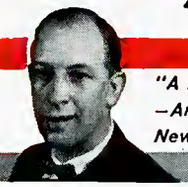
AUDIO

AUGUST, 1957
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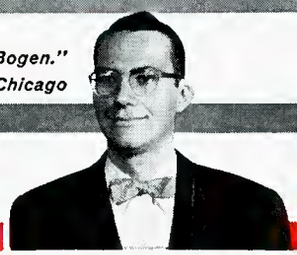
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"A marvelous hi-fi value!"
—Anton Schmitt, Harvey Radio, New York City

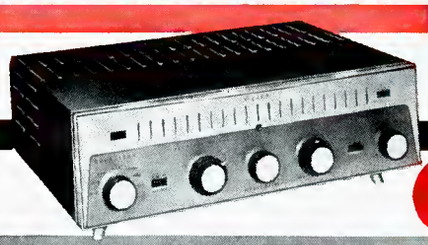
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"Price and features have sold me on Bogen."
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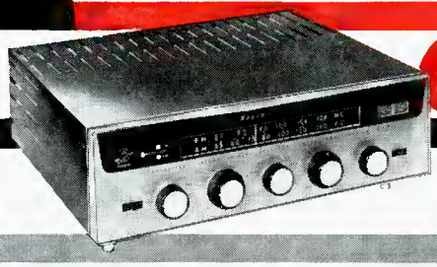




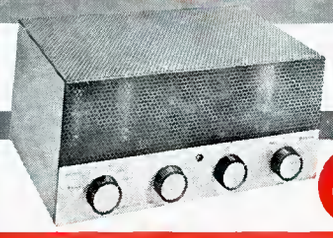
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"'Blue chip' in the world of sound."
—Vollmer Hetherington, Radio Shack, Boston





5



6

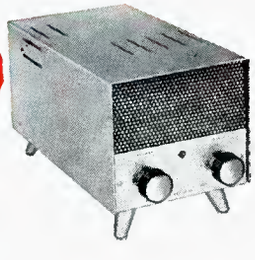
Audio consultants, such as those quoted here, don't use words like "marvelous", "superb" and "blue chip" lightly. Their studied opinions, and the fact that more Bogen high-fidelity components are in use today than any other brand, are ample proof that for more engineering "firsts", more years of brilliant performance, more rugged good looks—the choice is Bogen.

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7



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Sounding Board

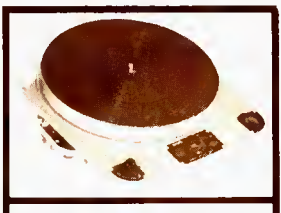
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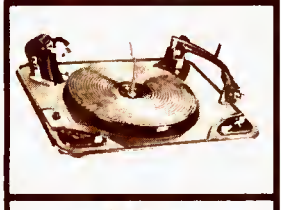
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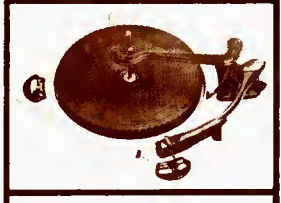
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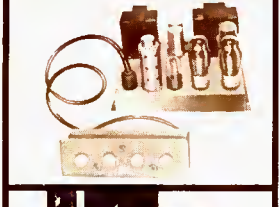
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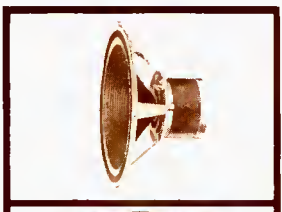


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The original KT66, Britain's famous power-amplifying tetrode . . . and the original Z729 low-hum input tube.
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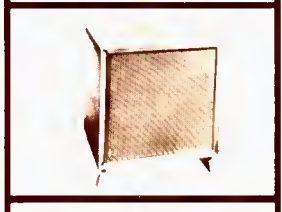
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Built under the personal supervision of world-famous engineer, G. A. Briggs. Unique soft suspension of cone.



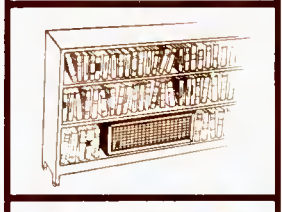
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high fidelity
is the ultimate



The all new
S-1000 II 20 watt amplifier

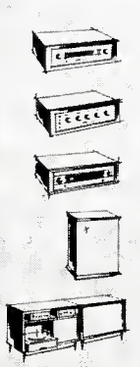
	Sherwood S-1000 II • $ 99.50	A $ 99.95	B $109.95	C $109.50	D $115.00	E $ 99.75	F $ 95.00	G $124.50	H $139.50	I $ 99.50	J $ 99.50	K $124.50
Feedback tone controls	√	•	√	•	√	√	√	•	√	•	√	•
EF86 low-noise preamp. tube	√	•	•	•	•	•	•	•	•	•	•	•
Presence-rise control	√	•	•	•	•	•	•	√	•	•	•	•
Tape-head equalization	√	√	√	•	√	•	√	•	√	√	•	•
Inputs, selectable at front panel	6	5	5	4	6	4	5	5	6	5	4	5
Microphone equalization	√	•	•	•	•	•	•	•	√	•	•	√
Tape-monitor switch	√	•	•	•	√	√	•	•	•	•	•	•
Damping-factor selection	√	•	•	•	√	•	•	√	•	•	•	√
IM distortion at 20 watts	1.0	1.0	1.0	1.4	1.0	2.0	2.0	1.2	1.6	1.5	2.4	2.0
12db/oct. scratch filter	√*	•	√	√*	√	•	•	•	√*	√	•	•
12db/oct. rumble filter	√*	•	√	√*	√	√	√	•	√	√	√*	√
Cathode-follower recording output	√	•	•	√	•	•	√	√	√	•	•	•
Phono sensitivity (mv) for full output	3	6	5	6	5	5	6	12	5	3	10	15
Unused inputs shorted to prevent crosstalk	√	•	•	•	√	√	•	√	√	√	•	√

*With sharp turnover provided by inverse feedback or inductor.

Data is manufacturers' published specifications for current "flat-cabinet" amplifiers (20 or more watts).

Technical literature available on request. Write Dept. A-8

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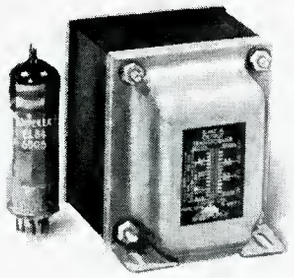


The complete home music center

Only Sherwood tuners feature
0.95 μv FM sensitivity!

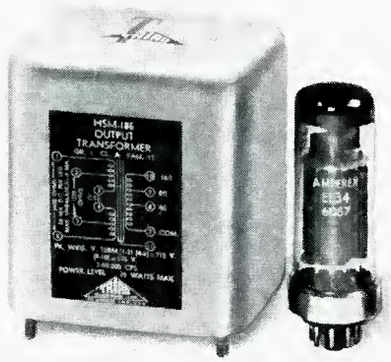
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TRANSFORMER NEWS FROM TRIAD



High Fidelity Output Transformers

For the new EL-84 and EL-34 Tubes



Triad Type No.	*Primary Impedance	Secondary Impedance	Max. Level Watts
FOR PP EL-84 (6BQ5)			
HSM-181	8000/2000 CT Split Primary	16/8/4	15
HSM-182	8000/2000 CT. Split Primary	500/250/125	15
S-142A	8000 CT.	16/8/4	15
FOR PP EL-34 (6CA7)			
HSM-186	6600 CT.	16/8/4	25
HSM-187	6600 CT.	500/250/125	25
S-146A	6600 CT.	16/8/4	25
FOR PP Par EL-34 (6CA7)			
HSM-192	4000 CT.	16/8/4	65
HSM-193	4000 CT.	500/250/125	65
S-152A	4000 CT.	16/8/4	65

*Proper taps on Primary for tapped screen operation.

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AUDIOCLINIC??

JOSEPH GIOVANELLI*

NOTE

Some of you have asked that I do not use your names but prefer that I use only initials when your questions are to appear in my column. The question submitted by Mr. S. W. is an example. I am, of course, happy to comply with your wishes. However, unless you specifically say that you do not wish me to use your name, I shall assume that I may use it.

Since the Tenth Anniversary issue, in which my biography appeared, I have received letters from some of you with questions concerning visual aids, such as scopes, VU meters, and the like. Some have felt that perhaps these questions were in poor taste and overstep propriety because I don't see and therefore cannot make much use of such devices. Let me assure you that although I cannot use these devices, I have had to understand them in order to work out means for circumventing their use; also, such an understanding of them enables me to talk intelligently with others whose frame of reference is based on these visual aids.

I'd like also to remind you to enclose a stamped, self-addressed envelope with your question. You see, whether or not your questions are suitable for use in this column, they will be answered by mail. Your enclosed envelopes help speed this process enormously. Thank you.

Tuner Output

Q. I have an FM tuner which is giving me considerable trouble. Even after alignment, there was a severe loss of output. Tubes test good, selectivity seems good, and it limits on a few more stations than before. Signal eye is strongly deflected and sound quality is good. I used to play the tuner directly into the power amplifier, which checks good; I got ample volume with the control turned up a quarter of the way. Now I must insert a separate voltage amplifier (6J5), after the tuner and, even so, on some stations have to crank the pot so far up that hum and buzz come in from the tuner, not the voltage or power amplifiers which are both clean. If there is complete limiting on more stations than before, I assume the IF's are offering a strong signal to the limiters. Have you any idea where the extreme loss of gain is taking place? S.W., New York, N. Y.

A. Low output from your FM tuner may be attributed to many things: defects in the limiter circuits, improper alignment of the primary of the discriminator coil, defective components in the stage or stages immediately following the discriminator. If possible, check all voltages and resistances; then check capacitances for possible shorts or opens. To test for shorts, try to pass a current through the capacitor, after disconnecting one side of it from the circuit under test. If current can be passed through it, the unit is shorted. If an ohmmeter is available, measure the resistance of the capacitor. The resistance of conventional coupling capacitors approaches infinity. To check for an open capacitor, you need a capacitance checker. The procedure consists of noting the labeled value of capacitance and comparing it with the measured value.

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

Replacing Components

Q. On a straight Williamson amplifier in use for seven years, still clean sounding, which components will need replacing? S. W., New York, N. Y.

A. If the unit is still clean sounding, it probably needs no maintenance. It is possible, however, that some improvement in performance will result from replacing the output tubes and the rectifier.

Cabinet Bracing

Q. My system is composed of components which I consider reasonably good. The weak link seems to be the speaker cabinet. The trouble stems from the non-rigidity of it. Especially around the back panel, it seems to shake, rattle, and roll. How can I solidify the cabinet? It is made of three-quarter inch plywood. The vibration around the back panel is so violent that the screws have pulled out more than once, with the result that many of them don't hold any longer. Would bonding an additional piece of plywood to the back help? B. Goerner, Corte Madera, Calif.

A. Panel resonances may be broken up by placing heavy hard wood strips at random points on the offending surfaces. If vibration occurs at the junction of two panels, a glue such as Weldwood or Elmer's glue should be used with the aid of furniture clamps to firm up these joints. This procedure will probably require taking the cabinet apart to be able to get the glue into the proper places. The back should not be glued, however, as it is quite likely that you will want at some time to gain access to the interior of the cabinet. However, the use of many screws plus a layer of weather stripping, rubber or cork placed between the back and side panels would remove all vibration. If vibration still occurs, it would be advisable to place some ozite or similar material on the offending panels. This material is available as the liner for carpeting.

VU Meter

Q. I am not an electrical engineer, but a chemical engineer who enjoys square-dance-calling as a hobby. I have been trying to install a VU meter in the amplifier used with the phonograph to play the necessary records. I am not interested in actual db output, but would like to set a record at a reference level on the scale and then set all succeeding records to that same point. The reference point would vary from hall to hall. Can you tell me how to wire this meter into my speaker circuit? George Cable, East St. Louis, Ill.

A. For normal levels that would be expected in your application, the simplest way of connecting the VU meter to the speaker line would be to install a 1000-ohm potentiometer directly across the output terminals of the amplifier, and connect the meter from the arm of the potentiometer to the grounded end. You would thus have a continuous adjustment of the meter swing from about a quarter of a watt up to the maximum output of the amplifier. For a 16-ohm output, the signal across the speaker is 4 volts at one watt, derived from the formula $P = E^2/R$. Changed around to give voltage directly, $E = \sqrt{P \times R}$, where P is the power in watts and R is the impedance

(Continued on page 37)

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NEW!

MODEL **TPA/10**

THE DISTINGUISHED TRANSCRIPTION

TONE ARM

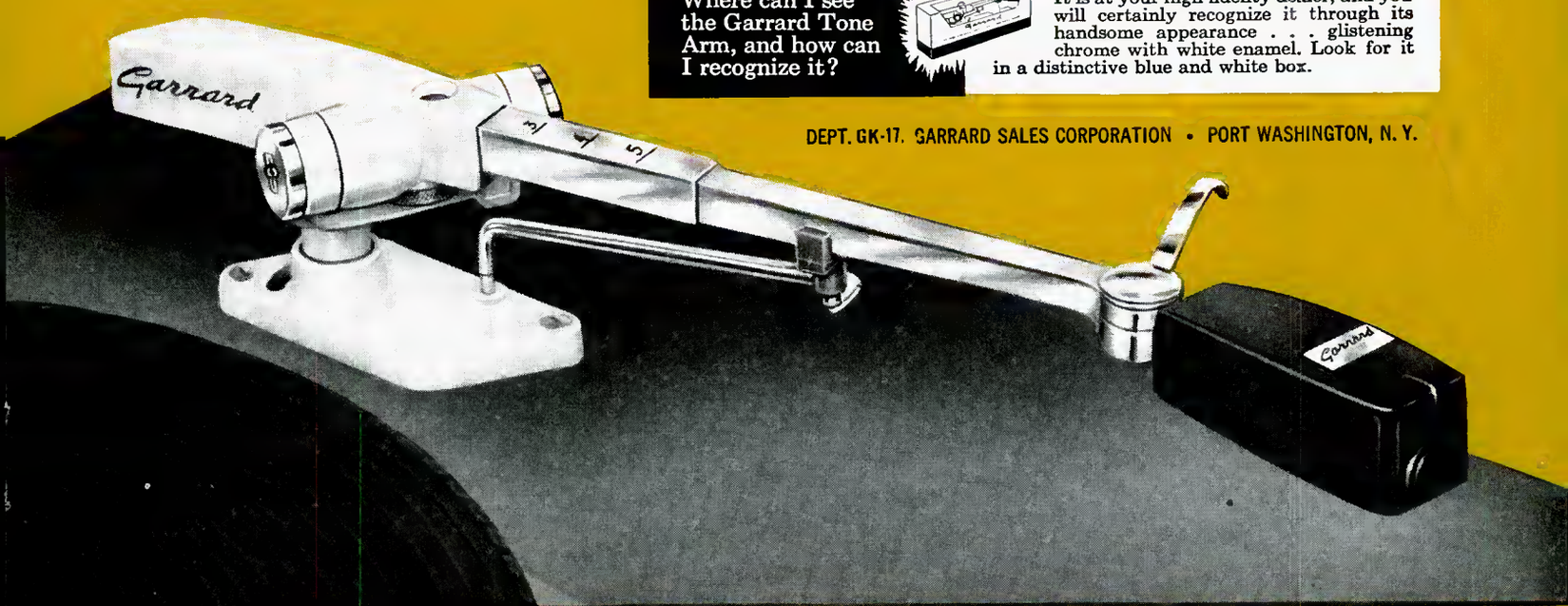
BY

Garrard

Some of the significant questions being asked about it . . . and their exciting answers

Q	A
How much is the Garrard Tone Arm?	$24.50
Is it built to give me professional-quality performance?	Yes . . . because this precision design, by incorporating the smallest number of pivots, reduces traversing friction to an absolute minimum. This also results in the least amount of wear and tear on records, through the use of spring-loaded, cone-type ball-bearing pivots . . . similar to those you will find in the finest chronometers. The vertical pivot is a specially-designed bearing, combining the features of a ball-bearing journal suspended on a single ball thrust.
What else is "different" about this Tone Arm?	Infinite versatility! It is the only tone arm which is fully adjustable in length and tracking angle. This means that with the Garrard arm, you can make every adjustment you would conceivably wish to make on a tone arm.
Why is it important for me to be able to set it to any length?	For two reasons: (1) You can set it for the longest position permitted by the space you have available now. (2) If you change the installation, you will be able to readjust this arm, keeping the important benefits of using a "longer" arm . . . playing a full 16" record.
Doesn't this require changing tracking angle?	Yes, of course. In fact, there are many opinions regarding optimum tracking angle for any given length.
How do I adjust the tracking angle?	With the protractor which is supplied with the tone arm. In a few seconds, this ingenious accessory lays out the recommended angle on which to align the cartridge for the arm length you are using. Since there are various opinions regarding the optimum tracking angle at various radii, this protractor will also enable you to set the angle at any desired radius.
Will it take any cartridge, and is it easily installed?	Yes, the removable head will take just about any cartridge on the market. This tone arm is designed to be used with any transcription turntable, and adjusts easily for height and stylus pressure. The special templates supplied show you the exact mounting location. Incidentally, the instructions are the clearest and most complete we have ever seen with a tone arm.
Where can I see the Garrard Tone Arm, and how can I recognize it?	It is at your high fidelity dealer, and you will certainly recognize it through its handsome appearance . . . glistening chrome with white enamel. Look for it in a distinctive blue and white box.

