, but which turns the entire final performance over to the musicians, leaving nothing at all for the engineers to do but start the tape and stop it. This method involves clearly audible, low-volume musical cues from the speakers as the live musicians play during the demonstration. The audience cannot hear the cue music, but the players, especially the second violin and the cello in our demo, can hear what is needed to keep the live playing exactly coordinated with the pre-recorded tape. In our case, the two speakers (stereo) were directly behind the second violin on one side and the cello on the other, not two feet from the players.

It is true that this cue music sounds continuously while the live players are playing the same music. It is true that, in the absence of the live players, it could be heard, at low level, by the audience. But in actual practice, as I can state very definitely from personal experiment at many listening locations, the cue music is indistinguishable and inaudible at a distance of as little as four or five feet in front of the players. It plays softly; they play at

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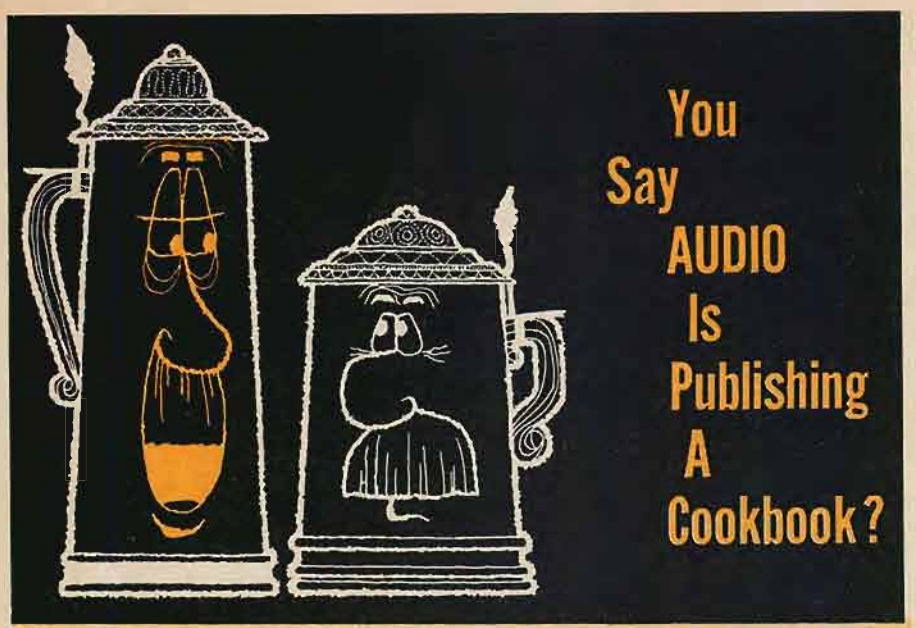

Yes, AUDIO is publishing a cookbook—not that we intend to extend the subject of gastronomy to include recipes in future pages of AUDIO.

You may ask...why?

And we would answer—Simply because we feel that people who read AUDIO, and enjoy the finest quality music reproduction also enjoy really good food on their tables.

Your next question may be...Is it a different kind of cookbook?

Of course our reply would be—Yes! Oh, it doesn't have a revolutionary format and it appears to look like any ordinary cookbook. But, the secret of its goodness is the recipes that fill its 148 pages... recipes responsible for the heart warming, flavorsome, homespun aromas experienced only in the kitchen of an Adirondack country home.

The name of the book is PLACID EATING, and it is chock full of palate-tempting recipes compiled by Climena M. Wikoff, owner of the Mirror Lake Inn ...at (you guessed it) Lake Placid, New York.

Actually, the first edition (now out of print) was discovered by Mr. AUDIO (C. G. McProud) during his stay at Mrs. Wikoff's Mirror Lake Inn, where, in Mr. McProud's own words—"*...every meal is so tasty that eating becomes a real joy, where each night's dessert excels the one from the night before, where one has to push himself away from the table before upsetting the daily calorie count.*"

Here is a cookbook that will enable you to recreate in your own homes superb dishes experienced only at the Mirror Lake Inn—dishes like *Lake Trout Baked In Wine* and *Adirondack Apple Pie*, recipes for which are reproduced below—

LAKE TROUT BAKED IN WHITE WINE

Remove heads and tails from a 2-pound fish. Split open down back and rinse well. Remove backbone and rub inside with lemon, salt, pepper and thyme to taste. Knead 1 tablespoon of butter and anchovy paste the size of a large pea; placing mixture inside fish. Place fish in a greased baking pan and cover with ½ cup of white wine. Bake 25 to 30 minutes in moderate oven, 350 degrees. Baste frequently. Garnish with parsley and lemon and serve with plain boiled potatoes.

ADIRONDACK APPLE PIE

1 c. sugar
2 tbsps. sifted flour
½ tsp. grated nutmeg
½ c. orange juice
⅓ c. melted butter
3 tbsps. white corn syrup
6 to 8 tart apples, thinly sliced
pastry

Mix together the sugar, flour, nutmeg, orange juice, corn syrup and melted butter. Add the sliced apples and mix thoroughly. Butter a pie pan heavily before putting in your pastry. Fill the pie shell with the apple mixture and make pastry strips for the top which should be dipped in melted butter before putting on the pie. Bake in 400 degree oven for 15 minutes: reduce heat to 250 degrees and bake 35 to 40 minutes longer.

This colorful book, plastic bound for easy handling, will contribute many wonderful adventures in food for everyone in the family. Order a copy today, the Lady-of-the-house will adore you for it. Incidentally...it makes a wonderful gift for anyone. PLACID EATING, 152 pages, Plastic Bound: $3.95.

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full concert volume, and the live playing simply masks the cue music—masks it to all but the players immediately next to the speakers.

At least, this was the case in the 1960 demonstration I'm talking about. I've heard that some earlier demos of this sort erred in that the cue music was loud enough to constitute a rather obvious violation of the listener's confidence. I wasn't there, but I'll agree that an "unfair" demonstration could easily take place under such circumstances. It might even be unintentional—the louder cue music, after all, makes the musical switchovers easier for the players! Conversely, the fainter the cues, the more likely are the musical breakdowns—cues missed and the transition from live to recorded sound derailed.

You can understand that from the musicians' viewpoint this little matter of not missing the cues becomes alarmingly important in a public show—to the exclusion of everything else. Jack up the volume on those cues, George, and make things easier for us! Could happen.

It's true, I'll further admit, that the transitions from live to recorded sound can be done on the basis of stopping the tape altogether, or running it in complete silence, while the live portions are played. It has been done. But this system, while technically above reproach, poses very tough problems of coordination. How is the taped passage to be brought in against the live music, in exact time? Who is to start the tape at the right cue-point, in a split second? Or if the tape runs continuously, how are the musicians to measure the exact silent interval and end their playing as the taped music starts? It is musically impossible for a good ensemble to play a passage exactly the same again and again—especially in different acoustic locations. To switch from live to pre-taped music without a hitch is thus a problem that is risk-laden and, at best, soluble in this fashion at only a few limited points in the music.

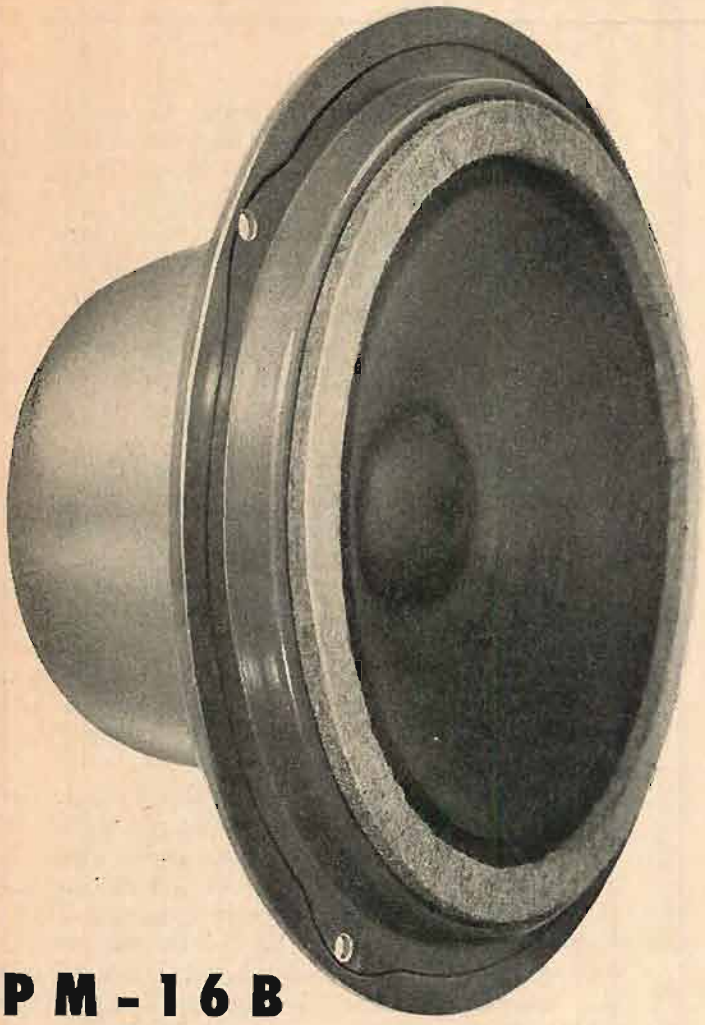
The continuous-cue system, on the other hand, allows the live musicians to keep in perfect coordination with the taped performance throughout, at all times. The transitions may be made easily and without nervous crises, almost anywhere that seems likely to give a smooth "cross-fade"; good musical splices are almost 100 per cent assured. If it can be done honorably and fairly, this system is clearly the best for the music. It is the only method that from the musicians' point of view can ensure a really musical performance and from the audience's viewpoint guarantee an enjoyable musical experience as well as a good audio-musical stunt.

The Musical Fade

But there's a further argument involved here. There are two ways to create the musical fades on the pre-recorded demonstration material that act as cue music while the live musicians are playing at full volume. The obvious method is all-electronic, the simple fade. In this case, the musicians would pre-record the entire piece of music at normal volume. Then the fades, down to minimum cue-volume, would be accomplished via playback volume control.

(*Continued on page 75*)

LET'S ENJOY THE INTERMEDIATE RANGE MORE FULLY!



PM-16B

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

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

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

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

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

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

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

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

SPECIFICATIONS

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

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

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

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

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

SPECIFICATIONS

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

DN-5

pioneer

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

EDITOR'S REVIEW

NEW YORK SHOW A SUCCESS

THE NEW YORK HIGH FIDELITY SHOW has come and gone for 1960, and it was—contrary to what was expected by many—a great success in several ways. In the first place, the attendance was at least as good as in 1959 (although official figures have not been given out), the general appearance of the exhibit rooms was considerably improved over previous years, and the interest and intelligence shown by those who came as visitors was of a consistently high calibre. We might add that the demonstration techniques were somewhat improved, and even those exhibitors who have been notorious in the past for "high decibel gain" were much more subdued this year—not that you couldn't hear them properly, but they didn't blast you.

We were particularly impressed by the Rockbar exhibit with its Collaro and Goodmans products. The room was decorated to look like a typical den in a comfortable home. There was no impression of a showroom—the appearance was that of a place in which one would like to spend some leisure hours. Then there was the Marantz room in which the subdued and dramatic lighting accented the products that were being featured.

McIntosh introduced an intelligent and attention-getting idea at this show for the first time with a "Maintenance Clinic." Announced only in AUDIO of the monthly publications, the clinic offered to make a thorough check of any McIntosh product, regardless of age, and to replace any needed parts *and tubes*—all at no cost to the owner. All he had to do was to bring the equipment in, leave it while he visited the show, and take it home with him when he left. Two hundred thirty-nine people took advantage of this offer—one from as far away as Durham, N. C., others from Washington, D. C. Philadelphia, and points in New Jersey and Connecticut as well as upstate New York. Aside from the fact that this shows a great amount of integrity on the part of the manufacturer, it also shows one of the advantages of component high fidelity—it is difficult to imagine some package hi-fi manufacturer inviting owners to cart in their consoles for a thorough check and repair.

This show also marked the introduction of H. H. Scott into the kit field with a high-quality FM tuner packaged in such a manner as to offer quite a few advantages to the person who becomes a kit builder for the first time. The shipping package serves as a holder for the progressing tuner as the work goes on, and when the builder quits for the night he simply closes down the top of the box and everything is out of sight—there aren't even any wire clippings on the floor since all wires are factory-cut to the exact required lengths.

The Citation division of Harman-Kardon showed the third, fourth, and fifth of the series for the first time—an FM tuner, and another pair of stereo amplifiers. The IV is somewhat simpler than the I yet provides most of the functions as the original preamp; the V is a dual-40 stereo power amplifier. Also the Citation X, a loudspeaker.

Two companies—Fisher and Sargent-Rayment—showed component reverberation systems. Both of these work on the same principle, with delays introduced in controlled amounts to produce the desired effect.

The Sound-Span introduced by Bogen-Presto combined into a single integrated stereo amplifier unit all the facilities needed to enable the user to reproduce two separate monophonic programs at the same time to different speakers—such as FM radio in one room and phono in another—or to convert the amplifier into a stereo unit. Such switching has often been done in the home by the advanced hobbyist who knew what he wanted and at the same time knew what to do to get the desired results. Now it is available in a single cabinet, ready to hook the speakers up to.

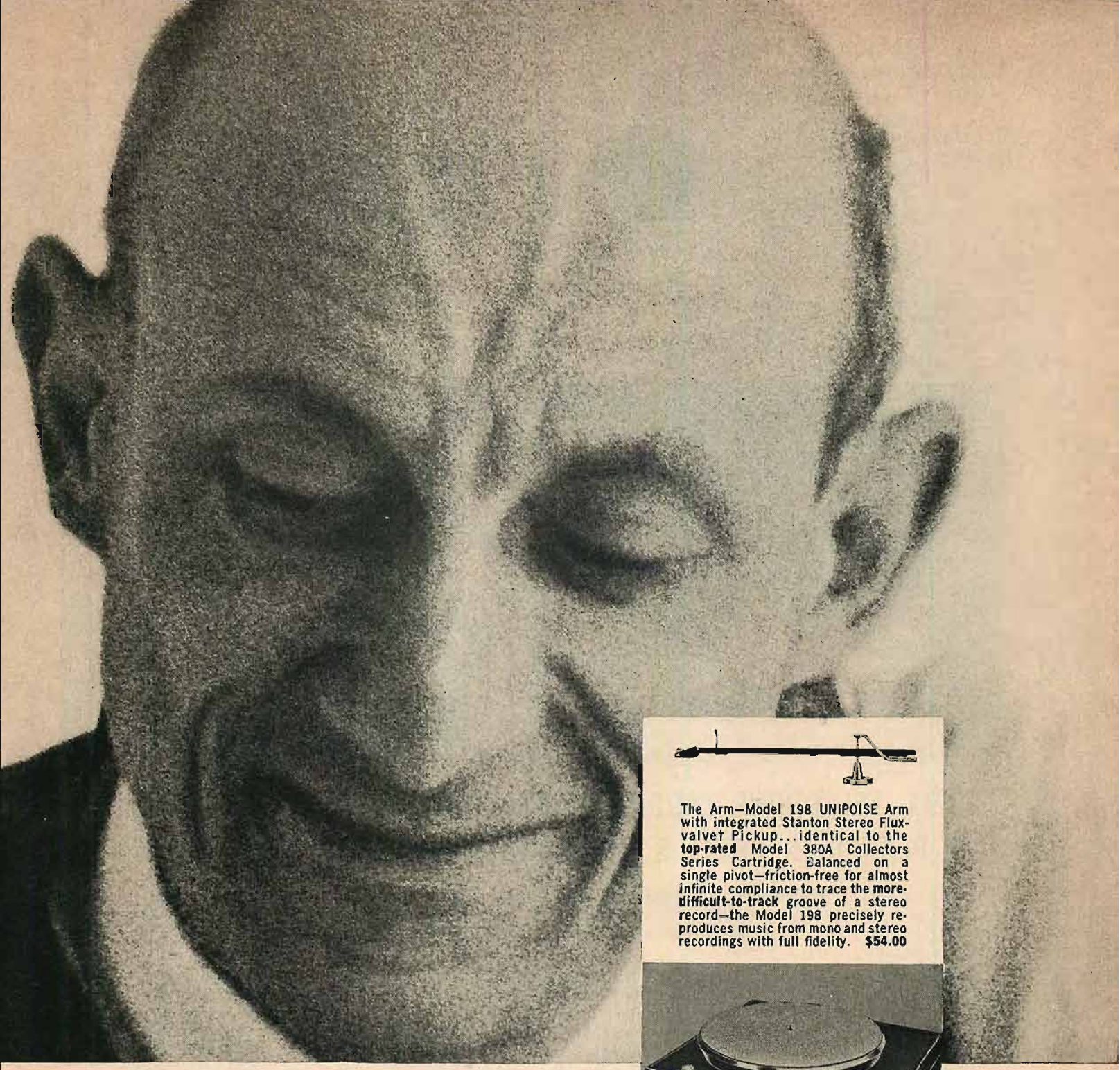
Electro-Voice exhibited—in addition to their wide line of loudspeakers—their new electronic organs, and rather than having a professional demonstrator for the instruments, anyone interested was able to play them. EICO showed a new tape recorder kit—all mechanical work done, but the kit builder puts the electronic parts together. KLH displayed their new Model Nine full-range electrostatic speakers, and were surprised how many people were interested in such relatively high priced units.

Across the street in the Hotel New Yorker, the Fine Arts Quartet gave an excellent demonstration of live *vs.* recorded music and we must admit that we couldn't tell when it was live and when it wasn't. One outstanding number was the octet—a sort of glorified "music minus four"—in which the quartet played live along with itself playing from the tape, a real neat trick. Mr. Canby tells how the recordings were made in AUDIO ETC, beginning on page 10 in this issue.

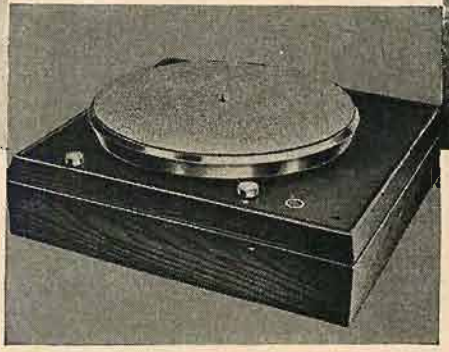
All in all it was a wonderful show. Here's to more like it.

ERRATA

In the TAPE GUIDE for September, it seems as though we allowed the gremlins to creep in again—twice in the same column. On page 34, third column, twenty-second line, the formula for C should have been $1/4\pi^2f^2L$; the simplified formula for C a few lines down should be $C = 25{,}000{,}000/f^2L$, where C is in $\mu\mu$f, f in kilocycles, and L in millihenries. Let us hope this will answer adequately any letters which may be forthcoming.



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



two...perfect for stereo

*Perfect **Stereo-mates*** *for the best **Stereoplayer** ever!*

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

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

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FOR THOSE WHO CAN HEAR THE DIFFERENCE

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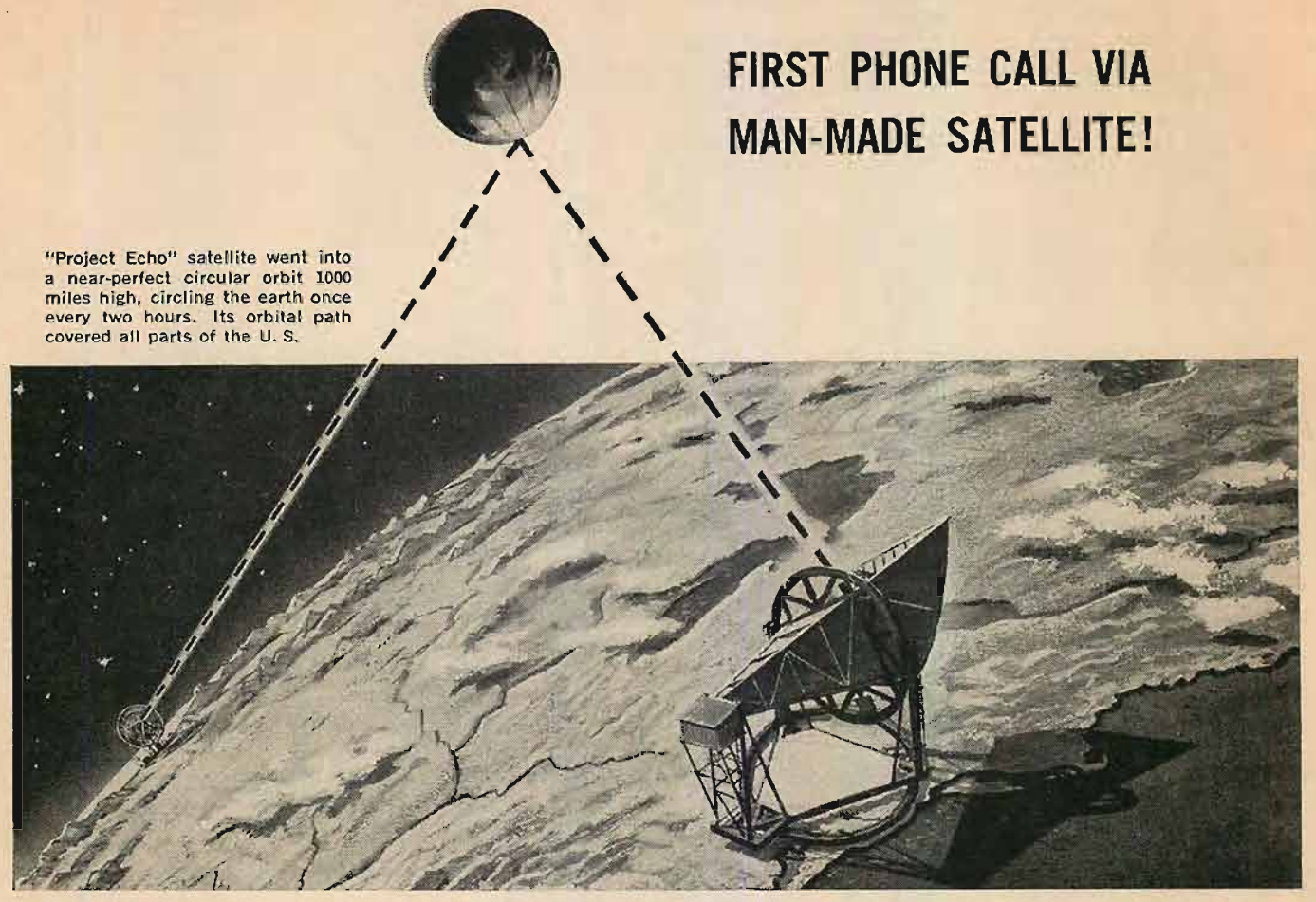
Send for Pickering Teoh-Specs—a handy guide for planning a stereo high fidelity system... address Dept. B100

†U. S. Patent No. 2,917,590

*The Model 198 and Gyropoise 800 are sold separately

FIRST PHONE CALL VIA MAN-MADE SATELLITE!

"Project Echo" satellite went into a near-perfect circular orbit 1000 miles high, circling the earth once every two hours. Its orbital path covered all parts of the U. S.



BELL TELEPHONE LABORATORIES BOUNCES VOICE OFF SPHERE PLACED IN ORBIT A THOUSAND MILES ABOVE THE EARTH

Think of watching a royal wedding in Europe by live TV, or telephoning to Singapore or Calcutta—*by way of outer-space satellites!* A mere dream a few years ago, this idea is now a giant step closer to reality.

Bell Telephone Laboratories recently took the step by successfully bouncing a phone call between its Holmdel, N. J., test site and the Jet Propulsion Laboratory of the National Aeronautics and Space Administration (NASA) in Goldstone, California. The reflector was a 100-foot sphere of aluminized plastic orbiting the earth 1000 miles up.

Dramatic application of telephone science

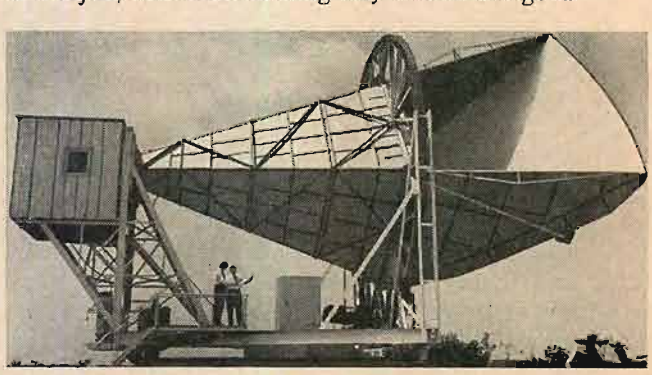
Sponsored by NASA, this dramatic experiment—known as "Project Echo"—relied heavily on telephone science for its fulfillment . . .

▪ The Delta rocket which carried the satellite into space was steered into a precise orbit by the Bell Laboratories Command Guidance System. This is the same system which recently guided the remarkable Tiros I weather satellite into its near-perfect circular orbit.

▪ To pick up the signals, a special horn-reflector antenna was used. Previously perfected by Bell Laboratories for microwave radio relay, it is virtually immune to common radio "noise" interference. The amplifier—also a Laboratories development—was a traveling wave "maser" with very low noise susceptibility. The signals were still further protected from noise by a special FM receiving technique invented at Bell Laboratories.

"Project Echo" foreshadows the day when numerous man-made satellites might be in orbit all around the earth, acting as 24-hour-a-day relay stations for TV programs and phone calls between all nations.

This experiment shows how Bell Laboratories, as part of the Bell System, is working to advance space communication. Just as we pioneered in world-wide telephone service by radio and cable, so we are pioneering now in using outer space to improve communications on earth. It's part of our job, and we are a long way toward the goal.



Giant ultra-sensitive horn-reflector antenna which received signals bounced off the satellite. It is located at Bell Telephone Laboratories, Holmdel, New Jersey.

BELL TELEPHONE LABORATORIES

WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT

A Transistorized Stereophonic Control Unit

RICHARD Y. MOSS*

Stereo controls and their functions have been a source of confusion for the audiofan. The following analysis dispels some of the confusion and leads to the design of a high quality preamp.

STEREOPHONIC SOUND arrived suddenly, perhaps unexpectedly, transported by the media of compatible disc recordings, FM multiplex, and simultaneous AM–FM and AM–TV transmissions, and multitrack magnetic tape recordings. While each of these techniques requires a different method of conversion from electromagnetic or acoustical information to an electrical signal, all have the common characteristic that two similar but separated audio channels are required for compensation and amplification. This article will discuss the design of a stereophonic control unit by examining the problem in two parts: first, the philosophy of stereo reproduction and the functions of the various controls which are necessary to such reproduction; and second, the actual circuit design and construction of such a control unit, incorporating transistors for increased reliability, low hum and microphonics, and compactness.

After a brief examination of the stereophonic control units on the market, one would be forced to the conclusion that the transition from monophonic to stereophonic reproduction entails an increase in the complexity of controls by a factor of at least two-to-one, and perhaps greater. This observation is supported by the initial approach of most manufacturers of stereo equipment, namely, to provide two of everything plus some peculiar additional functions. While "two-of-everything" is certainly a straightforward solution, it does not reflect very favorably upon the engineering "know-how" of these manufacturers, since such a solution does not imply anything more than a very superficial analysis of the problems of stereophonic reproduction. In lieu of any further criticism of what has not been done, let us proceed instead with a first-order analysis of what should be done, and reflect this analysis in the design of a control unit intended for stereo, not merely a double-barreled approach to monophonic sound.

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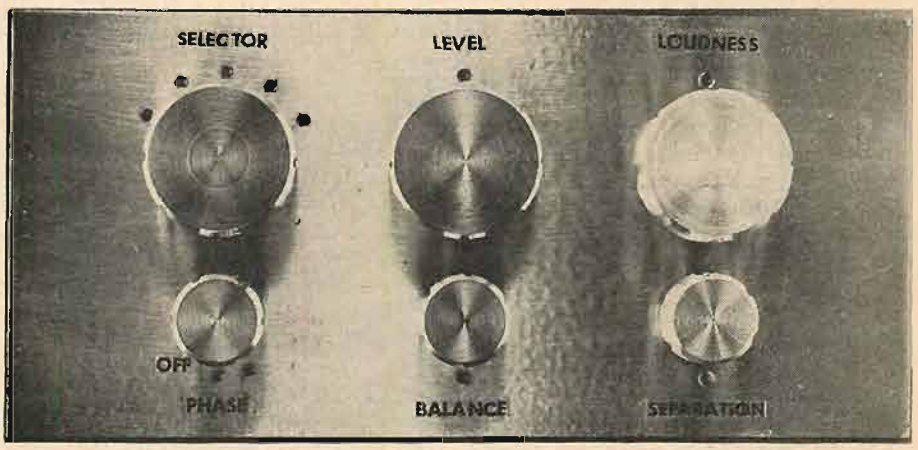

Fig. 1. Front panel of control unit.

Audio Controls in General

Audio control functions in a stereophonic system may be divided into two general categories: first, those functions which are common to all types of audio reproduction in general, and hence can be controlled in both channels simultaneously; and second, those functions which are peculiar to stereo, and which may require some definition before they can be appraised. In the first category we find: (1) input selector switching, (2) phonograph record and magnetic tape playback equalization, (3) master level control, (4) loudness contour compensation, (5) tone control, (6) scratch and rumble filtering, and (7) power switching.

It is often convenient to incorporate the first two functions, input selector switching and equalization compensation, into a single control, especially since most modern monophonic disc recordings and virtually all stereophonic discs are recorded with the RIAA characteristic, and the NARTB recording curve has become standard for tape recording at the 7½ and 15 ips speeds. The selector-equalizer should thus control at least three low-level inputs: a high-impedance microphone input, a magnetic phono input which incorporates RIAA equalization, and a magnetic tape head input with NATRB equalization. At least two high-level inputs are also necessary, one for a tuner, and one to be used for pre-equalized tape playback or a high-level phono cartridge. While level control of each input would be a pleasant luxury, it is desirable to limit the number of level pots to one per preamp channel, so as to be able to adjust the output of the low-level preamp to approximate the signal at the high-level inputs, thus avoiding sudden changes in volume when switching from any of the low-level inputs to a high-level signal.

Level control needs little discussion, except to point out that such a control should be ganged to both channels, avoiding the inconvenience and added complexity of separate concentric controls and unreliable mechanical clutches which are supposed to permit operating the two knobs in a ganged fashion.

Loudness contour compensation and tone controls may usually be considered simultaneously, since in the ordinary listening environment either will produce a satisfactory result, and in installations where both are present it is common that the loudness control produces such satisfactory results that the tone

controls soon become dusty with disuse. For the purposes of a compact installation, then, the tone controls may be eliminated from the control unit and made a part of the power amplifier, wherein they are adjusted to compensate for unusual room acoustics and then left set; in many cases tone controls may be eliminated from the system entirely. In any case, the loudness contour is a necessity, and should be capable of reproducing the Fletcher-Munsen equal-loudness contours from the 0 db, or full room volume, curve to a fairly low listening level, say – 35 db. It is also possible to consider scratch and rumble filtering under the general heading of tone control, but logical consideration of this topic soon leads to the conclusion that the audiophile who is interested in building his own control unit is probably using a professional turntable or high quality changer, and is concerned almost entirely with the reproduction of high fidelity program sources, thus predicating the proposition that the inclusion of filters designed to compensate for the shortcomings of lower quality equipment and low fidelity sources, is a waste of effort in an ostensibly high fidelity system. Even the enthusiast who may wish to play badly worn or scratched discs which are collector's items isn't likely to find much utility in such controls. He is more apt to dub these irreplaceable recordings onto tape using special filters as a part of the recording system, and then play the tape to save wear and tear on the originals. The conclusion to be drawn from this argument is that the elimination of rumble and scratch filters from a stereophonic control unit intended primarily for the reproduction of new, high quality recordings with professional quality equipment will hardly impose any hardship by limiting the flexibility of the control unit.

Power switching is a subject which could be expanded into a volume by itself, but in this control unit such switching will be confined to controlling the d.c. power for the unit itself, plus one additional circuit which may be used to control the coil of a power relay, and this in turn controls all the a.c. power to amplifiers, tuner, turntable, and tape or other auxiliary equipment. This is a more desirable situation than trying to mount a switch to handle as much as half a kilowatt within the control unit itself, and if the d.c. power is used in the relay control circuit, then there will be no a.c. power within the control unit except signals, with attendant advantages in hum pickup reduction.

The preceding analysis has thus reduced the original seven monophonic functions to four: (1) a combined selector-equalizer, (2) a master level control, (3) a loudness contour control, and (4) power switching. In each case, where there was doubt about the inclusion of a function, assumptions of high quality equipment and logical function were advanced in order to determine whether such a function was a necessity or merely a luxury.

Stereo Controls in Specific

A second set of control functions becomes necessary with the advent of stereophonic reprodnction. Such terms as "balance," "separation," "phase reversal," and "channel reversal" have begun to appear in the profusion of recent literature on the subject of stereo, and the consequent confusion about their meaning warrants a brief definition of each, as well as an examination of their importance.

Balance means simply a comparison of the relative volume levels of the two audio channels; if the inputs are assumed equal, as is usually the case, the term "balance" describes the gain ratio of the A and B channels. Since the overall gain of each channel must necessarily include everything from the cartridge to the acoustic output as it reaches the listener's ears, it seems obvious that even if all the reproducing elements and amplifying elements are exactly balanced, the position of the listener within the room may be such that the sound does not seem balanced to him. Moreover, even the assumption of balanced inputs is unrealistic, thus the necessity for a control to adjust balance is compelling. Such a control usually operates so as to vary the gains of the two channels differentially; that is to say, to increase the volume in one channel while simultaneously decreasing that in the second channel.

"Separation" is a term which defines a more subjective phenomenon of stereo; that is, the separation of the two halves of the apparent source of sound. The two limiting cases of this effect are easy to imagine: on the one hand, a total lack of separation would cause the apparent source of sound to seem to be located at a point midway between the two speakers; the other extreme would occur when the speakers were located so far apart that there seemed to be a "hole-in-the-middle" of the sound emanating from the left and right hand speakers, giving an exaggerated stereo or "ping-pong" effect. Since this effect depends upon the electrical channel isolation, on speaker placement and room acoustics, and, in fact, on the microphone placement in the original recording studio, it would seem almost a necessity that some means of continuous adjustment of the separation should be included. One means by which this adjustment can be achieved electrically is by adding a portion of the signal from one channel to the signal in the other, and vice-versa. Each channel would then contain some information which is common to both and hence is monophonic in character, serving to fill the "hole-in-the-middle"; each channel would also contain some information which is peculiar to that channel and hence retain its stereophonic character. Using this control it would be possible to attain a "curtain-of-sound" spread across the space separating the two speakers, regardless of variation between recordings, room acoustics, and so on. It is scarcely necessary to mention, however, that the adding type of control can only reduce the separation of the two channels, since if it could increase the separation beyond that of the recording it would be possible to make monophonic recordings sound stereophonic! There have been circuits designed which use a matrix to take advantage of the separation already inherent on the stereo recording and improve upon it, but such circuits are nearly impossible to construct, except on paper, because of the extreme precision required.

The third term mentioned was channel reversal, which means simply the reversal of the two channels in left-right orientation, and is a purely aesthetic effect which assumes prior knowledge of the subject arrangement. An illustration of this effect would be a recording of a symphony orchestra, which has standardized so that the strings are to the left of the conductor, the percussion to the right, and so on. In the event that this is reversed in the reproducing system, it is a simple matter to correct, since the two channels may be interchanged at any point in the system, from the pickup leads to the loudspeakers. In view of this fact, a separate control to accomplish this function is not felt to be important enough to merit inclusion on any save a very elaborate control unit, and such a control will not be included in this case.

The fourth term, "phase reversal," is perhaps the most difficult to describe. The need for attention to this function arises because of the relative youth of the stereo art, so that there is no universally observed standard as to what direction of excursion of the phonograph stylus shall produce a signal of a given polarity; or in the case of magnetic tape, what state of magnetization of the oxide layer on the tape shall produce a signal of the same given polarity. In a purely stereophonic system, (i.e., the channels are assumed to have perfect isolation), the result of improper phase orientation will be cancellation of some of the signals. In the case where there is electrical adding of the signals, as in a separation control, the out-of-phase components will cancel and reduce the overall signal level; and in the case

where the signals are not added electrically there will still be acoustic interference of the same sort which arises in an improperly phased public address system. The remedy is simple in principle: just reverse the direction of excursion of the speaker cone in one channel for a signal of a given polarity, providing that no electrical adding takes place. In the case where there is adding, then the phase of the signals in one channel must be reversed before the addition, either by interchanging the pickup leads for one channel, or by inserting a stage with a voltage gain of −1 in the voltage amplifying stages of the preamp; and since the introduction of a switch to reverse pickup leads is more than likely to introduce hum, and may not be possible with a three-lead system, a stage with a gain of −1 is by far the better solution.

The Control Unit

We have thus arrived at a realistic complement of controls for a flexible yet compact stereo control unit, see *Fig.* 1. The front panel contains six controls, four of which operate upon both channels simultaneously to cover the important monophonic functions, and the remaining three control the essential stereo functions. (This totals seven, but the phase reverse and power switch functions are combined in one control.) The remainder of this article will describe the design and construction of the control unit, incorporating all the electronic refinements which are consistent with high quality, reliable performance. This design takes advantage of the freedom from hum and microphonics which characterize the transistor, an attribute which provides a convenient solution to the problem of the low-level output of most stereo cartridges. The small size and weight, and the lack of heat generation of the transistor will also serve us in good stead so far as a compact design is concerned, and the reliability of a properly designed transistor circuit is such that it should practically never require service.

DESIGN DATA FOR THE TRANSISTOR CONTROL UNIT

The first portion of this article has discussed the philosophy of a simple but adequately flexible stereo control unit. After examination of the requirements for such a control unit, a set of functions was specified which would meet the needs of nearly any audiofan. The design problem now becomes one of electrical realization of the functions thus specified, and of high-quality, high-reliability audio equipment design in general. In considering each channel separately we must observe the performance criteria which have become standardized in specifying the performance of monophonic equipment; the design is specialized only insofar as the peculiarities of stereo are concerned.

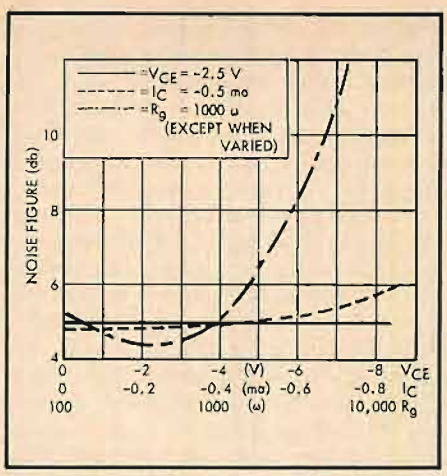

Fig. 2. Typical noise characteristics of a low-noise germanium transistor.

At the time that the idea for this control unit was conceived, it was decided that such a unit should be transistorized. Many reasons for such a decision may be advanced, and several of these merit examination. First, when a transistor is operated within its conservative ratings, it has an extremely long lifetime, or "mean-time-to-failure." For a high-quality transistor this lifetime approaches that of a passive device such as a resistor or capacitor, and even for the lower-priced transistors which we shall use, months or years will elapse before a typical transistor will require replacement. Second, the transistor and its associated circuitry are small and generate almost no heat. This means that the advent of stereo, requiring almost twice the equipment that monophonic reproduction entails, will not necessarily increase the size of the system by a factor of two to one. Transistor eqpipment can be made very compact, it does not require much power to operate, and the lack of heat generation means that such equipment may be mounted in the cabinetry without much thought to ventilation. Third, the transistor is virtually free from hum and microphonics, and this means that the hum level in the preamplifier—a problem because of the extremely low output voltages of some of the popular stereo cartridges—will be almost unmeasurable. In addition, we shall see that "transistor noise," which has manifested itself as a hiss or "frying" sound in early units, can be reduced to a vanishingly low level if proper design techniques are applied.

The discussion to follow will be somewhat different from the ordinary construction article. Because of the novelty of transistor circuits compared to their vacuum-tube counterparts, some detailed information will be included concerning the operating points of the transistor stages, and the equations used to calculate stability *vs.* temperature change, feedback resistors, and gain will be presented. While such calculations are necessarily tedious, it is hoped that by their presentation the reader will gain a better understanding of the approximations and computations associated with the design of transistorized equipment.

The circuitry of the control unit, *Fig.* 3, may be divided into two sections: the low-level preamplifier, where noise figure and exact frequency compensation are the important factors, and the high-level control stage, where signal-handling capabilities are important. The low-level preamplier circuit consists of two low-noise transistors Q_1 and Q_2, connected in the grounded-emitter configuration. The first transistor, Q_1, is operating at a low collector voltage and very low collector current to minimize the noise figure of the transistor, and the load resistor for this stage is a deposited-carbon type for the same reasons. The bias configuration is the "H" type, with the temperature-stability factor (defined as $S = \Delta I_c / \Delta I_{co}$) chosen to have a numerical value of less than 4. This value for S is chosen mostly from experience, which has shown that this is a reasonable criterion for reliable class A operation over the rated temperature range of a germanium transistor. The "H" bias configuration depends upon a large resistance in the emitter circuit to achieve stability, and then this resistor is bypassed with a large capacitor to maximize a.c. gain. In proceding with the design of this stage, the value of the collector-to-emitter voltage, V_{ce}, and the collector current, I_c, are first chosen from a graph of the noise characteristics of a typical transistor versus V_{ce}, I_c, and the generator impedance R_g. (*Fig.* 2) the values thus selected are:

$$V_{ce} = -8 \text{ vdc.}$$
$$I_c = -0.35 \text{ ma.}$$

Before resistor values can be calculated from the operating point, there are several restrictions on the parameters of the stage which must be taken into account. First, the voltage gain, G_v, and the input impedance Z_{in} must conform to external considerations. A survey of the popular stereo cartridges shows that an input impedance of 50,000 ohms is sufficient for all the cartridges requiring high-impedance, low-level inputs, and a lower Z_{in} may always be achieved by loading the cartridge with a resistor. It must be remembered that high values of input impedance are difficult to achieve in transistor stages which also have voltage gain, and for this reason we shall not attempt to make Z_{in} any higher than necessary. The compensated closed-loop gain of the low-level preamplifier should be about 40 db ($G_v = 100$) so that a 10-mv input will produce a 1-volt output. Since about 20 db for bass boost is re-

quired for the RIAA curve, the preamplifier will require an open-loop gain of 40 plus 20, or 60 db ($G_v = 1000$). This means that each stage within the loop should have a gain of 60/2 = 30 db ($G_v = 31.5$).

We are now in a position to calculate some resistor values for the first stage. With the "H" bias configuration and the large amount of feedback present, the input impedance of the first stage will be primarily determined by the parallel combination of R_2 and R_3; we shall call this equivalent resistance R_b', and we can then say that approximately:

$$Z_{in} \cong R_b' \qquad (1)$$

The next restriction on the values of the resistances in this stage is the S factor. For a grounded-emitter stage using a transistor with a high grounded-emitter current gain Beta (β) and small internal base and emitter resistances compared to the circuit values, S can be given by:

$$S \cong 1 + \frac{R_b'}{R_e'} \qquad (2)$$

where R_e' is the total external emitter circuit resistance, $R_4 + R_5$. But we have specified R_b' at 50,000 ohms, and S can have a maximum value of 4, so we can easily calculate the minimum value of R_e' necessary to achieve this stability factor, and this turns out to be 16,000 ohms. Allowing an ample margin of safety, we will let R_4 equal 22,000 ohms, and the voltage drop across R_4 is $I_e R_e$ = 7.7 volts. Making one additional assumption, that there is a small and nearly constant voltage difference between the base and emitter terminals of the transistor, amounting to about 0.3 volts, we know that the voltage across R_2 is 7.7 + 0.3 = 8 vdc. We can similarly deduce that the voltage across R_3 is the supply voltage to the stage less 8 volts. In our case the power supply voltage is 30 volts, selected because experience has shown that this is a convenient voltage for audio work in transistors. To make certain that there is no cross-coupling between stages, there are two decoupling resistors in the supply line, R_7 and R_{19}, and the supply voltage to the Q_2 and Q_3 stages is actually about 28 volts, and that to the Q_1 stage about 25 volts. This shows that there are 25 − 8 = 17 volts across R_3, and now that we know that the ratio of R_2 to R_3 is 8 : 17 (assuming that he current in the base of the transistor is negligibly small) and that the parallel equivalent of R_2 and R_3 is 50,000 ohms, we can easily calculate their values, which are 73,000 ohms and 156,000 ohms, respectively. Increasing these to the nearest 10 per cent EIA values gives: $R_2 = 82{,}000$ ohms, and $R_3 = 180{,}000$ ohms, and recalculation of R_b' now yields 56,000 ohms, still sufficiently close to the target figure of 50,000 ohms.

We have only two resistors left to calculate, the load resistor R_L (R_6), and the small unbypassed emitter resistor R_5, which controls the voltage gain. R_6 is actually already determined since we know the collector current (which equals the emitter current, approximately) and the voltage at the collector (which is the supply voltage less the V_{ce} and $I_e R_e$ drops), and the calculated value is 26,600 ohms, the closest value in a deposited-carbon resistor being 26,100 ohms. Once the load resistor is known, we can calculate the value of the feedback resistor R_5 from the equation for gain with feedback:

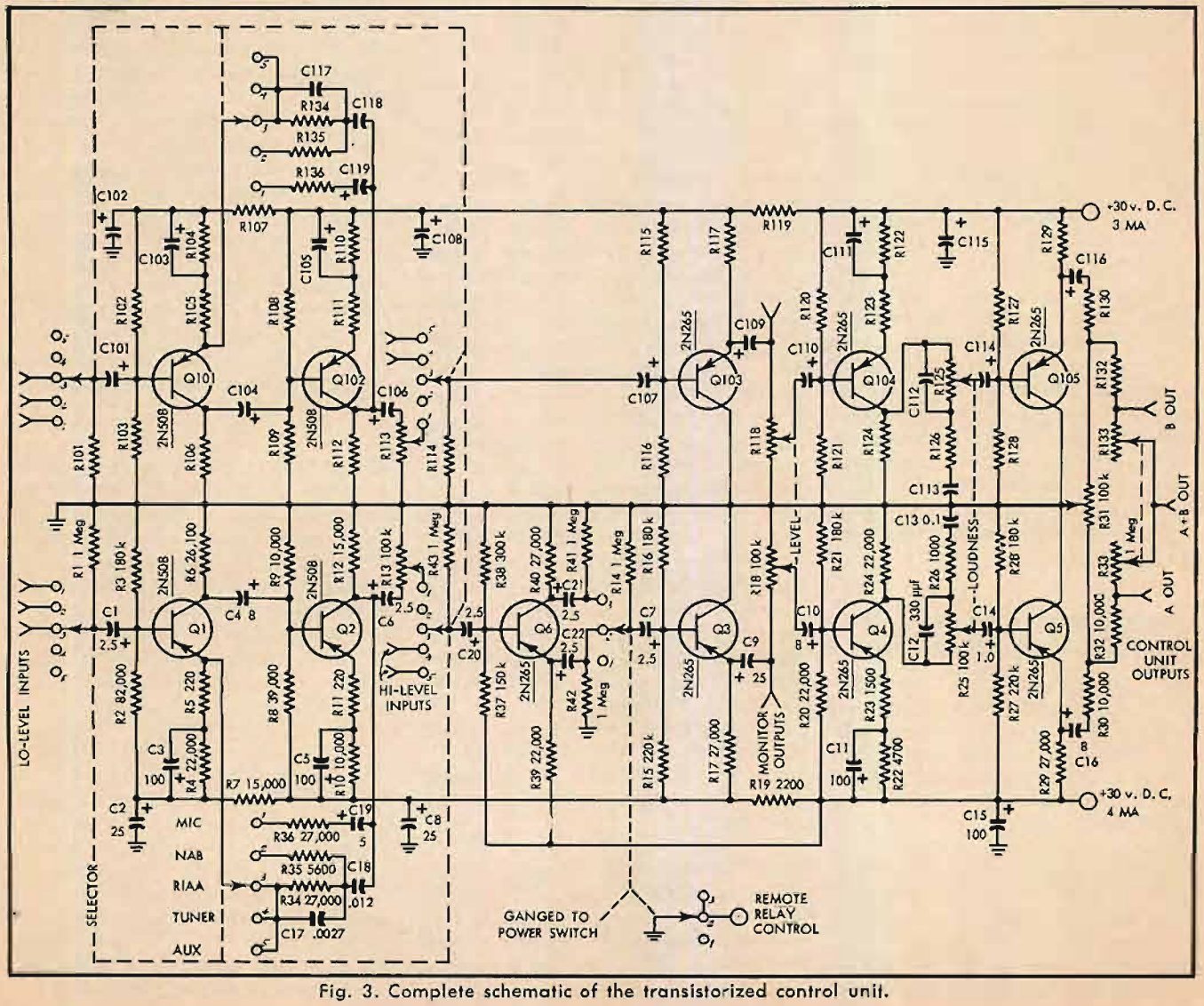

Fig. 3. Complete schematic of the transistorized control unit.

$$G_v \cong \frac{(\beta R_L')}{(h_{ie} + \beta R_5)} \qquad (3)$$

where R_L' is the equivalent load imposed by the load resistor and any subsequent circuitry. H_{ie} is the grounded-emitter input impedance of the transistor, as specified by the manufacturer. It is interesting to note that this is the first time the parameters of the transistor have entered the equations explicitly; all the previous calculations have simply assumed some range of values.

Choice of Transistors

At this point, then, it will be necessary to select the specific transistor to be used in the circuit. A survey of the inexpensive, commercially available germanium "p-n-p" transistors with low noise-generation characteristics results in the selection of any of two or three types, all of which are pretty much interchangeable. The GE 2N508, the Philco 2N535B, (a newer version of the 2N207B), and the Raytheon 2N422 will all perform well in the preamplifier, and from this point forward we shall assume the characteristics of the 2N508. This transistor has a β of 100 and an h_{ie} of 3000 ohms, and a typical noise figure of less than 6 db (0 db = 1 μv.). Using this data, and assuming a loading by the following stage of 15,000 ohms, we can calculate from Eq. (3) that the G_v will be approximately 33 for an R_5 of 220 ohms. For the remaining control unit circuits, where noise is not so critical but larger signals entail larger collector voltages, we select a transistor with the same general characteristics but an increased maximum V_{cc}; such a transistor is the GE 2N265 or the Philco 2N534.

The preceding discussion has covered all the computations which are peculiar to the design and stabilization of a transistor stage with a specified voltage gain and input impedance. The values of coupling and bypass capacitors are calculated in the same manner as those for vacuum tube stages, that is, by making the time constant of the equivalent circuit small compared to the period of the lowest frequency we wish to pass or bypass. The technique just illustrated may now be repeated for the Q_2 stage, using the conditions and approximations just discussed, and assuming the loading of subsequent circuitry to be 50,000 ohms. Once this stage is completed, we are ready to calculate the values of the feedback and compensation resistors and capacitors, $R_{34\text{-}36}$ and $C_{17\text{-}19}$.

When the selector switch S_1 is in position 1, R_{36} and C_{19} are the elements in the feedback loop. This corresponds to the "microphone" position, and we are desirous of a flat frequency response and a closed-loop gain of 4 db (G_v = 100). The value of R_{fb} (R_{36}), in the condition where the presence of this resistor does not upset the open loop gain excessively, is:

$$R_{fb} \cong -\frac{(R_5)\ (G_v)}{(K-1)} \qquad (4)$$

where K is the ratio of the open loop gain G_v to the closed loop gain G_v'. This equation gives a value of 24,000 for R_{36}, but since this would load the output of the second stage and change the open loop gain slightly, (we assumed a loading of 50,000 ohms) the corrected value of R_{36} becomes 27,000 ohms. In this case, C_{19} is merely a coupling capacitor with

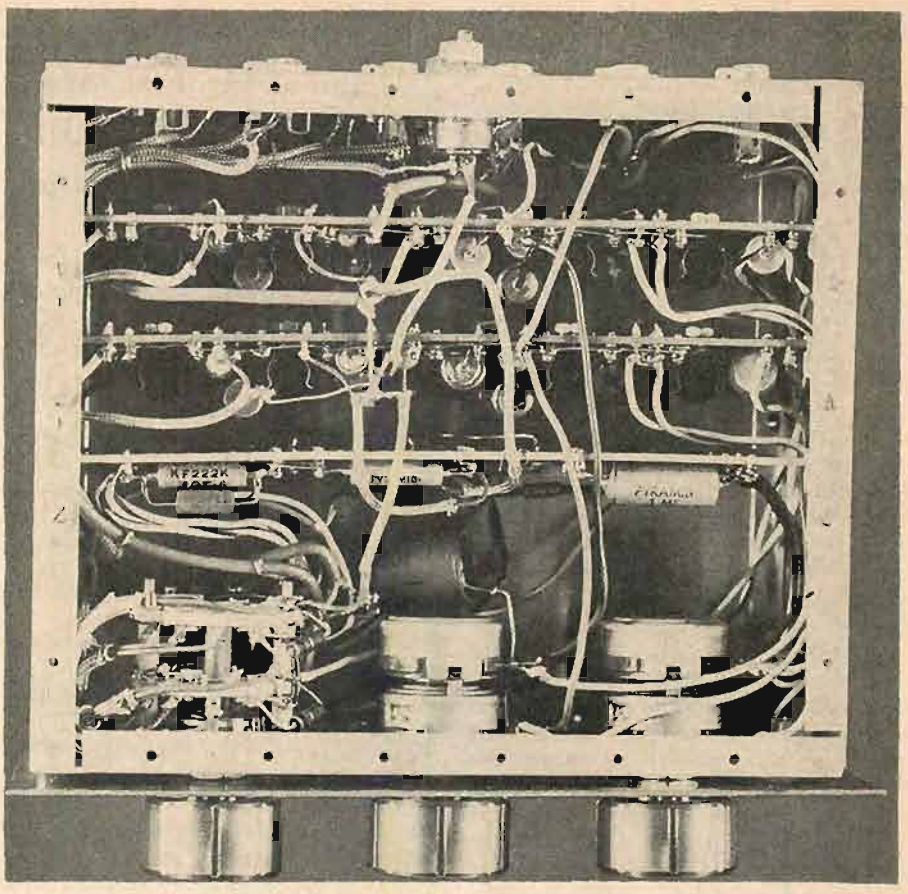

Fig. 4. Top view of the completed preamplifier unit. The upper two resistor boards are identical; the lower contains the equalization networks, loudness-control components, and the phase-reversal stage.

PARTS LIST

*R_1, R_{11}, R_{41}, R_{42}, R_{43}	1 megohm, ½ watt
R_2	82,000 ohms, ½ watt
R_3, R_{16}, R_{21}, R_{28}	180k ohms, ½ watt
R_4, R_{20}	22,000 ohms, ½ watt
R_5, R_{17}	220 ohms, ½ watt, 5%
R_6	26,100 ohms, ½ watt, 1% deposited carbon
R_7	15,000 ohms, ½ watt
R_8	39,000 ohms, ½ watt
R_9	120k ohms, ½ watt
R_{10}, R_{30}, R_{42}	10,000 ohms, ½ watt
R_{12}	15,000 ohms, ½ watt, 5%
R_{13}, R_{21}	100k ohms, ½ watt
R_{15}, R_{27}	220k ohms, ½ watt
R_{17}, R_{29}	27,000 ohms, ½ watt
R_{18}, R_{25}	100k-ohm dual potentiometers, linear, 10%
R_{19}	2200 ohms, ½ watt
R_{22}	4700 ohms, ½ watt
R_{23}	1500 ohms, ½ watt, 5%
R_{24}, R_{33}	22,000 ohms, ½ watt, 5%
R_{26}	1000 ohms, ½ watt
R_{28}	1-megohm potentiometers, linear, 10%
R_{31}, R_{36}, R_{40}	27,000 ohms, ½ watt, 5%
R_{38}	5600 ohms, ½ watt, 5%
R_{37}	150k ohms, ½ watt, 5%
R_{38}	300k ohms, ½ watt, 5%
*C_1, C_6, C_7, C_{20}, C_{21}, C_{22}	2.5 μf, 25 v, electrolytic
C_2, C_8, C_9	25 μf, 25 v, electrolytic
C_3	100 μf, 6 v, electrolytic
C_4, C_{10}, C_{16}	8 μf, 25 v, electrolytic
C_5, C_{11}	100 μf, 10 v, electrolytic
C_{12}	330 μμf, 300 v, mica
C_{13}	0.1 μf, 100 v, paper
C_{14}	1 μf, 6 v, electrolytic
C_{15}	100 μf, 50 v, electrolytic
C_{17}	.0027 μf, 100 v, paper
C_{18}	.012 μf, 100 v, paper
C_{19}	5 μf, 12 v, electrolytic
S_1	6-pole, 5-position switch, shorting
S_2	2-pole, 3-position switch, shorting
*Q_1, Q_2	"p-n-p" transistor, (GE 2N508)
Q_3, Q_4, Q_5, Q_6	"p-n-p" transister, (GE 2N265)

* Values given for subscripts from R_1 to R_{20} (except R_{21}) apply also to resistors with subscripts R_{101} to R_{120}; values given for capacitors C_1 to C_{10} apply also to capacitors with subscripts C_{101} to C_{110}; transistor types listed for Q_1 to Q_2 apply also to transistors Q_{101} to Q_{102}.

All resistors 10% tolerance unless otherwise specified.

negligible reactance at the frequences from 20 to 20,000 cps.

The RIAA phonograph curve is realized by a low-frequency boost with a characteristic time constant of 300 microseconds, and a high-frequency rolloff time constant of 75 microseconds. Since the midfrequency gain is still supposed to be 40 db, R_{34} is 27,000 ohms. The bass-boost capacitor C_{18} will have a value of 0.012 μf, the boost time constant divided by R_{34}. Similarly, the rolloff capacitor C_{17} will be the rolloff time constant divided by R_{34}, and this yields a value of 0.0027 μf.

The NAB tape curve is realized by a single low-frequency boost with a time constant of 67 microseconds, where the high-frequency gain is considered the closed loop gain G_v'; thus the computation in this caste will be somewhat different. The output from a tape reproducing head is generally lower than that from a phono cartridge, so that it would be desirable to have the highest over-all gain possible with the equalization required. The total equalization between high and low frequency is 32 db, and since the open loop gain is 60 db, this means the maximum high-frequency gain (in this case the closed loop gain), will be 28 db ($G_v' = 25$). For this value and the known value of C_{18}, we calculate the corrected value of R_{35}, which is 5600 ohms. If we now calculate the gain at 500 cps (which is the crossover frequency for the NARTB curve), this midfrequency gain is 150, or about 43 db. This means that a tape head output of only 3.5 mv will produce a 0.5 volt output, while a 5-mv phono or microphone input is required to produce the same output.

At this point, it is timely to interject a note concerning the behavior of the large values of capacitance necessary in R-C coupled transistor stages. In order to maintain flat frequency response down to the lowest audio frequencies, the values of coupling capacitors tend to become very much larger than those in vacuum tube circuits, with values as large as 25 μf not uncommon. These are usually low-voltage midget electrolytics, and as such as subject to leakage currents considerably larger than those in the typical paper tubular capacitor. Therefore, it is important that d.c. return paths be provided for these leakages at inputs and outputs, and that the variable controls be arranged in such a way that the operation of the control does not change or reverse the d.c. voltage on the electrolytic, lest the resulting nonlinear discharge generate an audio signal not unlike a Bronx cheer.

The over-all characteristics of the low-level preamplifier stages may now be tabulated:

(A) *Flat Equalization:*

Frequency response flat ± 0.5 db from 20 to 20,000 cps.
Sensitivity 5 mv for 0.5 volts output.
Intermodulation Distortion 0.25 per cent at 1 volt output.
Harmonic distortion not measurable at 1 volt output.
Noise level more than 65 db below 1 volt output.
(This noise is characteristically below 30 cps.)

(B) *RIAA Equalization:*

RIAA equalization ± 0.5 db from 20 to 20,000 cps.
All other specifications equalled where applicable.

(C) *NAB Equalization:*

NAB equalization ± 0.5 db from 20 to 20,000 cps.
Sensitivity 3.5 mv for 0.5 volts output.
All other specifications equalled where applicable.

High-Level Section

The input to the high level section is made through the selector switch S_1, resulting in the choice of either the preamplifier output or a high-level input. The signal is then fed to the base of the emitter-follower Q_3. With the emitter-follower configuration we are able to realize a high input impedance and low output impedance at the cost of unity voltage gain, much in the same manner as the cathode follower in vacuum-tube circuitry. The output of Q_3 is labelled the "monitor output," and may be used to drive a tape recorder for dubbing, headphones, or almost any impedance greater than a few hundred ohms; this output is equalized to have a flat frequency response and constant amplitude, independent of the settings of the level and loudness controls R_{18} and R_{25}.

There is little to describe in the design of the emitter-follower stage because it is an extremely simple configuration, and there is no gain calculation to make. Suffice, then, that the operating point of the transistor is chosen so that:

$$V_{cc} = -12.5 \text{ vdc.}$$
$$Ic = -0.5 \text{ma.}$$

and the S factor is again less than 4.

The Q_4 stage, like the Q_1 and Q_2 stages, is connected as a grounded-emitter amplifier with voltage gain determined by emitter degeneration. The smallest input anticipated at the high level jacks is 0.1 volt, and a 1-volt output of the control unit is sufficient to drive most power amplifiers to full output, so that an over-all voltage gain of 10 will satisfy the needs of the high-level portion. If each of the emitter followers has an over-all gain of 0.95, the gain of the Q_4 stage must be 12. Making the assumption of 50,000-ohm loading by the subsequent stages, and using exactly the technique described for the Q_1 stage and an operating point of:

$$V_{ce} = 11.5 \text{ vdc.}$$
$$I_c = 0.7 \text{ ma.}$$

the result is a gain of 12.5 for a load resistor of 22,000 ohms and an unbypassed emitter resistance of 1500 ohms.

The output of the fourth stage drives the loudness control R_{25} which, despite its simplicity, will approximate the Fletcher-Munsen loudness contours reasonaly closely from the 0 db to the −35 db curves. The output of this control is connected to the fifth transistor, which is an emitter-follower circuit identical to the third stage. The output of Q_5 drives the balance control, R_{31}, and the separation control, R_{33}. The balance circuit is capable of an infinite range of attenuation, but the important range near balance is spread out so that it occupies a large portion of the range of rotation of the control. With this arrangement the balance can be adjusted very finely for nearly equal signals, or one channel can be eliminated from the output completely, by a 150-deg. rotation of the control. The separation control is likewise nonlinear in operation, making only about 6 db of variation in the separation through the first 100 deg. of rotation, and then decreasing the separation rapidly to zero at full rotation.

The output impedance of the control unit is about 20,000 ohms as a conse-

(*Continued on page 82*)

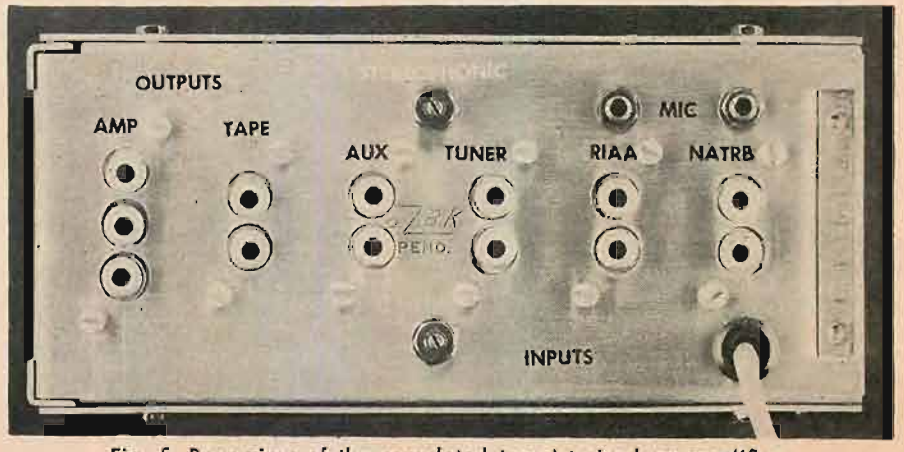

Fig. 5. Rear view of the completed transistorized preamplifier.

Audio Engineering Society

TWELFTH ANNUAL CONVENTION

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

Tuesday, October 11

9:30 a.m. PSYCHOACOUSTICAL ENGINEERING.

Harold L. Barney, Bell Telephone Laboratories, Chairman.

What is Psychoacoustics?
Gerard G. Harris, Bell Telephone Laboratories.

Sound-Induced Analgesia
Wallace J. Gardner, Cambridge, Mass., and J. C. R. Licklider and A. Z. Weisz, of Bolt, Beranek, and Newman.

Psychoacoustics of Stereophonic Reproduction
R. L. Hanson, Bell Telephone Laboratories.

Listening Test Methods and Evaluation
F. A. Olson and K. Schjonneberg, General Electric Co.

Effect of System Parameters on the Stereophonic Effect
Harwood B. Moore, General Electric Co.

Distortion of Auditory Perspective Produced by Interchannel Mixing at High and Low Audio Frequencies
Donald S. McCoy, RCA Laboratories.

Subjective Evaluation of Factors Affecting Two-Channel Stereophony
F. K. Harvey and M. R. Schroeder, Bell Telephone Laboratories.

1:30 p.m. SPEECH ANALYSIS, SYNTHESIS, AND COMPRESSION.

James L. Flanagan, Bell Telephone Laboratories, Chairman.

Some Problems in Remaking Speech
Franklin S. Cooper, Haskins Laboratories.

Synthesis by Analogs and Articulatory Coding
George Rosen, Massachusetts Institute of Technology.

Correlation Techniques for Speech Bandwidth Compression
M. R. Schroeder, Bell Telephone Laboratories.

Digital Data Processing for Voice Communication
Caldwell P. Smith, Air Force Research Div.

A Spectrographic Study of Formant Transition
S. Joseph Campanella, Melpar, Inc.

Speech Compression by Analysis-Synthesis
F. H. Slaymaker and R. A. Houde, Stromberg-Carlson Co.

7:30 p.m. MUSIC AND ELECTRONICS.

Daniel W. Martin, The Baldwin Piano Company, Chairman.

European Electronic Music Instrument Design
Harold Bode, The Wurlitzer Company.

Relationships Between Electronic Organ Timbre and Sound Spectra
Earle L. Kent, C. G. Conn, Ltd.

Electronic Production of Percussive Sounds
Herb Hearne and Marvin Korinke, The Wurlitzer Company.

Electrical Action for Pipe Organs
Albert R. Rienstra, Morristown, N. J.

Electronic Production of Choral Tone
William C. Wayne, Jr., The Baldwin Piano Company.

A New Tool for the Exploration of Unknown Electronic Music Instrument Performances
Harold Bode, The Wurlitzer Company.

Wednesday, October 12

9:00 a.m. SPEECH INPUT COMPONENTS AND SYSTEMS.

John Bourcier, American Broadcasting Company, Chairman.

The Reduction of Wind Noise in Microphones
L. R. Burroughs, Electro-Voice, Inc.

A Microphone with an Elastic Cable
Russel J. Tinkham, Vega Electronics Corporation.

Use of Polyester Films in Microphone Designs
Alex Badmaieff, Altec Lansing Corp.

Personal Microphones
H. F. Olson, J. Preston, and J. C. Bleazey, RCA Laboratories.

Small Unidirectional Dynamic Probe Microphone
Ernest Seeler, Shure Brothers.

High Quality, High Reliability Amplifiers
James J. Noble, Altec Lansing Corp.

The Integrated Use of Miniature RF Microphones in TV Studio Production Versus Prerecording
Willard C. Merrill, Port-O-Vox Corp.

Design of an Audio Delay Line for Compatible Stereo Broadcasting
Raymond E. Lafferty, Boonton Electronics Corp.

Audio Transmission over Leased Line Facilities
John W. Hudson, Chesapeake and Potomac Telephone Co. of Va.

1:30 p.m. LOUDSPEAKERS.

John Preston, RCA Laboratories, Chairman.

Compact Arrays of High Power Horn Drivers for Generating Intense Sound Fields
Sidney E. Levy and Richard W. Carlisle, University Loudspeakers.

Minimizing Interference Effects in Tweeters and Tweeter-Woofer Combinations
Joel Julie, University Loudspeakers.

The Fundamentals of Loudspeaker Design
F. H. Slaymaker, Stromberg-Carlson Co.

Production Development of a Miniature Speaker
R. E. Hamson, RCA Victor Home Instruments.

Amplitude Control of Loudspeaker Cone Motion in the Resonance-Frequency Range
W. C. Trautman, Liberty Manufacturing Corp.

Analysis of the Effects of Nonlinear Elements upon the Performance of a Back Enclosed Direct Radiator Loudspeaker
Harry F. Olson, RCA Laboratories.

Isolation Network for Combined Bass Stereo Reproducers
J. F. Novak, Jensen Manufacturing Company.

The Bi-Phonic Coupler
Abraham B. Cohen, Advanced Acoustics Corp.

7:30 p.m. AMPLIFIERS.

Victor Brociner, University Loudspeakers, Chairman.

The Design of Low-Noise Transistor Audio Amplifiers
James W. Halligan, Philco Corp.

Class B Power Amplifier Performance with Silicon Transistors
D. V. Jones, General Electric Company.

A High Power Stereo OTL Amplifier
Julius Futterman, Harvard Electronics.

Design Considerations of Transistorized Portable Public Address Systems
Joel Julie, University Loudspeakers.

A Transistorized Stereo Amplifier
W. S. Barden and C. F. Wheatley, RCA Semi-conductor and Materials Division.

A High-Sensitivity Power Pentode Using the Shadow-Grid Technique
J. W. Troutwein and C. D. McCool, General Electric Company.

Audio Frequency Magnetic Amplifier
D. F. Marcks and R. M. Bergslien, Lumen, Inc.

Thursday, October 13

9:00 a.m. DISC RECORDING AND REPRODUCING.

Benjamin B. Bauer, CBS Laboratories, Chairman.

Photomicrograph of Record Groove Profiles
John H. McConnel, Electro-Sonic Laboratories.

Mechanical Impedance at the Stylus and the Design of Stereo Phonograph Cartridges
Norman H. Dieter, Sonotone Corp.

The Quest for an Ultralightweight Phonograph Pickup
F. V. Hunt, Harvard University.

Reproduction Distortion—Its Measurement and Influence on Stereo Phonograph Cartridge Design
Philip Kantrowitz, Sonotone Corp.

New Approach to Tone Arm Design
George Alexandrovich, Fairchild Recording Equipment Corp.

Design of a Stereophonic Pickup Cartridge
G. A. Morrell, Jr., Astatic Corp.

Some Aspects of Wear and Calibration of Test Records
Roger Anderson, Shure Brothers.

A Versatile Phonograph Pickup
George Grover, Electro-Voice, Inc.

1:30p.m. MAGNETIC TAPE RECORDING AND REPRODUCING.

Walter H. Erickson, Chairman.

Tape Talking Book System for the Blind
Alfred Korb, Library of Congress.

Tape Recorder Designed for the Blind
Herman Levin, Cook Research Laboratories.

Tape Duplicating Systems for Talking Book Program
Sidney Himmelstein, Cook Electric Co.

The Characteristics of High-Sensitivity Magnetic Tape Coatings
Edward Schmidt, Reeves Soundcraft Corp.

A Miniature Combination Record, Reproduce, and Erase Head for 8-mm Magnetic Sound-on-Film Systems
M. S. Shatavsky, Sonotone Corp.

Visible Magnetic Recordings
W. P. Guckenburg and C. D. Mee, CBS Laboratories.

A Modern Acoustic Missile Launch Location System, The AN/TNS-5
R. M. Carrell, RCA.

The Effect of Bias Amplitude on Response at Very Short Wavelengths
John G. McKnight, Ampex Professional Products.

The Design of A Portable Professional Recorder
George Rehklau and Charles A. Wilkins, Ampex Professional Products.

(Continued on page 68)

A Dictionary of Modern Engineering Usages

DANIEL R. BUTTERLY*

Even in these stubbornly serious pages there exists an occasional opportunity for a laugh or two, or maybe only a little chuckle. We enjoyed it, and we hope you will too.

USAGE AND LOGIC are old sparring partners, which, like Heredity and Environment, have the peculiar power to force all people into rigorous partisanship; the possibility that both could jointly influence the fate of a word is universally intolerable. We ourselves take the middle view that both exert influence, but observe that usage progresses faster than logic, and that in a rapidly changing world it holds the upper hand.

In the interest of greater clarity in engineering reports, technical manuals and sales brochures, we have compiled a little lexicon of recently acquired terms, which we feel will be of value to the more discriminating engineers and writers throughout the field.

AUTOMATION: Automatization. It's all in knowing when to add syllables and when to drop them. The *-ize* that was dropped here has been added to *final-* (which see).

CONCEPT: This has replaced the more commonplace word *idea*, through its power to suggest *idea* on a higher psychological level.

CONFIGURATION: An amount; e.g., 3. In Personnel, a salary. So, *configuration image*, salary expected.

COMPLEX, MISSILE LAUNCHING: A missile launching complex is a means of launching missiles, not a compulsion to do so.

COMPONENT: adj., as in *component part*. A component part differs from an ordinary part in the sense that it is part of a whole consisting of other parts, or other component parts, that is, it is part of a component whole; or, that is—oh the hell with it!

COUNTDOWN: The act of counting up.

DRAMATIC: Applicable to anything, but most commonly to prices. *Don't miss these dramatic values*, etc. This is wrong. Prices are often comic, more often tragic, but they are never dramatic. The term is best restricted to particular components, as in a recent advertisement of hi-fi equipment: *a new electronic tuning bar is dramatically framed in the massive body of the tuning escutcheon.*

FACILITY: More elegant than setup. The rule is to use the more abstract term where there is a choice. Thus, production *facility*, not production setup; medical *facility*, not medical room. Likewise, mathematical *discipline*, not branch of mathematics.

FEASIBLE: Literal: able to be feased; free: having the approval of the chief engineer.

FINALIZE: It's *finalized* means it isn't finished but the hell with it. *Finalize* takes *up*. (*Finalized up* is not exactly synonymous with *fouled up*, but in most applications the distinction may be neglected.)

GEOMETRITION: Distinct from ordinary geometry only with respect to terms. *Triangle* becomes *triangulation*, *circle* becomes *circulation*, *convex* becomes *convexation*. Likewise, *algebrettist*, *calculization*, *triggernomenclature*, *arithmetabolism*, etc.

HI-FI: Having the capacity to emit sound.

INITIALIZE: To start thinking about. *Initialize* takes *out*; *finalize* takes *up*. Example: The project must be finalized up research-wise before it can be initialized out production-wise. Translation: We must finish the research before we can start production.

MEANINGFUL: Not a very meaningful word, especially in such applications as *meaningful life tests*. A life test has no deeper significance; it merely tells how long it takes for something to blow up.

MODERATOR: In a panel discussion, or stuttering bee, one whose function it is to see that the argument doesn't reach a conclusion.

MOMENTARILY: When a radio announcer says *I'll be back momentarily*, don't let your hopes soar; he means *in* a moment, not the conventional *for* a moment. He may be back *in* a moment and talk *for* an hour, and still be within the nunciatorial usage of the word.

NOTATION: The word originally meant a system of notes, as in *music notation*, *color notation*, etc., but now means *note*. If things go right we may be able to say *notationize* instead of the verb *to note*.

OBSOLETIZED: Preferred to *obsoletated*. The simple form *obsoleted* has been obsoletized.

OPTIMIZATION: Finding the hardest way to do something. So, *optimiz- er, or;* not *optimist*, *optometrist*, or *opportunist*.