DEPT. GK-17. GARRARD SALES CORPORATION • PORT WASHINGTON, N. Y.



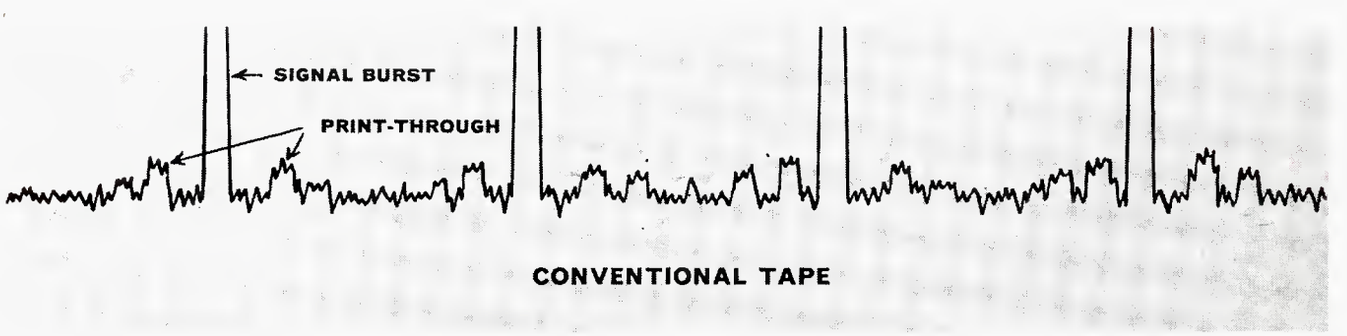
THERE'S A **Garrard**
WORLD'S FINEST RECORD PLAYER FOR EVERY HIGH FIDELITY SYSTEM



LOW



New



Strip chart clearly shows print-through signals before and after 1-second, 1-kc tone bursts on a conventional tape stored 5 minutes.

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PRINT

Another 3M first! gold seal professional tape cuts print level 8 db!

Is print-through a problem with you? Even the most carefully made tape recordings can be marred by print-through . . . layer-to-layer signal transfer in tape wound on rolls. Solve your problem by using new "Scotch" Brand Low-Print Magnetic Tape with the lowest print level of any tape on the market.

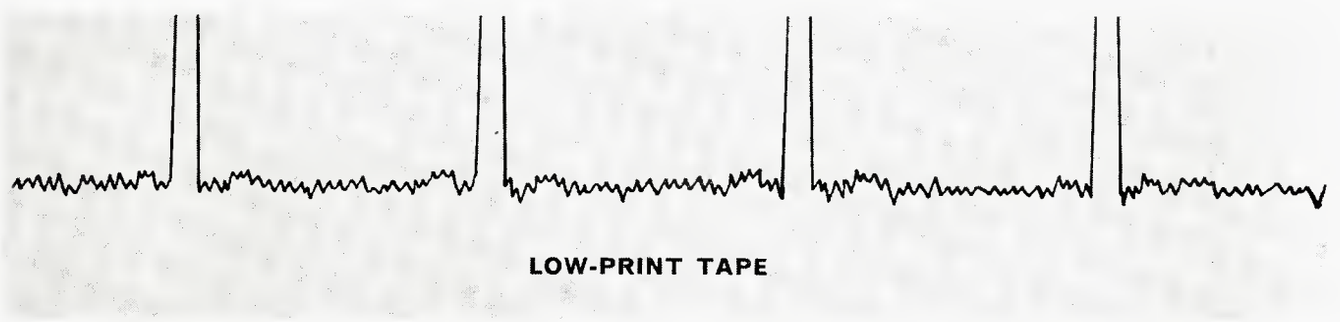
New gold seal Low-Print Magnetic Tape gives you 8 db lower print level. It's the first and only tape to reduce print-through to a point below noise level on most professional machines. First tested commercially a year ago, this new tape is the product of 8 years of intensive research in 3M Company laboratories.

Superb recording characteristics are another feature of new "Scotch" Brand Low-Print Magnetic Tape. New oxide construction provides increased potency, greater sensitivity. Available in widely used 2400 ft. length, as well as 1200 and 4800 ft. lengths.

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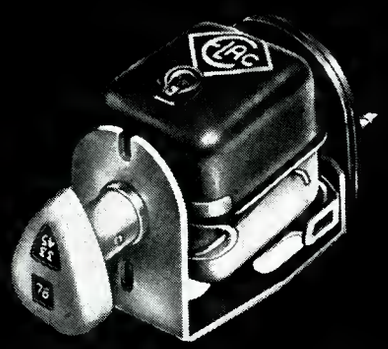
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LETTERS

Microphone Correction

SIR:

I suppose it is a sign of naivete to read an interview involving oneself and react with a "Did I say that?" I was generally gratified to find my pontifications set forth in the July JAZZ AND ALL THAT, even if one or two of the "quotes" seemed completely strange to me. Actually, most of the errata are of a comparatively trivial nature, involving shades of meaning to which I am probably the only one likely to be sensitive.

However, there is one correction that I find necessary to make. The measurements made at RCA Camden comparing my modified 44A and RCA's laboratory standard microphone did not definitely establish that the 44A had "superior performance below 50 cps and above 10,000." They did establish that the 44A had *more* output at these frequencies, but RCA's engineers would question the evaluation "superior," since it is their contention, supported by considerably greater knowledge, experience, and also by a carload of test equipment, that the greater low-frequency response of my microphone is due to undamped resonance of the ribbon. It is my contention, supported only by speculation and wishful thinking, that the fact that my ribbon has only half the mass and is also less springy than theirs has reduced bass resonance effects to negligibility, since the ribbon is subject to considerable air loading and magnetic damping.

None of my acquaintances at RCA had anything to say about the superior response of the modified 44A above 13,000 cps.

DAVID B. HANCOCK,
127 West 88th St.,
New York 24, N. Y.

More Corrections

SIR:

I would like to correct an error and clarify two points in connection with my article, "Above All, The Ear," in the May issue;

I stated that one volt equals 10^7 ergs. This absurdity resulted from my leaving off the end of the sentence, which should have read: ". . . one volt is equal to 10^7 ergs *per ampere second.*"

As I had expected, quite a number of people were astonished by the statement ". . . there is no known method of measuring sound exactly." Their incredulity might have been tempered somewhat had I made it more clear that the quality of sound to which I was referring was loudness as opposed to intensity or pressure. Loudness is subjective, and like pleasure or pain, cannot be measured with physical apparatus. I had thought that this point would be clear inasmuch as the topic of almost the entire article was the subjectivity of sound.

There has been some small objection to my rather loose reference to the decibel as a "unit of sound." Although the reference was not quite punctilious, I believe that most people knew what was meant. One reader attempted to correct me on this point by informing me that the decibel was "a unit on the scale of sound pressure level." This, of course, is not correct since the decibel is a unit on the scale of sound *intensity* level. Sound intensity and sound pressure are not at all the same; in fact,

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they are not even proportional, intensity increasing at the square of pressure.

The above facts can be verified in *University Physics* by Sears and Zemansky (Addison & Wesley, 1955).

JAMES A. NUNLEY,
225 "J" Street,
Salt Lake City 3, Utah

(*We thought Mr. N should have the last word, even if belated.* ED.)

Engineer PLUS Musician—not VS.

SIR:

Of the many relationships between the arts and the sciences, none is more interesting or more compatible than that between music and electronics. Electronics is the junior partner, of course, but its contribution is full measure.

Of all the things that can be said about audio, the most inaccurate would be that it is static. In general, the aim and orientation of audio has been good music. Progress has been made even while exploring the technical fringes. For example, we passed through a period recently when engineers—or "music lovers," I am not sure which—listened through their slide rules. We awakened finally to the realization that perfection is a will-of-the-wisp. It was the era of "High Futility."

Today we seem to be experiencing a return-to-the-music movement. Quite properly we use as our standard for judging system or total performance the original itself. We might borrow a line from *Teahouse of the August Moon*—"a step backward in the right direction."

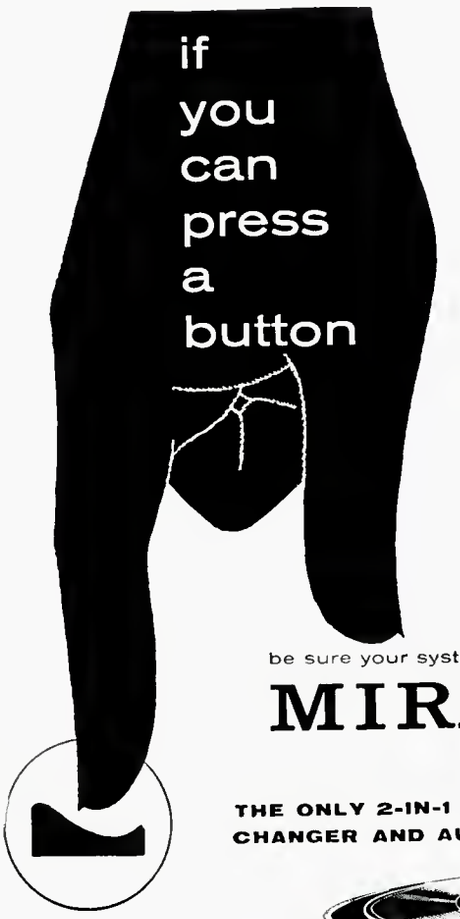
Now the question—just how preoccupied with the sound of music shall we get? Must we surrender engineering methods—analysis, objective measurement, universal standards—simply because we suddenly discover that the final result of our work is to be judged subjectively? I, for one, have had enough of designing for sound effects and testing to the criteria of aural fatigue. Controls to optimize system performance under varying conditions are one thing; those used to rewrite the music or undo the work of the conductor are quite another. Stravinsky and Strauss do not sound alike alive; if we relax our engineering discipline they may on playback.

To me it is a ridiculous situation wherein engineers, professing an interest in music, lapse into acoustic surrealism. Equally ridiculous, but less prevalent, perhaps, are the attempts of "musician-designers" (e.g., the muddy-clean boys) to achieve "presence" without understanding frequency-response characteristics (candid Canby is an accepted exception).

This is not a question of hobbyist *vs.* professional. Nor is this a suggestion that musicians and engineers stay each in his own backyard. Each needs the other. Beyond the team effort required to provide a wide segment of the public with good, well reproduced music is the need of the musician for an accurate device to evaluate his own technique. Likewise the audio engineer needs accurate sources and measuring instruments if he is to evaluate his designs. While the audio engineer supplies the "laboratory" equipment used by the musician, the converse is not true.

Let's let the musicians handle the tones and the engineers the frequencies. In this way the worth of the whole will exceed the sum of the parts.

JOE DICKEY
Lindamoor,
Annapolis, Md.

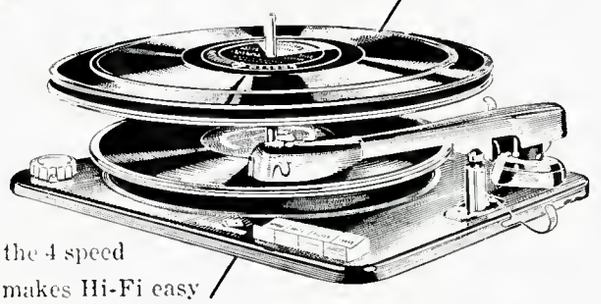


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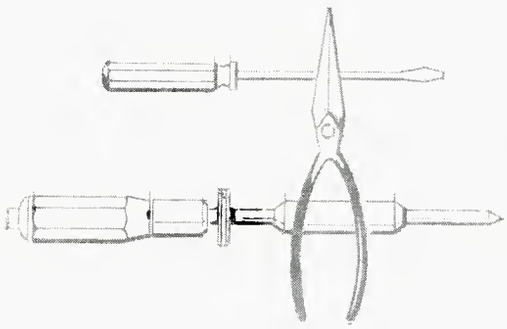
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This unit is designed to operate as the "master control" for any of the Heathkit Williamson-type amplifiers, and includes features that will do justice to the finest program material. Frequency response within ±1½ db from 15 to 35,000 CPS. Full equalization for LP, RIAA, AES, and early 78's. Five switch-selected inputs with separate level controls. Bass and treble control, and volume control, on front panel. Very attractively styled, and an exceptional dollar value. Shpg. Wt. 7 lbs.

MODEL WA-P2 **$19.75** (with cabinet)

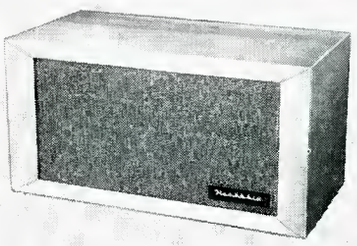
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The very popular model SS-1 Speaker System provides amazing high fidelity performance for its size because it uses high-quality speakers, in an enclosure especially designed to receive them.

It features an 8" mid-range-woofer to cover from 50 to 1600 CPS, and a compression-type tweeter with flared horn to cover from 1600 to 12,000 CPS. Both speakers are by Jensen. The enclosure itself is a ducted-port bass-reflex unit, measuring 11½" H x 23" W x 11¾" D and is constructed of veneer-surfaced plywood, ½" thick. All parts are precut and predrilled for quick assembly.

Total frequency range is 50 to 12,000 CPS, within ±5 db. Impedance is 16 ohms. Operates with the "Range Extending" (SS-1B) speaker system kit later, if greater frequency range is desired. Shpg. Wt. 30 lbs. **MODEL SS-1 $39.95**

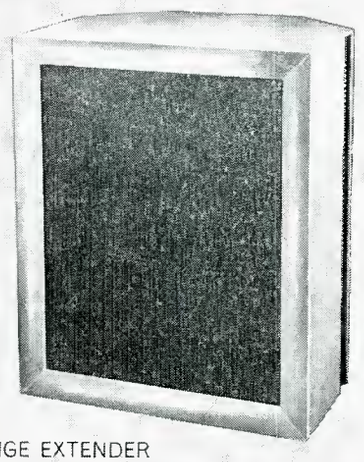


"BASIC" SPEAKER SYSTEM

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The SS-1B uses a 15" woofer and a small super-tweeter, to supply very high and very low frequencies and fill out the response of the "Basic" (SS-1) speaker system at each end of the audio spectrum. The SS-1 and SS-1B, combined, provide an overall response of ±5 db from 35 to 16,000 CPS. Kit includes circuit for crossover at 600, 1600 and 4000 CPS. Impedance is 16 ohms, and power rating is 35 watts. Measures 29" H x 23" W x 17½" D, and is constructed of veneer-surfaced plywood, ¾" thick. Easy to build! Shpg. Wt. 80 lbs.

MODEL SS-1B $99.95



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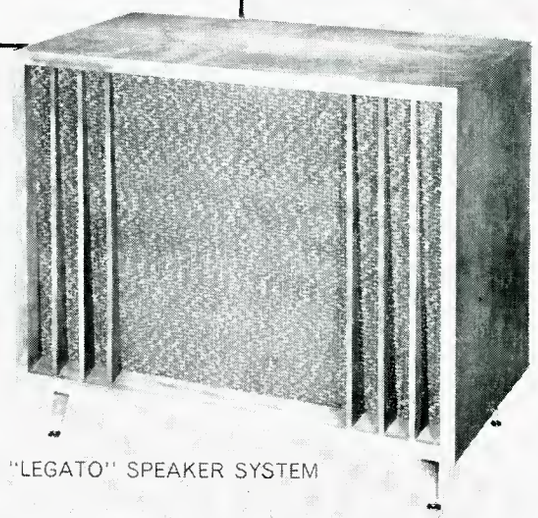
Frequency response is ±5 db 25 to 20,000 CPS. Two 15" theater-type Altec Lansing speakers cover 25 to 500 CPS, and an Altec Lansing high frequency driver with sectoral horn covers 500 to 20,000 CPS. A precise amount of phase shift in the crossover network brings the high-frequency channel into phase with the low-frequency channel to eliminate peaks or valleys at the crossover point. This is one reason for the mid-range "presence" so evident in this system design.

The attractively styled "contemporary" enclosure emphasizes simplicity of line and form to blend with all furnishings. Cabinet parts are precut and predrilled from ¾" veneer-surfaced plywood for easy assembly at home. Impedance is 16 ohms. Power rating is 50 watts for program material. Full, smooth frequency response assures you of outstanding high fidelity performance, and an unforgettable listening experience. Order HH-1-C (birch) for light finishes, or HH-1-CM (mahogany) for dark finishes. Shpg. Wt. 195 lbs.