PERSUASION: More elegant than *belief* or *profession;* preferred whether one has been persuaded to his profession or just drifted into it against his better judgment. Thus: *His background is of an electronics persuasion.* But, *The draperies were of a blue-green persuasion*, is overdoing it.

PHASE IN: In Engineering Personnel, to hire. Example: *We are not phasing in any electronic engineers at the moment.* So, *phase out*, to fire. Since a hiree and a firee are 180 deg. apart, one's employment status can be considered as a function of his phase angle and may be expressed in radians.

PICTURE, STORY, SCENE, THEATRE, AREA, ARENA, CLIMATE: They mean the same thing, so must not be confused. No rule can be established; a reference table of usages is here supplied: weather *picture*, weather *story*, but not weather *scene*, and certainly not weather *climate;* industrial *scene*, industrial *picture;* political *climate*, *scene*, *arena;* war *theatre*, *arena;* cultural *area*, *scene*, *climate;* American *Scene*, Philadelphia *Story*, European *Theatre*, etc.

PHILOSOPHY: The word is rapidly replacing *statement*, and *idea;* it is more elegant and has two more syllables. Examples: *computer philosophy*, *sales philosophy*, *go no-go philosophies;* but *sales metaphysic* is not used by the discriminating.

PROGRAMMING: In radio broadcasting, a program is for people who wear suits and shirts; a programming is for people who wear suitings and shirtings.

ROADABLE: Attaching the suffix *-able* to a noun as well as to a verb is a charming innovation, but *roadizable* would be more consonant with the best engineering usage, and would have the advantage of an additional syllable.

TYPE: A word used to bridge the gap between an adjective and a noun. Its omission denotes unfamiliarity with engineering practice. Examples: paper *type* capacitor, Hartley *type* oscillator, chicken *type* checker, striped *type* pajamas, filter *type* pipe, movable *type* type, etc. However, by pushing the noun and the adjective closer together the problem can be alleviated: paper capacitor, Hartley oscillator, etc.

TOTALIZE: It doesn't mean the same as *add*. In addition, we get a sum; in totalization, we get a total.

Example:

addition:		totalization:	
	2		2
	2		2
	4 sum		5 total

So, *totaliz- er, or;* not *totalitarian*.

-WISE: May mean *like*, *ways*, or *with respect to*, depending on which it means. In *clockwise* it means *like*, in *otherwise* it means *ways*, in *money-wise* it means *with respect to*. May be used with or without a hyphen or a space, depending on how it is used. May be used after a noun, verb, adjective or other adverb, indiscriminately. A valuable word because of its extreme flexibility. May not be used in AUDIO in any editorial matter whatsoever—only in the advertisements, over which the editors have no control as to good English usage. Æ

* *Chief Usologist, 114-104 227 St., Cambria Heights, N. Y.*

Checking Other Aspects of Performance

Correct recording bias is a key to maximum treble response at minimum distortion. Equally, a key to achieving the best performance of your tape machine is an understanding of the how and what-to-do of tape speed variation. This article covers these topics—and much more.

HERMAN BURSTEIN*

THE PRECEDING ARTICLE discussed techniques of measuring frequency response, equalization, and azimuth. The present article is devoted to techniques of measuring other important aspects of tape machine performance.

Bias Current

It is vital that bias current be set at the correct value in order to achieve the best practical compromise between extended treble response and low distortion, a compromise that varies with tape speed.

The method employed to check record equalization, shown in *Fig.* 1, is also frequently used to measure bias current. A 100-ohm resistor inserted in the ground lead of the record head is generally a suitable value for the purpose. If the meter has insufficient sensitivity, it is often feasible to use a 1000-ohm resistor instead. The problem is to ensure that the resistor in series with the head offers negligible resistance to current compared with the impedance of the head. A typical record-playback head, with an inductance of about 0.5 H, has an impedance exceeding 150,000 ohms at the bias frequency, so that the additional impedance presented by a 1000-ohm resistor is then negligible. On the other hand, a head designed only for recording may have an inductance of but a few millihenries, so that an additional impedance of 1000 ohms becomes significant.

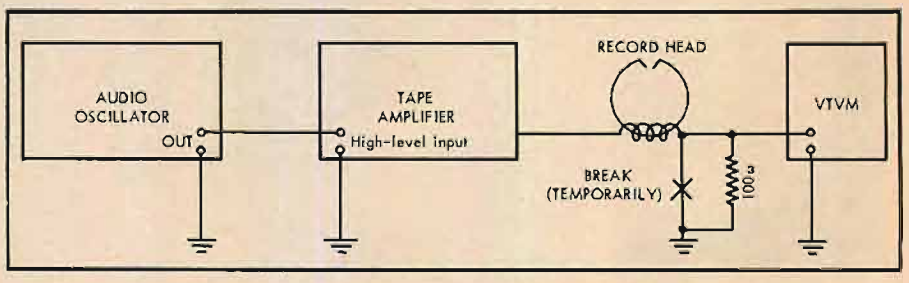

Fig. 1. Setup for measuring bias current.

The resistor in question should of course be accurate, preferably to 1 per cent. Similarly, the meter should be accurate. Current is calculated by means of Ohm's Law, namely $I = E/R$, where I is current in amperes, E is voltage in volts, and R is resistance in ohms. For example, if one measures 70 millivolts (.07 volt) across a 100-ohm resistor, then $I = .07/100 = 0.7$ ma (milliamperes). It happens that a bias current of 0.7 ma is typical of a number of machines in home use. However, the required value, depending upon the head, can deviate a good deal from this. Hence the optimum value should be obtained from the manufacturer of the tape recorder, or possibly from the manufacturer of the head if the two are not the same. Moreover, one should obtain the optimum value for the speed at which one plans to do the most recording, inasmuch as the optimum value is different at the various machine speeds. To illustrate, at 7.5 ips the optimum value may be 0.7 ma, whereas it may be 0.6 ma at 3.75 ips.

As components in the bias oscillator circuit warm up, they tend to change value somewhat, and the frequency and magnitude of the bias current tend to change accordingly. Thus it is desirable to measure and adjust bias current only after the tape recorder has warmed up for a period, say for 15 or 20 minutes. (In use, it is similarly desirable to provide a warmup period before making a recording.)

Another technique for adjusting bias current involves measuring the change in recorded signal amplitude as the bias is varied. While this method can be used with machines having a combination record-playback head, it is such a tedious procedure that it is primarily recommended for machines with separate re-

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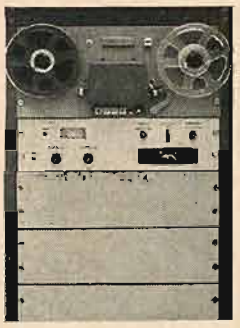

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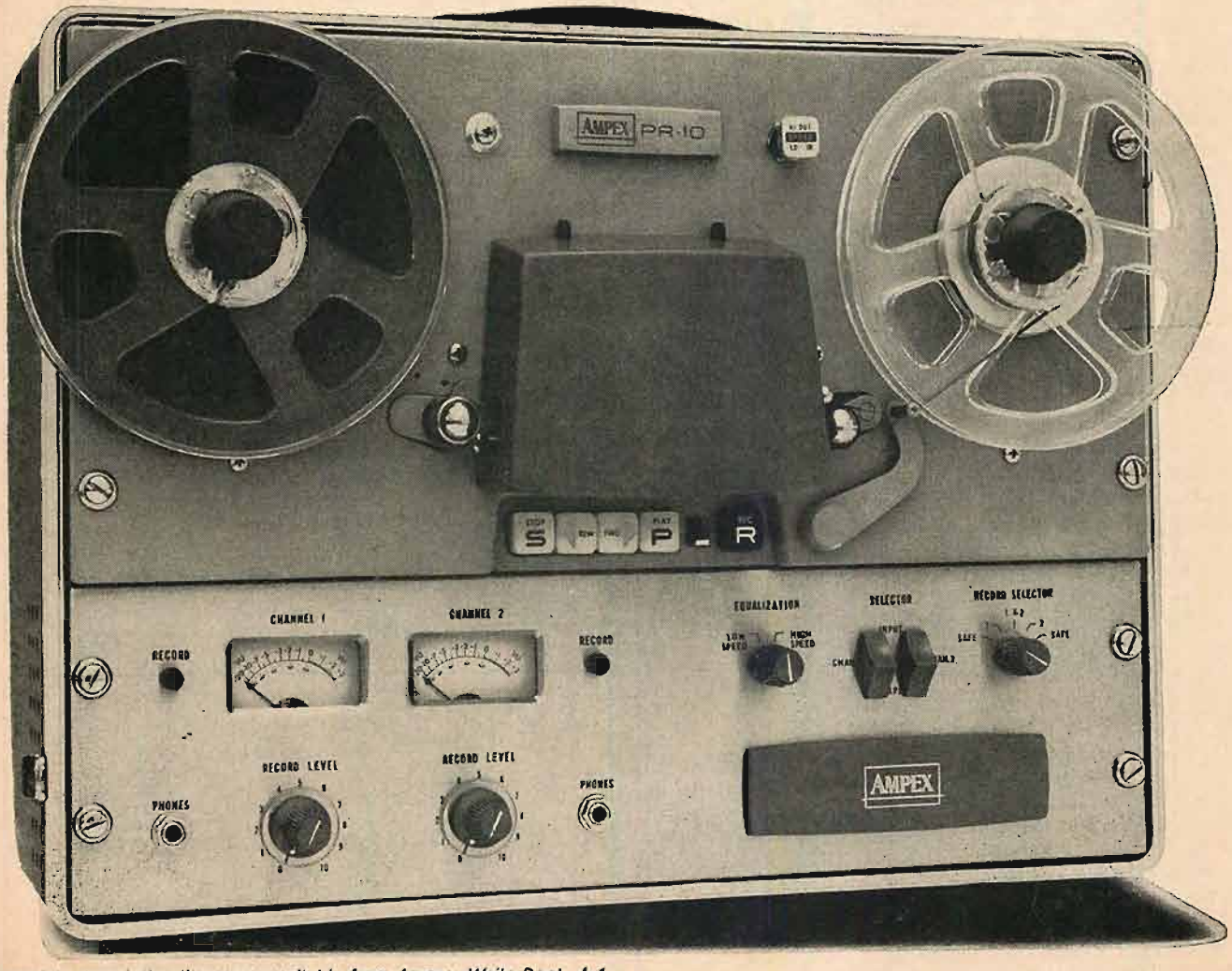

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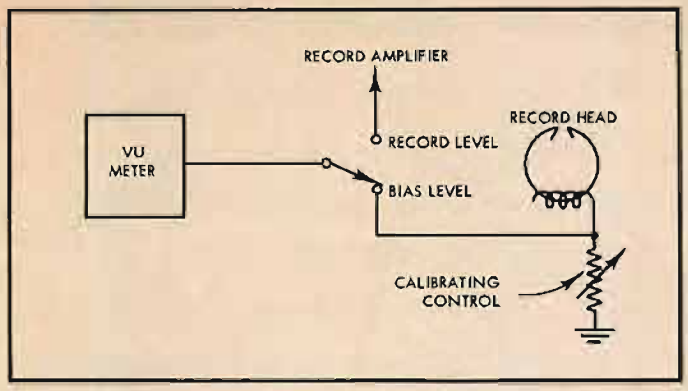

Fig. 2. Checking bias current with a VU meter.

cord and playback heads. At a given frequency, usually 1000 cps, bias current is adjusted until maximum signal amplitude is recorded on the tape. This is determined by measuring the playback signal. The gain controls of the record and playback tape amplifiers are not varied during this procedure.

It is often recommended that instead of adjusting bias current for peak output, one should set it at about "0.5 db above peak." This means *increasing* bias current until the signal amplitude (1000 cps) drops 0.5 db. Note carefully that it is the signal amplitude which is to drop 0.5 db, not the bias current. At this point slight changes in bias current, upward or downward, have a minimum effect on distortion and frequency response. An authority has stated: "For optimum results in recorders with wide frequency range at low tape speeds, it seems desirable to set bias at not under 0.5 db above peak. . . . This offers close to optimum distortion characteristics, while producing minimum change of relative response with bias change."[1]

Still another technique for gauging and adjusting bias current relies upon an instrument for measuring distortion, either intermodulation or harmonic distortion. First record at a relatively high level so that variations in distortion due to bias current changes may be readily perceived. Next adjust bias for minimum distortion. Then high-frequency record-playback response is checked at a much lower recording level, at least 20 db below maximum permissible level. Bias is reduced until treble response is considered adequate. Satisfactory treble response also entails adjustment of the amount of treble boost used in recording, assuming that the record amplifier contains a control for varying the treble boost. It is not advisable to go much above 20 db treble boost at 15,000 cps, for this raises the danger of overloading the tape at high frequencies on program material.

At a tape speed of 15 ips, it will probably be found that the bias corresponding to minimum distortion also permits response substantially flat to 15,000 cps without undue treble boost in recording. But at 7.5 ips and lower speeds, it will be found that, in order to obtain satisfactory high-frequency response, it is necessary to reduce bias current below the quantity corresponding to minimum distortion. It is then necessary to ask oneself whether and to what extent it is worth achieving extended treble response at a cost of increased distortion. Through trial and error, one can arrive at the point which carries flat response a fairly long way, say to 10,000 or 12,000 cps at 7.5 ips, without an undue increase in distortion. But trying to reach "all the way out," namely to 15,000 cps, may cause an increase in distortion disproportionate to the added realism of reproduction achieved by extending flat response from 12,000 cps out to 15,000 cps.

It is necessary to take into account that the amount of bias current suitable for one brand of tape may not be the optimum for another brand. To illustrate the point, following are the results of a test conducted to determine the amounts of bias current producing minimum distortion for four brands of conventional tape. Using Tape A as a reference, bias current for minimum distortion was 0 db for Tape A, +0.75 db for Tape B, −0.50 db for Tape C, and 0 db for Tape D. While the differences in bias current, expressed in decibels, appear small, nevertheless they are great enough to have appreciable effect upon distortion and upon frequency response above 10,000 cps. Accordingly, it is desirable to adjust bias current on the basis of the brand of tape one plans to use for most recording purposes.

The individual seeking maximum performance from his tape machine will wish to check bias current periodically because its magnitude may change as the result of aging of the oscillator tube and of other components in the oscillator circuit. Relatively slight changes in bias current can produce relatively large changes in distortion and frequency response. In tape recorders of professional and semi-professional quality, it is usually the practice to incorporate a switching arrangement that permits the VU meter to check the bias current. The meter does not provide an absolute reading but does indicate in relative terms whether bias current is at correct level. As shown in *Fig.* 2, a calibrating control is incorporated to cause the meter to read 0 VU (or some other designated figure) when bias is correct.

Bias Waveform

It is important to check not only the magnitude of the bias current but also its waveform. Obvious distortion can readily be detected by connecting an oscilloscope across the record head. Harmonic distortion in excess of 5 per cent is apparent to the eye. Ideally, the bias waveform should be a perfect sine wave. If harmonics of the bias frequency are also present, they will produce noise in recording. Therefore some tape machines include a control for balancing the oscillator tube to achieve minimum distortion, as shown in *Fig.* 3. This adjustment can be performed by ear on a machine having separate record and playback heads. With no audio signal fed in, one simultaneously "records" and plays back a blank tape, meanwhile adjusting the balance control for minimum noise. It is advisable to use a test tape that has been thoroughly erased by means of a bulk eraser, so that noise due to the bias current waveform will be readily apparent and not masked by tape noises.

Bias Frequency

If for any reason the bias frequency should change radically, there will tend to be the following deleterious effects: (1) If the frequency is too low, there

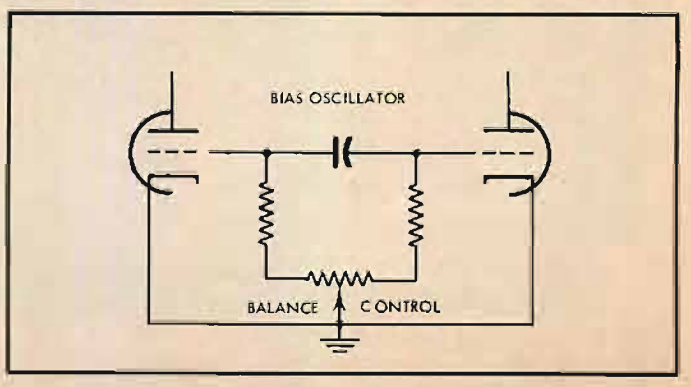

Fig. 3. Oscillator circuit incorporating a balance control for minimizing noise.

[1] C. J. LeBel, "More on recorder bias," *Audio Record*, March–April 1956, p. 7 (formerly published by Audio Devices, Inc., New York City).

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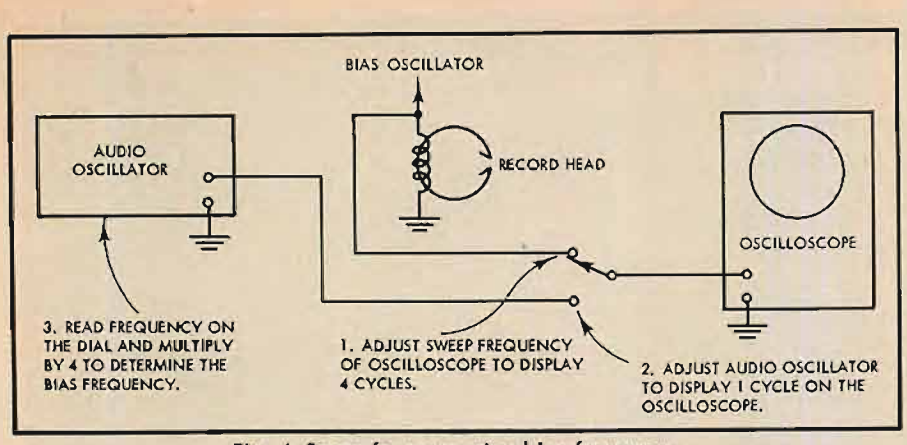


Fig. 4. Setup for measuring bias frequency.

will tend to be audible beat notes between the bias frequency and the harmonics of the higher audio frequencies; the bias frequency should be at least four to five times the fundamental of the highest audio frequency to be reproduced. (2) If the bias frequency is too high, the effectiveness of the erase head (which is supplied current by the same oscillator that feeds the record head) is usually diminished. Thus in rerecording a tape, one may hear some of the first recording, particularly the lower frequencies, coming through the second recording. (3) With a change in frequency, there may be a change in the amount of bias current reaching the record head; an increase in current will reduce distortion and restrict high-frequency response; a decrease in current will increase distortion and extend high-frequency response, possibly producing an undesirable peak.

An audio oscillator and an oscilloscope may be used to check the bias frequency, as illustrated in *Fig.* 4. Connect the oscilloscope to the record head and obtain a display of four cycles. Then connect the oscilloscope to the audio oscillator and adjust the latter's frequency until one cycle appears on the oscilloscope. The frequency indicated by the dial of the oscillator is one-fourth of the bias frequency. If the audio oscillator goes to 100,000 cps, then one may adjust the oscilloscope for a reading of one cycle when connected to either the record head or the oscillator. The accuracy of the method described depends upon how precisely the oscillator is calibrated. However, a slight error is unimportant, and almost any audio oscillator will be sufficiently accurate for the purpose.

Distortion

Whereas such audio components as control amplifiers, power amplifiers, and tuners are commonly checked for intermodulation distortion as well as harmonic distortion, the general practice is to test tape recorders only for harmonic distortion, although an IM test is usually quite revealing.

Figure 5 shows the setup for checking total harmonic distortion (THD) of a tape machine having separate record and playback heads. A signal from an audio oscillator is fed into the tape recorder, and the output of the latter is measured by a harmonic distortion meter. The procedure is essentially the same in the case of a machine that uses a single head for both record and playback, except for the fact that the recording of the test signal and its measurement take place at different points of time; after recording the test signal it is necessary to rewind the tape and play back the signal into the distortion meter.

The test frequency is usually 400 cps or thereabout for a variety of reasons. (1) Peak audio energy of most sound sources occurs in the neighborhood of 400 cps. Hence, at a given recording level, a test in this region is indicative of the maximum distortion likely to occur. (2) It is desirable to use a relatively low frequency in order to be able to record on the tape a large number of the harmonics due to distortion. Thus if the test frequency were, say, 5000 cps, and if the tape machine had a range extending to 15,000 cps, only the second and third harmonics could appear.

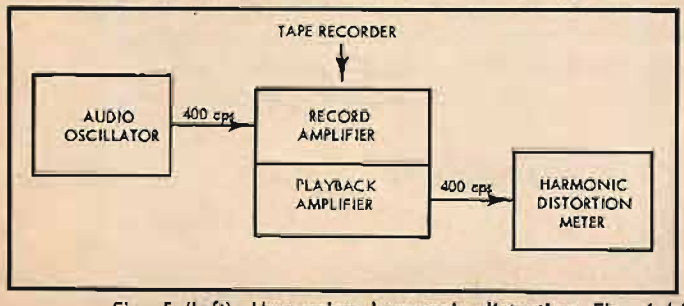
Testing harmonic distortion at the higher frequencies—above 5000 cps or so—is not apt to be very meaningful. On the one hand, the pronounced treble boost in the record amplifier tends to exaggerate high-frequency distortion. In recording natural sound sources, this high-frequency emphasis tends to be offset by a decline in audio energy of the source; but there is no such offset when dealing with a test signal. On the other hand, to the extent that the tape recorder has limited high-frequency response, say to 15,000 cps with a very sharp decline thereafter, harmonic distortion shows up only to a slight extent if at all. One can easily establish this fact by recording a high frequency such as 10,000 cps at a very high level at 7.5 ips and viewing the playback waveform on an oscilloscope. Since the harmonics are beyond the reproducing ability of the tape recorder, the playback waveform will appear as an undistorted sine wave no matter how high the recording level.

The fact that distortion in the high frequency range fails to show up on a harmonic distortion test does not mean there is no problem here. Overloading at high frequencies can create havoc in terms of intermodulation distortion. To illustrate, a 10,000-cps note and a 12,000-cps one, if over-recorded, may intermodulate to produce spurious distortion products that are audible.

Measurement of intermodulation distortion offers a much more sensitive test of the performance of a tape recorder. At a recording level where a harmonic distortion test may reveal only 2 or 3 per cent THD, the IM test may reveal 10 per cent, 20 per cent, or even more IM distortion. *Figure* 6 shows the setup for checking IM distortion, requiring only the use of an IM analyzer; this assumes that the IM analyzer supplies the frequencies, usually about 60 cps and 6000 cps, needed for the test.

Record Level Indicator

The test of distortion must have reference to the recording level as indicated by the record-level indicator. If the indicator is of the magic eye type, maximum permissible recording level corresponds (or should correspond) to eye closure, that is, minimum fluorescent shadow. If the indicator is of the neon lamp type, maximum level is denoted by ignition of the lamp. If the indicator is a VU meter,



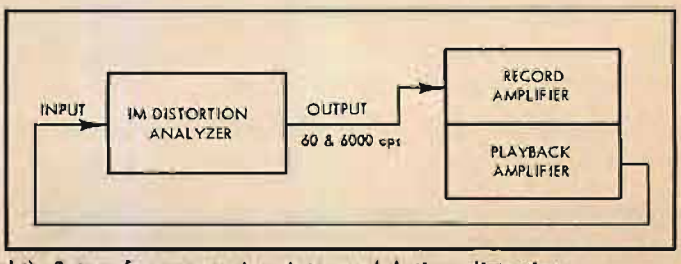


Fig. 5 (left). Measuring harmonic distortion. Fig. 6 (right). Setup for measuring intermodulation distortion.

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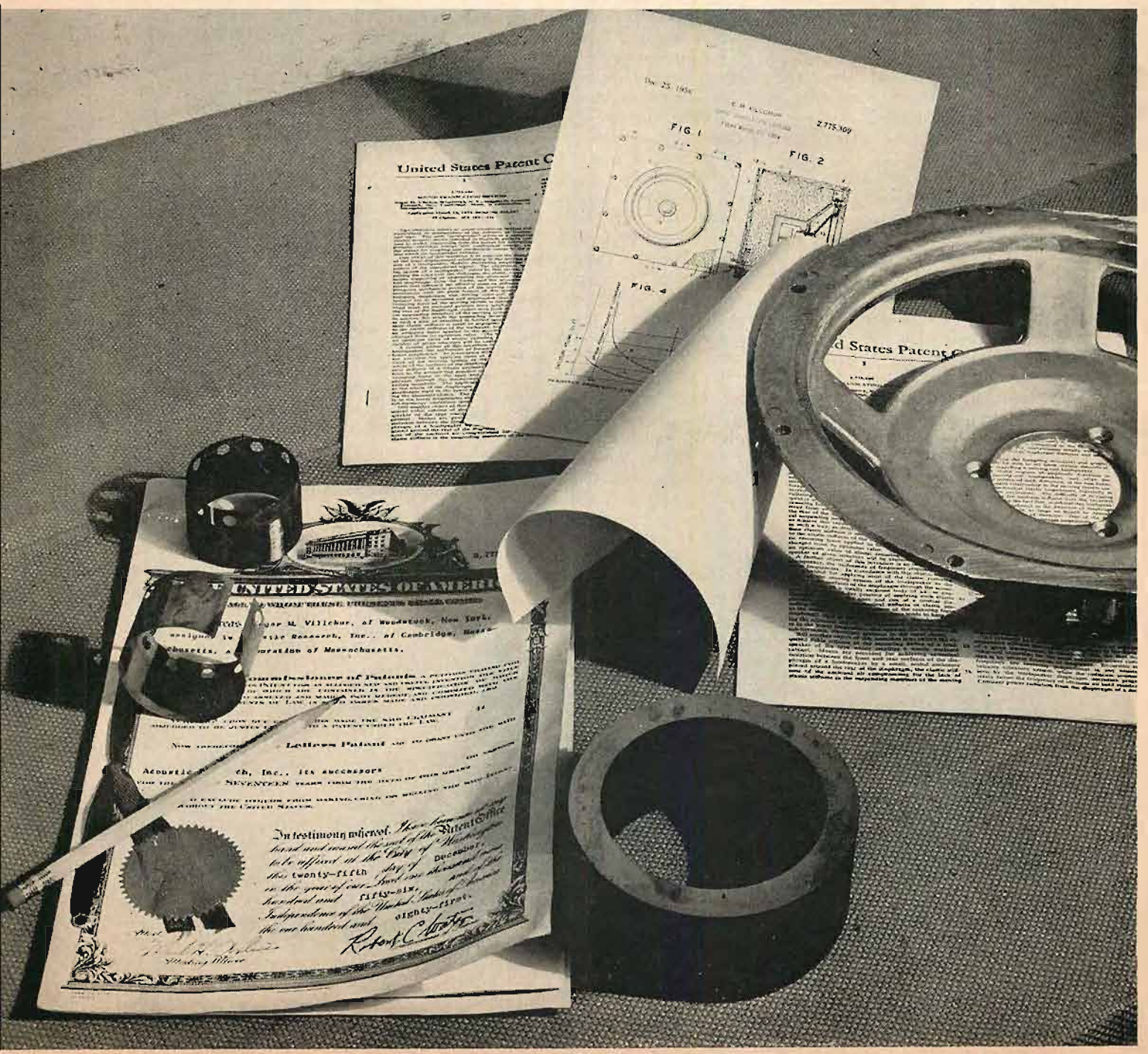


maximum recording level is generally 6 to 8 db above the 0-VU reading. For example, in the case of a number of professional tape recorders, when the meter reads 0 VU on a steady signal this is intended to correspond to a recording level that produces 1 per cent total harmonic distortion. The level that produces 3 per cent THD is about 6 db above 0 VU. If the recording level that produces 3 per cent THD is considered to be the maximum permissible amount, then there is a 6 db allowance for the mechanical lag of the VU meter. Thus to measure distortion at maximum permissible recording level, the input signal should be 6 db higher than that required to drive the meter to 0 VU.

One can obtain test tapes containing a signal recorded at a level producing a stated amount of harmonic distortion. Thus Ampex produces a test tape with a 250-cps tone recorded at a level resulting in 1 per cent harmonic distortion. Dubbings Sales Corp. in the past produced a tape with a 400-cps tone recorded at a 2 per cent harmonic distortion level; although not presently in production, it may still be available from some mail order houses and other distributors of audio supplies.

Such tapes can be used to check the calibration of the record-level indicator with reasonable accuracy. To illustrate, assume the use of the Ampex test tape. Play the tape and measure the level of the output signal. Using an audio oscillator or test record, record the same frequency (250 cps) or a nearby one on another tape and adjust the recording level until the same playback level is obtained as with the test tape. Then one is recording at a level producing approximately 1 per cent harmonic distortion, assuming bias current is at "normal" value.

If the tape recorder is rated on the basis of 3 per cent harmonic distortion, the input signal can be raised about 6 db to obtain an increase from 1 to 3 per cent harmonic distortion. At this point the magic eye indicator should close or the neon lamp should ignite. In the case of the VU meter, the 0 VU indication should have been reached at the 1 per cent harmonic distortion level or earlier.

If the tape recorder is rated on the basis of 2 per cent harmonic distortion, the input signal can be raised about 3 db to obtain an increase from 1 to 3 per cent harmonic distortion.

Of course, the more direct method of checking calibration of the record level indicator is to measure distortion at the point where the magic eye closes or the neon lamp ignites or the VU meter reads 0 VU.

Signal-To-Noise Ratio

Signal-to-noise ratio is measured on the basis of maximum permissible recording level, namely that which produces 1, 2, or 3 per cent harmonic distortion. Assuming that 3 per cent harmonic distortion is considered acceptable, as is commonly done, and that the record-level indicator is correspondingly calibrated, the procedure for measuring signal-to-noise ratio is as follows: A frequency between 250 and 1000 cps —usually 400 cps—is recorded at maximum permissible level. The playback signal level is measured. The tape is rewound and the process repeated, except that this time no audio signal is recorded. Again the playback signal is measured. Now the output is due to noise and hum of the record amplifier and of the playback amplifier (largely the latter in most cases), noise produced on the tape as the result of distortion in the bias-current waveform, tape hiss, and imperfect erasure by the erase head. The ratio of the first playback signal (with an audio input signal) to the second playback signal (without an audio input signal) constitutes the signal-to-noise ratio of the tape recorder. In a high quality machine, the predominant contribution to noise will be tape hiss.

If one is measuring the signal-to-noise ratio of a tape machine designed only for playback and not for recording, the measurement has to be made on the basis of a test tape. As stated before, test tapes are available carrying frequencies recorded at a given level of harmonic distortion. Comparison of the output level when playing the test tape and when playing a blank virgin tape yields the signal-to-noise ratio. If the test signal is at a level corresponding to 1 per cent harmonic distortion, the signal-to-noise ratio at the 2 per cent distortion level can be approximated by adding 3 db; at the 3 per cent distortion level, by adding 6 db.

In a high-quality tape machine the signal-to-noise ratio will range upwards of 50 db, or a voltage ratio exceeding 300:1. Therefore the measuring instrument has to be a vacuum-tube voltmeter of high sensitivity. Typically, the output of a tape machine (before the power output stage, if any) is about 1 volt. Hence if the noise is 50 db lower, the output voltage is only about 3 millivolts. If the machine has a signal-to-noise ratio as high as 55 db, as some do, then, based on a maximum signal output of 1 volt, the noise content will be less then 2 millivolts.

Wow and Flutter

A quantitative measurement of wow and flutter requires equipment unlikely to be in the possession of the home recordist and therefore will not be discussed here. However, a simple and effective test can be made by recording and playing back a tone in the vicinity of 3000 cycles, where the ear is highly sensitive to changes in pitch. The signal source can be an audio oscillator or a phonograph test record. However, inasmuch as the phonograph or the record or both may be a source of wow and flutter, an audio oscillator is the better source. Wow will be apparent as a quavering effect. Flutter will be apparent as graininess or coarseness of the tone.

In the case of tape machines designed for playback only, there are a number of test tapes which can be used for checking wow and flutter by ear. These tapes incorporate a frequency in the range of 2000 to 5000 cps.

Tape Speed

Tape speed may best be measured by means of a tape stroboscope, such as shown in *Fig. 7*, consisting of a wheel that is pressed against the moving tape and therefore moves at the same speed as the tape. The wheel contains a number of bars along its circumference, and these bars are viewed under a 60-cycle light source; for greatest clarity, a neon or fluorescent lamp is desirable, although the ordinary incandescent lamp will do. If tape speed is exactly correct, the bars on the stroboscopic wheel will appear to be standing still. If speed is slow, the

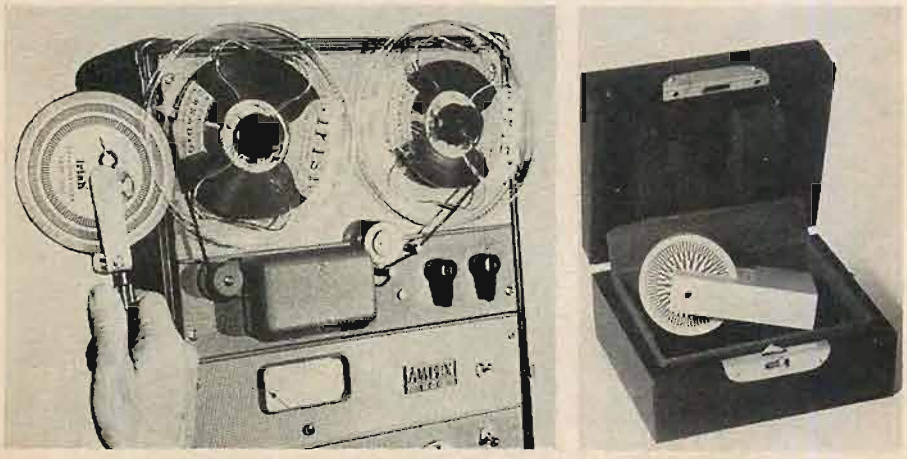
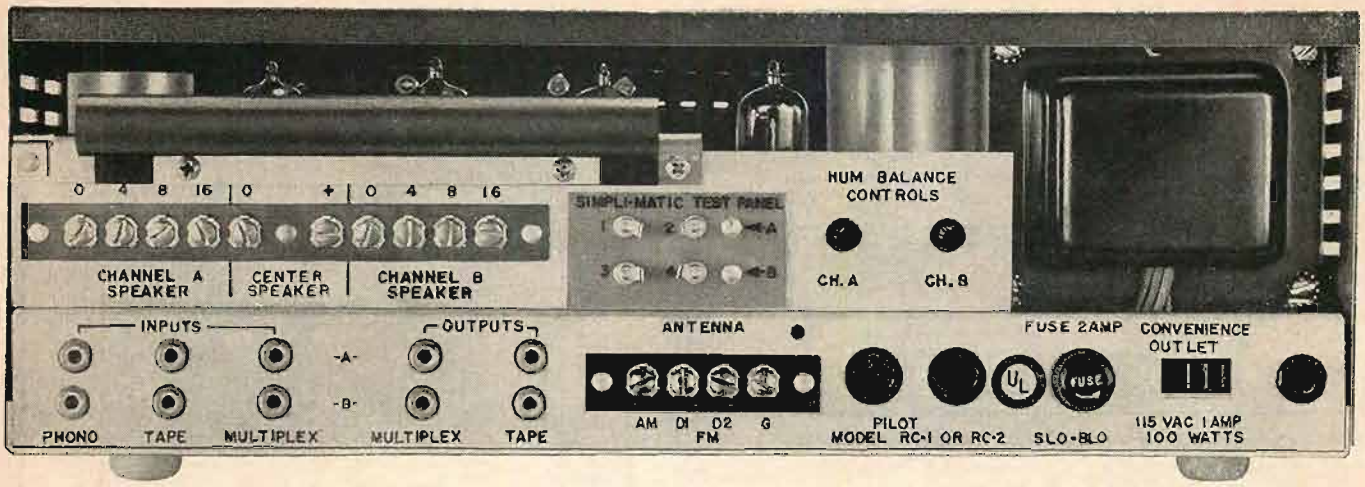


Fig. 7. Two stroboscopes for measuring tape speed.



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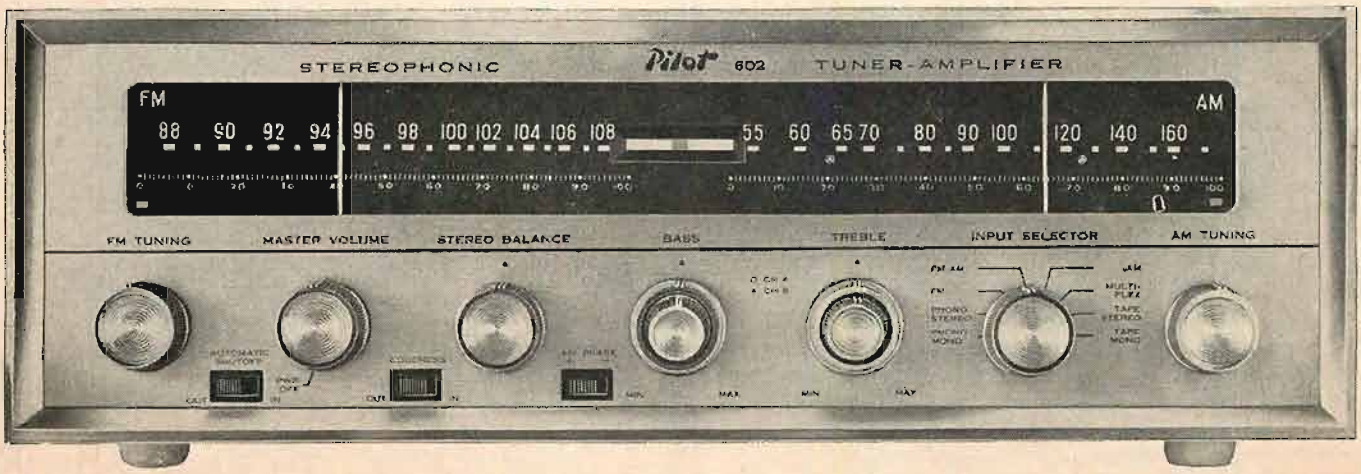

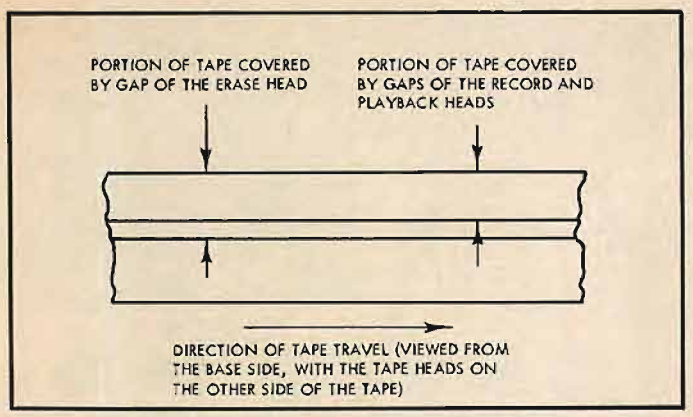

Fig. 8. Portion of the tape spanned by the gaps of half-track heads.

bars will appear to be moving backward, that is, in the direction opposite to tape motion. If speed is fast, the bars will appear to be moving forward, or in the same direction as the tape.