MODELS HH-1-C or HH-1-CM $325.00 each

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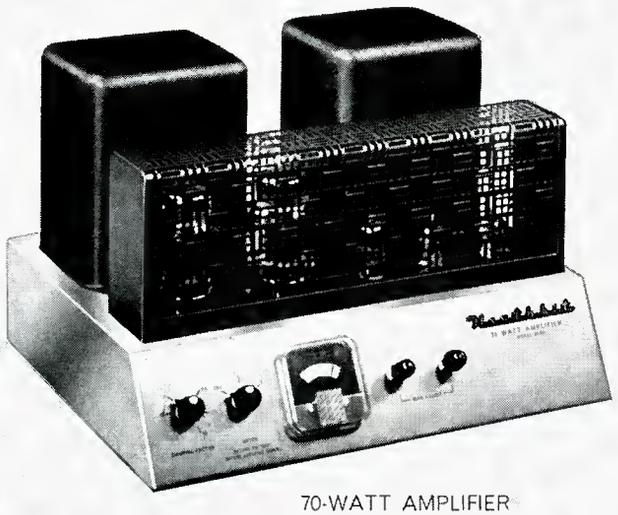
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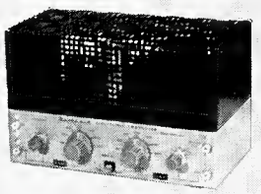
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HEATHKIT 25-WATT HIGH FIDELITY AMPLIFIER KIT

The 25-watt Heathkit model W-5M is rated "best buy" in its power class by independent critics! Faithful sound reproduction is assured with response of ±1 db from 5 to 160,000 CPS at 1 watt, and harmonic distortion below 1% at 25 watts, and IM distortion below 1% at 20 watts. Hum and noise are 99 db below rated output, assuring quiet, hum-free operation. Output taps are 4, 8 and 16 ohms. Employs KT66 tubes and Peerless output transformer. Designed to use WA-P2 preamplifier. Express only. Shpg. Wt. 31 lbs. **MODEL W-5M $59.75**

HEATHKIT ELECTRONIC CROSS-OVER KIT

This device separates high and low frequencies electronically, so they may be fed through two separate amplifiers driving separate speakers. The XO-1 is used between the preamplifier and the main amplifiers. Separate amplification of high and low frequencies minimizes IM distortion. Crossover frequencies are selectable at 100, 200, 400, 700, 1200, 2000, and 3500 CPS. Separate level controls for high and low frequency channels. Attenuation is 12 db per octave. Shpg. Wt. 6 lbs.

MODEL XO-1 $18.95

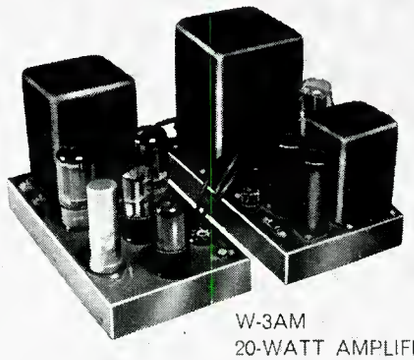
HEATHKIT W-3AM HIGH FIDELITY AMPLIFIER KIT

Features of this fine Williamson-type amplifier include the famous Acrosound model TO-300 "ultralinear" transformer, and 5881 tubes for broad frequency response, low distortion, and low hum level. Response is ±1 db from 6 CPS to 150 KC at 1 watt. Harmonic distortion is below 1% and IM distortion below 1.3% at 20 watts. Hum and noise are 88 db below 20 watts. Provides output taps of 4, 8 or 16 ohms impedance. Designed to use WA-P2 preamplifier. Shpg. Wt. 29 lbs. **MODEL W-3AM $49.75**

HEATHKIT W-4AM HIGH FIDELITY AMPLIFIER KIT

A true Williamson-type circuit, featuring extended frequency response, low distortion, and low hum levels, this amplifier can give you fine listening enjoyment with a minimum investment. Uses 5881 tubes and a Chicago-standard output transformer. Frequency response is ±1 db from 10 CPS to 100 KC at 1 watt. Less than 1.5% harmonic distortion and 2.7% intermodulation at full 20 watt output. Hum and noise are 95 db below full output. Transformer tapped at 4, 8 or 16 ohms. Designed to use WA-P2 preamplifier. Shipped express only. Shpg. Wt. 28 lbs. **MODEL W-4AM $39.75**

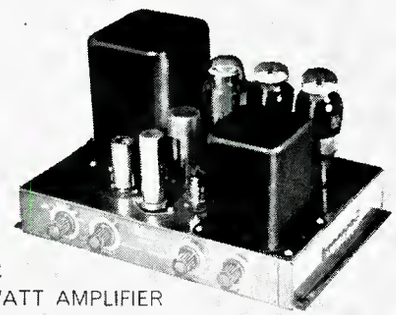
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A-9C
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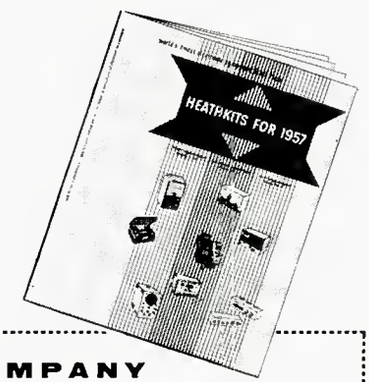
This amplifier incorporates its own preamplifier for self-contained operation. Provides 20 watt output using push-pull 6L6 tubes. True high fidelity for the home, or for PA applications. Four separate inputs—separate bass and treble controls—and volume control. Covers 20 to 20,000 CPS within ±1 db. Output transformer tapped at 4, 8, 16 and 500 ohms. Harmonic distortion less than 1% at 3 db below rated output. High quality sound at low cost!
Shpg. Wt. 23 lbs. **MODEL A-9C $35.50**

HEATHKIT A-7D
HIGH FIDELITY AMPLIFIER KIT

This is a true high fidelity amplifier even though its power is somewhat limited. Built-in preamplifier has separate bass and treble controls, and volume control. Frequency response is ±1½ db from 20 to 20,000 CPS, and distortion is held to surprisingly low level. Output transformer tapped at 4, 8 or 16 ohms. Easy to build, and a fine 7-watt performer for one just becoming interested in high fidelity. Shpg. Wt. 10 lbs. **MODEL A-7D $17.95**

Model A-7E: Same as the above except with extra tube stage for added preamplification. Two switch-selected inputs, RIAA compensation, and plenty of gain for low-level cartridges. Shpg. Wt. 10 lbs. **$19.95**

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EDITOR'S REVIEW

MONEY IN COVER PHOTOS

MANY OF US TAKE PRIDE in our home component-high-fidelity systems, and others of us are always looking for ideas for attractive ways to use them in our own homes—possibly not from any intention of duplicating exactly what another has done but perhaps just for an idea or two for some means of adapting the equipment to the room. Since our new cover design involves photographs, we believe that readers might enjoy "making" the cover with especially interesting pictures of how they solved the problem of installation in a convenient and attractive fashion—one that is accepted by everyone in the household, particularly by the "little woman."

Therefore, we will pay ten dollars for each photo accepted for use on our new cover. Photos must be at least 8×10, glossy, sharp, and of good photographic contrast. Those which are not accepted can not be returned, and if any people appear in them a signed model release must accompany the photo.

This month's cover shows an attractive installation executed by Kierulff Sound Corporation of Los Angeles and their ten dollar check is already on the way. Will your installation be next?

DOODELAC, ANYONE?

We have all heard of the Studillac—a combination of a Studebaker chassis and body with a Cadillac engine. But the Doodelac is our own idea—nourished by some suggestions from Ed Cornfield, Executive Secretary of the IHFM—and stems from the thought that we can start doodling on a piece of paper and come up with just what we want in an automobile. A few weeks ago *Business Week* carried an article which showed conclusively that there was no such thing as a "standard" automobile, each one being practically a custom model made for the special requirements of the buyer. This is quite obvious to anyone who has ever bought a car or who has even read any of the ads. When you get ready to sign on the dotted line for a new jalopy you have the opportunity of stating your preferences in a number of particulars —color, second windshield wiper, backing light, power steering, power brakes, power windows, power seat, radio, heater, rear seat speaker, white sidewalls, Hydramatic, overdrive, and—as some wags put it—wheels, seats, engine, and so on. This is just what we do when we go to our component-high-fidelity dealer and select a home music system—we choose the things we want.

Of course, for the economy minded (or economy enforced) and for those who do not know how much more enjoyment can be had from some of the refinements in an automobile, there is the stripped economy model, equipped with only the barest minimum of necessities. Such cars run, naturally, and even serve their users' needs well enough, even though they do not have the advantages we have come to enjoy and expect. Since these economy models do not come in the popular two-tone finishes, they are often referred to as the "one-tone" models.

And this brings us to another similarity between high fidelity and automobiles—for there are also "one-tone" models in hi-fi. These are likely to be *really* "one tone"—with juke-box bass booming at around 100 cps and with precious little below. It is easy, for example, to use a loudspeaker with a relatively small magnet—and consequently little natural damping—and get an artificial bass which sounds real good to ears accustomed to a $12.95 mantel radio—(the kind that sell now for $39.95). Even the ads about these "one-tone" packaged sets sound at least as good as those about quality merchandise.

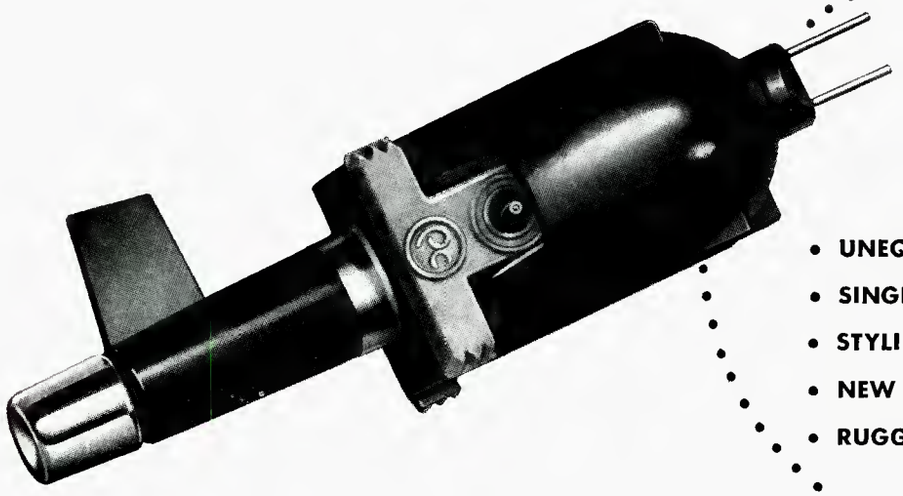
One we read recently deplores the do-it-yourself trend with the suggestion that you shouldn't do it yourself if you can get others to do it for you, though this is not in the good old American tradition, to be sure. The ad suggested that even the word *screwdriver* has different connotations to different people.

We submit that some of the current hi-fi ads seem to be the product of the Madison Avenue "screwdriver mechanics"—liquid screwdrivers, that is. Anyone can call his product "hi-fi" since there are no industry standards by which performance can be judged hi-fi or not—just print it on the nameplate and the shipping box and you have it. Thanks to the component high fidelity industry, the public has become conscious of the terms "high fidelity" and "hi-fi," and in order to sell at all any phonograph must be called hi-fi regardless of what it sounds like. Fortunately there are plenty of people who can tell the difference simply by listening, but it is not often that they have an opportunity of hearing both component-high-fidelity and ready-built "packaged" hi-fi side by side, since these are rarely sold by the same dealers. One doesn't go to Aeolian-Skinner Organ Company to buy a mouth organ.

Manufacturers of component high fidelity are either too honest or too naive to foist some of the current advertising effusions onto the public to sell their products, we are pleased to note. When you have a quality product, you have only to state facts—when you have a shoddy imitation of quality you sell it with words, not performance.

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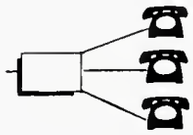
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Pacemakers in the technology of our electronic age

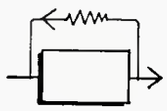
Certain discoveries, inventions and developments of Bell Telephone Laboratories have been truly epochal in their effect upon the technology of our time. Each has come out of a single quest—a search for ways to make telephony ever better. But many have opened the way to exciting advances in TV, movies, radio, horology, astronomy. Here are ten of Bell Laboratories' contributions to the modern world.



Electronic amplifier. First high-vacuum electronic amplifier. Made possible long distance telephony and then opened the way to radio broadcasting.



Wave filter. Precisely separates bands of frequencies. Provided major key to economical sharing of the same wires by many voices or radio programs. Indispensable control tool in radio, television and radar.



Negative feedback amplifier. Provides distortionless and stable amplification. Made possible the enormous, precisely controlled amplification needed in long distance telephone calls. The principle is now basic in high-quality amplifiers for radio, TV and high-fidelity reproduction.



Quartz crystal. Standard super-accurate quartz crystal oscillator developed for frequency controls in radio telephony. Has also become the standard control for clocks in world's astronomical laboratories.



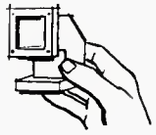
Coaxial cable system. Hollow tube with a central conductor was developed to transmit hundreds of voices simultaneously. Now also provides long distance carrier for TV in partnership with microwave beams.



Transistor. Tiny solid-state device uses extremely small amounts of power to amplify signals. Makes possible electronic telephone switching and much smaller hearing aids, radios, TV sets and electronic computers.



Dial system "brain and memory." Takes over your call and sees that you are connected in the best and quickest way. Newest example: Direct Distance Dialing from home telephones to any part of the nation.



Waveguide. Hollow conductor transmits high-frequency waves. From this came the "pipe" circuits that are essential to radar and very short-wave radio communications.



Microwaves. Bell Laboratories developed long distance microwave transmission. It operates by focusing radio beams from station to station, carries cross-country telephony and TV.



Radio astronomy. This great new science began in the study of radio interference at Bell Laboratories . . . with the tremendous discovery that radio waves emanate from the stars.

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High-Quality Treble Amplifier

Cdr. CHARLES W. HARRISON, JR., USN*

The author describes a four-watt amplifier which employs a single-ended output stage, and which is intended for use as a driver for the tweeter of a two-way speaker system for home use. This unit will considerably decrease the cost of a two-amplifier system.

1. *Introduction*

IN A RECENT PAPER[1] the writer described a dual-channel playback system consisting of a dividing network and two identical amplifiers for driving the bass and treble sections of a dual loudspeaker. This arrangement is economical when speaker elements of approximately the same efficiency are employed, as for example, horn-type speakers for the reproduction of both the low and high frequencies. When the bass section is much less efficient than the treble system, as will be the case when direct-radiator dynamic loudspeakers are used for bass and a horn-type speaker for treble, it becomes entirely feasible to use amplifiers of considerably different power output ratings in a divided amplifier system. For example, if a direct-radiator bass speaker, in the appropriate baffle, has a conversion efficiency of 5 per cent, and the high frequency driver with horn has an efficiency of 50 per cent, 40 watts input to the woofer and 4 watts input to the tweeter will result in the radiation of 2 watts of acoustic power in each channel. One will be able to achieve low-frequency/high-frequency balance[2] under most circumstances, and simultaneously utilize the power capabilities of the bass and treble amplifiers. As a practical matter the proper setting of the volume controls on the amplifiers to obtain the most pleasing response must be determined experimentally by conducting listening tests in the room in which the dual loudspeaker is located.

The purpose of this note is to describe a simple 4-watt single-ended amplifier intended for use as a driver for treble speakers, such as the Western Electric 594A, Jim Lansing D-375, or Altec 288B, when used in a home music reproducing system, or small auditorium. The fact that the power output of the amplifier cannot exceed 5 watts, regardless of the frequency and amplitude of the excitation voltage, insures that the tweeter diaphragm will not be fractured by the inadvertent application of low-frequency signals, or by the development of faults in the treble amplifier.

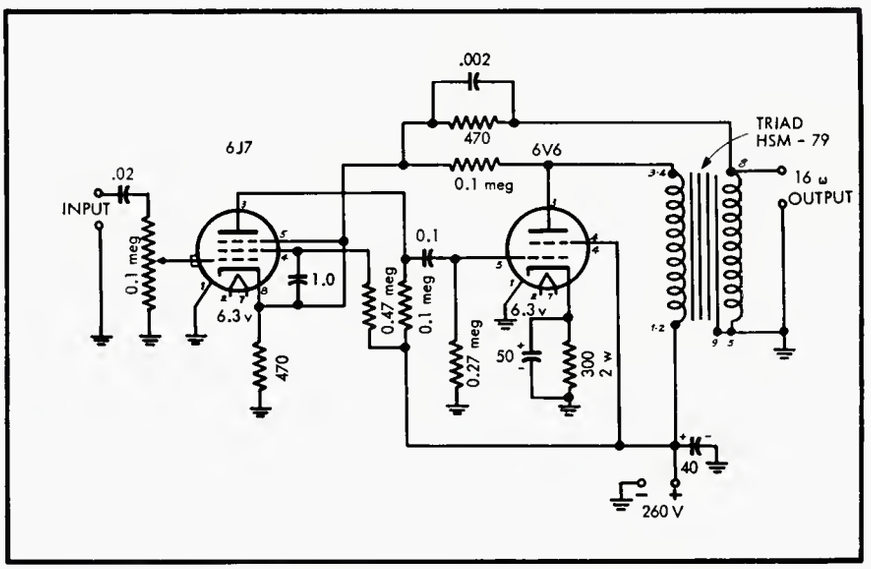


Fig. 1. Schematic wiring diagram of 4-watt treble amplifier.

The Amplifier

The amplifier is built around the Triad HSM-79 hermetically sealed, high-fidelity output transformer. This transformer has a 5000-ohm primary designed to carry an unbalanced current of 40 ma, and secondary impedances of 16, 8 and 4 ohms are available. The guaranteed frequency response is within 1 db from 50 cps to 25 kcs.[3] The response is greatly improved particularly at the high end of the frequency spectrum, by the application of negative feedback around the transformer. Two tubes are used in the amplifier—a 6J7 followed by a 6V6. The schematic is shown in *Fig.* 1. Two feedback paths are employed—one from the plate of the 6V6 to the cathode of the 6J7; the other path is from the secondary of the output transformer to the cathode of the 6J7. These paths are not independent, i.e., changing the circuit parameters in one path changes the effective value of feedback into the other path.