Apparent motion of 72 bars per minute past a given point, say the tip of a pencil, corresponds to a speed error of 1 per cent. Fair to good home machines may be expected to have speed errors not exceeding 2 per cent, namely 144 bars per minute. Good to excellent home machines should have speed errors not exceeding 1 per cent. Machines of semi-professional quality will have speed errors under 0.5 per cent, while professional ones will have speed errors not exceeding 0.2 per cent.

Erasure

The ability of the erase head to perform effectively may be tested by recording program material at a level great enough to produce maximum *permissible* indication on the record-level indicator, putting this tape through the recording process once more but without a signal input, and then playing the tape. A properly operating erase head will leave none of the first signal, at least not enough to be heard even at a high playback level.

However, if the tape has been recorded at excessively high level, one that produces a great deal of distortion, even a very good erase head may not achieve adequate erasure. It may then be necessary to put the tape through the erase procedure twice, or else use a bulk eraser.

Inability of the head to erase a normally recorded tape may be due to the following factors:

1. *Insufficient erase current.* High-frequency current through the erase head can be measured by the same technique that is used to measure bias current through the record head. As was illustrated in *Fig.* 1, a low-value resistor, say 100 ohms, is inserted between the ground lead of the head and ground. Voltage across the resistor is measured, and current is computed by Ohm's Law. The measured voltage divided by the resistor equals the current. Thus if one volt is measured across 100 ohms, current is 1/100 ampere, or 10 milliamperes. Erase heads in many home machines typically use between 10 and 15 milliamperes of current. Some, however, use a good deal more.

2. *Improper vertical positioning of the erase head.* If the gap of the erase head does not fully span the recorded area, because the head is positioned too low or too high, complete erasure cannot take place. One can tell if this is the cause because the signal remaining on the tape will then have full frequency content. But if incomplete erasure is due to other causes, the remaining signal will consist mostly of low frequencies, which are the most difficult to erase.

3. *Improper azimuth alignment of the head.* If the gap departs considerably from correct azimuth, which is a position at right angle to the length of the tape, erasure may be affected. A slight azimuth error, however, will usually have little, if any, effect.

4. *Frequency of the erase current.* As pointed out earlier, the erase head tends to become less effective as the erase current increases in frequency. Means of checking this frequency have already been described.

5. *A defective head.* An erase head with shorted turns will not function properly. The test here consists of head substitution. A head of poor design will give inadequate performance. Here one may try using a different brand of head, assuming it can be mounted on the tape deck. Some manufacturers produce two kinds of erase heads, one with a single gap and the other with two gaps side by side so that the tape is twice exposed to an erasing field in a single pass. Substitution of the two-gap head may achieve the desired improvement.

Head Height

The erase, record, and playback heads must be vertically positioned so that their gaps all span the same portion of the tape, that is, the same track. This is illustrated in *Fig.* 8 for half-track (mono) recording. The same principle applies to two-track and four-track stereo heads.

As pointed out in the preceding section, if the erase head is out of vertical alignment, incomplete erasure results. If the machine has separate record and playback heads, there are two additional problems should these heads be out of vertical alignment with each other: (1) Playback signal will be less than maximum, with consequent deterioration of the signal-to-noise ratio, if the playback gap does not span as much of the recorded track as possible. (2) There may be crosstalk—signal pickup from an adjacent track—because the playback head partially spans or comes too close to an adjacent track.

In the case of half-track heads, visual alignment can often suffice. This means aligning by eye the edge of the tape with the edge of the gap. To maximize the chances of accurate alignment, the position of the tape relative to the head should be that which occurs in the normal "dynamic" state—that is, when the tape is moving past the head. To obtain the dynamic position, place the transport in motion, then shut off the power (if necessary, by removing the power plug from the wall outlet) so that the tape is stationary against the head. If pressure pads are employed, remove the pressure pad holder after shutting off the power. Then visually align the gaps to the tape.

To check the height adjustment of the playback head, one can play back a commercial prerecorded tape and move the head up and down. When the output is maximum, as measured by a VTVM, playback-head vertical alignment is correct. It is advisable to use a test tape with a low-frequency signal, such as 400 cps or less, so that slight changes in azimuth as one moves the head do not appreciably affect the playback level.

If the tape machine uses a separate record head, the latter can be aligned to the playback head by adjusting the record head's height for maximum signal output while simultaneously recording and playing a low-frequency signal. Then the erase head height can be adjusted for maximum erasure.

In the case of stereo heads, involving two gaps one above the other, as shown in *Fig.* 9, vertical positioning is more critical than for half-track heads. Visual alignment is probably a preliminary step, with further steps more or less mandatory. The checks already described can be used. One can further check on the basis of crosstalk. When playing a commercial prerecorded two- or four-track tape containing program material, if the playback head is improperly positioned to the extent that it impinges on an adjacent track, the signal of the adjacent track will come through with full frequency content. If the playback head is incorrectly positioned so that it does not actually span

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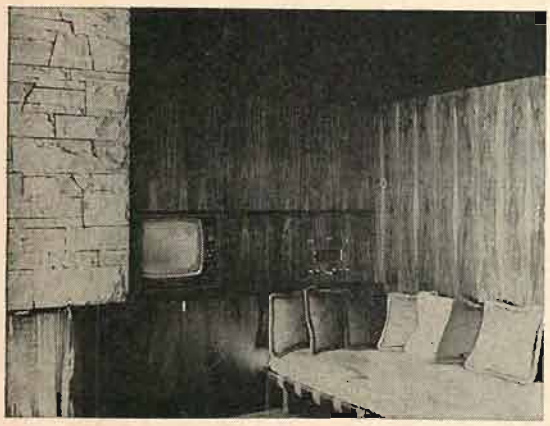

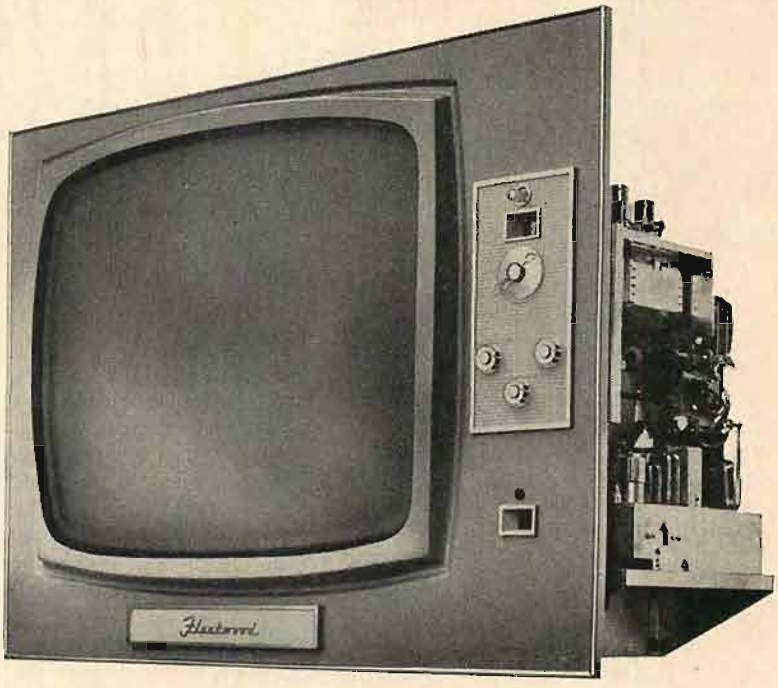

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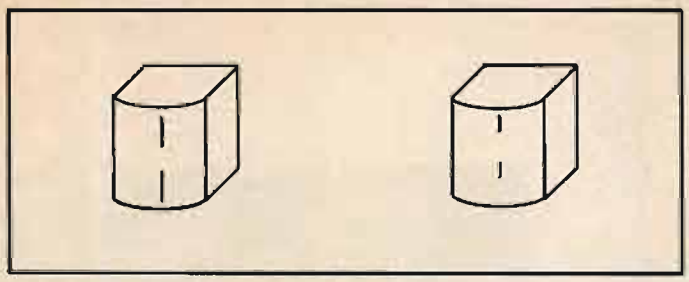


Fig. 9. Gaps of two- and four-track stereo tape heads.

part of an adjacent track but comes very close, then the crosstalk will consist predominantly of low frequencies, which extend beyond the track to a greater extent than the high frequencies. On the other hand, if the crosstalk consists predominantly of high frequencies it results in a tinny sound coming through from the adjacent track. This is indicative of crosstalk within the head, which has nothing to do with vertical position. Such crosstalk is in the nature of transfer of the signal from one section of the stereo head to the other because of magnetic coupling.

More precise and more direct methods of checking and adjusting head height are available, as follows:

1. *Test Tape.* RCA test tape No. 12-5-64T is illustrative of a tape containing a section—Part 1—specifically designed for height alignment of four-track heads. As shown in *Fig.* 10, the entire width of Part 1 of this tape is recorded except for a .043-inch band erased at the location of track 3, which is called A-2. The recorded signal is 1000 cps at 3.75 ips and 2000 cps at 7.5 ips. The instructions state: "In order to adjust the head assembly height, move the head up or down until the audible tone or the output meter reading on the A-2 track is at a null or minimum. Note that a head height either up or down from this proper position will cause an increase in signal level."

2. *Visual Indication.* Reeves Soundcraft Corp. makes a product called Magna-See that enables one to view the signal recorded on the tape. This has a number of uses, including checking head height, azimuth, and head wear. To use Magna-See, the tape is recorded at slightly higher volume than normal, the tape is immersed in a bath of Magna-See solution, and the tape is allowed to dry out, whereupon the recorded track becomes visible.

Fig. 11 shows how a two-track stereo recording would appear after exposure to Magna-See. One would first adjust the height of the record head on the basis of several trials with the aid of Magna-See. If the tape recorder has separate record and playback heads, then the playback head would be aligned on the basis of maximum output when simultaneously recording and playing a low-frequency signal. Or, one could perhaps temporarily connect the playback head to the record amplifier and make a recording through this head; then view the results by means of Magna-See. To align the erase head, one could erase a tape that has been recorded with an aligned head, and check the results with Magna-See to determine whether the recorded sections have been erased excessively or insufficiently.

Test Tapes

As indicated in this article and the preceding one, various test tapes are available to facilitate checking and adjusting tape machines. Some test tapes have but a single purpose, while others have several. Typically, the single-purpose tapes are for azimuth alignment. Thus Audio Devices produces an "audio alignment tape," containing tones of 1000, 5000, and 7500 cps when played at 7.5 ips. The two lower tones are of 30 seconds duration, while the highest lasts 60 seconds. The purpose of the lowest tone is to set level. A preliminary adjustment of azimuth is made with the 5000 cps tone, and a final adjustment with the 7500 cps tone.

Ampex's No. 5563 test tape is an example of a multi-purpose tape, to be used at 7.5 ips. It contains a 10,000 cps frequency for azimuth alignment, a 250-cps tone for setting playback level (adjusting the VU meter in playback), another 250-cps tone at a lower level to be used as a reference for a frequency response check, and a series of tones for checking frequency response at 10,000, 7500, 5000, 2500, 1000, 400, 200, 100, and 50 cps. Similar tapes are produced by Ampex for the 3.75 and 15 ips speeds.

One of the most comprehensive test tapes that has been made, intended specifically for use by the audiofan, is the one put out several years ago by Dubbings. Although no longer manufactured, it may still be available from some audio supply houses. This tape contains a series of beeps five minutes apart for checking tape speed; a 400-cps tone recorded at a level corresponding to 2 per cent harmonic distortion; a high-frequency tone for azimuth alignment; a series of tones for checking frequency response; a tone for checking wow and flutter by ear; and a series of progressively quieter signals for checking signal-to-noise ratio (when the signal on the tape is no greater than system noise, this indicates the signal-to-noise ratio, identified by a voiced announcement).

A number of tapes have appeared for testing stereo machines. For example, RCA Victor's 12-5-64T is a quarter-track tape, with recordings on two of the four tracks. Among the tests is one for adjusting the height of the head (as previously described); another is a tone that permits one to phase the

Fig. 11. Appearance of two-track stereo tape after exposure to Magna-See.

speakers—the tone appearing midway between the speakers when phasing is proper. Another stereo test tape is the Audiotester 30-208, which includes the sound of a metronome for stereo balancing. The Sonotape Stereophonic Alignment Tape includes a test for correct track placement; that is, namely sound from the left coming from the upper track and sound from the right coming from the lower track when the tape moves from left to right; tests for frequency and loudness balance between tracks; tests for proper speaker location based on degree of separation and mixing of sounds from each track.

A word of caution is in order with respect to test tapes, particularly those bearing on azimuth alignment and frequency response. The heads of a tape machine tend to become magnetized gradually, causing partial or complete erasure of high frequencies on a tape passing over the head. Therefore it is recommended that the tape heads be demagnetized before a test tape is placed on the machine. AE

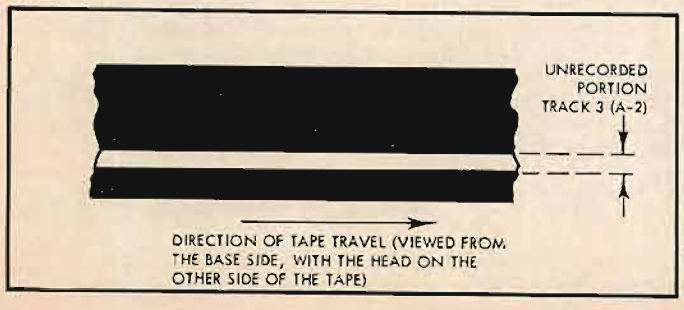
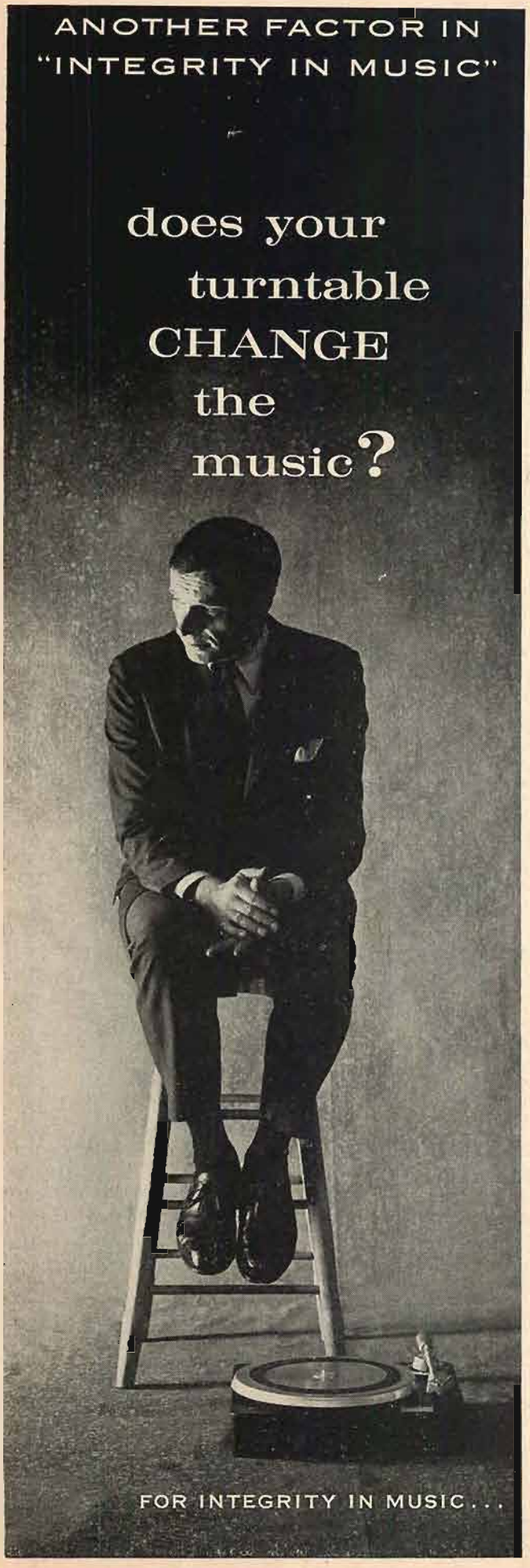


Fig. 10. Portion of RCA test tape No. 12-5-64T used for height alignment of four-track stereo tape heads.



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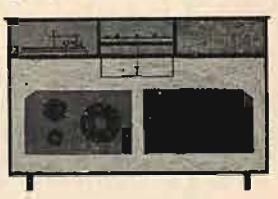

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E. R. MADSEN*

The advent of stereo records has placed new and stringent requirements on the phono cartridge. Here is how one cartridge designer met these requirements—in a highly original manner.

OVER THE DECADES, the technical development of the phonograph recording and playback process has been characterized by significant jumps forward, superimposed on the normal slow refinement of processes and procedures. The first large step forward was the shift from cylinder to disc which made mass production practical. Then came a big jump forward in quality with transition from mechanical to electrical techniques. Another significant leap forward has been the slow-speed, fine-groove, vinylite disc—a combination of long-playing, unbreakable, high-quality recordings which inaugurated a great new interest in phonograph reproduction.

All such large changes have been accompanied by the need to design new equipment for both recording and reproduction. Each step has forced the designers to do what previously had been considered almost impossible. Now, the most recent change—that which puts two signals into one record groove—imposes new problems for the designer. The phonograph pickup which can do justice to these new recordings would have been considered impossible a few years ago—at least it would have been impossible for a mass produced item which could have been sold at economical prices.

It is my intention to mention some of the particularly stringent requirements for a stereo pickup and to describe a design which meets these requirements in a practical way. The unit described is presently being produced by Bang & Olufsen, in Denmark, and has been trademarked "Stereodyne" in the principal markets of the world.

* *Chief Audio Engineer, Bang and Olufsen, Struer, Denmark.*

Stereodyne II pickup.

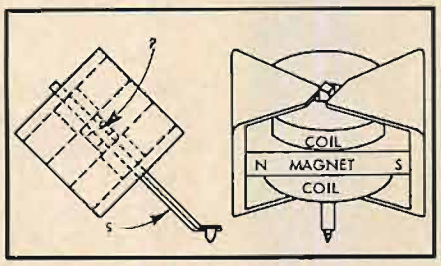

Fig. 1. Initial cartridge design.

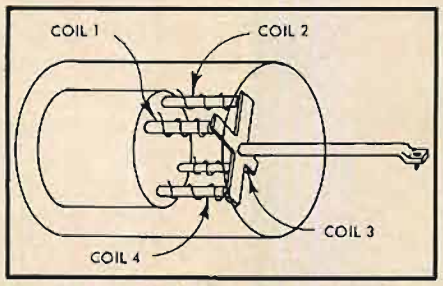

Fig. 2. Second design approach utilizing symmetrical poles and moving element.

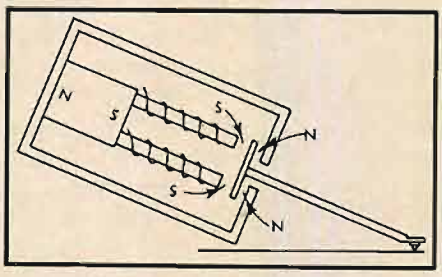

Fig. 3. Magnetic circuit of pickup.

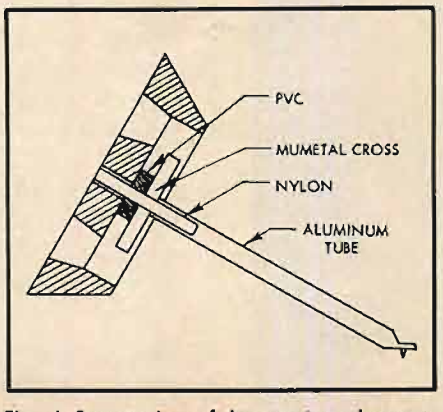

Fig. 4. Suspension of the moving element.

The design criteria established for the pickup were as follows:

1. The dynamic stylus-point mass must be as small as possible, only a few milligrams, to avoid distortion and record damage at high frequencies.
2. The stylus compliance must be large and equal in all directions so that heavy passages can be tracked at forces in the 2- to 4-gram region. The .0007-inch tip specified for stereo records means that tracking forces must be half those of monophonic discs for equivalent wear. Such light forces also cause problems of arm design as will be discussed shortly.
3. The pickup must be physically compatible with both stereo and mono discs.
4. The frequency response should be smooth, flat, and similar for both channels. Interchannel differences will cause instruments to seem to jump back and forth between the loudspeakers.
5. Distortion must be as low as possible.
6. The pickup should have a minimum of hum sensitivity.
7. There should be no magnetic attraction to a steel turntable.
8. Low mass is desirable to simplify the arm design.
9. The stylus should be interchangeable by the user.
10. There should be a minimum of 20 db separation between the channels, and this should be maintained over the widest possible frequency spectrum.
11. High output is desirable, and this should be equal between the two channels.

Naturally, the unit to fit this set of criteria must be capable of mass production and of sufficiently rugged construction to be handled by nontechnical people in the same way that they handle, or

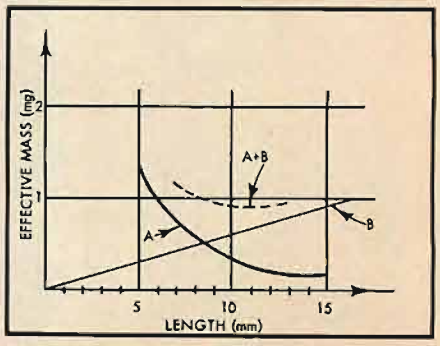

Fig. 5. Contribution of the moving elements to effective mass.

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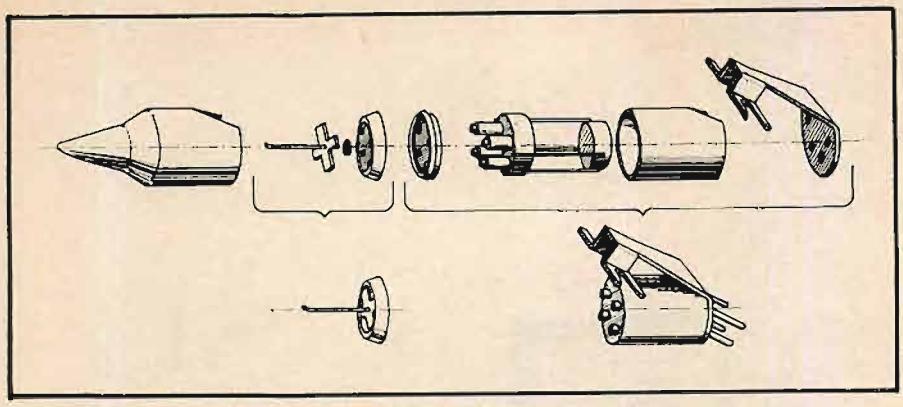

Fig. 6. Exploded view of the entire pickup.

mishandle, ordinary monophonic phonograph pickups.

The design of the unit described in this article was carried out without reference to other stereo pickups. The development process started with the idea of coupling two monophonic pickups and ended with a unit which completely breaks away from conventional monophonic designs.

The obvious starting point, that of connecting two separate units at right angles to each other, is superficially attractive. If these have their orientation such that their greatest sensitivity is at an angle of 45 deg. to the record surface, each channel will be reproduced by one of the units. However, this idea was quickly eliminated because the system is extremely complicated; it is almost impossible to make both elements move in exactly the same way, and the total moving mass will be high with two moving elements. It seemed evident that there should be only one moving element, and this should be suspended at only one point so it can move with equal freedom in all directions.

These conclusions resulted in an initial construction as illustrated in *Fig.* 1. Here there is one moving element, S, mounted at point P in a rubber ring. The upper half of S moves between a pair of poles inclined at a 45-deg. angle to the record groove, while the lower part moves between another pair of poles which are 90 deg. opposed to the first poles. Thus one of the stereo channels is derived from the motion of the lower half of the moving element and the other channel from the motion of the upper half.

This arrangement, shown in *Fig.* 1, gives satisfactory channel separation; and if the parts are properly proportioned, it gives a suitable high-frequency response. However, the response is not

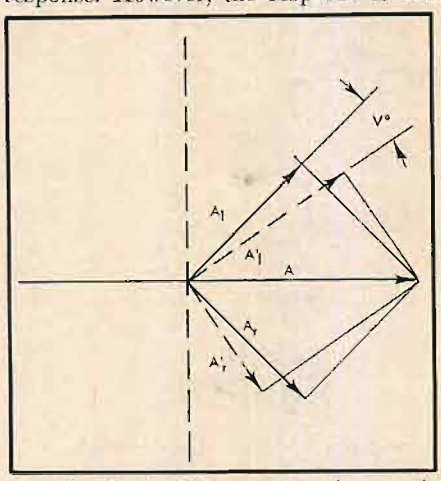

Fig. 8. Effect of incorrect stylus angle with equal signals in both channels.

exactly the same in both channels. The reason for this is that the design is not truly symmetrical. One-half of the moving element bears the stylus and contacts the record grooves; the other half swings in free air. The result of this asymmetrical operation is a frequency unbalance.

This led to the conclusion that the moving parts must be identical for each channel, and that there must be only one moving element. Therefore the poles must be placed symmetrically, and the moving element must have a symmetrical shape. The unit designed on this basis is shown in *Fig.* 2.

The armature is a small cross of mumetal which swings between the four pole pins. A hollow aluminum tube is swedged to this cross, and the stylus is secured to the other end of the tube. Opposing each arm of the cross is a pole pin on which a coil is wound. A 45 deg. motion of the stylus to the left will induce current in coils 1 and 3, but not in coils 2 and 4. The converse is true for stylus motion 45 deg. to the right. As can be seen, the opposing coils can be connected in a push-pull relationship which reduces the harmonic distortion caused by nonlinearity of the magnetic field. In addition, the coil arrangement is hum-bucking for external fields such as that from a phonograph motor.

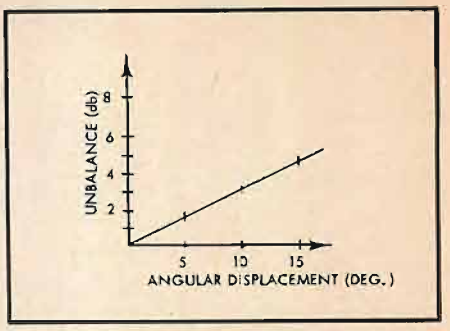

Fig. 9. Unbalance between channels for a given angular displacement.

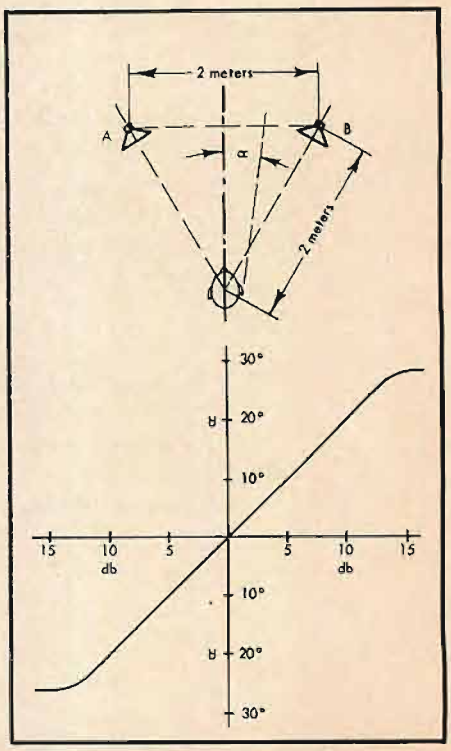

Fig. 10. Localization of sound from two speakers.

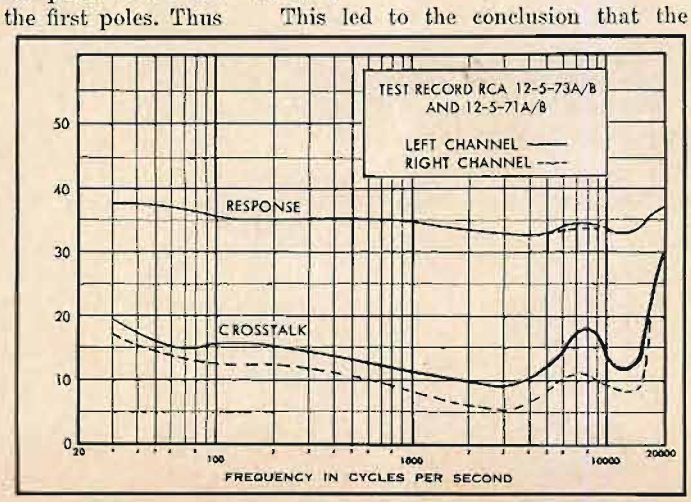

Fig. 7. Frequency response and channel separation characteristics of the pickup.

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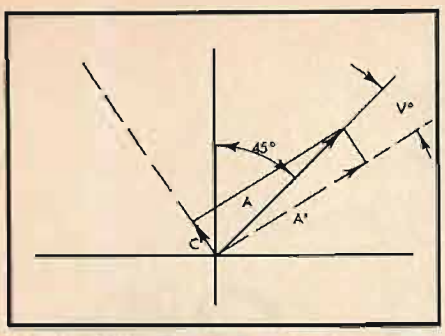

Fig. 11. Effect on left channel of displacement to right.

There are several hidden advantages of this push-pull, symmetrical, and complementary structure. Induction of crosstalk from one channel to the other is minimized since such a component is in-phase in opposing coils and is bucked out. Further, over-all crosstalk will be extremely low at any frequency since voltage induction comes only from changing the spacing of the crossarms from the pole pins. With 45 deg. modulation in one channel only, the crossarms in the orthogonal channel rotate without changing spacing so that there is no in-

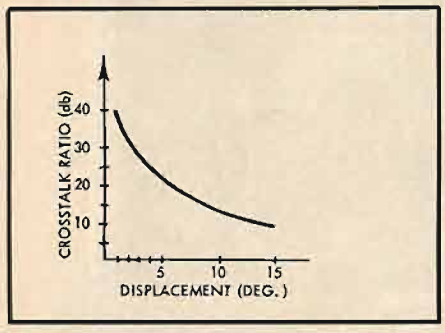

Fig. 12. Crosstalk for a given stylus displacement.

duced voltage in this channel—provided the positioning of the unit with respect to the groove is accurate. We will go into the latter in just a moment.

Fig. 3 shows the magnetic circuit. This is very much like the magnet structure of a modern loudspeaker with a center magnet. The arrangement makes a completely closed magnetic circuit which prevents leakage of the magnetic field. Being externally nonmagnetic,

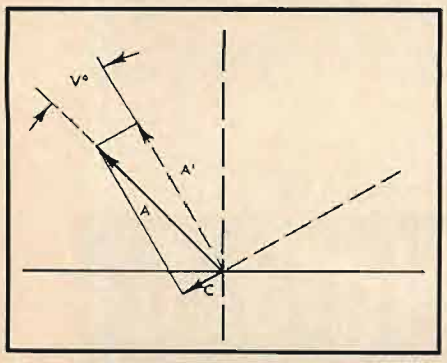

Fig. 13. Effect on right channel of displacement to right.

there will be no attraction to steel turntables; and at the same time the coils are shielded from external fields.

The most critical and important part of the design is that of the moving system and its method of suspension which are shown in *Fig.* 4. The mumetal cross is a small element which adds about one-half milligram to the moving mass as seen at the stylus point. The aluminum tube is very light, having a wall thickness of .002 inches. It pivots on a nylon thread which is bonded to a plastic support. The cross bears against a PVC disc, the resiliency of which controls the compliance and the damping of the system. The rotation point of the system is at the junction of the cross and the nylon thread. Critical points in this design are the effective stylus point mass and the output. Also the aluminum tube had to be long enough so that the body of the pickup would clear the surface of the record.

For a given thickness of tubing there is an optimum point at which the combined contribution of the mumetal cross and the tube to the effective moving mass is at a minimum. A comparison of the individual components of the moving system to the total effective mass is shown in Fig. 5. The effective stylus point mass of the cross decreases as the aluminum tube lengthens (curve A). The effective mass of the tube, referred to the stylus, increases with increasing length (curve B). Comparison of these curves shows that a tube length of about 10 mm is optimum for the type of tubing used. This also provides reasonable size relationships for the other parts.

Fig. 6 shows an exploded view of the complete unit. The diamond stylus is replaced along with all other moving parts by placing the new cross assembly onto the pole pins and sliding the outer casing into position, which closes the magnetic circuit and also acts as a double shield over the coils.

This design exhibits ideal characteristics of frequency response and channel separation. Curves of these characteristics, as measured on RCA test discs 12-5-73 and 12-5-71, are shown in *Fig.* 7. The frequency response requires no comment as it is quite smooth and flat over a wide band. The channel separation can be seen to be excellent over a very wide frequency range, but there is some difference between the two sides. This difference comes from a combination of production variation, unbalance on the recording, and incorrect positioning the pickup with respect to the record groove.

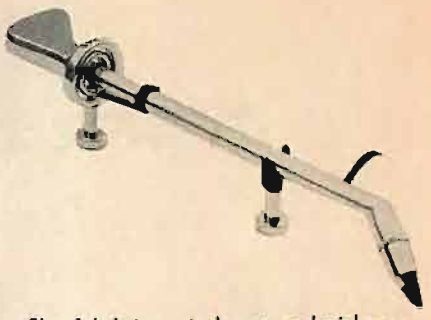

Fig. 14. Integrated arm and pickup.

Evidently, close production tolerances must be maintained to obtain close balance between channels and wide separation. However, it is not as widely recognized that the efforts which produce a fine pickup may be worthless when the unit is not properly used. The entire stereo effect can be diminished or made unnatural if geometric perspective is distorted by incorrectly positioning the pickup in relation to the record groove.

First, let us reconsider the situation when there are equal signals in both channels. These correspond to lateral modulation of the groove, and the sound should be centered between the speakers if the entire system is balanced. Referring to *Fig.* 8, we can determine the effect of incorrect stylus angle. O is the stylus point and A is the amplitude for the lateral groove modulation. A_l and A_r are the left and right signals for a properly positioned pickup, and these signals are equal. If the pickup is angled to the right by V degrees, the left channel will be increased to A'_l and the right

(Continued on page 80)

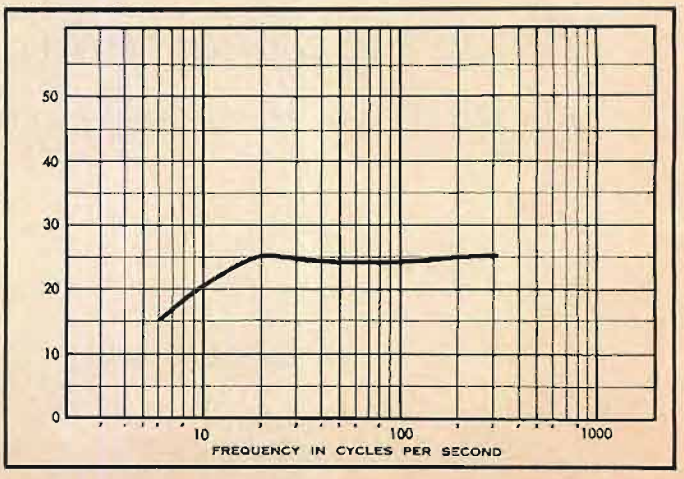

Fig. 15. Low frequency response of pickup and arm.

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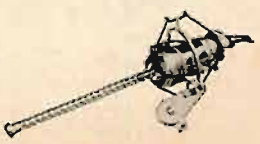


Discoveries and Patentable Inventions

ALBERT WOODRUFF GRAY*

Not every new idea constitutes "invention" that will be recognized by the Patent Office, and even though a patent may be granted, it may be ruled invalid.

OFTEN THE DEFINITION of the term "inventions," made by the courts and the distinction from mere discoveries takes on the characteristics of the small boy's definition of salt—what makes potatoes taste bad if it isn't put on.

"It is a trite saying that invention defies definition," asserted a Federal court a few years ago. "Yet through long years the word has acquired certain characteristics which at least give direction to its meaning. Invention is a concept, a thing evolved from the mind. It is not a revelation of something which exists and was unknown but is a creation of something which did not exist before, possessing the elements of novelty and utility in kind and measure different from what the art might expect from its skilled workers."[1]

Under the Patent Act, "Whoever invents or discovers a new and useful process, machine, manufacture or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor."[2]

In an action for infringement before a Federal District Court in Maryland, the owner of the patent of a high frequency transmission cable used in television installations was met by the defense of the alleged infringer that the patent was invalid, hence no infringement.

This invention, known as the Krueger patent, comprised an elongated hollow tube constructed of dielectric material with walls relatively thin compared to the diameter, with a plurality of electric conductors imbedded in the walls of the tube.

Before this invention the lead-in cable from the antenna to the set had a pair of parallel wires or conductors. So long as this lead-in was dry and clean it functioned satisfactorily, but once it had accumulated dirt or moisture or foreign substances such as chemical deposits, loss of good reception was the consequence, particularly in locations distant from broadcasting stations.

That difficulty was met by this invention imbedding this pair of wires in the opposite walls of a plastic tube with an air space between the two walls. Not until three years after the Kruger tube had been on the market was commercial production of the infringing tube established.