Performance Data

The performance data presented here was obtained from measurements made on an amplifier having circuit values shown in *Fig.* 1, with the following exceptions: (a) The .02-μf input capacitor was shorted. (b) A 270-ohm 2w resistor was used in the cathode circuit of the 6V6 output tube in lieu of the 300-ohm 2w resistor shown in the drawing. The measured grid bias was 12 volts. (c) The interstage coupling capacitor was 0.06 μf instead of 0.1 μf as shown.

A 16-ohm resistor was used to load the amplifier for all tests.

The component values employed in the feedback paths result in approximately 20 db loss in gain compared to the gain of the amplifier without feedback.

Figure 2 is the power curve of the amplifier. It was obtained by adjusting the input signal voltage at each fre-

* *1401 N. Pocomoke St., Arlington 5, Virginia*

[1] Charles W. Harrison, Jr., "High-quality dual-channel amplifier," AUDIO, January, 1956.

[2] Balance between the low and high frequencies depends on such factors as the directive properties of the speakers, crossover frequency, speaker locations, room acoustics, and the spectral distribution of the energy in the program material. Consideration of these factors may dictate different power ratio requirements for a given system.

[3] Some readers may feel that the low-frequency response of the Triad HSM-79 transformer is inadequate. The fact that the primary winding carries unbalanced d.c. makes it difficult to achieve high primary inductance. Thus one might anticipate degraded low-frequency response compared to the response of high-fidelity output transformer types designed for push-pull applications. If the amplifier is to be used in the treble channel of a dual-channel playback system, it is perfectly satisfactory—and even desirable—for the frequency response to begin falling off at approximately an octave below the crossover frequency. The "fusing" of the treble driver is enhanced by a rolloff in the bass response of the amplifier.

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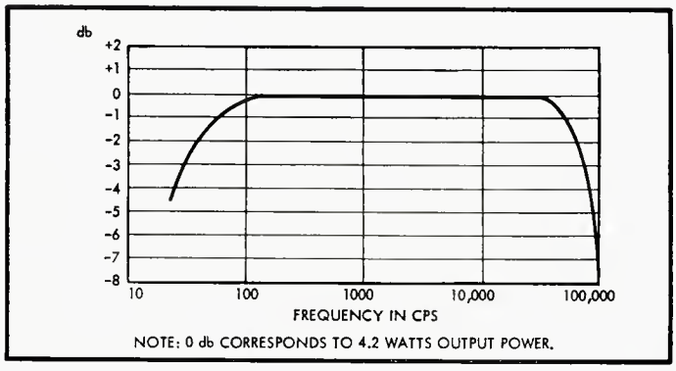


Fig. 2. Amplifier power curve.

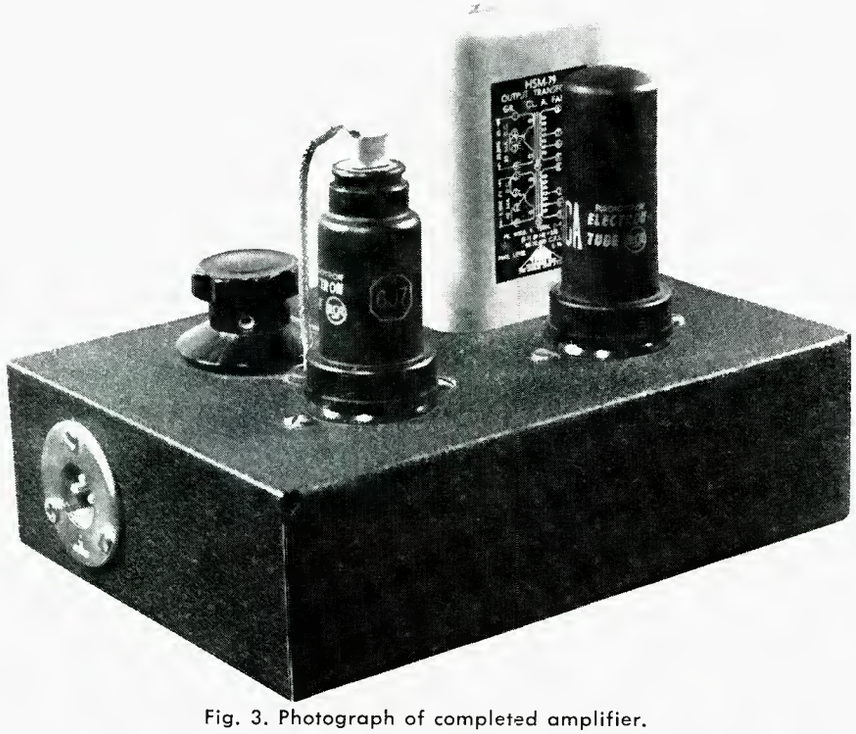


Fig. 3. Photograph of completed amplifier.

quency of measurement until barely visible waveform distortion occurred. The power output was then computed at that frequency. Thus *Fig.* 2 is in reality a curve showing power output as a function of frequency for constant distortion. 0 db corresponds to the power output of 4.2 watts. It is believed that approximately 3 per cent harmonic distortion in the amplifier can be detected by eye, when a good oscilloscope is used for viewing the output wave shape.

When the input signal voltage is adjusted so that the amplifier delivers 2 watts at 1000 cps, the amplifier is flat from 30 cps to 80 kcs. It is down 2.5 db at 20 cps and again at 100 kcs, tapering off to −8 db at 150 kcs and −12.5 db at 200 kcs.

The response of the amplifier to a 20,000-cps square wave is highly satisfactory; to a 10,000-cps square wave the response is perfect.

Constructional Details

The amplifier is easily built on a 5″ × 7″ × 2″ chassis. All resistors are 1 watt except the cathode resistor in the 6V6 circuit. The output transformer must be connected in the circuit as shown to insure that the feedback is degenerative. *Figure* 3 shows the completed amplifier, and *Fig.* 4 shows the component arrangement.

The Power Supply

Many audio hobbyists possess a power pack that may be used to power the treble amplifier. The power supply described in a previous article[1] provides plate and filament voltages for both the bass and treble amplifiers in the writer's dual-channel playback system. A 10-watt resistor of 750 to 1000 ohms is required to drop the plate voltage to the correct value of 260 v. This resistor is shown in *Fig.* 4. The plate current of the 6V6 does not vary more than 1 or 2 ma from zero signal to maximum signal, so the voltage regulation of the power supply is not too important.

The power requirements of the treble amplifier are 6.3 v.a.c. at 0.75 a, and 260 v.d.c. at 45 to 50 ma. The schematic for a suitable, yet inexpensive power supply is given in *Fig.* 5. The transformer should have minimum ratings of 300 v.d.c. at 60 ma; 6.3 v.a.c. at 1 a, and 5.0 v.a.c. at 2 a. A 5Z4 is employed as a full-wave rectifier, and filtering is accomplished by use of a resistance-capacitance network. Such filters are recommended when the current drain does not exceed 50 ma. When choosing a plate transformer for use with RC filters it is important to remember that the power consumed in heating the filtering resistors must be provided by the transformer. If the power supply design is not carefully executed a transformer of

(*Continued on page 41*)

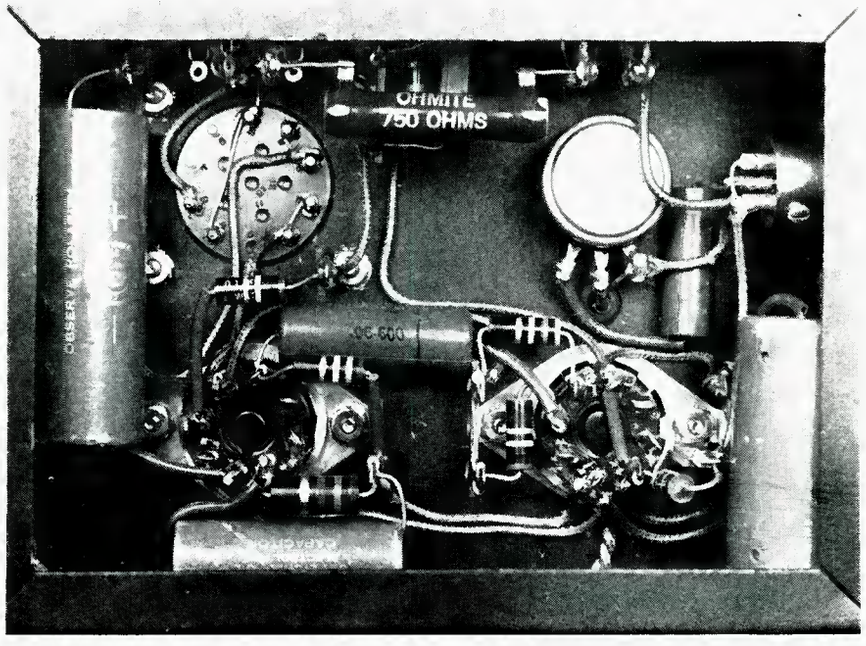


Fig. 4. Arrangement of components in the amplifier.

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Equalizer Design

NORMAN H. CROWHURST*

In two parts—Part 1

Presenting a thorough derivation of the formulas for calculating equalizers of the type commonly used in constant impedance circuits, but related to all audio applications.

THERE WAS A TIME when the addition of an equalizer merely consisted of inserting a .003-μf capacitor in series somewhere or putting a .00005-μf capacitor in shunt and seeing if it improved the reproduced sound. The result was judged by ear and if the improvement did not satisfy, the decision was made whether a larger or smaller capacitor should be used in this position, and then another value was tried. This cut-and-try process continued until the resulting reproduction sounded acceptable. But modern standards have gotten a long way from this indeterminate cut and try method. Nowadays we need to get a precision into our equalizer design to correspond with the precision with which we tailor an amplifier response to within plus or minus a fraction of a db throughout the audio spectrum.

Tailoring equalizer response to such precision by the cut and try method can prove a very protracted process, so we need a more direct method of design. The formulas involved in the basic building bricks of which equalizer circuits are built, are not very complicated and are given in full in the appendix to this article. Four basic types of circuits will be considered: (1), step circuits, sometimes called shelf circuits, which introduce a slope from one level to another; (2), peak circuits, which introduce a rise at one frequency and fall away symmetrically at both sides; (3), dip circuits, with a dip at one frequency, similarly symmetrical on both sides; and (4), finally, a peaking circuit at the end of the response curve, which may be used to maintain response in compensating for a high-frequency or low-frequency roll off. Each of these types of circuit is considered here in turn.

Step Circuits

This is by far the most useful building block for most equalizers. *Fig.* 1 shows the basic step circuit arrangement using boxes to represent the reactances which may be capacitors or inductances. Usually capacitors are used because they avoid some of the trouble that can occur with the use of inductors. *Figure* 2 identifies the kind of response produced

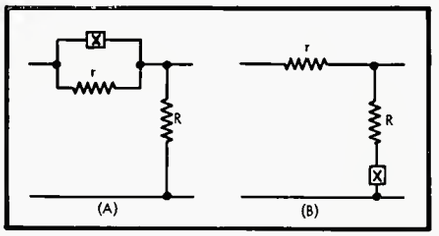


Fig. 1. Basic networks for step response. The component indicated as X may be either capacitance or inductance.

by each of the circuits shown in *Fig.* 1, and also shows the reactance element to use to produce each kind of slope and the formulas for finding the reference frequencies f_1 or f_3.

The simplest way of deriving the response characteristic uses one of these turnover frequencies, f_1 or f_3, as a reference, to derive the attenuation factor A given by Eq. (*1*) in the appendix. This produces an attenuation response equation of the form given at (*2*) in the appendix. This form is useful because it can readily be converted into a chart for computing the exact shape of such a step response. Such a chart may take the form of a universal graphical curve, of which the one presented in an earlier article[1] is an example, while many will prefer the nomograph construction of *Fig.* 3. While the latter presentation is not so visual as the graphical form, it is much quicker to use in plotting out any particular response curve required which is the practical function of the chart.

By using a different normalizing fre-

[1] N. H. Crowhurst, "Prediction of audio response." *Electronic Engineering*, July, 1952.

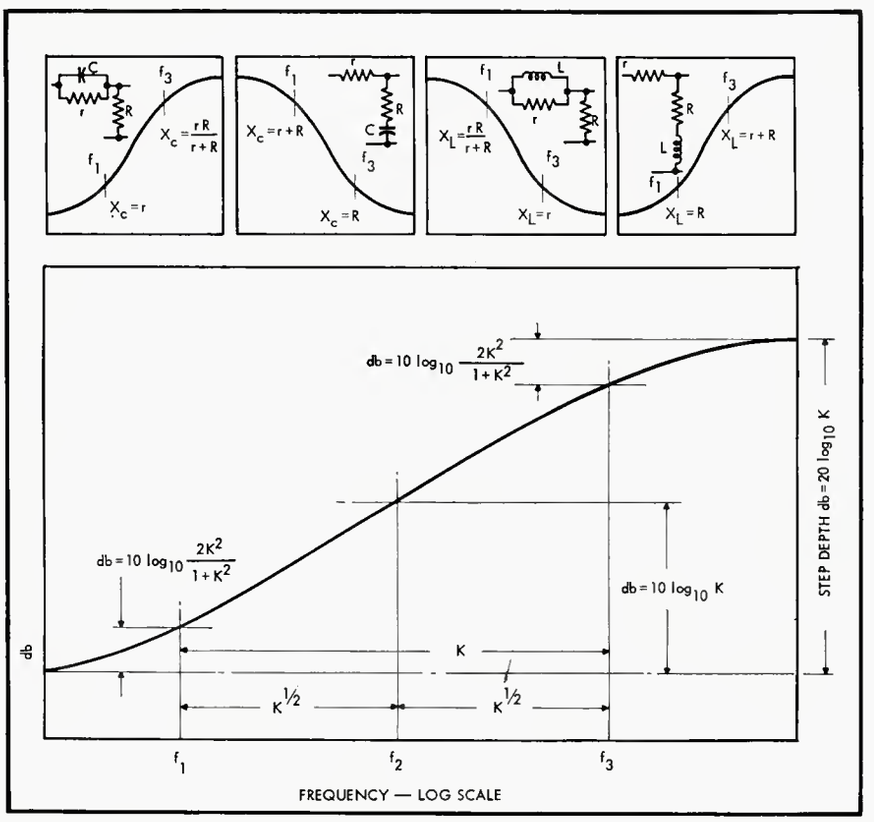


Fig. 2. Essential dimensions of a step response in terms of the circuit constants. The small figures at the top indicate the kind of response given by each possible arrangement, together with reactance values for f_1 and f_3 in each case. The large scale diagram shows the essential attenuation values in terms of $K = 1 + (r/R)$.

* *150 47th Road, Whitestone 57, N. Y.*

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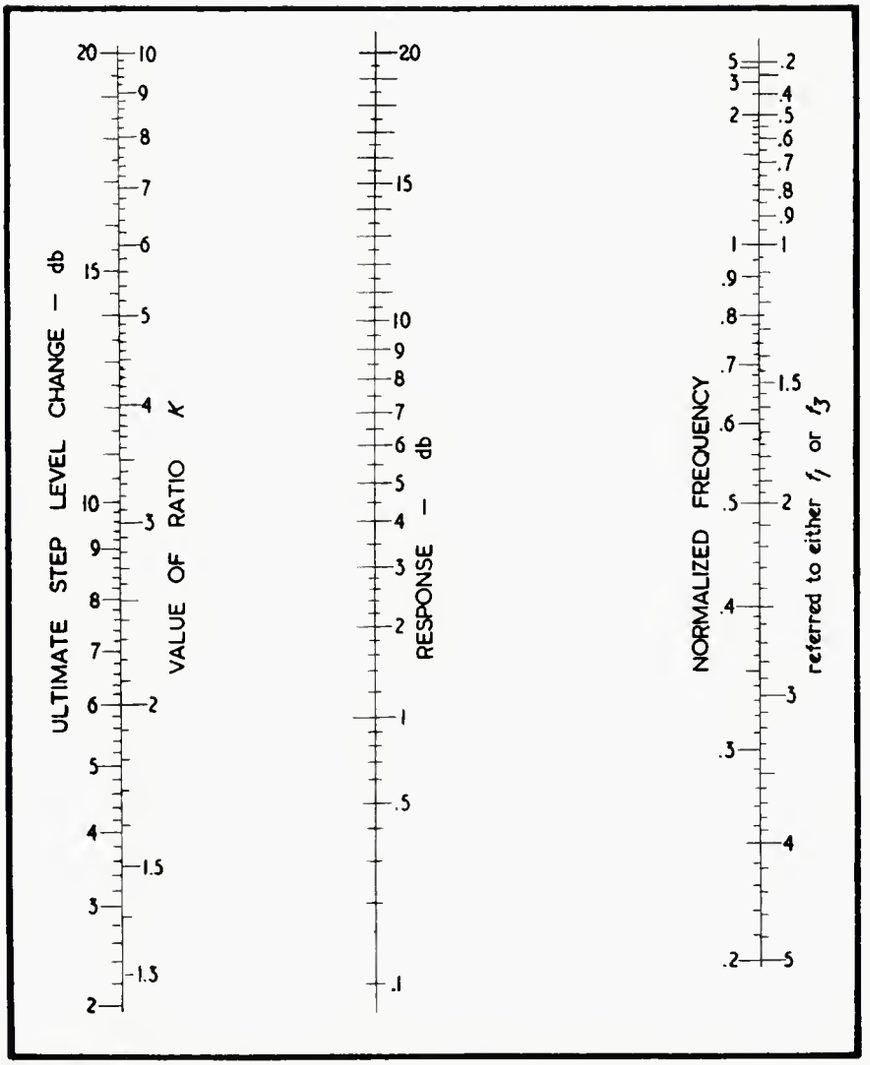


Fig. 3. Nomogram for quick computation of step response attenuation characteristic, normalized to either f_1 or f_3.

quency for the response, f_2 of *Fig.* 2, the phase characteristic can be presented in a similar universalized manner and such a chart was included in the article referred to, while the nomograph of *Fig.* 4 gives a quicker method of accurate computation.

The use of these charts can prove somewhat protracted in finding the correct response to fit a given purpose. To know whether a given set of values will achieve the required equalization, it is necessary to substitute these values into the appropriate equation given with *Fig.* 2, and then use the chart to plot out the response. If the response does not prove to be exactly what is required, the values are adjusted and the response replotted until a suitable one is found. We still need a more direct method of approach for precision equalization work.

Equalizers are often needed to produce a specific slope to compensate for some other slope within a specific range of frequencies. To aid in finding the best step response to approach this, graphs indicating the slope of step responses at different points on their characteristics will be helpful. *Figure* 5 gives data of this nature plotted from the equations developed in the appendix and includes characteristics of the slope at the midpoint of the step network, the slope at the turnover point, the attenuation or boost at the turnover point (which never quite reaches the ideal 3 db), and also some details about the phase correction introduced by step networks.

Sometimes these networks are required in feedback circuits as an aid to achieving stability, and the direct information given by the data of *Fig.* 5 concerning phase advance or delay produced by the step network is an aid in finding suitable values for feedback circuit design.

Sometimes a specified slope has to be continued beyond the range which can be achieved by a single step network. For example: a wide range of 3-db-per-octave slope may be required. This would have to be synthesized by a number of step networks arranged so that their maximum-slope points are, in this case, 3 db per octave and so spaced that one takes over where the next one leaves off. This kind of slope synthesis can also be quite protracted—even when one knows, from the precise slope at midpoint, the correct configuration to be used for each step: there is still the problem of how to space the steps over the frequency band.

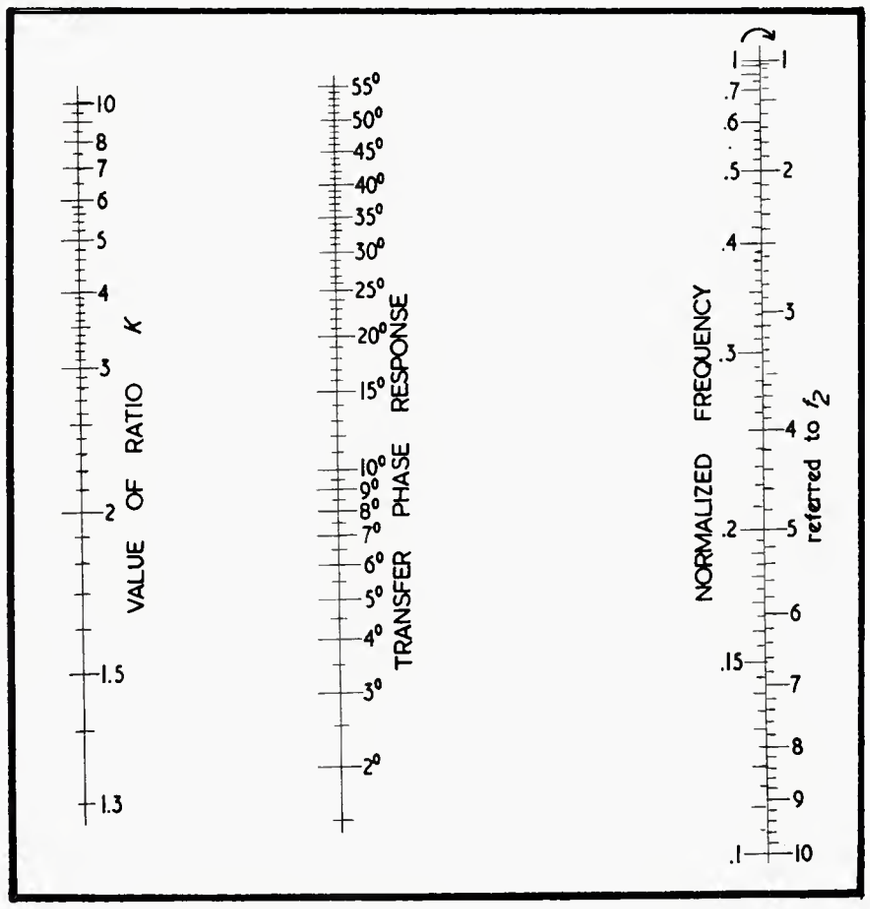


Fig. 4. Nomogram for quick computation of step network phase response, normalized to f_2.

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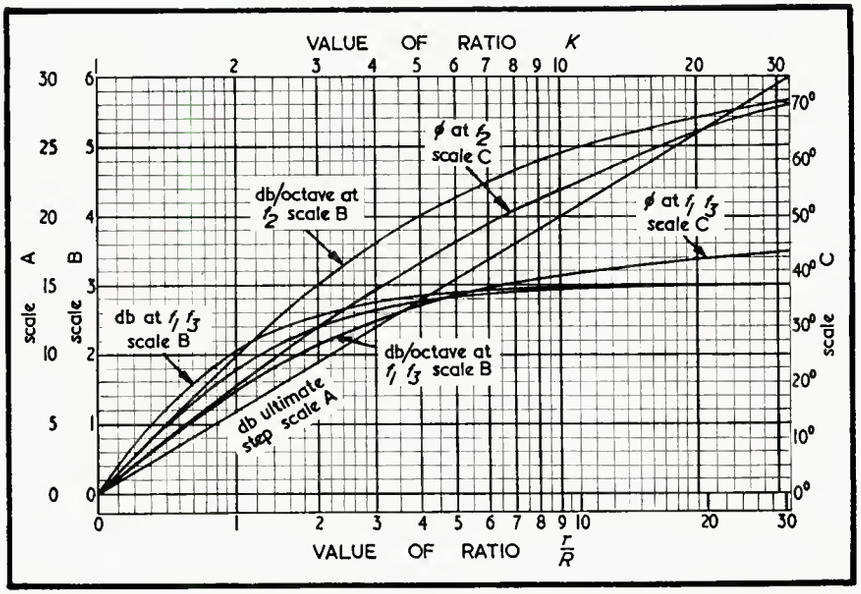


Fig. 5. These graphs aid in selecting the right step response to fulfill specific requirements, without unnecessary plotting out of trial response characteristics.

The solution to this is given by the data in *Fig.* 6, which plots the frequency spacing between reference points on individual step characteristics, and also the frequency spacing between reference points on adjacent step components of a synthesis so as to cause the half-slope points to blend and produce the best possible approximation to a constant slope over a wide range.

In the example quoted, the chart gives a value of 3 for the ratio K between the design frequencies, f_1 and f_3 on the same step network which means the value of r/R must be 2 and the insertion loss will be 9.5 db per step. The frequency ratio between successive steps requires to be 7.2 as given by *Fig.* 6. From this information a whole succession of designs can be quickly set out. For example the first step design frequencies will be between 50 and 150 cycles, the second step between 360 and 1080 cycles, with a third step at 2590 to 7770 cycles. These three steps will practically cover the entire audio range with a slope of 3 db per octave.

So far we have considered the basic networks for step responses. Later we shall give methods of applying the basic networks to practical circuit configurations.

Appendix 1

Using x to stand for f/f_o, where f_o is the normalizing frequency at the lower turnover of a low-frequency boost circuit, or f_o/f for a high-frequency boost circuit, the attenuation referred to the upper level is given by

$$A = \frac{1 + (1+a)x^2 + jax}{1 + x^2} \qquad (1)$$

where a is the ratio r/R (*Fig.* 1)

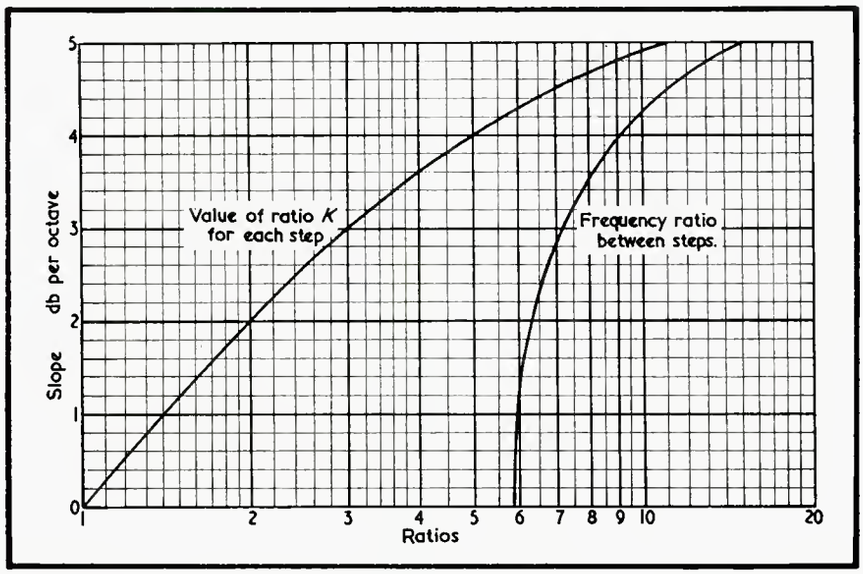


Fig. 6. These curves aid in synthesizing any desired slope over a wide range of frequencies. The curve at the right gives the ratio between points on the curve where the slope falls to one half its maximum value at midpoint.

From this the attenuation response is derived:

$$db\ loss = 10\ \log_{10} A^2$$
$$= 10\ \log_{10} \left[1 + (2a + a^2) \frac{x^2}{1 + x^2} \right] \qquad (2)$$

The ultimate step height is $20\ \log_{10} K$, where

$$K = 1 + a \qquad (3)$$

Substituting this into (2) gives the form:

$$db\ loss = \left[10\ \log_{10} \frac{1 + K^2 x^2}{1 + x^2} \right] \qquad (2a)$$

The phase response can be derived from (1) as

$$\phi = \tan^{-1} \frac{ax}{1 + (1 - a)x^2} \qquad (4)$$

$$= \tan^{-1} \frac{(K-1)x}{1 + Kx^2} \qquad (4a)$$

The variable x normalizes to one turnover. By writing

$$y^2 = Kx^2 \qquad (5)$$

the normalizing frequency for y is the midpoint, f_2 (*Fig.* 2). With this reference, the phase response can be written

$$\phi = \tan^{-1} \frac{K-1}{K^{1/2}} \times \frac{y}{1 + y^2} \qquad (4b)$$

Substituting $x = 1$ into (4a) gives the phase at frequencies f_1, f_3, as:

$$\phi_{13} = \tan^{-1} \frac{K-1}{K+1} \qquad (4c)$$

while for the mid-frequency f_2, substituting $y = 1$ into (4b) gives

$$\phi_2 = \tan^{-1} \frac{K-1}{2K^{1/2}} \qquad (4d)$$

Using the mid-level as an attenuation reference:

$$db = 10\ \log_{10} \left[\frac{1 + Ky^2}{1 + \frac{y^2}{K}} \right] - 10\ \log_{10} K$$

$$= 10\ \log_{10} \left[\frac{1 + Ky^2}{K + y^2} \right] \qquad (2b)$$

The midpoint is also the most useful reference for slope, because the curve is symmetrical about this point. Using the unit slope formula:

$$\frac{d\ \log\ A^2}{d\ \log\ x^2} = \frac{(K^2 - 1)y^2}{(K + y^2)(1 + Ky^2)} \qquad (6)$$

or, in db/octave, taking 3 as an approximation for $10\ \log_{10} 2$,

$$\text{slope} = \frac{6(K^2 - 1)y^2}{(K + y^2)(1 + Ky^2)}\ \text{db/octave} \qquad (7)$$

Slope at midpoint: $y = 1$,

$$\text{slope} = \frac{6(K^2 - 1)}{(K+1)^2} = \frac{6(K-1)}{K+1}\ \text{db/octave} \qquad (8)$$

Slope at turnover points: $y^2 = K$,

$$\text{slope} = \frac{3(K^2 - 1)}{K^2 + 1}\ \text{db/octave} \qquad (9)$$

Attenuation at first turnover, or boost at lower turnover, can be found by equating $x = 1/K$ in (2a):

$$db = 10\ \log_{10} \left[\frac{2K^2}{1 + K^2} \right] \qquad (10)$$

In slope synthesis, the half-slope point is useful, this can be found by equating:

$$\frac{2(K^2 - 1)y^2}{(K + y^2)(1 + Ky^2)} = \frac{K-1}{K+1} \qquad (11)$$

and then solving for y^2:

$$y^2 = \frac{K^2 + 4K + 1}{2K} \pm \sqrt{\left[\frac{K^2 + 4K + 1}{2K} \right]^2 - 1} \qquad (12)$$

(To be concluded)

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From the Archives of Bell Telephone Laboratories

Auditory Perspective

A quantitative study of the effectiveness of two- and three-channel stereo systems along with various combinations of microphones and loudspeakers mixed in usual phantom circuits.

W. B. SNOW

THE SUCCESSFUL ATTAINMENT of the reproduction of music in auditory perspective is the outcome of studies carried on by the Laboratories over a number of years. The word perspective is, of course, taken over from a visual phenomenon, and implies the recognition of relative locations in space. Auditory perspective thus means the ability to judge the location and distance of sounds by the ears. It might seem that the reproduction of music would not be much improved by this ability, but it has been found by many actual tests that the majority of listeners recognize an appreciably enhanced value of the aesthetic appeal if auditory perspective is present.

(Reprinted by permission from *Bell Laboratory Record*, Vol. 12, No. 7, March, 1934.)

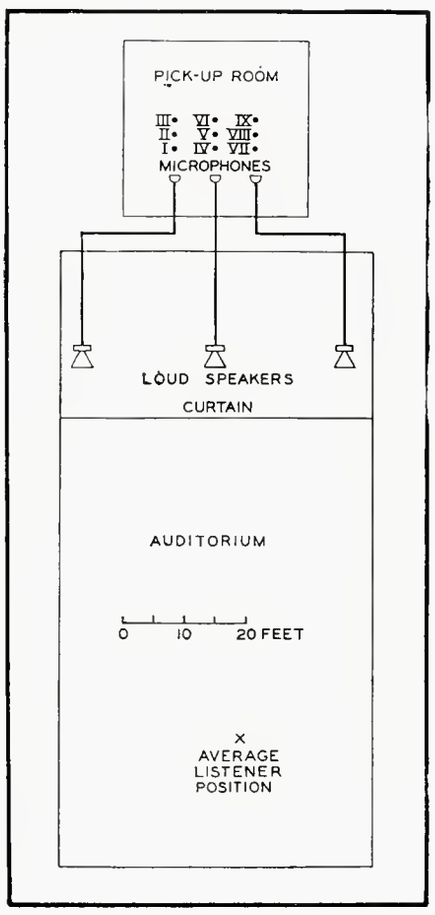


Fig. 1. For experimental purposes, pick-up microphones were mounted in a sound-proof room and connected by independent circuits to loudspeakers on the stage of the auditorium.

One method of securing the sense of localization for reproduced sounds is to pick up the source with two microphones located in the same relative positions to each other as are a person's ears. Then by providing a separate circuit for each microphone to two head receivers held to the ears of a listener in a distant location, the directional and distance sense is completely secured. This "binaural" reproduction has already been described.[1] With this type of reproduction the listener is to all intents and purposes transported to the position of the pick-up microphones, and hears exactly what he would hear if he were stationed at that place. The effects that can be produced in this manner are startlingly realistic, as visitors to the Bell System exhibit at the Century of Progress Exposition attested.

A binaural scheme for the reproduction of music before large audiences, however, would be very inconvenient. Every seat in the auditorium would have to be equipped with a pair of head phones, and in a hall of any size, the necessary wiring and its upkeep would be high. It seemed well worth while, therefore, to experiment with other methods of securing a similar effect.

It is obvious that when one listens directly to music, such as a symphony orchestra, one hears sound that—at least originally—passes through the opening between stage and auditorium. If this space were filled by an array of microphones, therefore, each of which was electrically connected by an individual circuit to a loudspeaker similarly placed before an audience at a distant point, the audience would then hear—assuming perfect transmission—exactly what they would have, had they been listening directly. Such an arrangement would, of course, be impracticable, but it is quite conceivable that a much smaller number of microphones, properly placed and connected by individual circuits to a similar set of loudspeakers, might produce an effect substantially similar. An extensive series of tests was run at Bell Laboratories to determine what was possible in this direction. These experiments were performed with either two or three channels since it is desirable to use as few channels as possible to produce the effect desired.

In the experimental set-up, shown in *Fig.* 1, three microphones placed in an acoustically treated room were connected by individual amplifier channels to three loudspeakers concealed behind a gauze curtain in the auditorium. At a little less than three-quarters of the distance back in the auditorium were seated a group of observers. Their average position is indicated by a cross on the diagram. Most of the observers had had no previous experience with this type of reproduction, and their only instructions were to note on a sheet of paper containing a line representing the curtain, the point from which the sounds they heard seemed to come. The positions from which the sounds actually originated are indicated by Roman numerals.

Tests were carried out in this manner for five different conditions. These were compared with each other and with a direct listening test in which the sounds originated on the stage in front of the listeners. The connections of the microphones and loudspeakers for the five schemes are shown at the left of *Fig.* 2. In the first, three microphones and three loudspeakers were connected by independent circuits. In the second, only two microphones and loudspeakers were employed but the two circuits were independent as before. The remaining three schemes employed various forms of coupling between loudspeakers or microphones. The third arrangement used three microphones but only two loudspeakers—the middle microphone dividing its output equally between the two loudspeakers. The fourth arrangement was the inverse of the third; three loudspeakers received the output of two microphones. The fifth scheme was a combination of the third and fourth. Although three microphones and three loudspeakers were employed, the middle microphone and loudspeaker were coupled to the two side channels.