Here, in holding the patent of the Kruger invention valid and infringed, the District Court said of this essential feature in the patenting of inventions.

"The act of invention consists neither in finding out the laws of nature nor in fruitful research as to the operation of natural laws, but in discovering how those laws may be utilized or applied for some beneficial purpose by a process, a device, or a machine.

"It is the result of an inventive act, the birth of an idea and its reduction to practice; the product of original thought; a concept demonstrated to be true by practical application or embodiment in tangible form."

This statement the court supplemented with a negative rule analogous to the small boy's definition of salt. "The mere aggregation of a number of old parts or elements which in the aggregation perform or produce no new or different function or operation than that heretofore performed or produced by them, is not a patentable invention."[3]

During the latter half of the last century an infringement action came for decision before the United States Supreme Court. There suit had been brought for the infringement of a patent granted to the manufacturer of a lead pencil tipped with a rubber eraser. Of the subject of this patent, here held invalid as not an invention within the meaning of the patent statute, the Supreme Court said,

Combination not Invention

"It is as if a patent should be granted for an article or a manufacture, as the patentee prefers to term it, consisting of a stick twelve inches long, on one end of which is an ordinary hammer and on the other end is a screwdriver or a tack-drawer, or what we will see in use in every retail shop, a lead pencil on one end of which is a steel pen.

"It is the case of a garden rake, on the handle end of which should be placed a hoe or on the other side of the same end of which should be placed a hoe. In all these cases there may be the advantage of carrying about one instrument instead of two, or of avoiding the liability to loss or misplacing of separate tools. The instruments placed on the same rod might be more convenient for use than when used separately. Each, however, continues to perform its own duty and nothing else. No effect is produced, no result follows from the joint use of the two."

Then of the demands made by this provision of the patent law in the definition of invention, the court continued, "The combination to be patentable must produce a different phrase or effect, or result in the combined forces or processes from that given by their separate parts. There must be a new result produced by their union. If not so it is only an aggregation of separate elements."[4]

This outline of the law was a few years later supplemented by that same court in its denial of the patentability of another discovery that failed to attain the dignity of an invention. "The design of the patent laws," said that court, "is to reward those who make some substantial discovery or invention which adds to our knowledge and makes a step in advance in the useful arts. Such inventors are worthy of all favor.

"It was never the object of these laws to grant a monopoly for every trivial device, every shadow of a shade of an idea which would naturally and spontaneously occur to any skilled mechanic or operator in the ordinary progress of manufacture.

"Such an indiscriminate creation of

(*Continued on page 86*)

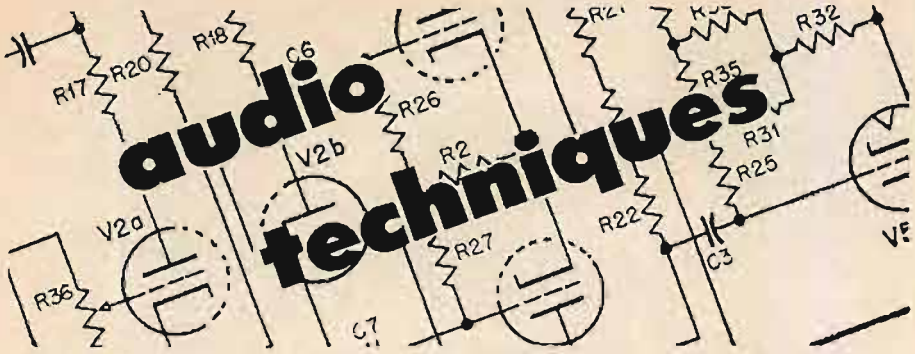
* *112-20 Seventy Second Drive, Forest Hills, New York.*

[1] Pyrene Mfg. Co. *v.* Boyce, 292 Fed. 480, N.J., July 11, 1923.

[2] 35 U.S.C.A.101.

[3] American Phenolic Corp. *v.* Pollard, 122 F.S. 172, Maryland, June 15, 1954.

[4] Reckendorf *v.* Faber, 92 U.S. 847, Oct. 1875.



JOSEPH GIOVANELLI*

NOTE. Well, you readers have asked for another installment of AUDIO TECHNIQUES. so here it is.

For those of you who are not familiar with this column, let me explain once more that it is *your* column in every sense of the word. In AUDIOCLINIC the readers supply the questions, but I supply the answers. However, this particular column belongs entirely to you. In other words, if any of you have run across a problem for which you have found a solution and you feel it would be of interest to your friends, the other readers, please send it in. In such a case it will certainly be included in AUDIO TECHNIQUES. Perhaps some of you have had a problem similar to one which appeared in AUDIOCLINIC and have found a different way of handling it. We would certainly like to know about it. In this way we can all get together and pool our knowledge for the benefit of everyone. If it is helpful, no idea is too small or too insignificant.

I, myself, ran across a couple of problems which I decided to submit for this installment of AUDIO TECHNIQUES. Perhaps some of you have another or better way of handling these same situations. Come on. Let's hear from you.

To Change the Tonearm

Many of us like to compare one arm with another. Such comparisons require mounting and dismantling at least once for each tonearm to be evaluated. Not only is the necessary wiring time consuming, but also it results in gradual shortening of the wires. To avoid both of these difficulties, I use and recommend the following procedure.

1. Solder spade lugs, having 6/32 clearance mounting holes, one lug for each wire from the arm. Wrap narrow strips of electrical tape around these connections. This will minimize the possibility of breaking of the wires off the lugs.
2. Mount on turntable base a Cinch-Jones Barrier Type Terminal Strip, code # 5-141.
3. Mount the lugs along one row of the strip.
4. Solder spade lugs as in step one to the various leads associated with carrying the signal from the tonearm to the preamplifier. The other ends of these leads should be fixed to their appropriate connectors.
5. The lugs of step 4 should be mounted along the other row of the barrier strip, taking care that the lugs are paired with the correct tonearm leads.

Straightening Warped Records

Here is a method of salvaging those warped records you did not wish to discard. The following materials are needed:

1. An *old* turntable—preferably 12 inches in diameter. (A new turntable is *definitely not recommended.* Reason—the considerable heat generated during the record restoration. If no *old* turntable is available, obtain a turntable made for use in a child's record player. Since the price of such a unit is low, its possible ruin will be of little consequence. The fact that such a table does not have a 12-inch diameter can be circumvented.)
2. A box in which the turntable can be mounted. This box should be equipped with a cover of sufficient clearance to allow the turntable to rotate with the cover in place. The depth below the turntable should be sufficient to clear a 75-watt light bulb.
3. One 75-watt light bulb.
4. One night light socket, such as that plugged into baseboard sockets to mark the head of a flight of stairs.
5. One extension cord.
6. Four heavy-guage aluminum-base lacquer discs.
7. Approximately ten 78-rpm 12-inch discs.
8. A weight of approximately two pounds.
9. One fahrenheit thermometer whose scale extends beyond 125 degrees above zero.

Procedure

There is much latitude for improvisation. Throughout this discussion, it will be assumed that microgroove records are to be salvaged. 78-rpm records may be reclaimed in much the same manner as will be described, but the temperature at the turntable should be approximately 90° Fahrenheit.

Step 1. Mount the turntable in the box in such a way that the cover, when closed, will clear the rotating stack.

Step 2. Place the 75-watt bulb and socket in the box underneath the turntable. Lay this bulb on a piece of asbestos or other heat-resistant material.

Step 3. Plug the extension cord into the nightlight socket. Make sure the bulb does not come into contact with either the extension cord or the wire carrying current to the motor. Also make sure it is as far from the turntable motor as the space and positioning of the table will allow. (If no night-light socket is available, an ordinary light socket may be used. Zip cord is screwed under the terminals; the other end of the cord is wired to a wall plug.)

Step 4. Place two of the lacquer recording discs on the turntable. This is especially necessary when the diameter of the turntable is less than the diameter of the record being repaired. These discs will provide needed support to the outer edge of said record. (If lacquer discs are not available, circles 12 inches in diameter cut from heavy guage sheet almuinum can be utilized.)

Step 5. Place the record to be repaired on the base lacquers. (I have not experimented sufficiently to determine how many discs can be satisfactorily repaired at one time. I have successfully repaired four 78-rpm shellac discs at one time, but I have never worked with more than one LP at a time.) Place remaining two lacquers on the stack. These last two lacquers prevent the 78-rpm records from assuming the conformation of the record undergoing repair. The resoration time would otherwise be lengthened.

Step 6. Place the pile of 78-rpm records on the two top lacquers. (If aluminum circles are used, interpose a piece of tissue paper between the circles and the stack of 78's. Such paper should be placed between the circles and the record undergoing restoration.) The 78-rpm records provide evenly distributed weight and make for good storage of, and distribution of, heat.

Step 7. Center the 2-pound weight on the stack.

Step 8. Set the turntable rotating at a speed which will not cause the pile to be dislodged by centrifugal force. Rotation is necessary to insure even heating during the actual restoration process and even cooling after the completion of the process.

Step 9. Place the thermometer at the approximate height of the turntable and as close to it as possible.

Step 10. Close the box.

Step 11. Light the bulb.

Step 12. After 15 minutes of operation, open the box and check the temperature. For proper results, I have found 125 degrees to be optimum. I believe that a higher temperature would cause groove deformation. A lower temperature would slow down the whole operation. The bulb may require several repositionings before the operating temperature will stabilize at the proper value. (If a Variac is available, you can vary the temperature merely by varying the voltage input to the bulb. I did not have a Variac on hand at the time I did this work, so had to rely on positioning the bulb with respect to the turntable to achieve the necessary variation.)

Step 13. After a period of six to eight hours, check the condition of the record. If not properly restored, continue the process.

Step 14. Allow the restored recording to cool for two hours before playing it. Leave the disc in its position in the stack with the box open; the light extinguished—the turntable rotating. This last step is necessary to prevent the record undergoing restoration from re-warping and to prevent the 78-rpm records from requiring restoration treatment of the foregoing character.

Turn It On

Sometimes my various duties require that I burn the midnight oil. (Translation: to stay up later than I should.) On one such occasion I was repairing an FM tuner. All went smoothly—I thought. Finally came the "moment of truth." The amplifier was connected, the antenna was connected. I tuned around and nothing happened. I rechecked the voltages; I rechecked the fuse. After a few minutes of the various and sundry checks I advise others to make, I found to my relief and embarrassment that I had never turned the switch to the "on" position.

You think it can't happen to you. It can. Consider this as my "I told you so" in advance when you leave out that rectifier tube or that fuse, or perhaps—that wall plug.

The moral of all this is: Don't suspect the worst when something goes wrong. Assume until you must give in that the trouble you are having with a piece of gear is relatively simple. This is the philosophy I use whenever I troubleshoot, and it usually saves me much in worrying and in wasting time. Æ

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

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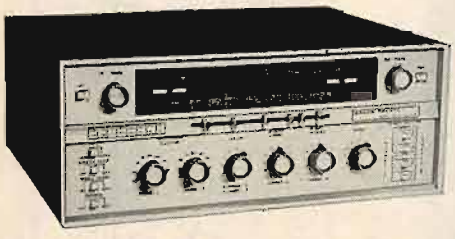

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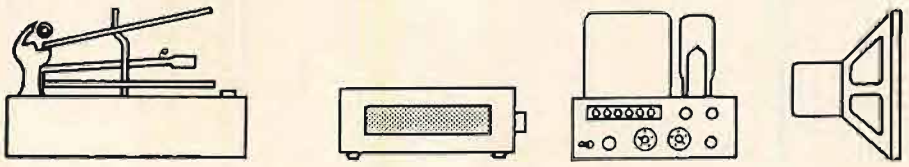

LAFAYETTE KT-250-A 50-WATT INTEGRATED STEREO AMPLIFIER KIT

ONE OF THE PROBLEMS of acquiring a complete stereo system is the need for two of everything—practically—which naturally is more expensive than the monophonic systems were. In most instances, modern stereo amplifiers are all built on one chassis, to be sure, but there has not been enough simplification to result in a noticeable reduction in cost—simplification that could provide almost the same facilities at much less expense.

Kits are a step in the direction of permitting the audiofan to save considerable money. Amplifiers are the most common form of kit construction because quite a bit of labor goes into building an amplifier, even on an assembly-line basis, and most of this can be provided by the audiofan with no outlay of money. Most kit builders get pleasure out of the actual construction, and while their rate of "pay" for the time spent in putting a kit together may be much lower than factory labor, it is at least more profitable than watching television, for instance.

But taking another forward step in the direction of reducing cost has usually resulted in the elimination of some of the facilities desired—or presumed to be desired—by the ultimate user. Therefore, practically every amplifier on the market—both kit and factory-built—follows the conventional form of circuitry, which means that there will be a selector switch, a function switch, bass and treble tone controls, volume and/or loudness controls, balance control, and so on. In the Lafayette KT-250-A, shown in Fig. 1, the design has been simplified greatly and without eliminating any of the desired functions—so much so that one is inclined to wonder why someone didn't think of it before.

First, there is the conventional and most necessary selector switch, separate bass and treble tone controls, a ganged but clutched volume control which provides for balancing, a separation (or blend) control, and four slide switches. Of these latter, one cuts in or out the loudness contour compensation, the second provides phase reversal for one speaker, and the other two serve as the function control—one connects the A amplifier to either A or B inputs, and the other connects the B amplifier to either A or B inputs. This simplifies both wiring and operation, and certainly reduces cost. For a mono source to be fed to both speakers, both switches are set at A or B, depending on which source is desired. For stereo, one is set at A and the other at B; for stereo reverse the two switches are simply reversed. If the FM tuner is on A and the AM tuner is on B, two separate programs may be fed to the speaker systems—pos-

Fig. 1. External appearance of the Lafayette KT-250-A dual-25 integrated stereo amplifier.

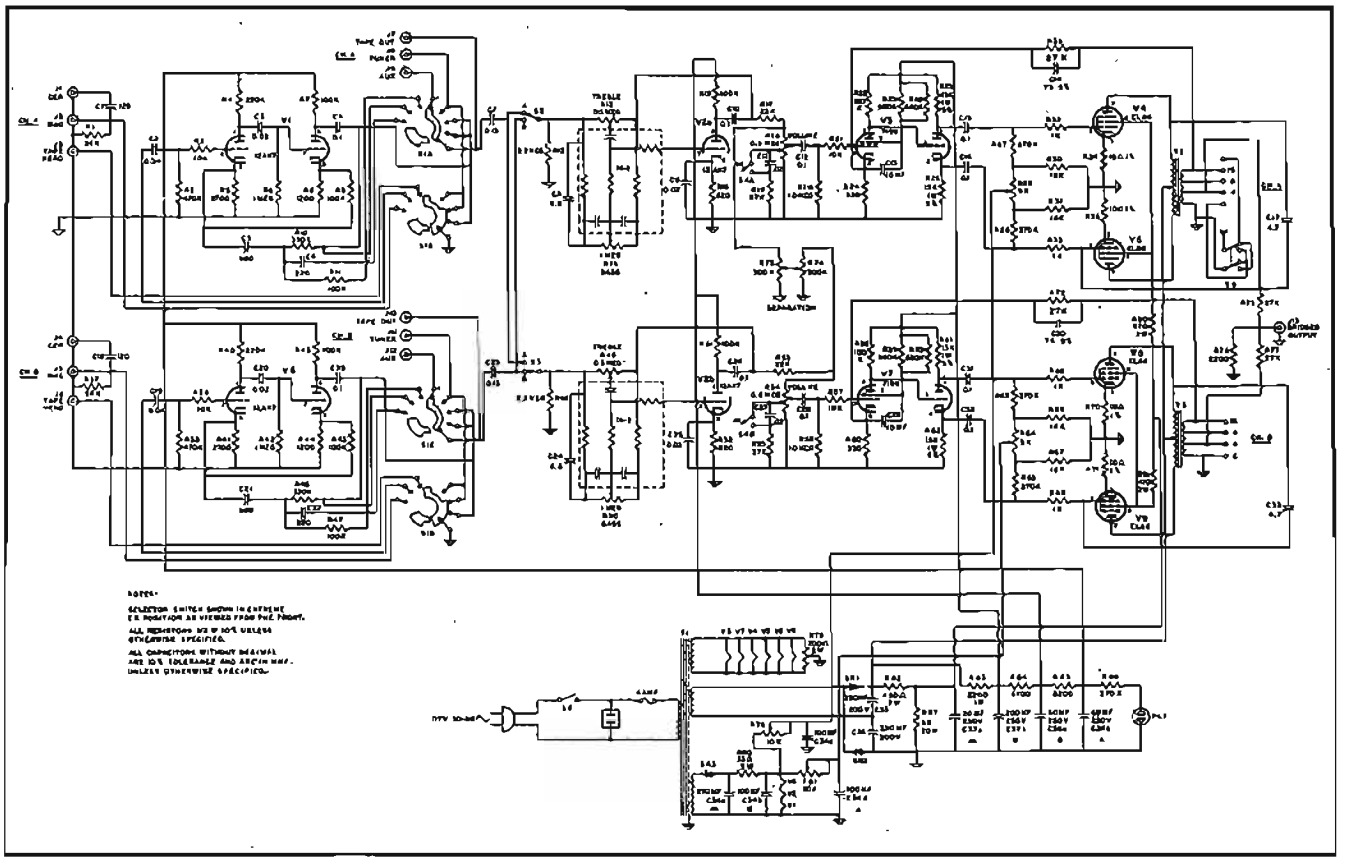

Fig. 2. Complete schematic of the KT-250-A kit amplifier.

sibly requiring external speaker switching, but allowing one program to be fed to one room and a second to another. Certainly the system provides adequate flexibility for most any ordinary home use. To be sure, there is no rumble filter and no scratch filter, but with LP records there is little need for the latter, and when over-all system cost must be kept relatively low, it is not likely that the loudspeaker systems will have enough response in the low-frequency region for rumble to be much of a problem. In addition to the features already listed, there is a "bridged output" jack which provides a high-impedance A + B signal which may be fed to another amplifier for a "center-fill" speaker or for loudspeakers throughout the home.

Circuitry

We have considered the KT-250-A to be sufficiently interesting to reproduce the entire schematic, *Fig.* 2. Both sections of the amplifier are identical except for the phase reversing switch in the speaker circuit of the A channel. The preamplifier stage, a 12AX7 with equalization in the feedback circuit, accommodates tape head and magnetic or ceramic phono cartridges —the switch has only four positions, so one cannot select between the two types. Two high-level inputs are provided for each channel—tuner and the usual "aux," and the tape out jack is fed from the output of the selector switch. This is followed by the two "function" slide switches which feed the Baxendall-type tone-control network which works with one half of another 12AX7, and its output feeds the clutch-type volume-loudness control and the separation control—which consists of a dual 500 k-ohm potentiometer with the top ends connected to the top ends of the volume controls, the bottom ends grounded, and the two arms connected together. The loudness contour switch shorts out a capacitor in the tapped volume control circuit.

A 7199 pentode-triode amplifier and phase splitter follow, and it in turn drives the EL86 output tubes, providing 25 watts in each channel. Output impedances of 4, 8, and 16 ohms are provided, and a DPDT slide switch reverses the speaker leads in the A channel only. Two silicon diodes are used in a voltage-doubler circuit to provide 260 volts at the plates of the output tubes, which are of the low-voltage, high-current type. Another silicon diode provides the fixed bias voltage for the ouput stages as well as d.c. for the first three tube sections in each channel—the preamplifier stages and the tone-control amplifier stage, V_{1a} and V_{1b}. Both bias adjustment and balance controls are provided for each channel, and a hum control helps reduce the hum level to a satisfactory low.

Construction and Performance

Time required for construction should run from 12 to 15 hours, depending on the individual's proficiency. The instructions are complete and accurate, and we found no errors in lengths of wires, order of construction, or specific application of the hardware furnished. While the finished unit may not be a "deluxe" model, it is certainly a "utility" model, and its performance exceeds specifications in most particulars.

IM distortion measured less than 0.5 per cent up to 10 watts, then increased gradually to 1.9 per cent at 25 watts (average of the two channels, neither exceeding 2 per cent at 25 watts). Average harmonic distortion at 1000 cps measured 1.1 per cent at 25 watts. Hum measured 56 db below 1 watt on high-level inputs and 41 db below 1 watt on phono and tape inputs. This figure is comparable to the specifications of 70 and 50 db below *rated* output —although not quite as low—since 1 watt is 14 db below 25 watts. We adjusted the hum control for optimum, but made no changes in tubes after first placing them in their sockets before making the measurements. Minor adjustments in lead dress reduced the hum some 6 db further, but this would require individual experimentation. In any case, the hum at this level is not noticeable on loudspeakers of average quality.

Signals of 3.5 and 3.6 mv, respectively, gave the rated output from the two channels on phono and tape-head inputs, with 0.46 and 0.51 volts being required at the high-level inputs for the same outputs. At a 1-watt output on both channels, the bridged (A + B) signal measured 0.14 volts. Tone controls provided boosts and cuts of 12.4 db at 10,000 cps and of 16 db at 50 cps with both channels tracking within 3 db throughout the range. The volume control tracking was within 2 db throughout.

In physical dimensions, the KT-250-A measures 14½ in. wide, 12¾ in. deep, and 5½ in. high, and its weight is 28 lbs. The entire unit is neat, attractive, and a very good performer in spite of, or because of, its simplicity. K-21

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The "Citation Sound," acclaimed by audio authorities everywhere, was developed by Harman-Kardon in the design of its remarkable new Citation instruments. It is precisely this quality that distinguishes the performance of the new TA260: the clean, solid bass; the silky transparent highs. And, there is power—power to spare, to drive the most inefficient speakers. The result: the new Stereo Festival II actually sounds recognizably best—regardless of price.

*Music Power Output in accordance with IHFM standards, ½% distortion.

The TA260 includes a powerful 60 watt stereo amplifier (120 watt peaks), separate and remarkably sensitive AM and FM sections and dual preamplifiers with all the controls necessary to achieve the finest performance from all program sources.

Features: SPECIALLY DESIGNED MASSIVE OUTPUT TRANSFORMERS insure superior bass and high frequency response; HEAVY DUTY OUTPUT TUBES, conservatively rated, provide high power output with far less heat and longer life; DUAL FRICTION-CLUTCH TONE CONTROLS; BLEND CONTROL to eliminate "hole-in-the-middle" effect; SPEAKER PHASING; TWO MAGNETIC INPUTS; SPECIAL HEADPHONE RECEPTACLE; CLOSE TRACKING LOUDNESS CONTROL; CONTOUR, RUMBLE and SCRATCH FILTERS; separate BAR-TYPE TUNING EYES for AM and FM; THIRD CHANNEL AMPLIFIER OUTPUT. The Stereo Festival II is handsomely designed in brushed gold and charcoal brown. The Stereo Festival II, Model TA260...$299.95. CX26 Metal Enclosure...$12.95. WW30A Walnut Enclosure...$29.95.

For more complete information on the Stereo Festival II, write: Dept. A-10, Harman-Kardon, Westbury, N. Y.

All prices slightly higher in the West.

harman kardon

Fig. 3. The Fisher FM-100 stereo FM tuner.

THE FISHER FM-100 STEREO FM TUNER

By this time, of course, anyone who has any familiarity with Fisher equipment expects a high standard of quality, and the new FM-100 continues in that tradition. The term "stereo" applied to an FM tuner may appear misleading, but in this case it is meant to imply that there is already a provision for a multiplex adapter which may be added when—and if—the long-hoped-for decision is forthcoming. Because of the multiplex provision, the circuitry becomes a little complicated beyond the wide-band ratio detector, but up to there it is fairly conventional of a high-class design.

The input stage is an ECC88 used as a cascode amplifier in which the signal is fed into the grid of one triode section whose plate load is the plate resistance of another triode section. This circuit provides a high gain with a very low noise level. The mixer-oscillator is another dual triode, an ECC85, with one section serving as mixer and the other as the oscillator. No a.f.c. is required for two reasons—the wide-band ratio detector is not critical in this respect, and the physical design of the entire receiver and the component tolerances mitigate against any appreciable drift. Four i.f. stages are used, two purely as amplifiers and two as short-time-constant grid-leak limiters, aided by an instantaneous dual-dynamic limiter consisting of two germanium diodes. The ratio detector employs a pair of matched germanium diodes in a hum-free circuit which is extremely linear, as viewed on a 'scope. A muting circuit—an unusual oscillator which is sensitive to signal voltages appearing in the i.f. amplifier and whose output is rectified and fed to the last limiter grid to shut it off completely—provides smooth and readily controllable interstation silence. An indicator tube is used to show proper tuning, and it functions even though the signal is below the muting threshhold as set by the user.

Switching is provided to allow for normal FM, multiplex stereo—either with the soon-to-be-available plug-in adapter, or with an external multiplex unit—and either the main channel or the multiplex channel alone, for checking and adjusting relative levels. A multiplex separation control is already in place, so one only needs the green light and the adapter to be able to receive multiplex stereo.

Because of the extremely high sensitivity —specified as 0.8 microvolts for 20 db quieting with a 300-ohm antenna—it is likely that many users would find that their tuner would be overloaded in locations near transmitting stations. A built-in 20-db pad may be connected into the antenna circuit very simply from the outside of the tuner chassis. Switching is also provided to permit connecting another tuner—FM or AM, as necessary—to be able to play FM-FM or FM-AM stereo.

We cannot claim to verify sensitivities as high as this tuner has, but it is perfectly obvious that it is far more sensitive than any other we have tested to date. The most important feature of the FM-100 is, to our opinion, the fine quality that is usually observed with wide-band ratio detector circuits when they are well executed. The listening quality is superb, and when combined with the smooth-acting muting circuit gives one the impression of jet airliner travel compared to the old—but still reilable—DC-3's.

The FM-100 may be mounted in a furniture cabinet which is available for it, or it may be installed in a custom cabinet, requiring an opening 4-7/16 in. high by 14⅞ in. wide, and a depth of approximately 12¾ in. to clear cables and plugs. K-22

VIKING STEREO COMPACT

In the years since the Viking tape equipment first made its appearance, it has become more and more popular—largely because it has been available in a variety of forms so that anyone can assemble just what equipment he needs to provide any specific requirement without having to go any further than his own limitations. It has been available in several forms heretofore which resulted in a complete tape recorder. but it is probable that most users started with a simple playback "deck" just to get their feet wet with tape. It is to Viking's credit that accessory components have always been available to permit the step-by-step tape novice to advance just as fast as he wished.

The Stereo Compact is the latest form in which the basic deck and a pair of recording amplifiers have been offered—and in this form it provides all the facilities of a tape recorder which is to be integrated into a typical home system. It consists of an 85 Series deck mounted on a single panel with two RA72 recording amplifiers. The Stereo Compact provides separate heads for recording and playback, but no playback amplifier is furnished since it is presumed that the heads would be connected directly into the tape-head inputs of a stereo preamp. Thus it is always possible to monitor the recording *from* the tape, rather than before the signal goes onto the tape, and the recordist can always be sure that the tape is recorded—which is not always the case when he simply monitors the signal as it goes onto the tape. With some preamps it is possible to compare the two by throwing a switch, but this would depend on the equipment external to the Stereo Compact.

The Deck

The tape deck proper employs two motors—the capstan motor is a 4-pole induction type, while the takeup reel is driven by a 4-pole variable torque motor. The capstan is belt driven and is stabilized by a 1½ lb. dynamically balanced flywheel. A front panel control premits a choice of either 7½ or 3¾ ips, and flutter and wow is 0.2 per cent or less. The 4-track play heads may be positioned for proper reproduction of either 2- or 4-track recordings by means of a front panel knob. *Figure* 4 shows the deck alone—at the upper right

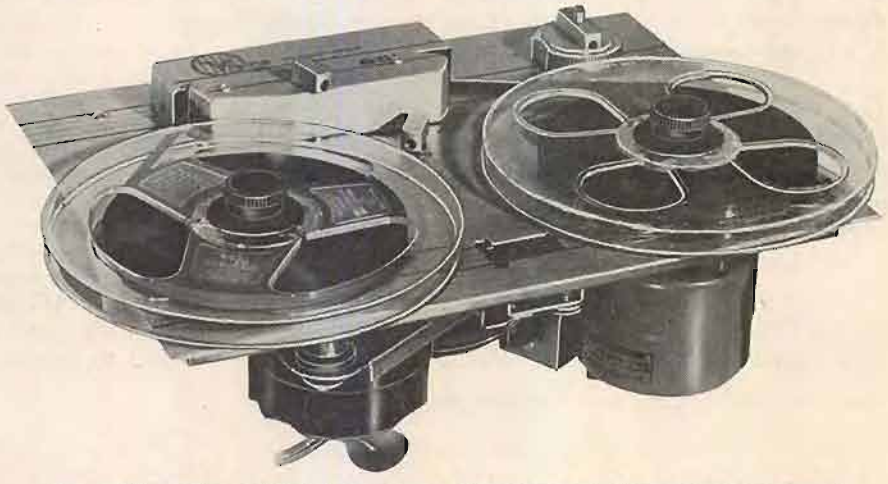
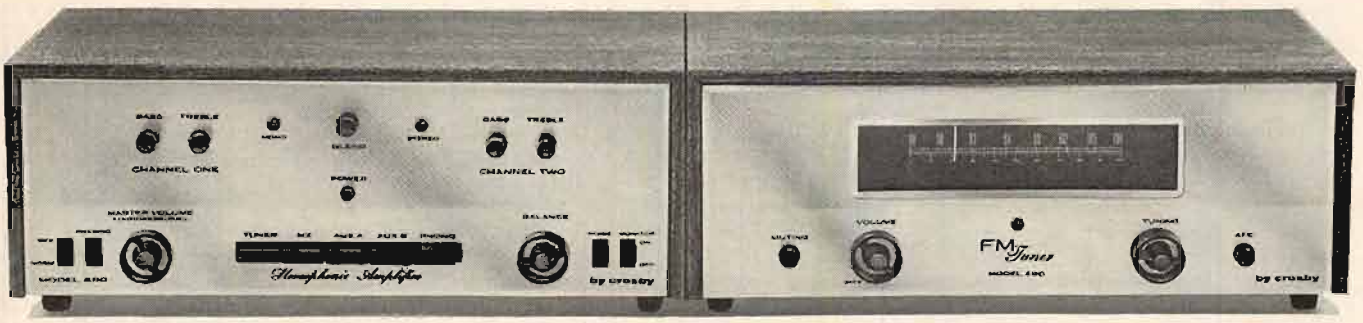


Fig. 4. The Viking 85-Series transport which is a part of the Stereo Compact.

a touch of Crosby...



The deft touch of Murray G. Crosby on electronic gear makes the everyday into something special. This is clearly evidenced by the introduction of two new high fidelity components—a super-sensitive FM tuner and a powerful 28-watt stereophonic preamplifier/amplifier. These twin units bring to home music enjoyment the technical achievement acquired through research and production of sophisticated military electronic equipment. And what makes Crosby's entry into stereo hi-fi even more exciting is the combination of these skills with handsome, compact design at a fair price.

left: Model 680 stereo preamp/amplifier 28-watts —$119.95

Featuring push-button source selection, colored light mode indicators, exclusive circuit mono/stereo blend control, center-channel stereo output, tape monitor input. Compact size—13½" w. x 4¾" h. x 6¾" d.

right: Model 690 FM tuner—$99.95

Extremely high sensitivity, dial-variable amplified AFC, variable interstation noise-muting control, chassis ready for Multiplex. Compact size—13½" w. x 4¾" h. x 6¾" d.

stereo BY Crosby

Crosby Electronics, Inc. · 135 Eileen Way · Syosset, L.I., N.Y.

Manufacturers and designers of stereophonic components, speakers and the Crosby Compatible Stereo FM Multiplex System.

Export: Microwave International Corp. · 36 West 44th Street, New York 36, N. Y.

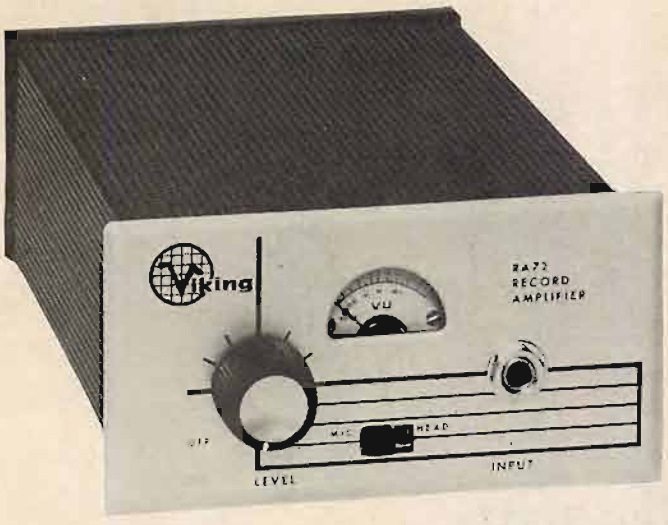


Fig. 5. One of the two RA72 recording amplifiers used in the Stereo Compact.

are the main operating controls which consist of the a.c. switch, a bar knob which has three positions for cueing, neutral, or forward tape motion. In the cueing position, the brakes are released but the pressure pads hold the tape against the heads so the reels may be turned by hand to locate a particular point. The outer ring controls the fast operations—rewind and fast forward.

The Recording Amplifiers

The RA72 recording amplifiers furnished with the Stereo Compact provide sufficient gain to work from a microphone or from another tape head, and provide the correct equalization for recording. In addition, they furnish both bias and erase voltages. The two amplifiers are identical, and since two oscillators are thus used, they are synchronized by a common coupling through the OSC SYNCH jack. A monitor jack is provided, and the recording level indicator is furnished with each amplifier. Recording level is controlled from the knob on the front panel, and recording head current—as related to VU meter indication—and bias current are separately adjustable from the rear panel. These amplifiers are in the professional tradition, with adequate isolation between signal circuits and meter and monitor circuits so as to avoid distortion. The RP72 recording amplifiers are fitted to furnish erase current to either low- or high-impedance heads—a fact in itself which should suggest these devices as a simple solution for the do-it-yourself recorder builder. The microphone jack is located on the front panel, and a switch permits selection of flat inputs, such as microphone or tuner, or head inputs which require equalization.

Operation

The over-all operation of the Viking transport is quite simple and practically foolproof. The braking system consists of a cord which fits in grooves in the supply and takeup reels, and a separate supply-reel brake mechanism that is adjusted independently of the other brakes. We have yet to see a Viking transport either break a tape or spill it when it was adjusted normally.

Over-all Performance

Assuming that 0 VU indication on the meter was the correct maximum recording level, we measured an input of 1.9 mv from the microphone input to obtain the normal output, and at the tape-head input a 1.85 mv signal was sufficient for the same output. Similarly, a 95 mv input at the high-level jack gave the normal recording level. Bias frequency is 65 kc, and bias current was continuously adjustable from 0.2 to 5 times the normal value. At the high-impedance erase head jack, the voltage was approximately 103, and at the low-impedance jack, 7.05. At an indicated 0 VU, a signal of 0.46 volts was available at the monitor jack for headphones or to feed another amplifier if used in a studio-type setup.

Playing a standard tape through an external preamp, we measured a variation from 50 to 10,000 cps (at 7½ ips) of less than 1 db, which verifies the playback setup. We next recorded a frequency run (at 20 db below indicated 0 VU) and played that back over the same system, with a variation of not more than ±2 db from 20 to 15,000 cps. Signal-to-noise ratio, measured below the 3 per cent harmonic distortion tape level, was 57 db.

The Stereo Compact is just the sort of machine that the tape experimenter would get the most enjoyment from because of its extreme flexibility. With it he can do a variety of recording tricks such as sound-on-sound and reverberation, and most machines are not capable of such a variety of uses. While it may not seem as simple to operate after reading these comments, there is no reason why it couldn't be connected up normally without any unusual arrangements and then used just as though it did not have all the flexibility built in. But it is just that flexibility that makes it an ideal recorder/amplifier combination for the real hobbyist. K-23

DYNAKIT MARK IV POWER AMPLIFIER

While practically everyone talks stereo, there are still many applications for monophonic amplifiers—even though one common use is to convert a mono system into stereo. And even in stereo systems, many people prefer to have their power amplifiers separate—one of the good reasons for this is that a failure in a dual amplifier puts the entire system out of commission, while a failure of one amplifier of a pair only puts one channel out.

Be that as it may, the Dynakit Mark IV is quite similar to one half of Dynakit Stereo 70. It puts out a clean 40 watts at a measured 0.85 per cent IM distortion, and measures flat with +0.5 db from 10 cps to 43 kc.

The circuit of the Mark IV is very similar to the original Mark II and the later Mark III in that it uses a pentode-triode in a voltage amplifier/phase splitter which drives the output-tube grids without an intervening driver stage. The output tubes, EL34's, are used in the distributed-load connection, with a portion of the plate tapped to feed the screens. This provides the high efficiency of pentode operation with the low distortion of triode operation when optimized—as it appears to be in the Dynakits we have observed to date.

Figure 6 shows the amplifier without its protective cover, with which it is normally used. The use of a printed circuit for much of the wiring places some relatively high voltages on the panel, and the cover keeps children or animals from possible danger; furthermore, tubes in 40-watt amplifiers

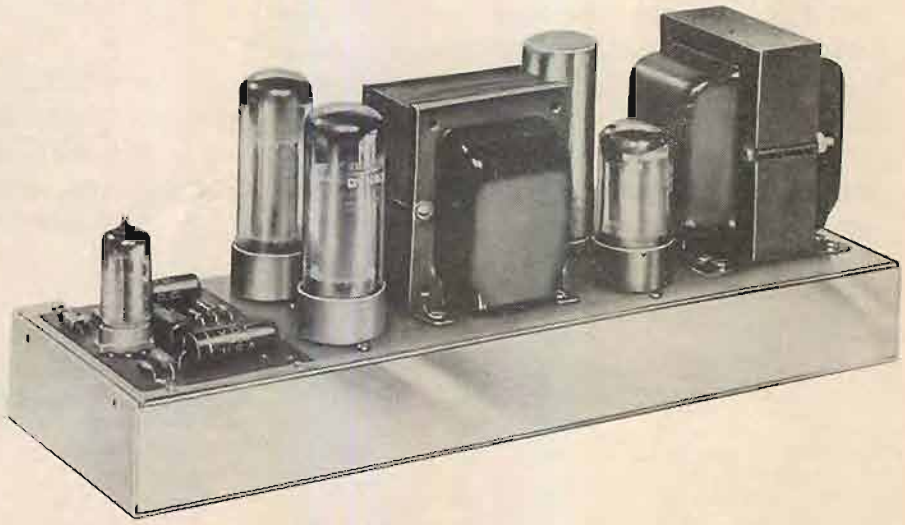
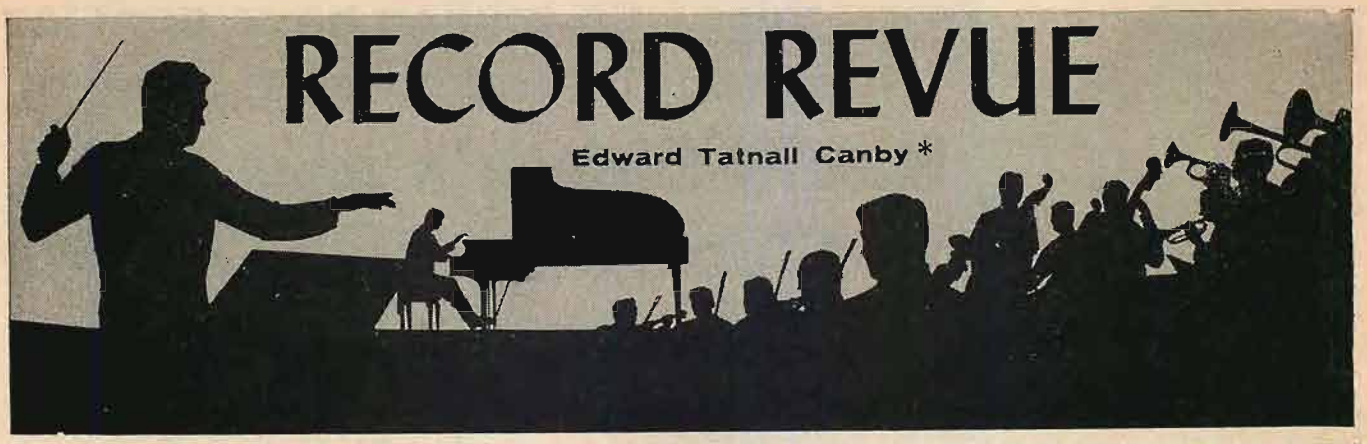


Fig. 6. The new 40-watt Dynakit Mark IV, with the protective perforated cover removed.



RECORD REVUE

Edward Tatnall Canby *

1. EVER-WIDENING HORIZONS

Bach: Brandenburg Concertos, complete (Nos. 1–6).

(a) Bath Festival Chamber Orch., with Yehudi Menuhin.

Capitol SGBR 7217 (2) stereo

(b) Netherlands Chamber Orch., Szymon Goldberg.

Epic BSC 105 (2) stereo (mono: SC 6032)

Two interesting new versions of the complete Brandenburgs and, for my cash, Yehudi Menuhin wins hands down—to my great surprise, I'll admit.

Szymon Goldberg made an early recorded reputation via his highly classic Mozart sonatas, along with Lili Kraus—their 78-rpm records were priceless, before the war. Since then, he has branched into chamber music and small-orchestra conducting, as per this recording and many earlier LP's. He is a dynamic violinist and an energetic leader, with a furious drive yet not much freedom and largeness of expression. His Brandenburgs are skillfully done but, for my ear, rather coldly and with a hard finish. They are all classical balance and proportion, without romantic aberrations but, also, with a lack of imagination in respect to the requirements of the very specialized original scores.

It's not that Goldberg uses flutes instead of recorders in No. 4 (they play with a coldly precise staccato effect) and ignores the violino piccolo in No. 1 in favor of the standard violin. Rather, it is the implication that these older instruments are inferior and unnecessary that seems to me a serious misunderstanding of the musical intentions. The liner notes make this attitude still more clear, not even being accurate as to their descriptions.

Yehudi Menuhin, who once was a boy-genius fiddler, open to the full exploitation of publicity that has ruined so many virtuosi of the sort, is now a first-class violinist (not the greatest) and a constantly growing musician, ceaselessly expanding his own private frontiers beyond and above the virtuoso role. It is typical that in the Menuhin Brandenburgs the older instruments are treated with enthusiasm and respect as well as top musicianship—a rare combination, let me tell you. One might expect a neo-Romantic slushy approach from him—far from it. The playing throughout is exemplary in style and, on the whole, better and more musically phrased than Goldberg's.

Menuhin himself plays violin, viola, and the violino piccolo part in No. 1; he directs from the viola desk in several of the concerti, exactly as did Bach himself. The full range of instrumental color in the originals is imaginatively exploited here. French-type French horns, nearest to the *corno di caccia* (hunting horn) sound of the original, a pair of excellent recorder players (and flutes, too, where indicated by Bach), excellent gambas for No. 6 and an acceptable high-B-flat trumpet for No. 2. And in No. 1 Menuhin himself plays a 17th century violino piccolo (it's tuned a third above the standard violin) which, he so rightly hears, is indispensable for the music with its peculiarly high, thin, other worldly fiddle tone. (Goldberg's recording calls it obsolete—it is, of course; but that is entirely beside the point. The concerto itself by the same argument is highly obsolete!).

The British recording in Menuhin's version is a lovely job, too, a lively, warm, faithful portrayal of these colorful instrumental combinations. Stereo adds an extra musical authenticity. I'd call this the best set of Brandenburgs yet.

Franck: Violin Sonata in A.
Brahms: Violin Sonata No. 3 in D minor, Op. 108.
Yehudi and Hephzibah Menuhin.

Capitol SG 7215 stereo

"It's like when spring comes," says Hephzibah, the pianist, playing with her famous violinist brother as of old when they were both kids. These two sonatas surely sound like sonatas should—as of, perhaps, thirty years ago when the Menuhins were growing up under elders now mostly departed.

Both sonatas will bring tears to oldsters who remember many a sonata recital in this manner warm, broad, enthusiastic, slow-tempo, the piano pedalled into an almost-blur (but not quite), the violin dialog sweet and earnest, the whole leisurely and comfortable, as well as big and Romantic. The Franck benefits most, relatively. That sweet and gentle sonata tends to wither on the vine under most playing situations today; it can't take modern efficiency.

I compared the Brahms, out of curiosity, with Szymon Goldberg's, Artur Balsam on piano, a 1956 Decca release (DL 9721). Interesting—Goldberg's is so much more efficient, louder, more intense, faster, cleaner, and the same with Balsam's excellent piano playing. Even the recording is drier and closer, where Capitol gives the Menuhins a ripe and luxurious liveness.

I'll have to admit to a wee preference, at least in this Brahms, for Goldberg and Balsam. I love the Menuhins but I'm a modern, in spirit at least, and can't help liking the recorded efficiency of the Decca version. It's nearer to the hepped-up demands of the recorded medium. The Menuhins play "live," as though for a devoted group of friends in a small audience, relaxed and unhurried. On records, it's just a bit too much of a muchness, laudable as the intentions may be. We have to live with our medium, alas, come what will. This is more an evocation than it is a performance. As such—terrific.

Bach: Cantatas No. 140 ("Wachet auf"), No. 4 ("Christ lag"). Vienna Chamber Choir, Vienna State Opera Orch.; Laurence Dutoit, soprano, K. Equiluz, ten., Hans Braun, bass, dir. Prohaska.

Vanguard BGS 5026 stereo

There are no works more difficult to get down on records than the cantatas of Bach, and no music more rewarding in its inner sense. Accordingly, we keep on bravely trying; perfection remains poignantly distant, yet Bach himself manages to get through. Until we create a wholly new *genre* of voices—which we will not do—the vocal expression in these works will mostly be inferred, rather than transmitted direct. Thus the Cantatas remain tough for any Bach beginner not yet familiar with their musical language—and superb for all who learn to hear what is there to be heard, "between the notes."

I'd rate this as a brave try, so-so in musical results. I feel again that Prohaska is a musical liability. In disc after disc, his hard, unyielding beat takes the eloquent edge off fine singing and good playing, spoils the fluid sense of good phrasing. I heard it here before I realized who was conducting. The soloists are earnest but uneven and not very accurate; the tenor has a poor sense of recitative flow, as well. The chorus is fine but, for my taste, too close to the mikes and not "chorusy" enough, especially the tenors.

I've searched every paragraph of Vanguard's notes for information on the soprano named Laurence, who has also appeared on several Vox discs. Male or female, I found her or him slightly off-mike here and not a convincing Bach singer.

The Kroll Quartet. (Haydn: Quartet in D, Op. 64, No. 5, "The Lark"; Schubert: Quartet "Death and the Maiden"; Tchaikowsky: Quartet in D, Op. 11; Prokofieff: Quartet No. 1.)

Epic BSC 108 (2) stereo (mono: SC 6037)

Here is a pleasant kind of study-in-depth of the work of one group of players, a top-notch American quartet that has been in business under this name and previously as the Coolidge Quartet for many years. This group has long been associated with the Library of Congress musical events. The two-disc album comes with a good looking four-page booklet, illustrated.

The Kroll Quartet is a singularly eloquent playing group, working in the American manner under fairly high tension but with so much of a lyrical bent that there is neither hardness nor cold drive. Ensemble is unusually fine, the top and bottom lines (violin and cello) particularly strong, making for a well-balanced and economical impact on the ear. The Schubert and Haydn are to me superbly played, the Tchaikowsky excellent, though that music isn't very exciting stuff, when you come down to it. At least, the Krolls don't try to push it beyond its somewhat frilly substance. The Prokofieff struck me as a trace less suited to their way of playing, though the group has covered enormous ranges of contemporary music in its long career.

The recording is superb, a full, round, natural sound of great presence. Heard close-to, with wide-spaced speakers, the stereo is rather sharply separated; but from almost any casual listening point the spread and blend of the four instruments is wholly natural. The gutty sound of individual strings is particularly well caught.

Orff: Der Mond. Philharmonia Opera Co., Sawallisch.

Angel 3567 (2) stereo

Phew—what an oddly Germanic sort of

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

popular "opera" this is! Orff (famed for his *Carmina Burana* hereabouts) has done a series of stage works intended to find a new theatre audience, for musicals in a new manner, and this was the first, performed on the eve of the War in early 1939 at Munich. It isn't remotely like any conceivable popular-style stage work in America. And yet it does have a strange sort of mass appeal. It also, for my ears, rings of the apocalyptic end of the German world in a quite eerie fashion and well it should have in those terrible days. Quite ghoulish and most convincing, notably the happy drunken scene where batches of peasant corpses revive and let go in a mausoleum, only to be put back to eternal sleep by Saint Peter, who joins in the fun for awhile before hypnotizing them into their graves.

Der Mond is the moon, and in this story it is a kerosene moon-lantern that hangs in a tree to light up things in a village where night reigns eternally. Bumpkin boys, local yokels, run off with it to another village, where it gets put to work in another convenient tree, until (as time passes) the boys die off, have it cut into quarters and deposited in their graves with them. Then comes the above grave scene, lit by the light of the reassembled kerosene moon—quite grisly as well as funny, and the whole thing so reeks of complex symbolism in starkly dramatic terms that one wonders why Hitler didn't take a dislike to it on the grounds of possible treason or something. But Hitler was pretty busy elsewhere in February, 1939.

Orff's music is like nobobdy else's. It runs not on kerosene but on sheer rhythm and repetition. Harmony, for him, mostly just stands still and jitters. Effective, hypnotic and very easy to catch onto—hence the Orff popularity. And he has a superb sense of stage drama, even on records. Like Menotti but even simpler and a lot more direct. Sophisticated listeners may find all this repetitive musical jittering a bit annoying in the end—but just as they do, a sudden turn of sheer drama will make them forget it fast.

There's Wagner, Puccini, Mozart (the German *Singspiel* style, partly spoken, partly sung, with peasants) and the knell of Hitlerian doom in this little piece, and the stereo is as good as the top-notch performance. Notes, complete text in both languages.

Dallapiccola: Five Fragments of Sappho; Two Anacreon Songs; Goethe-Lieder; Christmas Concerto; Five Songs. Elizabeth Soederstroem, Frederick Fuller; Instr. Ensemble, Dallapiccolo, Prausnitz.

Epic BC 1088 stereo (LC 3706 mono.)

This is Fromm stuff. The Fromm Music Foundation is virtually a one-man enterprise financed by wine—Paul Fromm is a Chicago wine importer—and it aims to help composers get together with performers. As an adjunct, the listeners are brought into the Fromm picture (if you buy the records) via Epic's continuing series of recordings.

Mr. Fromm is not out to please the capricious listener. Nor is Mr. Dallapiccola, one of the leading "twelve-tone" composers of the middle generation. I do not recommend this for light listening of an autumn evening. That does not mean, we must eternally remember, that there is no pleasure to be had from it. Not unless you consider yourself a wooden-headed, tin-eared dope. Alas, too many hi-fi fans do just this, and the more fool they, for not respecting their own intelligence in the face of things a bit new and different. I *do* recommend this interesting music to any person with, shall I say, an inquiring ear, and the patience to follow the texts as printed on the back of the record jacket.

"Twelve-tone" music can't be heard but only played on instruments? Singers, who have no keys to push down for their notes, can't cope with its wild jumps and 100 per cent lack of key and scale? Just listen to these two singers and you'll find that they can. *These* can. Soederstroem is the best; she's really terrific, by which I mean she sings atonally with full conviction and human feeling and utter pitch accuracy. Never any doubt as to what note she's aiming for. Mr. Fuller's baritone is just as accurate, if somewhat less persuasive in its dramatic presence. Both sing this extra-difficult music in a way to make you think that maybe modern music *is* kind to singers, relatively speaking. They just have to have ears, and be nimble. But so do Mozart singers.

You'll find the music generally what you will expect in the post-Schoenberg school, a collection of semi-solo instruments, close-up, small-orchestra style (and effective on records), individualized in color; a relatively mild rhythmic drive, never steady; much extreme leaping about; the voice an instrument among instruments; and over-all, a kind of post-Romantic mood of elevated seriousness.

In addition, Dallapiccola has an Italian sense for good voice writing that is conspicuously absent in others of his school of musical thought. Good stuff.

Folk Festival at Newport (July 11/12, 1959).

Vanguard VSD 2053/55 (3) stereo

Folk people everywhere will be buying these records and their mono equivalents as a matter of course. They are an edited, compressed documentary, boiled down from the 1959 two-day folk get-together (which took place before the lamentable riots that have since given Newport a slightly tarnished reputation in the festival world) and you can sense the atmosphere of the big show neatly and accurately—though I'll bet around 90 per cent of the elapsed time was edited out. There's the music, from practically everybody in big-time folk music. And there's MC stuff à la TV, applause, whistles, screetches and even, alas, considerable audience tepidity, clearly expressed after some of the items via lukewarm response.

Some of us will disagree with the majority audience-opinion here, which favors the loud, bumptuous famous-names over the more subtle folk music and the newer finds. People are people and folk fans are just as unmusical, sometimes, as symphony-goers. But in and among these many presentations are fine things, show-biz or no. You'll take your choice out of dozens of styles, including a few stylings I'd rate as plain dismal, speaking as a

folk fan m'self. Gotta please everybody, I suppose.

Can't list all the names—too many.

Bert and I . . . and Other Stories from Down East. Robert Bryan, Marshall Dodge. **A Maine Pot-Hellion.** (Produced by Bert and I).

Event 301, 302
("Bert and I." Box 26, Cambridge 38, Mass.)

These two amusing dialect records have been making quite a little splash in the region of the "Hub of the Universe" (Boston to you) and on down Eastwards. (Down, in that region, is to the North in case you didn't know.) I saw them in many record store windows on my last visit down-they-uh.

The slow, understated, deadpan stories aren't exactly an ethnic document, hee-yuh. The boys that tell them aren't the Folk themselves but reasonably good imitators of the same out of the highbrow classes. The accent is authentic all right, and the presentation is in the right style, if not any too expert in dramatic terms, at least via recording. These people are teachers, ah-ktects (*local pron.*), Yale grads, and so on, but all have personal knowledge of the region, though I bet they couldn't fool one 'o them natives down they-uh. Most have been entertaining at Rotaries, Saint Botolph Club and the like for years. First record is by two Yalies; second is a collection of almost a dozen tale-tellers, tied in via a faked-up postman going his rounds from gossip to gossip.

Fun, but I'll have to report that the recorded technique isn't up to par. So-so sound plus varied and annoying background noise, for one thing. More important, an amateurish approach to the recorded medium—the story tellers aren't at home with the mike, often hesitate (could have been edited out), time their climaxes poorly, miss the proper deadpan effects. Worst is the punk editing, that clips every story right into dead tape practically in the middle of the final syllable. Disconcerting, and it kills those superb underplay endings that should "sit" for a moment, to let the typical double-take sink in!

Even so, you'll get the points OK. Proof of the so-so recording technique hit me unexpectedly the other day—I ran into one of these story tellers in person (the ah-ktect), who summers in Connecticut. He told some of the same stories "live" at a social evening—and timed them marvelously well, bringing down the small house at the end as deftly as any Down Easter could manage. To transfer the same to recordings, though, you must know your recorded medium cold. Bert and I (not *me*, of course) don't—yet.

Bartok, Ives, Milhaud, Skalkottas. Zimbler Sinfonietta, Foss.
Siena S-100-2 mono.

This is just to signalize Siena, a new small company that has taken over a portion of the excellent ex-Unicorn catalogue and is reissuing the recordings with the same covers and notes but re-cut masters. This collection of short modern pieces (Bartok *Divertimento*, Ives *Unanswered Question*, Milhaud *Symphony No. 4*, Skalkottas *Little Suite*—he was Greek, died 1949) was originally taken down and cut by Peter Bartok, has been re-cut, I understand, by Decca, Bartok specifying that no "soupings-up" should be performed on his tapes.

On direct comparison with UN LP 1037, the original, I noted what really did seem a slightly clearer, cleaner sound—the original is excellent, as of 1956 or so. The improvement probably involves both cutter head and record plastic, or so I would guess.

Very high standard, anyhow, and Siena should be watched for more high-class reissues of this sort.

2. SYMPHONIC

DeFalla: El Amor Brujo
Wagner: Tristan; Love Music from Acts II and III. Shirley Verrett-Carter, sopr., Phil. Orch. Stokowski.
Columbia MS 6147 stereo (mono: ML 5479)

Happy event! After 19 years, Stokowski comes back to the orchestra that was his for 28 years, beginning in 1912. "Stoky" and the "Philly" played the first American performance of *El Amor Brujo* in 1922. It was Stokowski who popularized instrumental Wagner in this country through his masterful condensations of the operas, the *Symphonic Synthesis*, back in the 1930's.

Stoky's return to Philadelphia was a sensation in February, 1960. It's a sensation here too, on records; at least, it is for those who have known him a long time and warmly remember his vast influence on American music and on record listening, his stormy defense of new music over three decades.

The old Stokowsky opulence, so right in its best forms, is ideal here and very much of its time, the not-so-distant past. With this orchestra it does not fall into over-ripeness and inaccuracy. He's a ham when he wants to be and always was. But here, he works succinctly and honestly, as he always could.

Under his hands, *El Amor* is a rich period-piece, lush as it ought to be, the (negro) soprano solo as guttural as she must be, wonderfully imaginative in her Spanish role. As for *Tristan*, this is one of those complete Stokowski "Symphonic Syntheses" that so carried us away a quarter century ago—what an expert tailoring job, and so much more appealing than the uncomfortable stringing-together of badly matched excerpts that we often get from the opera! I guess RCA, who once owned both Stoky and the Philly, must have the rights to that title; I miss it here. But the music is lovely, title or no.

With or without titles, Columbia now has the Stoky-Philly monopoly all to itself. We won't get much more pioneering out of Stokowski today, a half century after he began it. But we can have some elegant reminiscences of a great period done into modern stereo, continuing the somewhat less elevated series Stoky did for Capitol. Columbia's offering is better music and better playing, if only because it's done with the Authentic Original Stokowski orchestra, the Philadelphia.

Prokofieff: Symphony No. 5, Op. 100. Cleveland Orch., Szell.
Epic BC 1079 stereo (mono: LC 3688)

Dr. Szell continues to grow, along with his rising Cleveland Orchestra; it's with music like this, appealing and well known but not quite in the inner circle of familiar repertory pieces, that he does best. This is a smooth, eloquent, wonderfully disciplined reading without the tendencies to bombastic playing and over-lush hysterics that come to such music easily in other hands. It brings out the best, notably the marvelous inner workings of instrumentation and line. I was absorbed in Prokofieff's work, straight through, and so will you be.

Credit, too for a complementary excellence in recording by the Epic (Columbia?) engineers who work in Cleveland.

Beethoven: Symphony No. 7. Cleveland Orchestra, Szell. **Epic BC 1066 stereo**

It seems that most conductors who are (a) young and on the make or (b) mature and aiming for the top tend to do funny things with the standard repertory works of exalted nature as though forcibly to impress themselves upon the music. It's more than cold calculating. Mostly, they can't help it.

I felt just that sort of reservation about this Seventh with Szell though perhaps on rehearing it might prove more interesting on its own. I noticed, first time, a surprising speed, a hasty sort of sound, even for these speed-up days. Very likely it's OK in its own terms; but you must be warned that if you have preconceived notions of the music from 'way back, this recording will whip you right along fast and, maybe, unwillingly.

I'm not just saying it is a poor job. Just a "different" job, with the differences there to be assessed, plus or minus, by you, the listener.

Prokofiev: Suite from "Love for Three Oranges"; Scythian Suite. St. Louis Symphony, Van Remoortel.
Columbia MS 6132 stereo

The new young conductor of the St. Louis here turns out two typical 1920's pieces by Prokofieff and I have found my attention wandering each time I play the record—several tries already. Why? Prokofieff's fault? Mine, for eating too much Sunday dinner?

I haven't time to wait and try again, but I suspect that it isn't all P. but maybe Van R. and the St. Louis. That orchestra is just emerging from a quarter century of old-fashioned Russianism under the excellent but somewhat limited Golschmann, who did Russion and French music just fine when it wasn't too modern. St. Louis itself didn't ever go for modern ikon-breaking (iconoclasm) and tended to react with jaundice, as I heard myself, to the brassy, dissonant, snazzy 1920's modernism exemplified in this recording.

What I hear, I guess, is a driving, somewhat chilly young conductor and a somewhat intimidated orchestra neither yet ready to project early Prokofieff with the warmth that can and often does redeem it.

Ravel: Daphnis and Chloe, complete. New England Conservatory Chorus, Boston Symphony, Munch.
RCA Victor LSC 1893 stereo

One of the nicest things the LP record did for music was to return the complete versions of many ballet and theatre scores to popularity, in place of those shortened suites that served so many years, both on records and in concerts, to represent the whole. Here's a splendid example replacing the once-too-familiar *Suite Number One* and *Suite Number Two* which were what we always heard from this work.

In concert, the suites were short enough to keep fussy audiences from getting restive when new works were thrown at them instead of the familiar Beethoven and Brahms. On records, the suites were ideal for the short-play 78. On LP, both situations are changed, clearly for the good. This is only the one area where records—not concerts—have been the decisive musical influence in re-shaping the current repertory, whether musicians like to admit it or not.

Munch is in his element in French music and so is the Boston, which for years specialized in Ravel first performances. The semi-pro student chorus (with alumni ringers to augment the sound) is well chosen for the music —wordless vocalizing throughout—and the stereo-hi-fi impact of the complex score is terrific. Good stuff.

Beethoven: Symphonies Nos. 1, 8. Beethoven Symphony #2; "Leonore" Overture No. 2. L'Orch. de la Suisse Romande, Ansermet.
London CS 6120, 6184 stereo

I played the first of these two, which must stand for both (and for other Beethovens from Ansermet). Here, you have an authoritative reading of a relatively old fashioned type, beautifully and consistently carried out, that somewhat massive, heavy, early Beethoven that was preferred by most in Ansermet's generation as of before the War. The performance is faithfully musical in detail and in the whole, but it strikingly lacks several modern touches that have come into common currency in recent years.

For one, this is not the lean, brilliant, crystal-clear early Beethoven we now often hear, as part of the serious, impartial modern approach that treats all Beethoven as alike in deserving our attention—early or late. Instead, there is a gentle parody feeling, the youthful music taken in almost exaggeratedly Beethovenesque manner, bear-like and ponderous, swift-clawed, as though to make very gentle fun of youthful precosity. Nobody does that any more, among the young! Here, we feel throughout that with all due reverence to a great man in his first maturity this isn't quite, after all, the Ninth, or even the Eroica.

It all goes with the old saw that the odd-numbered Beethoven Symphonies (excluding No. 1) are the "great" ones. They are, to be sure; but that compulsive need to compare everything with the "great" works no longer is as prevalent as it used to be. We make fewer comparisons, take our Beethoven Seconds and Eighths for what they are and can offer on their own. A healthy attitude, in the long run, and surely Beethoven's too.

I note that the always-difficult Eighth, less-than-great or no, gets a casually masterful treatment here that should make us open our eyes in the presence of an old pro. Old fashioned, yes; but when it comes to real musical problems, Ansermet can solve them in a trice where younger conductors flounder. The Eighth comes off here as it seldom does in the whole even though the performance is no marvel of inner subtlety. The old man knows how to make it tick.

Don't miss the Leonore No. 2, understudy for the much more famous No. 3. No. 2 is the same music sprawled out at greater length and much lower tension. I've always had a soft spot for it, again because of too many comparisons with its famous and more intense younger sibling. Give it a chance on its own —Ansermet can help you.

CHARLES A. ROBERTSON*

STEREO

Bernstein Plays Brubeck Plays Bernstein
Columbia CS8257

Dave Brubeck: The Riddle
Columbia CS8248

A certain segment of the jazz fraternity has yet to forgive Dave Brubeck for making the cover of *Time*, a distinction usually reserved for business tycoons and comedians. Ever since then his obvious faults have been stressed at the expense of his equally obvious virtues, and by some of the same people who began to downgrade Cannonball Adderley for suddenly selling quantities of records. A little popularity can often be damaging to all sorts of jazz reputations. There is no denying that jazz is the better from Brubeck's presence, but never before have his contributions assessed so high as on these two LP's. They comprise a more fitting accolade than any magazine cover. Perhaps now he can risk posing, glass in hand at the piano, in beverage ads as a Man of Distinction.

Leonard Bernstein conducted the Brubeck Quartet and the New York Philharmonic last December in the premiere of *Dialogues for Jazz Combo and Orchestra*, and the same cast encores it here. The new work in four movements is by Dave's brother, Howard, who is Chairman of the Music Department at Palomar Junior College in California. Superior sound on the stereo recording gives a far better impression than the radio broadcast of one of three Carnegie Hall performances, and listeners of both jazz and classical leanings will discover much to hold the attention. The composer took great pains to work out the problem of integration of symphonic orchestra and jazz instrumentalists, rewriting some movements several times. He comes closer to a solution than any of his predecessors, largely because of a thorough understanding of the Quartet as a whole, and each member as an individual. His orchestration is a real extension of the Quartet not a vacuous background or a separate entity by itself.

The history of jazz is alive with individuals who would make ideal subjects for the writer of extended orchestral works. Howard Brubeck is probably not the first to realize this fact, but he is the only composer to hit upon the correct formula for carrying off such a project successfully. During the same season, Bernstein also premiered a work featuring the brilliant trumpet technique and high notes of Maynard Ferguson. The personality reflected was more that of the composer, William Russo, than Ferguson, whose part might have been played just as well by Cat Anderson. Brubeck's creative impetus always seems to flow from the Quartet, or one of the improvised solos. However, there is room for both approaches, just as long as Bernstein gives them a hearing.

Perhaps the enthusiastic response accorded these works will convince other composers that such efforts are feasible and economically rewarding. Brubeck, having disposed of the pianist in the family, might try sketching the career of Fats Waller, from the youthful organist through rent-party days to the frustrated popular entertainer, while Russo might devote some thought to a study of the transitional periods in jazz, utilizing such figures as Roy Eldridge and Coleman Hawkins. And the conservatories can reclaim anyone unable to find something to write about in King Oliver's tragic life.

In the meantime, the present work can stand as a model for capturing the essence of a jazz group in musical terms that invade classical precincts, yet allow the soloists to determine the nature and duration of improvised passages. As an older brother, the composer is able to view the pianist's achievements with an objective eye and invariably focuses on the most pleasing aspects. Ample space is alloted in the melodic middle portions for both the pianist and alto-saxist Paul Desmond to show off their ballad styles. Drummer Joe Morello and Eugene Wright, bass, are never at a loss in unfamiliar surroundings, and Morello solos assuredly during the concluding fast blues section. On the reverse side, the Brubeck group demonstrates again why other pianists no longer dare string choruses together in haphazard fashion. The tunes from Bernstein musicals include *Maria, I Feel Pretty, Somewhere, A Quiet Girl,* and *Tonight.*

"The Riddle" finds Brubeck enjoying an intellectual holiday during the summer of 1959, when the Quartet was ensconced at Music Inn. Bill Smith, his guest on the date, was at nearby Tanglewood as clarinetist with the Fromm Chamber Music Players, and had prepared a set of variations on the basic theme of the English folk song *Hey, Ho, Anybody At Home* on commission from his former classmate at Mills College. The pair studied there under Darius Milhaud, but still needed rehearsal to master this puzzle. It should please all workers of acrostics, chess players, mathematical wizards, astronauts, and unravelers of schematics. But once jazz lovers hear Smith's clarinet, they will quickly realize that Tanglewood's gain was Music Inn's loss.

Miles Davis: Sketches Of Spain
Columbia CS8271

Celedonio and Celin Romero: Spanish Guitar Music
Contemporary S8502

After flirting with "the Spanish tinge" on previous efforts, Miles Davis and Gil Evans are now completely involved in the pursuit of a music which expresses the emotions of the blues and springs from a similar soil. On hearing the recording on Columbia (ML 5345) of Juan Rodrigo's contemporary work *Concierto de Aranjuez*, Davis fell under its spell and began to wonder how it would sound with trumpet instead of guitar in the principal role. Evans became interested, wrote a longer middle section, and worked with Davis on the arrangements while both engaged in a home-study course, listening to ethnic recordings of flamenco music and reading about gypsy life.

When ready to record, they were steeped in the subject and had enough material to fill an LP. Evans is an old hand ot the type of orchestration required for the *Concierto*, and the real test of his skill lies in the unusual rhythm patterns. Many are quite complex, and the definition and clarity of stereo is a great help to the listener. It is also highly effective during the street procession on *Saeta*, and in lifting the veil when Evans puts a gossamer coating on orchestral textures.

Davis penetrates more deeply into Spanish temperament than before, capturing the elusive phrasing of a guitarist and the vocal timbres of flamenco singers. One of the fascinating things about this music to both men is undoubtedly a purity of form which has endured for centuries. This tradition exists in jazz, especially among trumpet players, but has suffered grievous onslaughts from all quarters and is often obscured. Although Davis uses blues intonations and always plays jazz trumpet, *only once* is he encouraged to speak out in jazz terms. In that case, on *Solea*, there is the legitimate excuse of showing the close relationship between flamenco and blues. Here Evans makes the rhythm swing, and Davis crys the blues. Admirers of Manuel de Falla will find that composer damaged not at all on *Will O' The Wisp.*

Celedonio Romero is the father and teacher of Pepe, the youthful flamenco virtuoso who enjoyed a debut on Contemporary at the age of fifteen. Celin, the oldest son, often shared the concert stage with his father, just as he does on this program, before being drafted into the U. S. Army. The classic tradition of purity of form and touch is amply demonstrated on works by Fernando Sor, Albeniz, Malats, and Tarrega. The father also plays two of his own compositions, while the son unfolds two lovely folk melodies from Catalonia. The knowledge that "Miles is listening" should cause other jazz musicians to investigate this repertoire. A session with the Romeros is a fine source for rejuvenating that tired improvisational feeling. And there is another guitarist coming along in the family, Angelo, aged thirteen.

Sonny Terry and Brownie McGhee: Blues Is A Story
World Pacific 1294

An engagement last December at The Ash Grove, a folk music oasis in Los Angeles, gave Sonny Terry and Brownie McGhee the opportunity to make their second stereo recording. The first was issued on the Janus label and may not be available in most shops. For this reason, many listeners will be first tempted to hear the pair in stereo concert when their attention is drawn to the current release. Few will regret an affirmative decision, as the life-like placement of Terry's harmonica obbligatos in support of his partner's vocals is an aural experience not to be missed.

As well as being ideal stereo subjects, they can be recommended as reliable guides for anyone venturing down the path of the blues for the first time. Both are thoroughgoing professionals who polish their work to a high finish, without removing any of the raw vitality from such tunes as *Keys To The Highway, Louis, Prison Bound,* and *Pawnshop Blues.* Terry shows what can be done with a two-dollar instrument on *New Harmonica Breakdown,* while his teammate is featured on *Brownie's Guitar Blues.*

Henry Mancini: The Blues And The Beat
RCA Victor LSP2147

Taking a brief respite from the task of chronicling deeds of television sleuths, Henry Mancini does a bit of investigating on his own. Before sending men out into the field, he furnishes each one with a description and modus operandi of the subjects to be pursued, writing short overtures on both the blues and the beat. Four French horns reinforce the regular agents, and the reed section doubles on alto and bass flutes and piccolo. Elementary deductive reasoning tells them that the blues would hardly be lurking in a tune so labeled, and the search continues through *Smoke Rings, Misty, Blue Flame,* and *After Hours.* And if the blues are anywhere, one such hiding place is certainly Ellington's *Mood Indigo.*

The beat quest involves lots of stereo action, with crossfire from Victor Feldman and Larry Bunker on vibes, while brass and woodwinds take up defensive positions. Roland Bundock, bass, and drummer Jack Sperling test new rhythmic ideas on *Big Noise From Winnetka* and *Sing, Sing, Sing.* The case will enthrall admirers of Mancini's scores for "Peter Gunn" and "Mr. Lucky." Engineer Al Schmitt also is on duty again at the controls.

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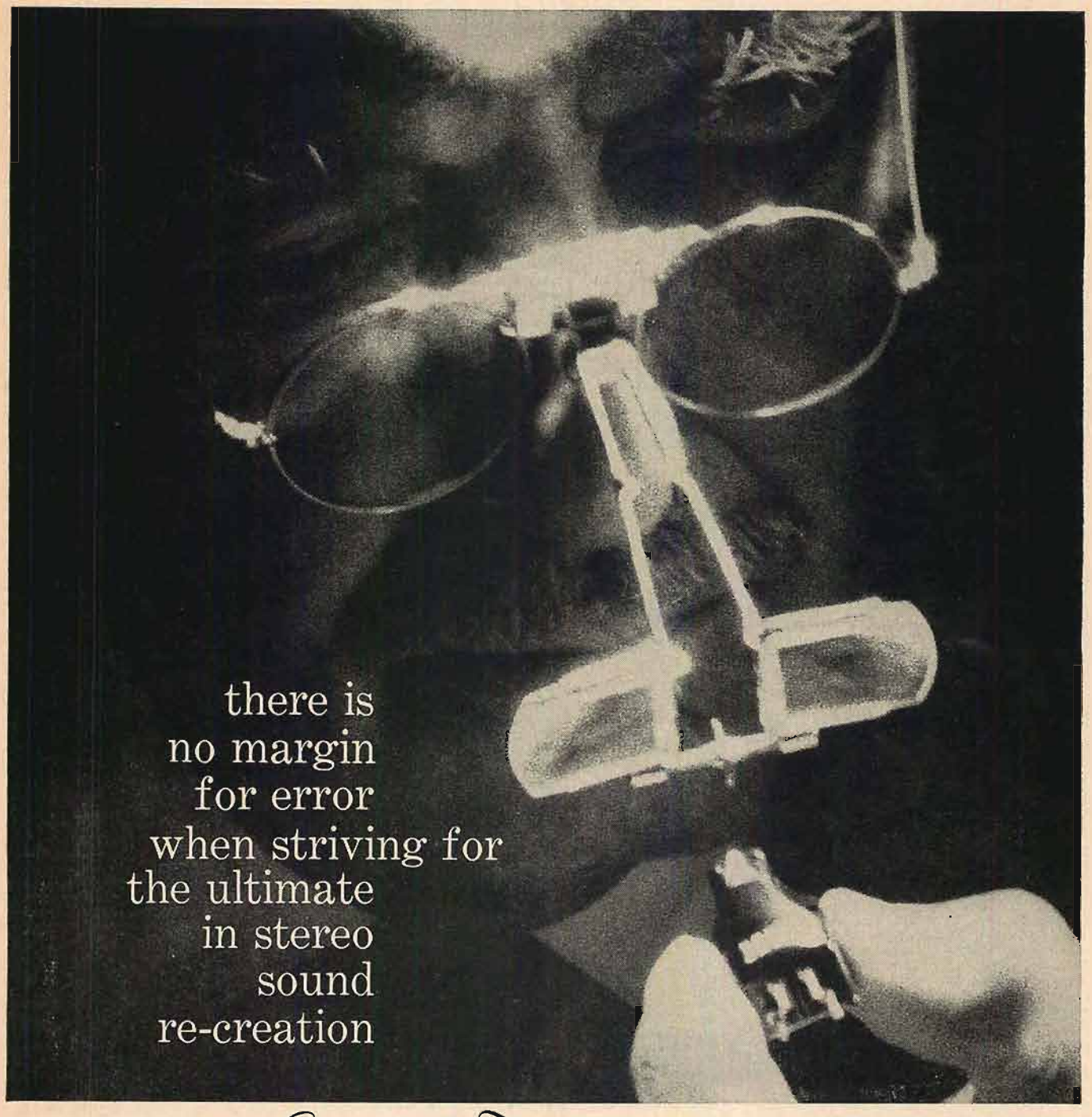

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Cannonball Adderley: Them Dirty Blues
Riverside RLP1170

After the sudden rise to fame and fortune of the new Cannonball Adderley Quintet on the crest of its first Riverside album, the company had a hard time catching it in one place long enough for a second. It was finally accomplished in two sessions in different cities. The interim between saw the departure of Bobby Timmons and the arrival of Barry Harris from Detroit to fill the piano post. Timmons was around to expound on his own *Dat Dere*, Gershwin's *Soon*, and bassist Sam Jones' *Del Sasser*. His replacement displays a fund of swinging lyricism on Duke Pearson's balladic *Jeannine*. The Adderley brothers unite on Nat's *Work Song*, and the leader's earthy title tune. By now, owners of the first album have bought the second and are enjoying it just as much. Jack Higgins recorded Timmons in New York, and Ron Malo of Chicago's Ter-Mar Studio handled the remainder.