[1] Harvey Fletcher, "An Acoustical illusion telephonically achieved." Reprinted in AUDIO, July, 1956.

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The results obtained under these five conditions, as well as those for direct listening, are indicated at the right side of *Fig.* 2. The average judgment of the position of the sound is indicated by circles identified by Arabic numerals, which may be compared with the actual position indicated by Roman numerals. All five arrangements give to some extent both sidewise (angular) and depth localization, but the degree to which they correspond to the actual conditions differ. Even with direct listening, the depth localization is distinctly inaccurate.

For the three-channel condition both angular and depth localization is very good although the positions at the rear of the stage seem nearer to the center than they really are. The two-channel condition gave slightly wider separation for the rear positions, but on the other hand the depth localization was not so accurate. With the bridged central microphone, condition three, the apparent width of the stage remained about the same but the centered positions were brought nearer the front. A bridged center loudspeaker, condition four, moved back the apparent positions of the central sounds but narrowed the apparent width of the stage. With center microphone and center loudspeaker both bridged, the apparent width of stage was considerably narrowed, although the depth was somewhat improved. None of the bridged conditions was thus as good as the independent channel conditions, and three channels were appreciably better than two.

The microphones on the stage receive both direct and reflected or reverberant sounds, and similarly the observers receive both direct and reverberant sound from the loudspeakers. Experiment showed that decreasing either the total loudness or the amount of direct sound relative to reverberant, gave the impression that the sound was moving back on the stage. Depth localization is thus a complicated function of loudness and relative reverberation. In the two-channel reproduction, for example, the center positions seemed further back because the distance of the sound from the microphones was greater, due to the lack of a central microphone. Under these conditions the ratio of direct to reverberant sound is decreased.

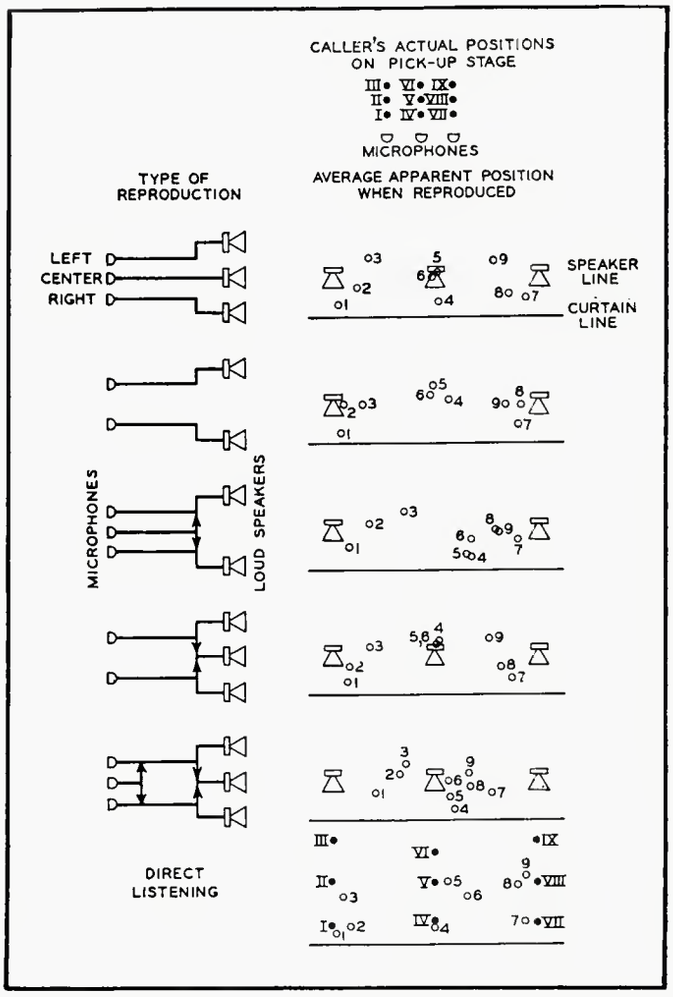
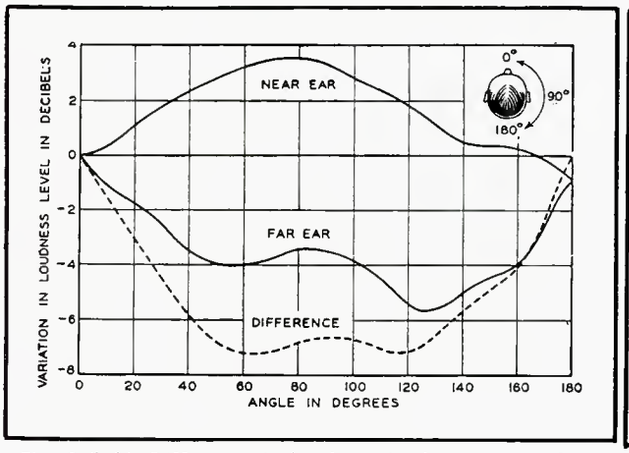


Fig. 2. Five different circuit arrangements of microphones and loudspeakers were tried and the localization obtained by the listener is indicated by circles identified by Arabic numerals.

Angular localization on the other hand was found to depend primarily on the difference in loudness of the direct sound reaching the two ears from the local speakers. Reverberation played a minor part. When one listens directly to a sound the configuration of the head causes the loudness and quality heard by each ear to differ by amounts related to the angle from which the sound comes. For speech the relationship between loudness and direction is shown by *Fig.* 3. The ears distinguish between the front and rear angles giving identical loudness differences probably because of the quality differences. When the observer listens to the acoustic perspective system, he hears sounds from several sources all in front of him and of like quality. Calculations show that when the outputs of the loudspeakers differ, resultant loudness differences are produced in the ears. If the ear always translates a given

(*Continued on page 45*)



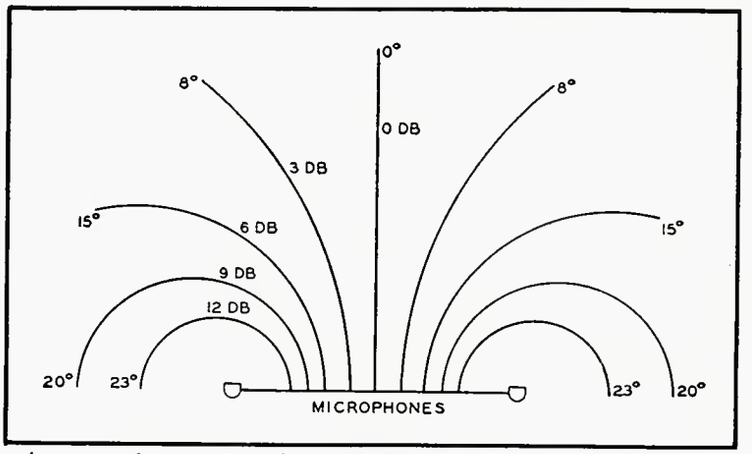


Fig. 3 (left). Difference in loudness in the two ears for speech coming from various directions. Fig. 4 (right). Curves of constant distance ratio to the two microphones become curves of constant angular localization to the listener.

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Understanding Intermodulation Distortion

MANNIE HOROWITZ*

The author explains the meaning of the term "intermodulation distortion," and describes methods of measuring it. Anyone comparing amplifier specifications is likely to encounter the term, and many want to know what it means.

IN PRE-WAR DAYS, when a music lover referred to high fidelity, he would discuss the frequency response of his amplifier and the associated equipment.

Just after the end of the war, high fidelity achieved a broader meaning. The frequency response was still important. Harmonic distortion was, however, the significant factor in determining how good an amplifier really was.

Amplifier designers were not satisfied with this for long. They found that there was little correlation between frequency response, harmonic distortion, and the listener's approval or disapproval of a particular high fidelity setup.

Some of the experts turned then to phase distortion. This type of distortion exists when it takes longer for an audio signal of one frequency to pass through an amplifier than a signal of another audio frequency. It was soon found that this type of distortion had to be extremely bad to be discernible during the playing of musical passages.

It was soon found that intermodulation distortion (abbreviated IM) was closely related to the degree of unpleasantness of sound reproduction to the human ear. Various methods were devised to measure the IM distortion factor in amplifiers. Acceptable standards of measurement were set up by at least one organization—the Society of Motion Picture and Television Engineers.

Non-Linear Tube Characteristics

Just as in the case of harmonic distortion, IM is due to the nonlinear characteristics of the vacuum tube. This nonlinearity is shown by the curves which describe the operation of these tubes. If a curve for the 12AT7 were plotted, assuming a load resistor of 30,000 ohms in the plate, the resultant nonlinearity would be obvious, as in *Fig.* 1. It can be seen that a change of −2 volts from the operating point, −3 v., to −5 v. in grid potential causes a change of 2.4 ma in plate current, while a change from −3 v. to −1 v. causes a plate-current change of 2.7 ma. If the curve were linear, a grid voltage change of 2 volts either way would indicate a plate current change of 2.7 ma either way. If a 4-volt peak-to-peak sine-wave signal were ap-

* *945 E. 26th St., Brooklyn 10, N. Y.*

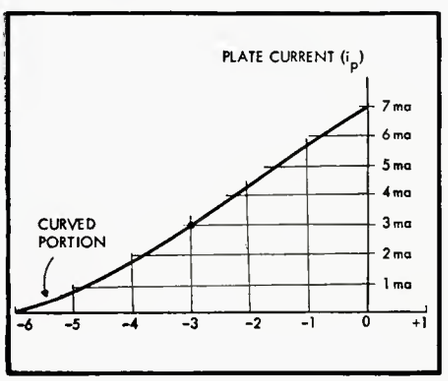


Fig. 1. Typical grid-voltage/plate-current characteristic curve. A plate load resistance of 30,000 ohms and a supply of 300 volts is assumed for the 12AT7.

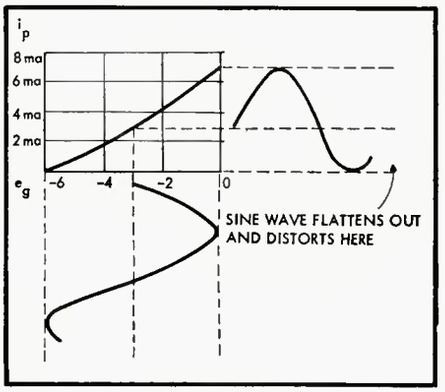


Fig. 2. A sine wave applied to a nonlinear portion of the tube characteristic.

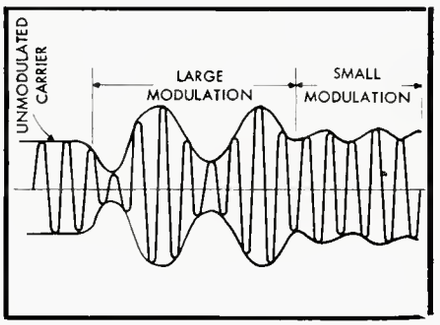


Fig. 3. Wave form of a modulated signal.

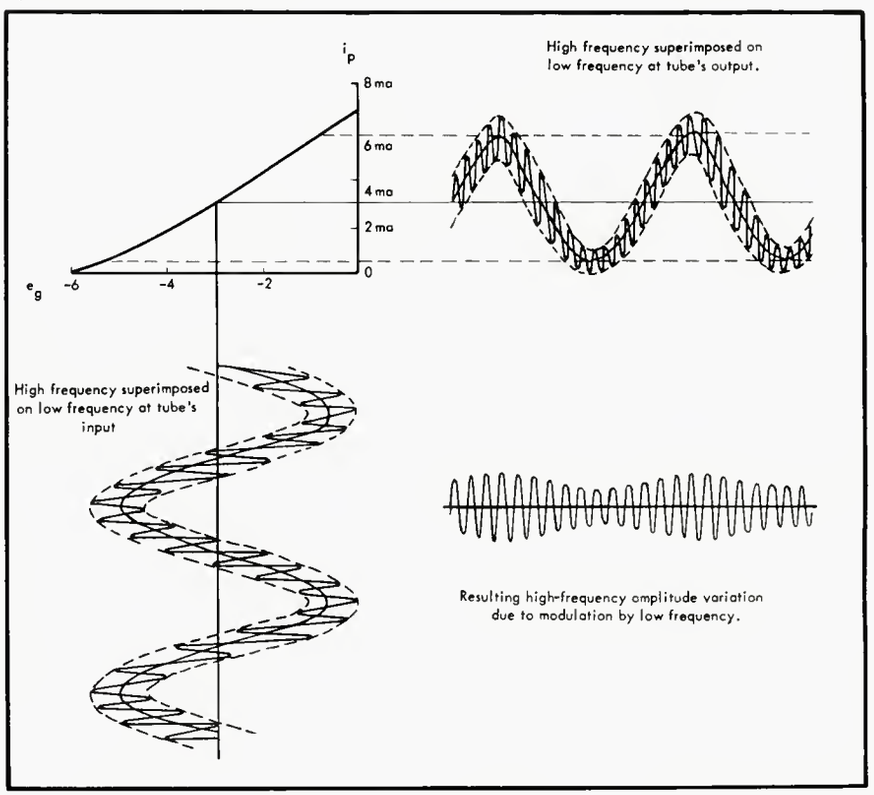


Fig. 4. Result of feeding two signals of different amplitude to the curved portion of the 12AT7 curve.

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PROOF UNIVERSITY SPEAKERS STAY SOLD!

To insure valid statistics, this tabulation covers the largest selling brands, based on a four-year survey (April 1953 to March 1957) of classified and "Swap or Sell" ads for used high fidelity loudspeakers. All ads authenticated as placed by private individuals in Audio, High Fidelity and Music At Home

PERCENTAGE OF TOTAL INSERTIONS			
SPEAKER "A"	SPEAKER "B"	SPEAKER "C"	UNIVERSITY
46½%	23¼%	16¼%	13%

Fewest number of ads offer University equipment . . . outstanding testimonial of user satisfaction.

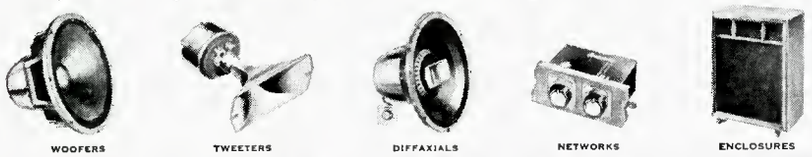
We have always believed that the tremendous volume of University speakers sold in the past to hi-fi enthusiasts attested to the genuine listening satisfaction designed into all our products.

We think that all legitimate hi-fi loudspeakers sound pleasing, but the acid test of listening satisfaction is a speaker's "staying power". Does it grow with your hi-fi tastes, continue to please year after year . . . or is it obsolete before its time . . . ready for swap, sale or discard?

Yes, in the "Swap or Sell" columns of the leading audiophile magazines, you soon know which of the prominent brands of loudspeakers readers outgrow . . . and, *by the absence of such ads*, which of these leading loudspeakers remain in the home!

The record speaks for itself. This accurate survey, taken over a span of four years, shows that speaker "B" has almost 50% more "for sale" listings than University . . . while speaker "A" is offered more than three times as often! Here is indisputable unsolicited testimony from average hi-fi users themselves that University *stays sold*, continues to serve year after year as a source of rich musical pleasure.

University offers the largest selection of speakers and components to meet every size and budget requirement



WOOFERS TWEETERS DIFFAXIALS NETWORKS ENCLOSURES

LISTEN *University sounds better*®

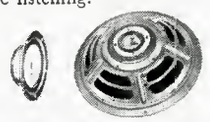
UNIVERSITY LOUDSPEAKERS, INC., 80 SOUTH KENSICO AVENUE, WHITE PLAINS, N. Y.

. . . and heres why

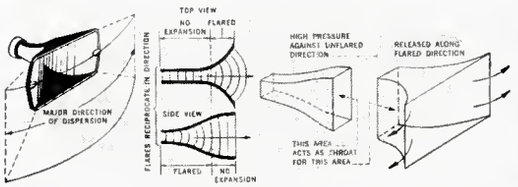


DUAL HORN LOADING RADIAL SOUND PATTERN HI FREQ DIFFRACTION

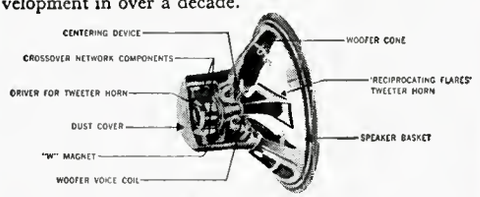
PATENTED DIFFUSICONE PRINCIPLE.
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Typical of University's advanced design and fabrication techniques is the unique bi-sectional construction of completely independent basket and magnet assemblies. This results in a precision product—vibration and shock-proof in operation, built for trouble-free long life.



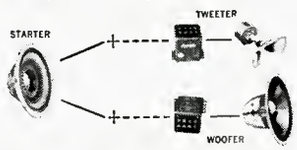
PATENTED "RECIPROCATING FLARE" DESIGN
On all University tweeters the compression driver is coupled to a "reciprocating flare" horn designed to provide *maximum* uniformity of wide-angle dispersion in the horizontal plane with optimum vertical coverage. This is the greatest single advance in wide-angle horn development in over a decade.



TRUE THRU-THE-AXIS DESIGN
In *true* thru-the-axis design, the tweeter driver unit is fitted to the "reciprocating flare" horn *thru the center* of the woofer magnet assembly. Only with *this* thru-the-axis design is it possible to project high frequencies thru a horn of scientific formula-correct length and configuration . . . and thus achieve highest efficiency, lowest distortion and uniform wide-angle treble reproduction.

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plied to the grid circuit of this tube, one half would be amplified more than the other half, as shown in *Fig.* 2. This distortion of the original shape of the wave of this signal is due to the nonlinear characteristic of the tube.

Harmonic Distortion

A wave of any shape—square, sawtooth, or even the distorted wave due to the nonlinearity of the tube characteristic—is made up of the sum of many sine waves. The distorted wave above contains not only its original frequency, known as the fundamental, but also numerical multiples of that frequency, which are the harmonics. Thus if a 350-cps wave were somehow distorted, it would consist not only of the fundamental 350-cps wave, but also of components of 700, 1050, 1400 cps, and so on. These added frequencies, referred to as the second, third, and fourth harmonics respectively, usually have smaller amplitudes than the fundamental. Adding all these harmonics together, in the proper amplitude proportion, will give the original distorted waveform.

A pure sine wave consists only of the fundamental, with no harmonics. Therefore it is said to have 0 per cent harmonic distortion. A distorted sine wave contains a certain amount of these harmonics. The percentage of harmonics in any wave determines the harmonic distortion, which is expressed in per cent. Obviously, an amplifier with a minimum of added harmonics due to nonlinearity is preferred to one with a large number of these generated components. Since these harmonics were not present in the original sine wave fed into the unit, it is undesirable for an amplifier to create them for the finished output.

Modulation

To the radio man, modulation is not a new concept. The radio station sends out a modulated signal (*Fig.* 3).

When an amplitude-modulated signal is analyzed mathematically, it can be seen that it consists of a high-frequency carrier, such as 1,000,000 cps with an audio signal, such as 400 cps, changing the strength or amplitude of this carrier. The result is a 1,000,000-cps wave varying 400 times a second in amplitude. When the variation of the 400-cps is great in amplitude, the peaks of the 1,000,000-cps carrier are greater; when the 400-cps modulating signal is low in amplitude, the carrier varies to a smaller degree. This is the method of transmitting audio waves by radio through the use of high-frequency carriers.

It can also be found that there are new frequencies created due to this variation. Not only are the 1,000,000 cps and the 400 cps being transmitted, but there are also sum and difference frequencies present. Thus, due to this modulation, four frequencies are present—1,000,000, 400, 1,000,400, and 999,600 cps. These latter

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two frequencies are known as the *sidebands*.

This same principle of modulation with sidebands is once again used in every superheterodyne radio receiver. The 1000 kilocycles (1,000,000 cps = 1000 kilocycles) arriving from the radio station is mixed with 1455 kilocycles (kc) created by the local oscillator in the radio. The result is the creation of the sum frequency, 2455 kc, and the difference frequency, 455 kc. Only the 455-kc sideband is amplified by the i.f. amplifier with the 2455-kc sideband being discarded. This process of mixing of the two signals by the first detector in the radio is accomplished because of the nonlinear action of this first tube. If this tube were perfectly linear as far as its input voltage-output current characteristics were concerned, there would be no mixing and no 455-kc sideband.

Intermodulation Distortion

Extending this theory of modulation to audio equipment, the mechanics of intermodulation distortion become obvious.

In music, there is always more than one frequency present. Assume in the simplest case, that there are only two frequencies available—100-cps and 5000-cps. If the amplifier were perfectly linear, there would be only two frequencies coming out of the unit—100 and 5000 cps—neither one of which would be distorted or mixed in any fashion. However, if the amplifier were not perfectly linear—as is usually the case—the 100 cps and the 5000 cps would mix, modulate each other, and there would be the addition of the sum and difference frequencies, namely 5100 cps and 4900 cps. The amount of these sum and difference frequencies present would constitute the percentage of intermodulation distortion.

However, this distortion goes one step further. Since the amplifier is non-linear, there is also harmonic distortion present. Thus not only are there 100 cps and its harmonics such as 200, 300, and so on; not only are there 5000 cps and its harmonics such as 10,000, 15,000, and so on; but there are also the sum and difference frequencies of these harmonics present to add more to the intermodulation distortion.

This process finally ends with the side bands, their harmonics and side bands, and the harmonics and sidebands of every conceivable combination outlined. The intermodulation distortion is a check on the percentage of all these undesirable frequencies present in the output of an amplifier due to the existence of the two original signal frequencies.

This is not as unwieldy as it might originally seem. The higher harmonics usually have small amplitudes and may be considered negligible. This by itself

(*Continued on page 42*)

PILOT

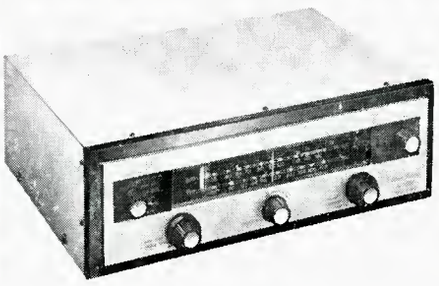
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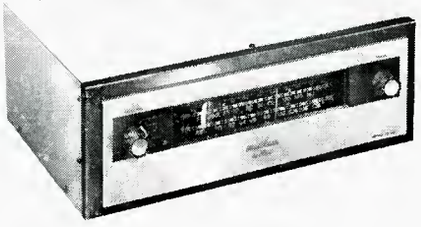


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Has tuned RF stage and dual cascade limiter-discriminator FM circuit for maximum sensitivity; — perfect quieting even with fringe signals; AFC with disabling switch; 10 KC filter for AM; flywheel tuning; built-in FM and AM antennas. Features preamp-audio control with five input channels; hum-free DC on tube heaters; tape head and phono inputs with separate equalization; bass and treble controls; separate cathode follower outputs for tape recorder and power amplifier. Housed in handsome enclosure finished in brushed brass and burgundy.

Dimensions: 4¾"h x 14½"w x 10¼"d.

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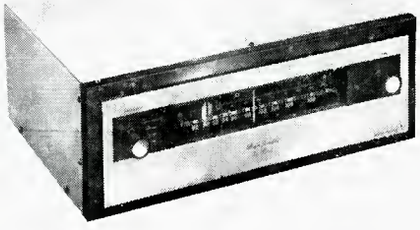


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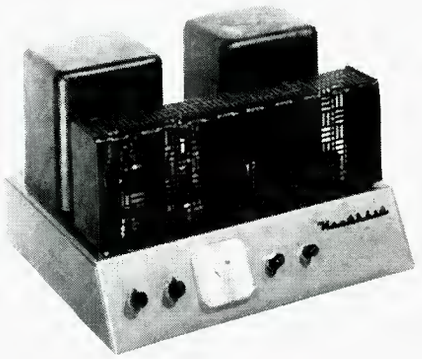
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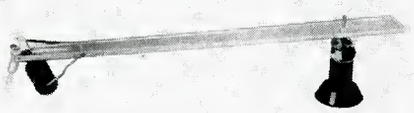
NEW PRODUCTS

• **Heathkit 70-Watt Amplifier.** Power to spare is inherent in this new amplifier which virtually "loafs" along at normal listening levels. Design features include 6550 output tubes and a special Peerless output transformer for minimum distortion and maximum stability. The power supply incorporates silicon-diode rectifiers.



A calibrated control varies the damping factor from 0.5 to 12 at all output taps. A quick-change plug selects 4, 8, and 16 ohms, or 70-volt, output and the correct feedback resistance for any desired conditions. A built-in meter reads plate current for balancing the output tubes. For full technical specifications of the Model W-6M amplifier kit write The Heath Company, Benton Harbor, Mich. **H-1**

• **"Dust Bug" Record Cleaner.** The "Dust Bug" is an assembly consisting of a lightweight plastic arm terminating in a small brush of Nylon bristles, each of which is pointed so that the bottom of record



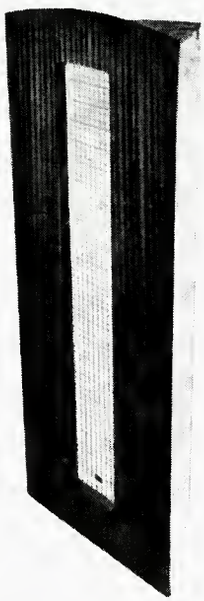
grooves may be thoroughly explored. The bristles also serve to track the arm across the record. A cylindrical plush pad is situated immediately behind the brush and serves to collect the dust particles which are loosened. The device is placed on the record just before the pickup is lowered and cleans the record as it is played. Mounting of the arm is accomplished by means of a suction cup which is attached to the turntable base. Electro-Sonic Laboratories, Inc., 35–54 36th St., Long Island City 6, N. Y. **H-2**

• **Pentron Custom Tape Components.** Consisting of three tape transport mechanisms, three preamplifiers, and newly-designed 4-channel mixer, the new Pentron line of tape recording components permits more than ten combinations for recording and playback. These combinations include monaural and stereophonic operation, with a choice of stacked or staggered heads. Features of the transports include a single rotary control for all functions, rapid speed change for either 7.5 or 3.75 ips operation, and automatic self-energizing differential braking. Flutter is under 0.4 per cent. Finished in harmonizing gray and gold, the mechanisms may be operated either horizontally or vertically. The CA-11 preamplifier is a self-powered tape playback unit with frequency response of 40



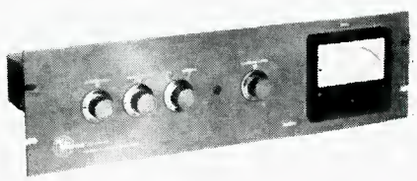
to 14,000 cps. The CA-13 (illustrated) is a self-powered recording amplifier and playback preamp. It incorporates an illuminated VU meter. The CA-15 is a stereophonic dual channel playback preamp with separate equalization for each channel. For complete details and technical specifications write The Pentron Corporation, 777 S. Tripp Ave., Chicago 2, Ill. **H-3**

• **Tandberg Corner Speaker System.** Exceptionally compact in design, the new Model 165BK Tandberg speaker system incorporates an 8-in. dual-cone speaker with



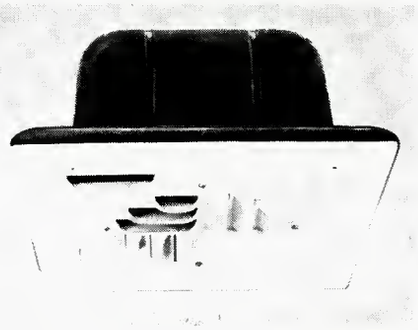
built-in crossover network. Enclosed in a 4-cu.-ft. cabinet, the entire assembly is so light in weight that it can easily be mounted at ceiling level. Available in hand-rubbed Norwegian mahogany, the enclosure measures 40"h × 21"w × 9½"d. The speaker is rated at 10 watts. Introduced by Tandberg, the system is distributed in the United States by Reeves Equipment Corp., 10 E. 52nd St., New York City, N. Y. **H-4**

• **Viking Rack-Mounted Tape Units.** A number of improvements are incorporated in the line of Viking tape transports and recording preamplifiers, recently announced as available in rack-mounted models for professional and industrial applica-



tions. The transport is floated on rubber shock mounts in a standard 10½ × 19 ins. rack panel. Of principal interest to commercial users is the 75P (half-track playback only), 75R (half-track erase-record), and 75RM (half-track erase-record-monitor). Also available are the 75B equipped with staggered heads for data recording applications, and transports equipped with full-track heads for broadcast use. The Viking RP61-VU recording and playback preamp (illustrated) is also supplied for rack mounting, and is equipped with a VU meter in place of the magic-eye indicator on the standard model. Full information will be supplied upon request to Viking of Minneapolis, 9600 Aldrich Avenue South, Minneapolis 20, Minn. **H-5**

• **Plastic Speaker Baffles.** A new company, Fourjay Industries, 2360 W. Dorothy Lane, Dayton 9, Ohio, has entered the field of low-level sound baffles with a complete line of original designs, constructed of high-impact plastic. Leading the new line is a bass-reflex enclosure which replaces one standard acoustical tile when used in ceiling installations. The unit features a "Spiral Sound" faceplate which incorporates directional ports to achieve 360° dispersion. Designed to handle an 8-in.



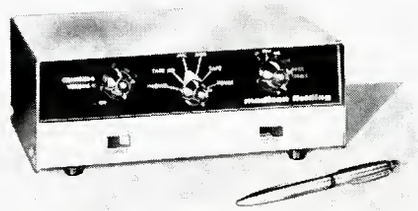
speaker, the baffle may be installed without the use of extra furring or blocking. Complete literature covering the Fourjay line is available upon request. **H-6**

• **Stereo Listening Chair.** Entirely unique is a chair designed essentially for listening to stereophonic music which has been introduced by Stereo Products Co., Severna Park, Md. Resembling a conventional wing-back seat in appearance, the chair has a loudspeaker built into each wing. The effect on the listener is closely akin to that



achieved while listening to stereo music with headphones. Music may be played from any stereo playback machine. Loudness may be set to any reasonable level without disturbing others in the room. A switch mounted on the back of the chair can be used to convert it to monaural listening when desired. **H-7**

• **Transistorized Audio Control.** Novel in both engineering and mechanical design, the "Transamp" meets the most exacting criteria for a preamp-control unit. Both low and high, input signals are fed into specially selected low-noise transistors, resulting in a signal-to-noise ratio which is exceptionally high. Two triode stages fol-



low which, by means of individual feedback loops, keep distortion and hum at an absolute minimum, and provide additional gain and tone control features. The use of transistors permits miniaturization of the Transamp, the entire assembly being mounted on a chassis which measures only 8"l × 5"d × 2¾"h. Six separate inputs are selectable by means of a panel-mounted rotary switch. Controls include infinitely variable compensation, gain control, record equalization, and rumble and noise filters. Full information will be supplied on re-

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quest by Madison Fielding Corporation, 863 Madison St., Brooklyn 21, N. Y. **H-8**

• **Filter Design Kit.** Designers of audio devices will find many uses for the Filtorpac, a kit which offers the user detailed filter data as well as a set of 18 high "Q" toroidal inductors which can be quickly assembled into all combinations of high, low, band-pass, or band-rejection filters. The



inductors are encased in plastic for ruggedness and are provided with single-screw mounting and turret terminals for maximum convenience in rapid assembly and disassembly of test setups. The Filtorpac fulfills the need for a convenient and economical method of rapidly designing and bench testing prototype filters, for making temporary filters for use in laboratory work, and for teaching the principles of electronic filters in school laboratories. Manufactured by Torocoil, 2615 Bristol Road, Columbus 21, Ohio. **H-9**

NEW LITERATURE

• **Belden Manufacturing Company,** Chicago 80, Ill., is releasing a new electronic wire and cable catalog. Catalog #857 contains many additions to the Belden line, including new audio cables, new microphone cables, new hook-up wire conforming to MIL spec. 16878-B, and a variety of other cable types. For quick reference, wires and cables are grouped according to use and application. **H-10**

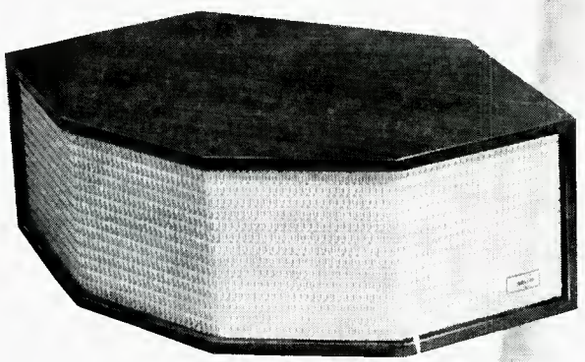
• **Reeves Soundcraft Corporation,** 10 East 52nd St., New York 22, N. Y. has just announced a free new pamphlet which discusses an often-neglected factor in successful home recording—"How to Choose the Right Recording Tape." This illustrated brochure offers general information on magnetic recording tape, recording characteristics, and the elements which govern the physical characteristics of the product. It also describes the individual requirements which should be considered in the choice of a recording tape. Permanence, longer play, dimensional stability, and economy are all features of the five Soundcraft tapes. **H 11**

• **Techniques Inc.,** 52 Jackson Ave., Hackensack, N. J., has available a printed bulletin on Supracote #3, an improved screen resist for printed circuits. The material is designed to withstand the action of alkaline cleaning and plating baths without lifting, pitting or undercutting. Sharpness and detail of pattern field laid down compare favorably with direct photographic process. **H-12**

• **Ohmite Manufacturing Company,** 3634 Howard St., Skokie, Ill., in Bulletin 148B describes two incredibly small "Tan-O-Mite" Series TW capacitors. The bulletin also reviews the new expanded line of Tan-O-Mite units, gives the maximum capacitance and voltage rating for each of six case sizes, and lists values available from stock. Copy of Bulletin 148 will be mailed upon written request. **H-13**

• **Cinema Engineering, Division Aerovox Corporation,** 1100 Chestnut St., Burbank, Calif., has just issued a new 16-page catalog titled "Audio Frequency Equalizers," with product illustrations and two dozen charts showing response characteristics, variable equalizer diagrams, and other pertinent data. The Cinema units provide standard networks which, in simplified and flexible arrangements, may be used to build up almost any type of audio frequency response characteristic. A unique deviation from the usual catalog style is the inclusion of eight case studies which describe problems and their solutions as encountered in actual field experience. Requests for copies of this catalog should be addressed to the attention of Mr. James L. Fouch. **H-14**

hear the music
not the speaker . . .