Gloria Smyth: Like Soul
World Pacific 1293
Mavis Rivers: The Simple Life
Capitol ST1408

Everyone is looking for the girl who will be the next great jazz vocalist, and these new entries show as much promise as any on the horizon. After starting out at the Apollo Theater in 1951, Gloria Smyth served a long apprenticeship in countless clubs across the country. Dick Bock heard her in Los Angeles and hit upon the idea of using four distinct groups from the World Pacific stable to introduce her on LP. Les McCann, Joe Castro, Ronnie Ball, and Terry Trotter all turn up on piano, and Teddy Edward's tenor sax is featured extensively. If the singer could forget about ever hearing Chris Connor, she would do better on ballads, but the accuracy of her rhythmic pulse never fails on *Running Wild*, *It Don't Mean A Thing*, and *Gee Baby Ain't I Good To You*. Most appealing are *I'll Be Over*, a song of her own devising, and the soulfelt *Motherless Child*.

Capitol is grooming Mavis Rivers for its popular division, but her lovely voice would be a real asset to jazz. With a little coaching from Peggy Lee and musicians of the sort Miss Smyth enjoys, she might uncork a few surprises. Her style at present is refreshingly free of eccentricities picked up from other vocalists, and she gets right under the skin of such tunes as *At Sundown, Early Autumn*, and *Get Out And Get Under The Moon*. The settings by Dick Reynolds blend well in stereo and also are unblemished by tricks. The Samoan lass recalls her native South Pacific Islands on *Far Away Places*.

Glen Gray: Swingin' Southern Style
Capitol ST1400
River Boat Five: On A Swinging Date
Mercury SR60186

With a few cornstalks stacked in the rumpus room corners and apple cider on the table, all any fall dancing party needs to get underway is either of these items on the turntable. In fact, Glen Gray's Casa Loma crowd is quite capable of ringing the rafters of a school gym. Component dealers are missing a sure bet, in these days of the hard sell, if they neglect to demonstrate stereo at dances held by PTA's and other organizations. Van Alexander, Jack Marshall and Larry Wagner are responsible for unusual big-band stylings of such favorites as *Milenberg Joys, Riverboat Shuffle*, and *Carolina In The Morning*. Considerable thought as to the best stereo placement of brass and reed voicings went into the planning of each number, but not at the expense of a dancing beat. Brand new rousers written especially for the album are *Cotton Belt Cannonball* and *Cajun Shout*.

The River Boat Five, while not of the same dimensions, is really a septet with a fine, fat-sounding tuba to ensure that novices practicing in far corners will not miss a step. Nappy LaMare, banjo, and drummer Ray Baduc are borrowed from Capitol and pep up the rhythm section. Ed Reed, clarinet, leads the group on such tidbits as *Cherry, Girl Friend*, and *If You Knew Susie*. Malcolm Chishom of Universal Recording engineered the date, and Dave Carroll's informative notes on the operation are even more detailed than usual.

Lionel Hampton: Silver Vibes
Columbia CS8277
Jonah Jones: A Touch Of Blue
Capitol ST1405

The latest luminary to take a flyer at the Jonah Jones formula is Lionel Hampton, who cuts down the power and glides gracefully through ten romantic tunes. Tommy Flanagan and Teo Macero provide arrangements which call for the sonorities of a trombone choir as a velvety frame for the leader's vibes. Eddie Bert, Bobby Byrne, Dick Hixson, and Bob McGarity or Santo Russo are all suitably arrayed and never overpower the soloist in stereo. Flanagan heads the rhythm section on piano, and the only member of Hampton's current group to be included is guitarist John Mackel. Hampton dips into his inexhaustible supply of melodic invention on *Day By Day, Speak Low*, and *What's New?*

Jonah Jones receives the support of a "swinginest chorale" on a dozen tunes with the word blue in the title, but alters his vivacious trumpet style not a whit. Surely he has sold enough albums for Capitol by now to be rewarded with the presence of a few old cronies on a purely jazz date. He shows the reason why during ad-lib choruses on *Dust Bowl Blues*, one of his own tunes. Stereo keeps the voices in the background and odd corners, while the quartet drives Jones straight down the middle on *Blues In My Heart, Blues Skies*, and *Blue Turning Grey Over You*.

MONO

Frederic Ramsey, Jr.: Been Here And Gone
Folkways FA2659

When the ninth installment of "Music from the South" appeared in 1957, Fred Ramsey promised to round out the project with another LP and the publication of a book on his experiences. Both items are now available, allowing Ramsey to mark finish to the endeavors of a decade spent on field trips, editing tapes and sifting material. The book, published by Rutgers University Press, is lavishly illustrated and also bears the title "Been Here and Gone." It is doubtful, however, that this adventurer with a tape recorder has traveled for the last time along Southern byways, and before long he should be "gone again."

A graduate of Princeton University in 1936, Ramsey has resided in the North most of his life. He now occupies a house, which he built for his family in 1952, on the side of a hill in New Jersey looking across to Bucks County. But he has covered more than 25,000 miles on visits to rural regions in the South, besides going into the interior of Jamaica with an expedition directed by Dr. Joseph Moore of Evanston, Ill. He became an ardent record collector before entering his teens, and an interest in jazz resulted in his collaboration on the book "Jazzmen," while working for Harcourt, Brace. Since then, as a free-lance writer, he has engaged in research and contributed critical articles to publications too numerous to mention.

Fully qualified to investigate the backgrounds of American Negro music when the project began, he now holds a unique position by virtue of the knowledge gained. He produced a one-hour film on the subject which appeared twice on CBS-TV and deserves to be shown again. He should be encouraged to continue the task.

Ramsey would also like to see other collectors out in the field exploring areas still untouched. There is increasing evidence that his records drafted a few hardy souls, and the book is likely to inspire still more. It takes the reader on a conducted tour of the remote localities Ramsey visited, introducing the people in homelike surroundings with the aid of 203 photographs distributed throughout the text. For the sake of convenience, Ramsey links his separate trips into one continuous journey, starting with the older country musicians and working up to the younger generation. On the way, he creates a sympathetic picture of an environment and tempo of life that will soon be gone. Ramsey avoided duplicating material obtained by others, so there are no prison camps or chain gangs on the itinerary. If any fault is to be found, it is that Ramsey makes his work seem deceptively easy.

The author has no desire to mislead the tape enthusiast, however, and his record notes contain a few warnings and much useful information. As the sound represented a great advance in the quality of field recording at the time, he was asked to amplify on his audio experiences for this review. Ramsey's first encounter with the practical side of the business was while working on OWI and Voice of America overseas programs during World War II. He produced albums of Leadbelly and Baby Dodds for Folkways in 1946, and recorded Leadbelly's "Last Session" on a Brush in 1948. His technical education progressed along with the growing tape industry, and he has used everything from a portable, battery-powered Magnemite to studio consoles. Among the professionals who helped him are Moe Asch, Peter Bartok and Dave Hancock, but a great deal was learned from reading as well as counter-hopping at Harvey's and at component outlets along Cortlandt Street.

When preparing to go out into the field, Ramsey bought a Magnecorder with Rangertone attachment in 1950, and it became his standby in taping about one-hundred hours of material in Alabama, Louisiana, and Mississippi. It proved to be rugged under the roughest conditions, traveling about 40,000 miles in seven years and testing out flat from 80 to 15,000 cps at the end of the period. Ramsey considers this fair for field work, and the machine was checked over before each trip. A pair of dog-ears permits a one-half hour run at 15 ips, which is especially helpful when working without an assistant. Ramsey always takes along a Leica and a Rolleiflex, has assembled a file of more than 3000 negatives in black and white or color, and often snaps pictures while in the middle of a session. He prefers a one-mike setup and used the RCA Starmaker for the most part, although in Jamaica two extra pickups were employed to follow the action of dance groups. Because of the cramped acoustics of most dwellings in rural regions, Ramsey developed a real talent for recording outdoors and learned to ignore the sound of passing trucks, stray crickets, or a flock of whip-poor-wills.

A few of Ramsey's rules of the road are: "Never ride gain, always test for peaks and stay with it. Watch any choral groups, and tend to record low. Always use headphones of high quality to spot acoustic or other distortions. Best source of juice in remote spots is battery-inverter with reed vibrator to hold to 60 cps a.c. Battery portables are likely to have too much speed variation for music, although they can be useful for interviews. Don't try for studio perfection in field work, as time is of the essence. It is often more important to do continuous recording, and catch the spontaneous moments, than to get absolute balance by pushing people around when they want to perform rather than be pushed around."

During the three years spent on the book, Ramsey went through his early material again, gathered new data, and came up with a more thorough grasp of his subject than before. Plans to have the final LP consist of "Talking Backgrounds" were changed in order to have it correspond roughly with the book's outline. Several of the people featured previously are revisited, including Louis Bonner playing an old country hunt horn, Horace Sprott, Freddie Small, Scott Dunbar, Mozelle Moore, and the Blackberry Woman, Dora Bliggen. As a crowning touch to a comprehensive survey of the beginnings of jazz, it follows Ramsey into New Orleans by way of three numbers from the Eureka Brass Band. For all practical purposes, it makes a better introduction than conclusion to the series and may well persuade many listeners to investigate the earlier volumes.

The notes are amply supplemented with photographs, and Ramsey repeats his conviction that much remains to be recorded and documented, with only a short time for it to be accomplished. While still certain that a way of life is fast disappearing, he seems less worried about a tradition of music fading away. Perhaps recent recording activities have given him confidence that it will last longer than expected. It always seems to come back strongest after being just about smothered under the mass of popular media. Ramsey certainly deserves a full share of the credit

for giving it renewed vigor and increasing its chances of survival.

The Return Of Roosevelt Sykes
Prestige/Bluesville 1006

Another old-time blues artist walks back into the recording studio after a long absence and makes a first appearance on LP. Unlike many of his contemporaries, Roosevelt Sykes managed to keep working as a single, but mainly in clubs where the demand was for "mostly progressive and jazz music, such tunes as *Honeysuckle Rose* and *Stardust*." Memphis Slim helped locate him, rounded up four sidemen, and made sure the atmosphere on the date was straight from Chicago's South Side. Even in his early days, Sykes had a gruff, masculine style, and the nickname "Honeydripper" was certainly not for his singing. His manner today is as rough and tough as a grizzly bear's, and lends credence to a remark he makes about his first instrument, which was located in his grandfather's church, "I don't play organ anymore, a fellow has to pound on something. You've got to mash it."

He attacks the piano with a powerful boogie beat, and all but two tunes are his own. Heard along with his first hit, *Night Time Is The Right Time*, are *Number Nine, Coming Home*, and *Runnin' The Boogie*. Although two guitars are listed, one is apparently a Fender bass, which is sometimes described as a bass guitar. Whoever plays it gets a distinctive sound, somewhere between electronic organ and a distant calliope.

Witherspoon, Mulligan and Webster: At The Renaissance
HiFiJazz J426

Were it not for Jimmy Witherspoon's successful performance last year at the Monterey Jazz Festival, it is doubtful this on-the-spot recording would exist. Before the event, no club on Hollywood's Sunset Strip would hire the singer, and the management would consider it a breach of contract if Gerry Mulligan played nothing but the blues. Ben Webster, tenor sax, and drummer Mel Lewis are the only holdovers from the Monterey accompanying group, but everyone is intent on maintaining the same high-spirited spontaneity that distinguishes the festival recording on this label. If the impact is slightly less, chalk it up to Whitherspoon's reluctance to do more than one of his own songs, *Time's Gettin' Tougher Than Tough*. He excels on original material and should find time to create more of it. But there is nothing wrong with his treatment of tunes associated with other singers, such as *Every Day, Outskirts Of Town*, and *Goin' To Kansas City*.

Mulligan obviously enjoys the outing, and the relaxed interplay of his baritone with tenor sax is something to hear on *C. C. Rider*. Webster and Lewis, ably abetted by bassist Leroy Vinnegar, are bulwarks as before. While not a pianist the caliber of Earl Hines, nor of Pete Johnson on *Roll 'Em Pete*, Jimmy Rowles comes up with interesting ideas of his own about the blues. A good recording, and the Renaissance audience is highly receptive.

Al Casey: Buck Jumpin'
Prestige/Swingville 2007

The Legendary Buster Smith
Atlantic 1323

Few attempts at recapturing the excitement which existed in jazz during the Thirties have turned out better than these visits to the studio by men who were away too long. While Al Casey's presence would have benefited many a recording date in the last decade, the former Fats Waller guitarist was buried in rhythm and blues bands. Just to prove his fellow workers also can play jazz, he brings along the rhythm section, with the estimable pianist Herman Foster, from the band of King Curtis, his current employer. Rudy Powell, an old friend from Waller days, is on clarinet and alto sax. Returning to unamplified guitar, Casey reveals a new version of his old specialty *Buck Jumpin'*, and delivers a pointed sermon about jazz roots on *Casey's Blues*. All that Casey learned from Waller is displayed on *Rosetta, Honeysuckle Rose*, and *Ain't Misbehavin'*.

Anyone wanting to know more about Casey is referred to Hugues Panassie, but the story

of Buster Smith and how he came to be recorded again is available only in a pamphlet sealed in the LP liner. Gunther Schuller's description of the efforts to locate Smith in Dallas and record him in Houston are worth the price of admission. On hearing the leader's alto sax and eight-piece band, oldsters will relive the moment when they discovered Basie's band on the way up from Kansas City. On hearing Leroy Cooper's baritone sax, youngsters will discover something to make recent poll winners sit up and take notice. Bob Sullivan's recording job is good.

Art Blakey: The Big Beat
Blue Note 4029

Max Roach: Quiet As It's Kept
Mercury MG20491

When either of these leaders takes a group into a studio of late, there are usually a few new faces if not an entirely new outfit. Perhaps drummers believe the best way to keep customers on their toes is to stay there themselves. Art Blakey's Jazz Messengers this time contains only one newcomer, Wayne Shorter, who earned a degree in Music Education at New York University and acquired a reputation on tenor sax while with Maynard Ferguson. However, Bobby Timmons is back on piano after his stay with Cannonball Adderley. So, with Lee Morgan elevated to the post of musical director, Blakely heads one of his better groups and can settle into some degree of permanency without disappointing his fans. Shorter contributes three originals, making a healthy down payment of dues owed another tenor player on *Lester Left Town*. Timmons prepares the congregation on *Dat Dere*, and Morgan's trumpet preaches the sermon. Aside from allowing Blakey to punch holes in *It's Only A Paper Moon*, the album title has nothing to do with rock and roll.

Max Roach introduces the Turrentine brothers, but changes made since this session will result in his being heard with still another group. Tommy's trumpet is featured on *To Lady* and *Lotus Blossom*, while Stanley's tenor sax enlivens the title tune, and a blues in 5/4 tempo. With an adequate amount of staying power, they could become as well known as the Adderley brothers. Trombonist Julian Priester is of the rapid-fire school and wrote *Juliano*. Roach's only rhythm aid is bassist Robert Boswell, and both work like trojans to keep the ensembles off the ground and the soloists moving.

Eric Dolphy: Outward Bound
New Jazz NJLP8236

Although playing around Los Angeles for a good fifteen years, Eric Dolphy was first heard by more than a limited audience when he toured with the Chico Hamilton Quintet in 1958. The job required him to play chamber jazz and affect an almost legitimate tone. Sounding and looking like a recent conservatory graduate, he played a number of instruments with great proficiency and restraint but little fire and imagination. This album presents him for the first time on his own and reveals what was concealed before, along with anything added since he decided to remain in New York.

A quick hearing is likely to leave the impression that here is Ornette Coleman's first disciple to play alto sax also. The two met in 1954 and Coleman's recent rise to prominence undoubtedly has encouraged Dolphy to exhibit greater abandon. As his development is still underway, it is much too early to assign him a definite role, especially when many of the formal characteristics which Hamilton drilled into him remain. It is enough, for the moment, that Dolphy is confounding those individuals who scoffed at Coleman and doubted he would influence jazz in any way.

Dolphy owes a debt to others who helped him get started, and pays his respects to Gerald Wilson on *G. W.*, and to Les Robinson on *Les*. He plays lyrical flute on Richard Rodgers' *Glad To Be Unhappy*. His most impressive number, *Green Dolphin Street*, involves a switch to bass clarinet, and the sounds extracted from this multi-toned instrument are colorful and unique. Freddie Hubbard is on trumpet, and an exceptional rhythm section consists of Jackie Byard, piano, George Tucker, bass, and drummer Roy Haynes. To attain full expression of his capacities as player and writer, Dolphy needs to head a similar group for a period of time. But what he says here is important and worth hearing.

Presenting Joyce Grenfell
Elektra EKL184

If civilization survives the crisis brought on by male sick comedians, it will be due to the beneficial effects of healthy girl humorists. After Beatrice Lillie, the leading member of the clan is easily Joyce Grenfell, who also is probably the healthiest. She always seems ready to depart on a ten-mile hike across English countryside after a performance, and her mind centers on things that keep the world together, such as girl chasing boy. Her wit is as wholesome and enticing as a bowl of strawberries and Devonshire cream. Even Ed Sullivan is known to smile at her television appearances in this country. This album of her best monologues is long overdue, and permits her to encore *Life and Literature*, *Nursery School*, and *Life Story*. On several of her songs, written in collaboration with the composer Richard Addinsell, she is accompanied by George Bauer at the piano.

AE

AES CONVENTION

(from page 25)

Friday, October 14

9:00 a.m. ARCHITECTURAL ACOUSTICS AND ELECTRONICS.
John M. Hollywood, CBS Laboratories, Chairman.

Reverberation System for Home Entertainment Equipment
Harrison E. Dow and Maurice E. Swift, Philco Corp.

Sound Control Techniques for the Legitimate Theatre and Opera
Harold Burris-Meyer and Vincent Mallory.

Colorless Artificial Reverberation
M. R. Schroeder and B. F. Logan, Bell Telephone Laboratories.

Acoustic Considerations in the Design of Recording Studios
M. Rettinger, RCA.

10:20 a.m. STEREOPHONICS I.
Robert C. Moyer, RCA Record Division, Chairman.

A New Portable Stereo Mixer
Charles A. Wilkins, Ampex Professional Prod.

Stereophonic Earphones
Benjamin B. Bauer, CBS Laboratories.

Projector—Stereo Sound for 16-mm Film
Richard H. Ranger, Rangertone Inc.

An Omnifunctional Tri-Channel Stereophonic Control Center
Ralph Glasgal, Fisher Radio Corp.

1:30 p.m. STEREOPHONICS II.
Robert C. Moyer, RCA Record Division, Chairman.

A Suggested Layout for a Stereo Mastering Installation
Stephen F. Temmer, Gotham Audio Corp.

An Automatic Stereophonic Phaser
A. Goldberg and G. D. Pollack, CBS Laboratories.

2:10 p.m. AUDIO APPLICATIONS.
S. Edward Sorensen, Columbia Records, Chairman.

An 8-mm Sound Camera and Projector
Ray Hennessy, Fairchild Camera and Instrument.

A High-Quality 8-mm Sound Movie Projector
John M. Moriarty, Eastman Kodak Company.

A New Concept in Motion Picture Sound Recording Trucks
Carl E. Warner, Location Inc.

Audio in Education
Edward Golub, Bureau of Audio Visual Instruction, Board of Education, New York, N. Y.

Broadcasting Closed Circuit and Via Public Transmission Channels Through Master Control Facilities
Werner Freitag, New York University.

A Professional System for Paging, Music, and Signalling in Schools
Philip C. Erhorn, Audiofax Associates.

7:30 p.m. MEASUREMENTS AND STANDARDS IN AUDIO.
Sheldon I. Wilpon, U. S. Naval Material Laboratory, Chairman.

Audio and Electroacoustic Committee of the Institute of Radio Engineers
Iden Kerney, Bell Telephone Laboratories.

New EIA Music Power Rating Standards
James A. Stark, General Electric Company.

An Artificial Voice for Close-Talking Microphone Measurements
Michel Copel, U. S. Naval Material Laboratory.

An Air Damped Artificial Mastoid
Erwin Weiss, Beltone Research Labratories.

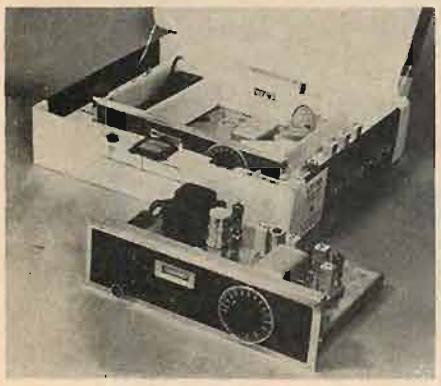
A Method of Testing Loudspeakers with Random Noise Input
Edgar M. Villchur, Acoustic Research, Inc.

Longitudinal Frictional Vibration in Magnetic Tape Recording
Robert Schwartz, U. S. Naval Material Laboratory.

Controlled Barkhausen Effect for Audio Applications
John Wiegand.

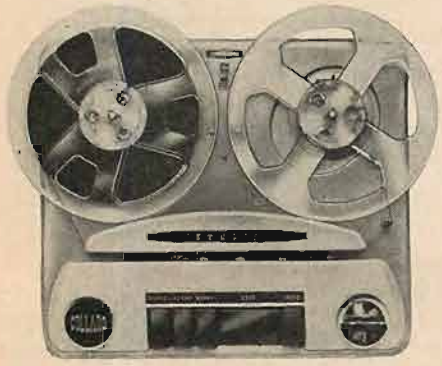
NEW PRODUCTS

• **H. H. Scott FM Tuner Kit.** The first kit ever put out by H. H. Scott, the LT-10 FM tuner kit incorporates many innovations which make it one of the best conceived FM kits to date. To start with, most of the mechanical components have been



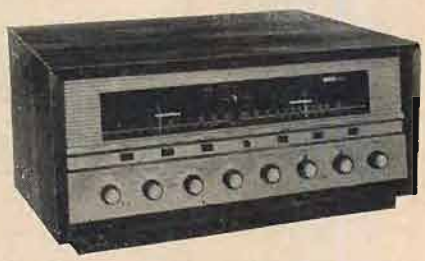
mounted at the factory—including the critical front end. The front end is the well-known H. H. Scott silver-plated front end, and is delivered both pre-assembled and pre-aligned. Another innovation is the packing box which is designed to be used as a portable work table—at the end of the day's labor the box is simply closed and put away. All parts are mounted on special boards which are coordinated with the instruction manual. The instruction manual is printed in full color so that resistors and other color-coded components are visually identified. All wires are color-coded, pre-cut, pre-stripped, and tinned. The alignment procedure for the LT-10 is also an innovation. No special equipment is required; the built-in tuning meter is used in conjunction with a tool which is provided. The biggest innovation of all is the mere 6 to 8 hours it takes to complete this kit—just long enough to realize that you have accomplished something worthwhile. For complete details contact H. H. Scott, Inc., 111 Powdermill Road, Maynard, Mass. **K-1**

• **Three-Motor Three-Speed Tape Deck.** Manufactured in England, the new Collaro tape deck is available as either a quarter-track stereo/mono recorder-reproducer or as a quarter-track prerecorded tape reproducer. The recorder-reproducer configuration incorporates separate heads for



erasing, recording, and monitoring. The reproducer model has one head. Utilizing three motors, the tape deck handles tape at speeds of 1⅞, 3¾, and 7½ ips. The new Collaro tape deck handles real sizes up to seven inches in diameter. Other features of this tape deck are band type brakes, full shielding on all motors, six jacks for input and output circuits. Rockbar Corporation, 650 Halstead Avenue, Mamaroneck, N. Y. **K-2**

• **60-Watt AM-PM Receiver.** The Harman-Kardon Festival II, model TA260, is a powerful stereo AM-FM receiver which delivers 60 watts essentially flat from 18 to 40,000 cps. The TA260 was designed to achieve the exceptional sound of the Citation kits. This encompasses the use of massive output transformers and conservatively rated output tubes. In addition to

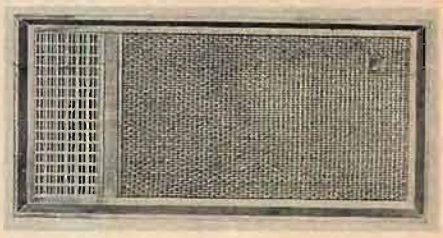


the 60 watt stereo amplifier, the TA260 includes separate AM and FM sections, and dual preamplifiers with sufficient controls for all necessary stereo functions. Included are dual friction-clutch tone controls; a blend control; contour, rumble, and scratch filters; a speaker phasing switch; and a loudness control. Also provided are separate tuning eyes for AM and FM, "third-channel" amplifier output, and a headphone receptacle. For prices and technical data write to Harman-Kardon Inc., Plainview, N. Y. **K-3**

• **Headphone Series.** Available in a variety of impedances, the Permoflux DHS series of binaural headphones achieve the full depth and presence available in binaural sound. The close coupling of the earspeakers eliminates the adverse factors of improper room acoustics and poor speaker placement. Available with 12/12, 16/16, 300/300, 600/600, and 10K/10K ohm ear-

pieces, and with several styles of earcushions, the DHS series is adaptable to a wide variety of circumstances. In addition various adapters are available which permit connecting up to four sets of headphones to one program source. For additional technical information and prices write to Permoflux Products Co., 4101 San Fernando Road, Glendale, Calif. **K-4**

• **"Ionovac" Speaker System.** Utilizing ionized air instead of the conventional speaker diaphragm for converting electrical pulsations into sound, the "Ionovac" high-frequency speakers are available either separately or as part of a complete speaker sysetm such as the DuK-20 full-range system shown. Based on the work of French physicist Sigfried Klein some years ago, the DuKane Corporation developed the principle to a practical reality. Heart of the speaker is a small open-end quartz cell, no larger than the eraser on a pencil, in which air is confined in a chamber which narrows down to a tiny aperture. Within this small space air molecules



are bombarded with a high-frequency, high-voltage current which knocks sufficient electrons free to ionize the air. The ionic cloud is modulated by signals from the amplifier and is then fed into a small horn which delivers them efficiently to the room as sound waves. The "Ionovac" has a frequency range from 3500 to 20,000 cps. The DuK-20 includes two midrange speakers and a 12-in. high-compliance woofer in addition to the "Ionovac." DuKane Corporation, St. Charles, Ill. **K-5**

• **Ready-Built Component Cabinets.** Designed to house complete monophonic or stereophonic systems, the new Heath equipment and speaker cabinets are completely factory assembled. Styled to coordinate with both modern and traditional decors, the new cabinets are available in

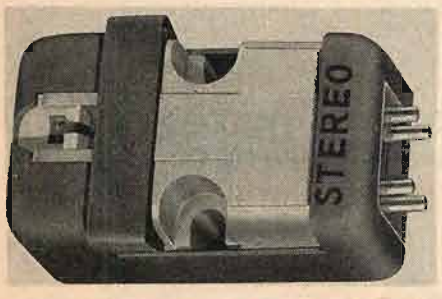
walnut or mahogany finishes—or unfinished. The center cabinet, model AE-20, has room for all components except speakers. The speaker cabinets, model AE-30 for 12-inch speakers and model AE-40 for 15-inch speakers, are designed to blend with the center cabinet. Adapter rings are provided for 8- or 12-inch speakers and a port is provided for installation of a horn type tweeter. Instructions are provided to modify the tube-vented design to match any speaker resonance. ¾-inch stock is used for all exterior panels and supports; solid woods for edgings, furniture grade veneers for front and side panels and shelves. Heath Company, Benton Harbor, Mich. **K-6**

• **70-Watt Stereo Basic Amplifier.** Conservatively rated at 35 watts per channel, the Fisher model SA-300-B stereophonic amplifier delivers full rated output at less

than 0.5 per cent harmonic distortion, plus or minus 1 db. Intermodulation distortion is less than 0.1 per cent by CCIR (European) standards, and less than 0.4 per cent by SMPTE (American) standards. Hum and noise are more than 100 db below full rated output. Each channel has connec-

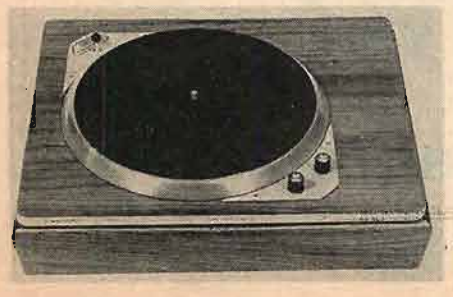
tions for four, eight, and sixteen-ohm speakers, and, in addition, terminals for adding a resistor to match the speaker's recommended damping factor. A "center channel" output jack is provided. Also provided are two input jacks for each channel; one with uniform frequency response and the other with controlled frequency response to assure optimum performance when using electrostatic speakers. Frequency response is 20 to 20,000 cps plus or minus 0.5 db. Controlled response is −3 db at 20,000 cps. Controls include input level, a.c. balance, d.c. balance, hum balance, balance adjust, and bias. Fisher Radio Corp., 21-21 44th Drive, L. I. C. 1, N. Y. **K-7**

• **New Magnetic Stereo Cartridge.** Designed to track at less than two grams stylus force, this new magnetic stereo cartridge, model DMS-900, marks an auspicious entry into the cartridge field by United Audio Products. The response range of the DMS-900 is 20–20,000 cps plus



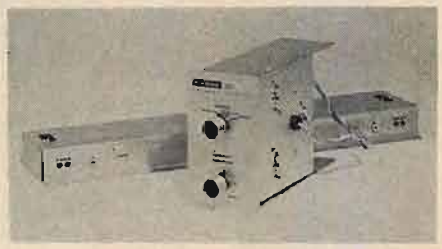
or minus 3 db; channel separation is 28 db at 1000 cps. Output level per channel at 1000 cps is 6 mv at 5 cm/sec. According to the company, laboratory tests reveal that the DMS-900 has good channel separation up to 15 kc coupled with exceedingly good symmetry of separation. A direct snap-in assembly makes changing the stylus a simple operation. For further information write to United Audio Products, 12 W. 18th St., New York 3, N. Y. **K-8**

• **Belt-Driven, Two-Speed Turntable.** The new Fairchild Model 440 features 2-speed operation (33⅓ and 45 rpm) from a single belt drive plus a "Speed Sentinel" control that varies turntable speed by ±1½%. Speed change is effected by a "finger" system which controls the placement of the



belt. The "Speed Sentinel" applies d.c. to the motor windings to control the rotational speed. The entire assembly is mounted on a channel for easy installation. Each turntable is packed with its final inspection record in the form of a graph. Fairchild Recording Equipment Corp., 10-40 45th Ave., Long Island City 1, N. Y. **K-9**

• **New Reverberation Unit.** One of the first reverberation units in the component field, the new Sargent-Rayment Reverbatron is a combination reverberation and echo unit fully compatible with all basic amplifiers. The Reverbatron, by introducing in your room the same type of reverberation produced by instruments in a concert hall, seemingly expands your room



to concert hall size. The Reverbatron consists of two sections; an electronics section which selects the desired function and intensity, and a mechanical section utilizing two delay lines of discrete pitch driven by two ferrite rotors controlled by the electronic portion. The reverberation effect is fully controllable in direction intensity. For additional information write to Sargent-Rayment Company, 4926 E. 12th Street, Oakland, 1, Calif. **K-10**

• **100-Watt Basic Stereo Amplifier Kit.** In keeping with the current trend towards quality, the Lafayette KT-550 stereo amplifier kit achieves sound reproducing

capabilities far in excess of the audible range—+0, −1 db from 2 to 100,000 cps. Utilizing multiple feedback loops, the KT-550 achieves extremely low distortion without evidence of ringing or instability. Total harmonic distortion is less than 0.5 per cent at 50 watts from 20 to 20,000 cps. Hum and noise are better than 90 db below 50 watts. Although rated at 70 watts, the 7027A output tubes are required to deliver only 50 watts thus insuring long tube life. Other features include telephone grade electrolytics; very high quality capacitors; deposited metal-film, glass core resistors; two printed circuit boards; and a step-by-step instruction manual with large pictorial type illustrations. The KT-550 is available in a factory wired version (LA-550). Lafayette Radio Corp., 165-08 Liberty Ave., Jamaica 33, N. Y. **K-11**

NEW LITERATURE

• **Rockbar Corporation,** 650 Halstead Avenue, Mamaroneck, N. Y. has issued a new 16-page Goodmans Loudspeaker catalogue entitled, "For the discerning listener." The booklet describes each of the Goodmans loudspeakers from the 8-in. "Axiette" up to the 15-in. "Audiom" woofers. Enclosure plans, the Acoustical Resistance Unit, and how to build a system in stages are also described. Free on request. **K-12**

• **Motorola Semiconductor Products,** 5005 East McDowell Road, Phoenix, Arizona. An attractive new 4-color brochure is available describing the complete line of Motorola industrial and military semiconductor products. The 12-page brochure lists key specifications for germanium power transistors, audio and switching transistors, silicon and germanium mesa transistors, silicon rectifiers, and silicon zener diodes. The booklet is free upon request. **K-13**

• **Jonathan Manufacturing Co.,** 720 E. Walnut Avenue, Fullerton, California has just released their new condensed catalogue listing ball-bearing slide mechanisms. This 16-page catalog lists dimensions, mounting patterns, and other descriptive information about ball-bearing slide mechanisms for electronic equipment cabinet chassis mounting. The Type II shock blocks, used to prevent damaging magnification of shock or vibration to slide-mounted electronic chassis and slide mechanisms, are also described. **K-14**

• **Dynaco, Inc.,** 3912 Powelton Ave., Philadelphia 4, Pa. announces the availability of a 6-page brochure describing its full line of high fidelity components. Included are descriptions and technical specifications of the Dynakit stereo and monophonic preamp and amplifier kits. In addition there is a complete description, including price, of the new Dynatuner FM tuner Kit. Other Dynaco high fidelity components described in this brochure are the Stereodyne II cartridge; TA-12 and the TA-16 integrated arm; and the Dynaco-B & O ribbon microphones. This bulletin is free on request. **K-15**

• **Vulcan Electric Co.,** 88 Holten Street, Danvers, Mass., has announced two new catalogs: a 12-page catalog on soldering tools, and an 8-page catalog on electric melting pots. The soldering tool catalog contains the latest prices and descriptions of soldering irons, soldering pencils, safety toolholders, solder pots, glue pots, and branding irons. The electric melting pot catalog describes the Vulcan line of electric melting pots for solder, lead, glues and other compounds. Catalogs available on request from the company. The soldering tool catalog number is VG-250, the electric melting pot catalog number is VG-201-P. **K-16**

• **Shure Brothers, Inc.,** 222 Hartrey Ave., Evanston, Ill. has available a new booklet on how to select, play, and preserve records. The booklet is designed to simplify the building of a record collection; to aid in the selection of phonograph equipment; and to guide in preserving the "first-play" quality of the recordings. Topics covered include ways to build a basic library, where to find reliable record reviews, the pros and cons of record clubs, and how to buy bargain records. Copies are available at 25 cents each by writing directly to the company.

LIGHT LISTENING

(from page 8)

wide backdrop for the refrain sung in the foreground by the male choristers. Sid Ramin's orchestra completes this study in depth perspective.

Vicky Autier: Vive Paris
Capitol ST 10245

This is a welcome change of pace. Unlike the typical, low-pitched and husky-voiced French chanteuse, Vicky Autier tickles the ear with a gossamer sound that doesn't cloy even in the last stages of the record. Part of the secret may lie in the work of the Paris engineers who managed the session. (This is one of Capitol's on-the-spot jobs in their Capitol-of-the-World series.)

Also on the different side is the choice of tunes offered by Miss Autier. An Irish ballad rubs shoulders with a Sidney Bechet original titled *Little Flower*. Metal rattles and finger cymbals build up the oriental atmosphere of *Adieu Tristess*. Sophisticated Latin tempos are found between such unexpected morsels as a swing arrangement of Anton Rubinstein's *Melody in F* and a ballad in the modern style with words and music by no less a cosmopolite than Elsa Maxwell. If you haven't gone in for this sort of fare in the past, it takes only a few moments to acquire a lasting taste for Mademoiselle Autier's song stylings.

Melachrino Strings: Bells Are Ringing
RCA Victor LSP 2279
Sammy Kaye: Bells Are Ringing
Columbia CS 8247

There are many ways to cover the tunes of a musical that has traveled from Broadway to the local movie house. Melachrino takes care of the listener seeking a subtle reminder of the hit songs in the Jule Styne score. Groove for groove, there's a bit more glamour and finesse in these arrangements than those used by the pit band in the original Broadway cast recording.

The Sammy Kaye album of dance arrangements is worthy of mention if only to help explain to the present generation what sort of sweetness some bands indulged in during the thirties. Very little has changed in the homey Kaye style which someone once described as the aroma of Mom's apple pie translated into music. Stereo serves to emphasize the cinnamon.

This is the Hollywood Bowl
Capitol SABO 8496

It would take several visits to the Hollywood Bowl to accumulate all the musical froth Capitol has gathered in this deluxe two-record album. Drawing upon a backlog of thirty albums released since 1954 by the Bowl Orchestra, seventeen sure-firing favorites in the Pops repertoire have been selected and brought up to date in brand new stereo pressings. Carmen Dragon, Felix Slatkin, and Alfred Newman take turns on the podium. Leonard Pennario stars at the keyboard in movie-based piano "concertos" by Addinsell and Rozsa. Acoustical liveness varies considerably within the span of six years covered in this release. At its best, the stereo illusion is limited to the somewhat rigid excitement of a large studio. While no one expects to hear a Capitol recording of an actual open-air performance on the stage of the Hollywood Bowl, I may not be alone in hoping that facilities may someday be found on the West Coast that will ensure greater acoustical freedom in future stereo sessions of this normally breeze-swept orchestra.

Roger Roger: Invitation To Paris
Everest SDBR 1093

A few more recordings such as this one and the dual-named M. Roger may become in this country the fixture he already is in France. When Everest, in an effort to round out its catalog, surveyed the light music scene in Paris, it wasn't too difficult to spot an orchestra leader who had written music for some five hundred films. The authentic arrangements feature a first-rate accordionist who paces the strings of the orchestra in pleasantries such as *Mademoiselle de Paris*, *Some of These Days* and a version of the *Beer Barrel Polka* that sports a French accent. The amount of echo introduced follows the fairly common French practice. It is noticeable only at the end of each selection.

Jane Morgan: Ballads of Lady Jane
Kapp KS 3191

Folk ballads such as *Molly Malone*, *Greensleeves*, and *Foggy, Foggy Dew* are served here as a dessert course. The medium is the whipped-cream voice of Jane Morgan. The Jack Elliott arrangements take advantage of Miss Morgan's innocence in matters dealing with histrionic ability and stress instead the straightforward appeal of a voice that is one of the easiest to mike in the business. The orchestral backgrounds are discreet and flavorsome. If you don't object to the idea of folk songs sung in evening clothes, this could be your dish of tea.

Robert Shaw Chorale: A Chorus of Love
RCA Victor LSC 2402

The smoothly-meshing sections of the Robert Shaw male chorus continue to confound less formal glee clubs with the agility of their serenades to the ladies. Of course, the Shawmen have been doing this sort of thing for some time now in a sizable batch of recordings. Even the title of the latest album is similar to one of their earlier collections called "With Love From a Chorus." Traditional love songs from Germany, Italy, Spain, France, Scotland, and Ireland tend to overshadow the three American tunes. The highlight of the album is the bouncy Czech drinking song, *Stodole Pumpa*.

AUDIO ETC.

(from page 14)

This could be done at the actual performance, necessarily by an engineer at the tape machines who had learned the musical cues; or it could be done ahead of time via a tape copy that would incorporate the proper fades.

The other way was used in the case of the Fine Arts Quartet demonstration—the "fades" were all-musical. I.e., the players themselves "played" the fades, at the outdoor recording session. They chose their own transition points—sometimes in straddled fashion, one instrument still playing loudly and the others softly, so that the moment of changeover, following musical lines of thought, actually would come at different points for each player. In one spot in the Tchaikowsky Quartet, the first violin plays a solo, recorded, to the accompaniment of the other three instruments, live.

There are enormous advantages to this system, as compared to the electronic fade that would at first seem the simpler method.

First, the musical-fade system puts the entire show in the hands of the musicians. They do their own fading, their own cuing, their own transitions, with minimum help from the engineering crew, who can concentrate on their own crucial problems. (Not that they didn't kibitz and even join intensively into the discussions with the players as to where the best points of transition might be—they did, and so did I. But we did not take the final responsibility. And in the actual demonstration, the engineers were finished with their work, once levels and balance and the like had been established. They just pushed the ON button and let 'er run.)

Second, the musical-fade system allows for a far *less* noticeable cue-sound, a lower volume level in the cue music, than the electronic fade. The reason is simple. During the cue passages, the musicians play the music at the lowest possible volume but *selectively*—as to significant notes, bits of tune, rhythms, rather than literally.

Anybody knows that to get the drift of a well known piece you don't have to hear

Fig. 1

all of it. Sometimes merely a faint squeak or two of distant sound will tell you in a split second that you're hearing so-and-so tune or symphony. A trace of suggestive rhythm, a single note placed just right, a faint *pizzicato*, is plenty to tell the experienced quartet exactly where they are in their own music—especially when the cues were played by themselves.

Thus the musical cues, though nominally complete in all four parts, were played back mainly with the idea of picking up these faint, quickly-interpreted fragments. The musicians did not need to hear the music as a whole—far from it.

I tried standing right on top of the quartet, within inches of the first violin and viola, just to see how the cue music sounded at that close range. Yes—occasionally I heard two cellos playing, or two first fiddles; but the reason was directional rather than because of loud volume. At that close range, the first violin was at my left, at perhaps 60 degrees, whereas the first-fiddle taped sound came from the speaker behind the second violin, about 15 degrees to the left of straight ahead. Later, I stood off to one side, and there I heard two cellos similarly from different angles.

Even under these extreme listening circumstances, I picked up only an occasional note of the cue music as the live musicians played with it. (We tried out every piece on the spot, of course, to see how it would work.) At ten or fifteen feet in almost any direction, the angles closed in and the differences in direction between cued and live performance became undetectible. The cue music then was entirely inaudible, or indistinguishable, at least, from its simultaneous and much louder live counterpart.

I'll grant that even though it is indistinguishable the cue music is there and does form a portion of the audible sound. Total silence from the speakers—were it not for the cueing problem—would be technically preferable. But under the circumstances, it seemed to me that this cue music represented a small factor among others that loomed far more important in the quality of the actual sound-match itself, between loudspeakers and actual stringed instruments.

For example, the first several hours of recording were to no avail simply because the mikes were set for the non-directional pattern. For reasons not very clear to me this produced a recorded sound that simply would not match up with the live fiddle sound, no matter how much we (they, I should say!) dickered with mike placement, instrument placement, playback equalization, and so on. When, finally, the simple change to cardioid pickup was made, the sound changed instantly and we had a near-perfect match in no time at all. In other words, the microphone pickup pattern, on this occasion, was a larger factor in the sound-match than the cue music and loudspeakers put together. The cue music wholly failed to disguise the unmatched tone quality between these first recordings and the live music; the speakers and amplifiers merely passed on the mismatch with "matchless fidelity"—i.e. with a very excellent approximation, which is what we can now achieve in the present state of the art.

The Background

I could write paragraphs about the humorous side-effects in this outdoor absolute recording. There were the crickets and the birds; the faithful neighbor who sat in his car at the turn of the road for a half hour, wainting for a break in order to drive away from that place; the enormous shotgun which the Boss unleashed into the maple trees to tell the birds to shut up—I got it on my portable recorder but practically burst my ear drums, as well as my mikes. There was that sound of maple leaves in the wind, which is exactly like the sound of unwanted tape hiss and thereby sends engineers into worrying fits. There was the constant confusion as the players and kibitzers out on the lawn shouted to the engineers inside the house—for we couldn't tell when the shouts were on the tape and when they were live. Time and again we answered a distant query from the house, only to find it was coming out of the loudspeakers from a tape made hours earlier.

These side-effects—the last-named—were indeed the signicant indications of the absolute recording's unusual nature. Not only did the live music sound like the recorded—everything else did too. And as in all absolute recordings, these could be played absolutely anywhere with complete and realistic impartiality. No double liveness, no hole-in-the-wall, no hollow echo. Just sound, virtually the original sound. After a couple of hours I simply gave up trying to distinguish between recorded and live conversation, as well as music. My eyes

told me one thing, my ears another, and that was that. Quite fascinating.

Incidentally, the birds and maple leaves and the non-sprayed crickets (thousands of them) are not important in the finished recordings for two excellent reasons—and herewith another odd argument for the musical-fade cue. The background noises were relatively low, what with cardioid mikes placed right on top of the four stringed instruments. But what really counts is that *the background stays with you* in the demonstration, because it is never faded down! It just goes on and on and it is background both to the recorded *and* to the live sound. By the well known rule of monotony, it is therefore entirely ignored by the listening ear.

Fade that background in and out in the demo and you'd hear every cricket for miles around.

* * *

It may be noticed, in these many paragraphs, that I have said virtually nothing about the quality of the playback equipment that reproduced this very convincing live-*vs.*-recorded demonstration. Natch, the whole show was put on to help publicize its merits, those of the speakers and those of the playback amplifiers and control system, both very well known.

This, I'll admit is in part a matter of tact, for it is not my present business to plug this equipment—it plugs itself, for better or worse, in actual demonstration and many readers have heard it, or will, via these same recordings.

I'm mentioning no brands (though nobody is being fooled) because it is my conviction that the really significant thing, for me, was the acoustical and musical coordination that was achieved via the principle of absolute recording. Without that, no equipment on earth now or in future can produce more than a happenstance live *vs.* recorded match.

I am sure that any reputable amplifier equipment, any good professional tape recorder—and many amateur recorders—could produce good results in this absolute fashion.

I am also sure that it is now within the art of speaker building to reproduce sounds so nearly "flat," that—*given the right accompanying conditions*, mainly the absolute recording—a creditable live *vs.* recorded match in sound can be achieved again and again, with very little left to illusion or imagination.

The AB test in this extremely special form is without any doubt the most literal test of speaker quality that can be devised via the ear alone, aside from sheer intuition. (Some people can just tell when a speaker is good or bad, and how or where.) I think that any speaker manufacturer now has it within his ability to produce this near-perfect AB comparison whenever he wants to.

I must admit, immediately, that I am quite sure many speakers now being manufactured will not pass the test, unless with some fancy jiggerings of playback curves. They are the worse for it. But I certainly do not think that this particular company has any monopoly on ideal speaker sound.

What we need is more absolute recordings and more speakers that can reproduce them anywhere—just like life. AE

ABOUT MUSIC

HAROLD LAWRENCE*

Music Criticism in the Electronic Age

THE DEDICATED AUDIOFAN, whose quest for the ultimate in sound reproduction represents a way of life, has been the butt of cartoonists for over a decade. One recurring theme pictures him surrounded by the fauna and flora of his electronic world: amplifiers, loudspeakers, cables, and so on. A record revolves on the turntable, but the speaker system is silent—our hero is peering intently at the oscilloscope.

A variation of this theme has been reported in Russia where engineers have invented an electronic device for testing singers without hearing them sing. According to the Moscow Radio announcement, "The sound frequencies making up the voice appear on film in the form of lines of different length. (This makes it) possible to determine whether a singer has a voice of professional calibre without actually hearing it."

In its role as a music critic, the Russian machine is unique, although the process of "reading" sound is a familiar one to engineers in many fields. Graphic representation of sound has been a valuable aid in analyzing a variety of sonic subjects, ranging from bird calls to human speech. The audio spectrograph, for example, reveals intensity, pitch, time and harmonic content of bird songs—a boon to taxonomists who can now pinpoint the geographic origin of a bird after a close examination of its audio graph. In the movie laboratories, where sight and sound synchronization is a vital matter, film editors have been utilizing visual sound registration for years. One method of inscribing sound waves, a cinematic counterpart of the etcher's technique, uses a stylus treated with a dry chemical designed to react with chemicals in the film coating. (*We have* heard *of this technique, but we have our doubts. Show us!* ED.) The scientists at Bell Laboratories opened a new avenue of approach in the field of soundwriting. Going beyond the boundaries of flat graphs and ribbons, they have emerged with a form of visible sound that can legitimately be called "stereo," which, from the Greek "stereos," means "solid." In an effort to improve the use of telephone coaxial cables, Bell's engineers have transformed speech into solid sound. The three-dimensional models of words which they have constructed resemble icebergs in whose peaks and valleys the components of the human voice can be studied.

In the world of music, many aspects of performance techniques can be placed under a sonic microscope using similar tools and methods. Three basic elements of vocal production—breath control, vibrato and intensity—are clearly perceived on the VU meter. One of the tests of a singer is his ability to rise gradually from a *pianissimo* to a *forte*. Whether the swell is made in fast or slow tempo, it should have the smooth, uninterrupted flow of a gull spreading wide its wings in flight. Through the X-ray picture of the VU meter, this is exposed with absolute clarity. A poorly launched tone will be seen to lose its momentum and falter a decibel or two in mid-flight before reaching its apex. Similarly, a headlong rush from *pp* to *ff* will show up on the meter as a violent, jerky motion. If the singer has, say, a sustained note at the dynamic peak, the needle may react in two ways: a wide and erratic oscillation would mark the presence of an excessive vibrato, better known as "wobble," whose span could encompass over four decibels; a narrow and steady quiver would indicate the singer has the note well under control. The dynamic plan of a performance may also be charted, provided, of course, that a careful level check precedes the test. When the dramatic and volume peaks of a song correspond, we can observe how some singers squander their opportunities for scoring powerful effects by shooting the works on several earlier minor climaxes.

Let it be said at once that level indications for voices are often extremely deceptive. Certain sopranos set the needles back on their pins at the slightest provocation, giving the meter-watcher the impression that great bursts of tone are being shot out of the singer's throat, when in reality nothing much is happening dynamically. In a soprano-bass duet, for example, the male voice may be louder to our naked ears, but the soprano will register peak levels with phenomenal ease, while *sounding* much softer.

Although the VU meter can tell us something about breath control and steadiness of tone, there is another more reliable means of examining musical performances short of naked-ear listening. For this we must return to the original recording played at half speed; that is, at an octave below normal pitch. If you can endure the ludicrous effect on singer's voices (half-speed tenors vividly recall Bert Lahr's unforgettable routines) you may discover some interesting facts. An ardent believer in half-speed musical detection is Jan Holcman, pianist and author (*The Legacy of Chopin*), who has auditioned over 1600 78-rpm piano discs at half speed, normal speed, and repeatedly. Holcman aims to publish a huge study of twentieth-century keyboard technique and pedagogics. He claims that finger technique is based on four elements which can be evaluated on a scientific basis. They are accuracy, quantity, speed, and symmetry. The first three are self-explanatory. "At half speed," Holc-

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man says, "you can detect technical failings that pass right by your ears in ordinary performance." An electronic counting device and a metronome handle quantity and speed. Finally, gradations in speed and intensity in rapid passages are brought to aural view with uncomfortable clarity.

Under the sonic magnifying glass, no artist is safe. At best he is *less* uneven and *less* inaccurate than the others. No one will dispute the fact that the "slow look" can help the student analyze his own technical shortcomings and can provide the tape editor with a useful guide in isolating blemishes, but a musician with sensitive ears can chase down nearly as many notes without the benefit of repeated hearings at half speed. As for those that pass him by, do they really matter? We all know that the world's greatest pianists have been known to drop a few notes—and at every recital, too—but we are concerned with expression and over-all technical mastery, not with accidents.

The Russian machine test differs from the above methods in one important respect: its results provide the exclusive basis of a definitive opinion, without reference to the original performance. For the music critic who has to attend more than his share of debut recitals, this could be a godsend, saving him many hours of painful listening. Sitting quietly in his office, he could await the filmed verdict after the first piece on the program. If the artist passes the test, then the critic will have to make a dash to the hall. If, on the other hand, the machine's graph indicates that the performer is manifestly unfit for a concert career, the critic need not bother to attend. (*Or maybe we won't* need *the critic.* ED.) Æ

AUDIOCLINIC

(*from page 4*)

of the recording amplifier. If this proves to be the case, you will need to put some kind of attenuating network in the mike line in order to keep the signal from causing this trouble. It is also possible that the maximum permissible recording level is adjusted too high. In other words, the recording indicator is reading too low. Many tape recorders make this indicator reading adjustable.

The frequency test record probably contained no transient or dissonant material which would show up as audible distortion to a greater degree than does a sine wave signal.

Try recording the same material, or piano music, 10 db lower than the indicated maximum. You will not be able to check distortion from the microphone, but you can check distortion in the tape system by standard methods. If you are unfamiliar with the techniques needed to make such measurements, refer to April and May, 1960, installments of AUDIOCLINIC.

If the recording amplifier is relatively free from distortion, it may be that you do not have sufficient bias. Lack of bias would result in a reduction in the maximum level which could be put on the tape, and the quality of the program would suffer. Many tape machines contain provisions for bias adjustment. Æ

PICKUP

(*from page 44*)

decreased to A'_r. The ratio of the resulting left channel signal to right channel signal, instead of being unity, will be

$$\frac{\cos(45° - V°)}{\cos(45° + V°)}$$

In *Fig.* 9 this ratio is expressed in decibels showing the unbalance resulting from a given angular displacement. When we refer to *Fig.* 10, which gives the localization of a sound source from two loudspeakers, we can judge the effects of a given amount of unbalance. Fortunately, these effects are not important as the balance must be adjusted for a given listening position anyway; and compensation can be made at that point for pickup unbalance. However, some other effects of incorrect pickup position are more serious.

Let us examine the situation with signals which are not the same in both channels. In *Fig.* 11, A is the amplitude for the left channel only. The pickup is positioned V degrees too far to the right. The resultant signal is A′, and the ratio of A to A′ is readily obtained as $1/\cos V$. This reduction in the amplitude of A is so slight as to be inconsequential. A shift of 10 degrees to the right causes only one-tenth decibel of signal loss in the left channel. However, this misalignment has a far greater effect on the channel separation and in a most unexpected way; the channel separation is decreased from left to right channel and increased from right to left channel.

Referring again to *Fig.* 11, C is the crosstalk, or signal in the wrong channel, which will be produced by a displacement of V degrees when playing a eft channel signal.

$$C = a \sin V° \qquad A'/C = \frac{\cos V°}{\sin V°}$$

The ratio A′/C, the crosstalk ratio, is shown in *Fig.* 12 with reference to the angular displacement. Since C is in the same phase as the existing crosstalk in the system, the effect is to make a poorer crosstalk relationship from left to right channel.

However, if the angular displacement is referred to the opposite channel, the effect is different. For example, the effect of a displacement to the right on the right channel can be seen in *Fig.* 13. The crosstalk, C, is opposite in phase to the existing crosstalk. If, hypothetically, there is 20 db of crosstalk with accurate pickup positioning, an angular displacement of about 5 degrees to the right will theoretically eliminate all crosstalk from right to left channel. However, the cross-

talk from left to right channel will be reduced from 20 db to about 14 db. It is obvious that a small tracking error will cause an apparent lack of symmetry in the relative crosstalk between the two sides even if the pickup is perfectly balanced in this respect.

The results of all of the above considerations have led to the design of a pickup and of a unitized arm and pickup. These are shown in *Fig.* 14. The pickup is mechanically suitable for use in conventional arms, while the unitized assembly is designed to give good performance at light pressures while minimizing the errors of displacement which were discussed above.

The arm is dynamically balanced in two planes, and stylus force is set with a small spring. This arrangement is not prone to groove jumping when jarred, a problem which gets to be important when working with the 2 gram force for which this assembly was intended.

The arm is suspended in a special gyro-suspension with free running bearings. It is of aluminum tubing so as to achieve stiffness with low mass. It pivots freely in all directions and has a plug-in cartridge arrangement (although other brands of cartridges are not intended to be used with it).

The natural resonance of the system is at 20 cps and it is heavily damped so as not to influence frequency response. *Fig.* 15 gives the low frequency response as measured with RCA disc 12-5-71 played at slower speeds to get extreme low frequency response.

Summary

A set of general criteria was listed. It was found that a design to meet them must have a single moving element, it must be completely symmetrical, and it must be properly oriented with respect to the record groove.

A balanced push-pull arrangement with a closed magnetic structure was designed. This was not a rework of a monophonic design but a fresh and uninhibited approach which led to a patentable unit of unique configuration and performance specifications. As can be seen from the curves, the frequency response and channel separation are excellent. The output is in a convenient range—7 millivolts per channel with a 5 centimeter cut. The effective stylus mass and compliance are proportioned so as to permit 2 gram tracking. Hum pickup is very low due to the balanced coil constructions, the relatively low impedance, and the shielding effect of the magnetic housing. The unit is small in size, light in weight, and physically able to be used in conventional professional and high fidelity equipment.

TRANSISTORIZED PREAMP

(from page 24)

quence of the isolating resistors R_{32} and R_{32}, so that the unit should work into an impedance of at least 50,000 to 100,000 ohms. If a really low output impedance is desired, and this may often be the case, the present outputs may simply be followed by emitter-followers, one for each channel, identical in design to the Q_3 or Q_5 stages. For a typical installation where long cable runs are not necessary, the unit is quite acceptable without additional emitter-followers, and the treble loss and hum pickup will be negligible.

The phase-reversal feature, as discussed in part I, has been retained for separate treatment. The circuit is a "split-load" or "matched-load" phase splitter of a configuration which is common in vacuum-tube power amplifiers. When this circuit is inserted in ONE channel just ahead of Q_3 then the output at the collector of the reverser corresponds to an inverted signal with the same amplitude as the input, and the output at the emitter is a signal identical to the input. The Z_{in} of this circuit is the same as that of the Q_4 stage, namely 100,000 ohms. The design of this reverser is identical to that of a grounded-emitter stage with a voltage gain of 1, taking into account the fact that the equivalent load and unbypassed emitter resistors change, depending upon which output is being used. The operating point of Q_6 is:

$$V_{cc} = -10 \text{ vdc.}$$
$$I_c = -1.1 \text{ ma.}$$

The section of S_2 which selects either output, is one deck of the power switch. Thus S_2 is a 2-pole, 3-position switch, and the three positions are: (1) OFF, (2) ON, PHASE NORMAL, and (3) ON, PHASE REVERSED.

One additional feature bears a passing examination; the "third-channel" output. Because of the construction of the separation control R_{33}, there is always a signal available which is the sum of the signals in the two channels, and hence is monophonic, representing the sound from the "middle." This signal may be used to provide a "phantom" or third channel by the application of a third amplifier and speaker; however, the impedance at this point is very high, and any loading of less than 1 megohm will reduce the sum-signal level and disrupt the operation of the separation control. Therefore, if this third channel is to be used, it would be advisable to follow it with a very high input impedance emitter-follower or a cathode-follower, and to implement this, a schematic of such an isolation amplifier is appended as *Fig. 7.*

The performance of the high-level portion of the control unit may now be tabulated:

(A) *0-db Loudness contour:*
- Frequency response flat ±1 db. from 20 to 20,000 cps.
- Sensitivity 100 millivolts for 1 volt output.
- Intermodulation Distortion 0.6% for 1 volt output.
- Harmonic distortion not measurable at 1 volt output.
- Noise level more than 65 db. below 1 volt output.
- (This noise is characteristically below 30 cps.)

(B) *−35 db Loudness contour:*
- Follows Fletcher-Munsen contour ±3 db.
- All other applicable specifications are equalled.

Construction

The circuitry of the author's control unit was laid out on three 2¾ by 6¾ in. perforated bakelite resistor boards; one channel on a board, except that the

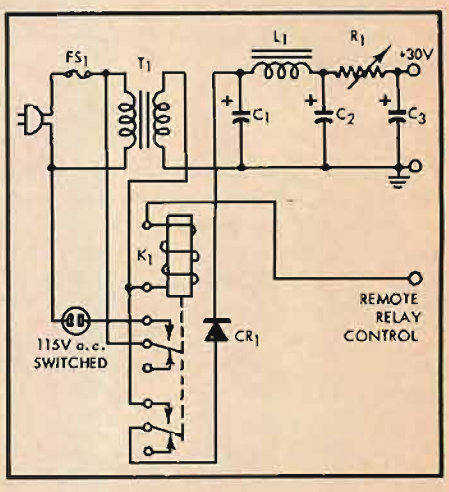

Fig. 6. Schematic of the control unit power supply.

PARTS LIST

C_1, C_2, C_3	100 µf, 50 v, electrolytic
CR_1	10-ma, 75-PIV rectifier, selenium or silicon
F_1	3-amp fuse
K_1	DPST relay, 26-volt a.c. coil, 3-amp contacts (Potter & Brumfield GA-11A)
L_1	20-H, 15-ma choke (Stancor C1515)
R_1	500 ohms, 2-watt potentiometer, 10%
T_1	Transformer, 26.5 volts, 0.5 amps (Thordarson 21F27)

equalization networks and loudness-control components, and the entire phase-reversal stage, were placed on a third board. It is interesting to note that printed circuits would be ideal for this application, and could probably be made using some of the kits which are presently available. The author's three resistor boards were mounted inside a 3 × 6 × 7 in. aluminum chassis as shown in *Fig.* 4, with one 3 × 7 in. panel serving as the front and the other as the terminal panel, *Fig.* 5. To achieve a professional-looking unit, a 3½ × 7½ in. brass front panel was added, rubbed to a satin finish with crocus cloth and then steel wool, sprayed with Krylon clear plastic and then letter decals added, followed by about six more coats of plastic spray until the surface was smooth over the decals. *Figure* 1 shows the finished appearance. The author used machined Dural knobs to further enhance the appearance, but these are inordinately expensive to purchase, and any knob would suffice.

The schematic of a simple remote power supply, *Fig.* 6, is included without lengthy explanation. The supply is switched on and off by controlling the current in the coil of relay K_1, so that there is no 115-volt a.c. power inside the

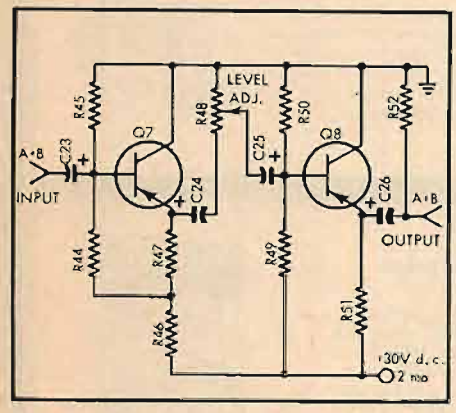

Fig. 7. Optional isolation amplifier for derived "third channel."

PARTS LIST

C_{23}	0.22 µf, 100 v, paper
$C_{24, 25}$	2.5 µf, 25 v, electrolytic
C_{26}	25 µf, 25 v, electrolytic
R_{45}, R_{52}	180k, ½ watt
R_{48}	470k, ½ watt
R_{44}	18,000 ohms, ½ watt
R_{47}	10,000 ohms, ½ watt
R_{49}	100k, potentiometer, linear
R_{50}	220k, ½ watt
R_{51}	27,000 ohms ½ watt
R_{46}	1 meg, ½ watt
Q_7, Q_8	PNP transistor, (GE 2N265) (All resistors 10%)

control unit at all. This supply will furnish +30 volts d.c. at the total current drain of approximately 7 ma required for the control unit; the output voltage is adjustable by R_{51}, and the total ripple is quite low, well below 1 mv rms. The supply voltage could be obtained in any of a number of alternative ways, the

(*Continued on page 85*)

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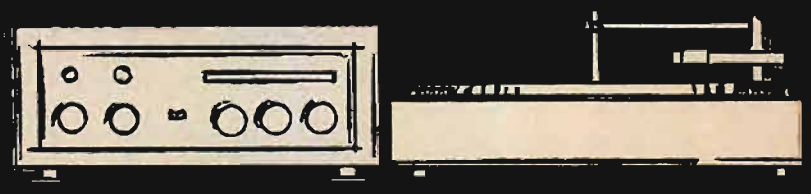

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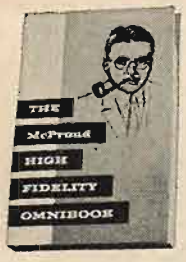

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only restrictions being that the ripple must not exceed 1 mv, and the supply voltage must never exceed +35 volts, on pain of a damaged transistor. These requirements are so slight that the voltage could be obtained by a simple bleeder from the power supply of a power amplifier, or even from a battery.

The author's control unit has been in operation for twelve months at the time of writing, and has performed entirely satisfactorily. There is a complete absence of hum, hiss, or microphonics, and no audible distortion. The controls have justified the time spent in selecting them, in that the system has proved entirely satisfactory for both stereophonic and monophonic applications. The over-all cost of all parts, including the power supply described, was about $75, which is certainly comparable in price with the stereo preamplifier kits on the market—and there is no doubt that the kits could be assembled in quantity for a smaller price. Whatever the cost, the convenience of a high-performance control unit with only six knobs is one which cannot be bought on the market, at any price.

Æ

EQUIPMENT PROFILE

(*from page 56*)

run quite hot, and here again the cover avoids unpleasant burns. You can still splash ice water on a pair of well heated EL34's and put them out of service, but with the cover in place you are not likely to get burnt.

With the difficult wiring done in the form of the printed circuit with all the parts soldered in place, the entire construction time for the Mark IV should not be more than three hours for the very newest novice. The amplifier is attractive and sounds good in listening tests. The EL34's are working at a conservative 430 volts in this model, as contrasted to as high as 475 in some others, and should therefore be capable of a long life. We are, however, still using a 50-watt Mark II with the original EL34's in it for at least three years—although not continuously—and we have had no trouble whatsoever. Nor, we might add, with any other of the Dynakits.

Since it appears that there are very few differences we can measure between good amplifiers of various designs and makes, it would seem that there are some parameters that we do not know about, because it is certain that while amplifiers may *measure* almost identically, they often *sound* much different. We can only say that the Mark IV sounds smoother on the low end than its predecessors, but we cannot measure the difference.

K-24

COMING EVENTS

Oct. 10–12—National Electronics Conference and Exhibition; sponsored by AIEE, IRE, Illinois Institute of Technology, Northwestern University, and University of Illinois. Hotel Sherman, Chicago.

Oct. 11–14—Audio Engineering Society Convention and Ehibits, Hotel New Yorker, New York City.

Oct. 12–15—Canada's Fifth Industry-Sponsored High Fidelity Exposition; Sheraton-Mt. Royal Hotel, Montreal, P. Q., Canada.

Feb. 26–Mar. 1, 1961—Pacific Electronic Trade Show; Great Western Exhibit Center, Los Angeles.

INVENTIONS

(*from page 46*)

exclusive privileges tends rather to obstruct than to stimulate invention. It creates a class of speculative schemers who make it their business to watch the advancing waves of improvements and gather its foam in the form of patented monopolies which enable them to lay a heavy tax upon the industry of the country without contributing anything to the real advancement of the arts. It embarrasses the honest pursuit of business with fears and apprehensions of concealed liens and unknown liabilities to lawsuits and vexatious accountings for profits made in good faith."[5] Æ

[5] Atlantic Works *v.* Brady, 107 U.S. 192, October, 1882.

LETTERS

(*from page 6*)

who will change over to tape when they see these features emphasized:

Plenty of fine music on recorded tapes.
Superior quality in tape music.
Ease of threading reel-to-reel.
A really superior tape player which will sell for the price of a disc player.

RICHARD LEWIS, Production Manager,
Chapel Records,
Mountain View, California.

(*We think there are some already.* ED.)

FOR SALE: Slightly used Viking RP62VU and compatible RP61VU. Each like new. Identical in appearance and function. For stereo use with series 85 or 95 deck. Original cartons. Both for $120.00 minimum. Write F. A. Duston, 61 Longhill St., Springfield 8, Mass.

RECORDS MADE, any size or speed. Send tape all details, and $4.00 to Box 56, Franklin Square, N. Y.

FOR SALE: U-47 Telefunken condenser microphone, $225; AR-1 Speaker (mahogany), $90; Heath Audio Analyzer, $45; SP-215 Pilot Stereo Preamp, $95; portable FI-CORD transistorized battery driven tape recorder (weighs 6 pounds) complete with battery charger, $165. All in excellent condition. JAC HOLZMAN, 116 West 14 Street, New York City. ORegon 5-7137

CLASSIFIED

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WRITE for confidential money-saving prices on your Hi-Fidelity amplifier, tuners, speakers, tape recorders. Individual quotations only; no catalogs. Classified Hi-Fi Exchange, AR, 2375 East 65th St., Brooklyn 34, N. Y.

SALE: 78 rpm recordings. 1900–1950. Free lists. Collections bought. P. O. Box 155 (AU), Verona, N. J.

Low quotes on everything. Hi Fi and Stereo tapes. Bargain list. HIFI, Roslyn 4, Pa.

COMPONENTS, recorders, free wholesale catalogue. Carston 125-N East 88th Street, New York 28, N. Y.

AMPEX, Concertone, Crown, Magnecord, Norelco, Presto, Bogen, Tandberg, Sherwood, Rek-O-Kut, Scott, Shure, Dynakit, others. Trades. Boynton Studio, Dept. AM, 10 Pennsylvania Ave., Tuckahoe, N. Y.

RENT STEREO TAPES—over 1500 different—all major labels—free catalog. Stereo-Parti, 811-H Centinela Ave., Inglewood 3, California.

WANTED: Altec Lansing Voice-of-Theater S26A Speaker Enclosure, Mahogany. Kirkpatrick, 4524 Tarpon Drive, Tampa 10, Fla.

FOR SALE: All issues of AUDIO through 1959. $100.00 F. O. B. Norman Harper, Charleston, Mo.

SALE OR TRADE Ampex 612, walnut cabinet, Scott 121C preamp, $225 and $50 respectively or make reasonable offer. Want Crown tape transport or 4-track prerecorded tape. Maj. John Parrott, Student, Armed Forces Staff College, Norfolk 11, Va.

MS: Will not come home; you said I loved tramps. I like it here. Maggie, 521 East 162nd St., New York 51, N. Y.

AMPEX portable cases for #350 tape recorder. New condition. $37 for both. Rek-O-Kut professional 3G2D (33 & 78) 16" turntable. Hysteresis motor. Excellent. $75. R. J. Entringer, 367 Bird Rock, LaJolla, California.

USED QUALITY COMPONENTS—Dynakit MK III $50.00. Dynakit preamplifier PAM-1 $25.00, McIntosh 50 WZ $110.00, Craftsmen 400 amplifier $20.00, Collins Audio FM/AM stereo tuner $40.00, Weathers seismic turntable $30.00, Weathers MT-1 tonearm $15.00, Weathers FM cartridge and oscillator (monophonic) $15.00, AR-1 WU speaker $75.00, JansZen 1-30U electrostatic tweeter $90.00, Altec Lansing 604C speaker $95.00. Professional stereo mixer (write for further details). Sola constant voltage transformer, 1 KW $50.00. All items are guaranteed to be in good condition. Remit full amount or 10% for COD orders. Otto C. Standhardt, 219 Johnson St., Pottstown, Pa.

ELECTRO-VOICE T-35 tweeter, $19.00. Stephens 122AX 12" coaxial bleached African mahogany enclosure $65.00; large mahogany enclosure $25.00; new, in carton, Viking 85RQ tape transport, half- and quarter-track heads, $99.00; Bogen DB135 amplifier with cover, $59.00; walnut base for Garrard 301 turntable, $9.00; all guaranteed perfect. 9016-B Arantz-Laughlin, Del Rio, Texas.

BEST OFFER: EV 30-watt amplifier; EV AM/FM tuner with preamp; EV 6HD horn; EV "Patrician." All excellent condition. R. Bailey, 216 Slade Ave., Pikesville 8, Md.

RENT-A-TAPE/stereo or monaural. No deposits—no minimums. Free catalog. Columbia, 9651 Foxbury Way, Rivera, California.

Industry Notes...

• **HARMAN-KARDON AND JERROLD TO CONSOLIDATE.** The Boards of Directors of Jerrold Electronics and Harman-Kardon have approved in principle a consolidation of the two electronic companies. Consummation of the transaction is contingent upon approval by Harman-Kardon shareholders. It is expected that the two companies will continue to operate as before with no change in management, program, or location.

• **AUDIO TECHNIQUES, INC.,** a comprehensive film and tape sound recording service, has been formed by John H. Beaumont, Lawrence J. Kreeger, and Howard M. Lawrence. Mr. Beaumont was formerly Eastern Branch Manager of the United Stereo Tapes Division of Ampex Audio, Inc. Mr. Kreeger is the former Supervising Film Editor of Transfilm-Caravel, Inc. Previously, for five years, he was film editor for March of Time. Mr. Lawrence was Production Supervisor for Robert Lawrence Productions, and Vice President of its industrial division, Loucks and Norling.

• **ULTRA ELECTRONICS, INC.** named United States distributors of the **Partridge Transformer** line. In addition to providing technical information, Ultra Electronics will also provide application engineering service.

• Clearing the way for distribution of ownership and earnings among key employees, **Jack Gilbert Associates** has announced its incorporation under the name of **Gilbert and Felix, Inc.** Under the arrangement just concluded, substantial stock interests have been acquired by Richard Felix, account executive, and Arthur Sharf, Production and office manager. According to Jack Gilbert, founder of the advertising agency, the purpose of these changes was to reward key employes who had made significant contributions to the agency's growth.

ADVERTISING INDEX

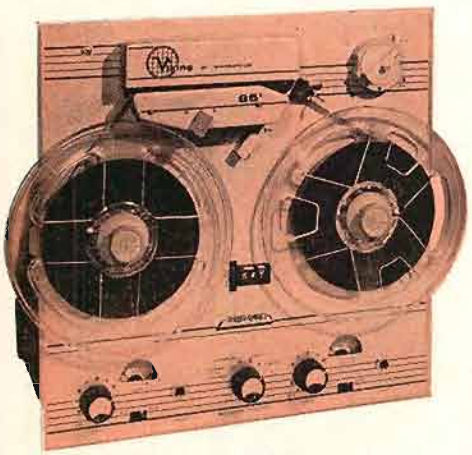
NEW VIKING STEREO-COMPACT IS THE PERFECT MEMORY FOR YOUR HOME MUSIC SYSTEM

Viking neatly combines its famous 85 tape deck with the superb RA72 recording amplifiers to give you a stereo unit unequalled for performance and quality.

The "STEREO-COMPACT" enables you to make stereo tapes from records . . . AM/FM broadcasts . . . and live program material with recording fidelity to satisfy the most demanding and simplicity of operation to delight even a beginner.

This package is designed for installation in wall or furniture, mounts in a 12½" square cutout.

Best of all, the Viking "STEREO-COMPACT" is yours at a surprisingly low price. Get complete information . . . visit your authorized Viking dealer or write Viking of Minneapolis.



AVAILABLE IN TWO MODELS:

STEREO-COMPACT ESQ—half-track erase and recording heads and short-gap quarter-track play models.

STEREO-COMPACT RMQ—Quarter-track recording model with exclusive wide-gap recording head and short-gap play heads.

Both models play ½ and/or ¼ track stereo tapes.

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Each component must work . . . and work with absolute certainty. The reliability of these components depends on the precision transistor to insure perfect operation under every conceivable environmental condition.

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Write now for complete specifications on the TEC S-25 All-Transistor Stereo Pre-Amplifier-Amplifier . . . 68 Watts, 34 Watts Each Channel . . . No Tubes, No Heat, No Hum, No Microphonics . . . Guaranteed for Two Years!

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