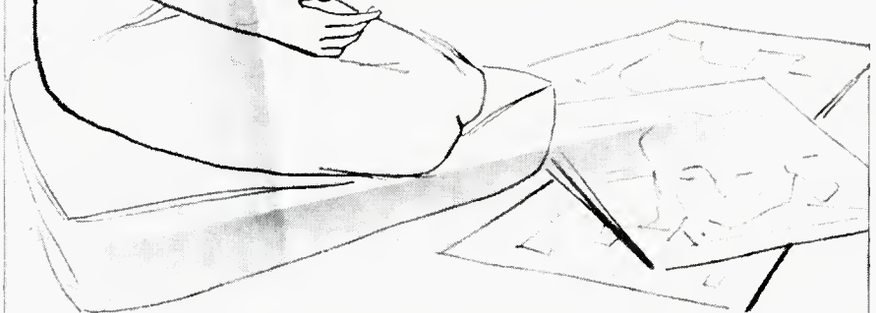


JansZen *Electrostatic*



It is interesting to note that women are more sensitive than men to overtones in the higher ranges. If your present music system includes a dynamic tweeter, the resultant distortion of these overtones may well be the cause of your wife's complaints about the "shrillness" or "loudness" of your music system.

The fact that the JansZen lets you hear the music and not the speaker, eliminating exaggerated and distorted highs, solves the problem for the sensitive listener. The key to JansZen's achievement is four electrostatic radiators, each of which is a virtually massless, stretched diaphragm driven over its entire surface by an electrostatic field. The result is completely uncolored sound for the first time in speaker development.



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EDWARD TATNALL CANBY*

STEREO TAPES

Menotti: Sebastian Ballet Suite. Members NBC Symphony, Stokowski.
RCA Victor CCS-29

Stereo Rating: 5

It is singularly fitting that this superb "hi-fi" stereo tape should be conducted by the old Maestro himself, the man who conducted the very first stereo orchestra a quarter century ago, as recounted in AUDIO for June of this year.

We'll let pass the slight confusion over nomenclature here—the music is for a regular-sized orchestra and the "members" of the NBC must have constituted a Committee of the Whole—all the members; also, the NBC Symphony has been the Symphony of the Air now for some time. Name-orchestra or no, this group plays superbly under old man Stokowsky who remains, when he wants to be, one of the finest conductorial technicians we've had. And the stereo effect—phew, it's up to all Stokowsky-based expectations.

This is really stereo hi-fi! That is, it is an exaggeration of stereo, but an effective one. The pickup is closer, sharper, than in the Reiner-Chicago stereos, the right-left separation more definite and pronounced, the fi of the individual instruments and groups ultra-ultra. But RCA hasn't forgotten the all-essential liveness. The huge space here is even bigger than the Reiner one, encompassing all the instruments in its golden liveness so that they really seem part of one big ensemble, in that space, no matter how closely they are miked.

It is quite a feat thus to combine sharp, close, hi-fi miking in stereo with a real over-all space-sense. Too often, close miking simply puts the individual instrument or voice right in your speaker box, only a few feet away, removing its sound entirely from the recreated space beyond and between speakers. That's not good—especially when some sounds are inside your speaker box while others, paradoxically, seem off in space. You can work up a very confusing sort of effect this way, for if part of an orchestra is imagined out in front in a concert hall, you can't very well have part of the instruments appear five or six feet away from you in what seems to be a nearby seat! (If it's a church, then some of the choir seems to have strayed out into adjacent pews next to you.)

You won't find any such inconsistency in this RCA job, though you will find the ultra-well-defined highs and the big "crump" to the bass that is popular in the snazziest monaural hi-fi recordings, such as Mercury's "Living Presence" jobs. Everybody, every instrument here, is right out in that big, golden liveness along with the rest of the orchestra.

The Menotti score, an early ballet (1944) is a fine stereo piece, full of soloistic color effects, clearly and transparently orchestrated. It's sharp and modern, but full of sweet sentiment too. The waltz-like music in the middle is particularly good in stereo. And as I say, the playing is wonderfully alive, plastic and expressive. Good old Stoky.

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

STEREO RATING.

Mr. Canby rates stereo tapes on a scale from 1 to 5 (5 being the highest value) as to specific stereo effectiveness, over and above the general values of recording and performance as heard in comparable monaural reproduction.

The rating is personal, includes both musical and technical features that contribute to stereo value. It is designed to measure the stereo worth of the recording in terms of the greater cost of stereo tapes and of stereo playback equipment.

All tapes were reviewed in the stacked (in-line) form. Some, but not all, are available for staggered heads as well.

A Concert by the Oberlin College Choir. Robt. Fountain, conductor.
Livingston 714-BN

Stereo Rating: 3-5

Choral music is a natural for stereo, and it isn't easy to go wrong, so gracefully does the choral sound project with two-channel help. This excellent and accurate young people's group sings in a somewhat too dead space—too dead, that is, for maximum stereo advantage over the equivalent monaural—but even so it makes an excellent record, the stereo sound more natural and seemingly less distorted and "squeezed" than the same via one channel. In the Bach Motet, which is sung by a double choir, the stereo advantage suddenly goes 'way up—for purely musical reasons. The slight separation of the two choruses, the added clarity of inner detail in the eight-part music, makes for much easier and more enjoyable Bach listening than in the inevitably muddy and turgid single-channel rendition.

The chorus has a splendid sense of pitch and of harmony, especially in the Bach, which is one of the more difficult pieces in the choral repertory. Not a chord is muffed, every harmonic progression is heard accurately and snug without slipping and sliding; diction is excellent and the English words easily understood.

I'm not fond of mixed programs like this, ranging the historical gamut, but that is what most people do expect. This one begins with old Alessandro Scarlatti, a juicy and pleasing "Exultate Deo", then moves to a post-Bach, pre-Mozart item by Graun and to the piece de resistance, the Bach motet; then, a sop to the moderns, a piece about David and Absolom by Norman Lockwood; I wasn't too much impressed. The end, nice and sweet, is "Beautiful Saviour", decked out with humming and what have you. A nice tape, all in all.

Mozart: Missa Brevis in F. Oberlin College Choir, soloists, Robt. Fountain.
Livingston 713-BN

Stereo Rating: 3

This early-style Mozart Mass is sung with the same choir plus orchestra—no doubt the student orchestra at Oberlin Conservatory—and soloists, also student I would guess. It seems more live in acoustics than the unaccompanied recording above, and is somewhat more effective as stereo sound, compared with its monaural equivalent. An interesting facet: the soloists are picked up *au natural*, at stage distance and at normal (distant) concert volume. Alas, after so many years of amplification, we can't so quickly adjust to literal concert hall practice! You'll probably feel as I did, that the soloists here, even with stereo's aid, tend to be drowned in the larger sound. Yet this is the way they actually do sound in performance. Interesting because some stereo producers have gone to the other extreme, amplifying their soloists according to standard monaural usage. That doesn't work well either. Stereo needs some sort of compromise on soloists, halfway between the natural sound and the accepted monaural balance, as used in standard recording.

The Mozart is sung nicely and neatly but not with any great feeling; this type of music is not at all easy to grasp for young people today, and though the execution is impeccable for the most part, I don't think this group really is quite onto the style, except in the Credo—where a familiar Mozart motto theme, the main theme of the "Jupiter" Symphony, is used to dramatic effect. But better this neat and accurate singing than the wobbly, sloppy renditions I've heard of such music by older choirs.

Jazz Hystereo. Jack Millman Quintet.
Stereotape ST 5

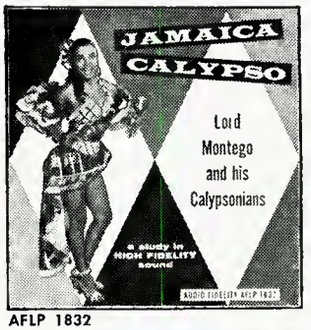
Stereo Rating: 4

BROTHER, you won't find any discreet mood music on this roll! It's real potent jazz-making, traditional in its form but definitely more modern than Dixie and twice as high powered. The recording is super-hi-fi and effective as all get out—monaural or stereo. You'll listen with all your ears or none, just like Bach. I liked it.

How different is jazz stereo technique from the stereo of the big concert hall classics! This is a close-up, very loud studio job, quite dead acoustically, and the end instruments are right in the loudspeakers, in your room. But the middle is right in the room too—this is an intimate ensemble, if high-powered—and so the stereo audible picture is natural and complete from side to side. Indeed, this is practically an Absolute recording, the instruments seemingly right in your room without any room-space of their own. Only the piano is noticeably off in the background a few feet.

In this sort of close-up work a surrounding liveness isn't necessary, as it is in classical concert hall recording where the middle of the music is far out in front, at a distance. There,

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AFLP 1832



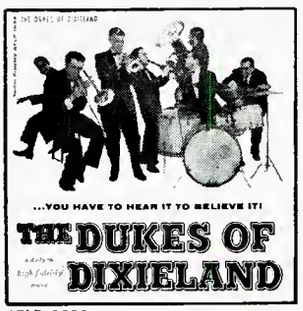
AFLP 1825



AFLP 1830



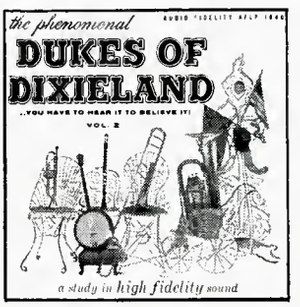
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AFLP 1823



AFLP 1851

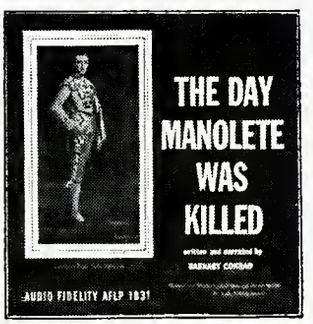


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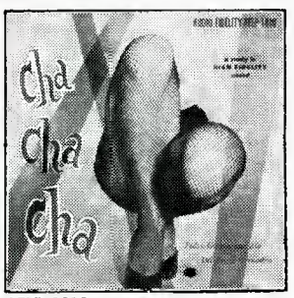
TOTAL FREQUENCY RANGE RECORDINGS



AFLP 1831



AFLP 1815



AFLP 1810



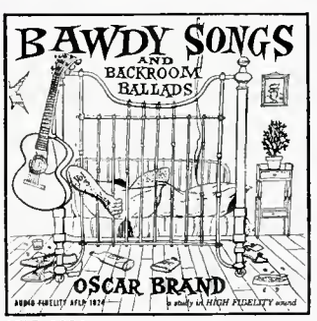
AFLP 1822



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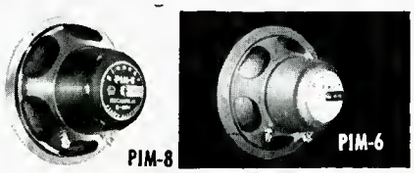
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FUKUIN ELECTRIC
5 Otowacho 6-chome, Bunkyo-ku, Tokyo

you must keep your end instruments out of the speaker boxes or you'll make hash of realism. In closeup popular music you don't worry about a middle that's probably within a dozen feet of the mikes anyway.

Classic chamber music will work out well too in this style *if* it is the sort that flourishes in dead, modern acoustics. But most of it that we hear is unsuitable for dead studio sound—it needs a soft liveness to go with its older style. Take Bartok or Stravinsky, though, and you can apply jazz stereo techniques to it with stunning effect. It's modern.

I suggest you look out for other Stereotape jazz items of this sort, in case I don't get hold of them. They're good.

Liszt: Piano Concerto #1 ("Triangle"). Artur Rubinstein; RCA Victor Orch., Wallenstein. **RCA Victor BCS-31**

Stereo Rating: 5

This is an unexpectedly interesting stereo, one of the most successful solo-orchestra renditions I've yet heard—but in a way that never would have occurred to me. It's recorded chamber-music style, close-to and dead, in sharp contrast to other RCA classical tapes. This, of all music! But it works.

First, the piano is picked up not with the big, distant stage sound you might expect but, instead, with a close and immediate sound that suggests Mr. Rubinstein is either right in your living room or, perhaps, on a small stage in a tiny concert hall about fifteen feet from you. Intimate, though the piano tone itself is enormous and beautifully natural. This piano is definitely *not* in any conceivable large concert hall, as you hear it.

Now if that sound were combined with the huge, spread-out orchestra in RCA's Boston and Chicago Symphony stereos (and the NBC with Stokowski), there would be h—— to pay. A big, close piano and an orchestra far out in a big auditorium just don't mix. Your mind would hear the piano close-up "inside" the orchestra's big space—which would put it in the middle of the air like a Disney giant.

There are such recordings. RCA's earlier Brahms Violin Concerto with Heifetz come to mind. Heifetz and his fiddle, blown up to huge size, seem to hover in the air somewhere above the orchestra. Disturbing.

Now maybe this new tape was an accident, maybe it was the calculation of a stereo genius. Whichever was the case, the big, close-up piano is here matched to a close-up orchestra in the same, rather dead chamber music style, and the two coalesce with the greatest of ease. You'll have no trouble at all in placing the piano right along with the orchestra (and the solo triangle, not to mention an occasional solo violin which seems to stand off to the left, right next to the piano). The whole music, piano and orchestra together, is close, lively, immediate.

Now I'll grant that this Concerto would sound pretty silly in an actual chamber music hall. It wouldn't fit; this is a full-sized orchestra. But the stereo *effect* of chamber intimacy is another matter. It seems to suit the music well and it makes possible the big piano sound *and* the big orchestra, brings the soloist up close and the orchestra along with him.

Naturally, the actual recording hall or studio was hardly of chamber music size. I'm speaking strictly of the imagined effect, as heard via this tape.

As for the music, Rubinstein plays in his new and very musical manner for most of this work. The grand old piece rolls out with all its dramatic thunder, if with a good deal of modern high tension as well. Only the last section shows that familiar hard pounding that Rubinstein's powerful fingers produce when he is just playing for show. Basically a good performance, if a bit streamlined, and the orchestra plays up to the pianist throughout.

Ravel: Rapsodie Espagnole; La Valse. Boston Symphony, Munch. **RCA Victor CCS-36**

Stereo Rating: 5

RCA most assuredly has the rest of its classical competitors by the scruff of the neck in respect to stereo know-how for big band. This is another hi-fi stereo, deliberately worked out to sound that way and it's a huge success, if hi-fi stereo is what you're after. The performance, of course, is the best of the best, with a superb orchestra and a conductor who knows this music for every bit of its wild hysteria and icy cool control.

Somehow once again RCA has managed here to get the sharp edge and exaggeration that goes with hi-fi sound without introducing the slightest trace of stereo spacial distortion—instruments that seem unnaturally close and out of spacial context. The telephone-bell triangles and rolling snares of super-hi-fi are all here, but in the stereo listening they seem to be right down in the orchestra, on the stage, as natural as you please. If this was made in Symphony Hall, then an AB comparison with the Messiah recording on Livingston (Unicorn) made in the selfsame place will be very instructive. Such different effects!

Note incidentally that RCA is using thin tape and very large center hubs, the recordings appearing to the eye as skimpy—just the outside of the reel filled. But the timing is reasonably long when you play these rolls, whatever the looks of them. The recorded level is somewhat lower. I'd say, than in that on other tapes made with standard thickness tape, but the difference is not enough to make for noise troubles. I have yet to hear any print-through in the RCA thin tapes, though I've heard a bit now and then in some of the regular-thickness tapes from other companies. RCA has it pretty carefully calculated, I'd guess.

Organ Concert. Austin Organ, First Meth. Church, Evanston, Ill. Austin P. Lovelace. **Concertape 24-3**

Stereo Rating: 3

This is a conventionally competent organ recital that somehow never gets far beyond a sort of neutral unimagination, though the reasons are not too easy to fathom. The Austin organ, somewhat modernized (i.e. converted to the old "Baroque" stops) has a serviceable sound, of no great distinction. There's a Sunday organ recital program, the usual mixture of several Bachs, a bit of neo-Romantic loud organ and merging into modern. Nice little item by Pachelbel (pre-Bach) and a somewhat colorless rendition of an old Daquin (French). Nothing very brilliant in the hi-fi way, neither hi nor low but plenty of well recorded organ sound. The playing is similar—competent serviceable but not very exciting.

And, to round out the neutral picture, the stereo effect is good and an improvement over the equivalent monaural sound, somewhat broader, bigger and more immediate, but the total effect isn't anything very striking, even so. Good liveness, but not really impressive. A good piece of neutral workmanship, from beginning to end. I was sort of bored.

I'd like to add, if you'll pardon my being a bit on the pessimistic side for the moment, that I am not very enthusiastic about Concertape's round plastic boxes for tape. Numerous advantages are claimed but I find them, with their tiny feet, clumsy, uncomfortable, inconvenient—particularly when they are stacked in among their square counterparts. Can't read their labels easily, they tend to roll forward and dump themselves on the floor—also they are hard to open unless you pay close attention . . . well, this is a personal reaction and many tape users may disagree. So better look at them yourself.

Organ Recital (Vols. 1, 2). Prof. Kurt Rapf, Piaristenkirche Organ, Vienna. **Audiosphere 711-ST; 712-ST**

Stereo Rating: 4

This recording from Vienna is much bigger in sound than the above, more spectacular, and the stereo advantage is somewhat greater as well, not so much right- and left-wise as in a more pronounced sense of presence and space. The registration, too, seems more flamboyant and showy, to match the big sound of the instrument and the large liveness. Both tapes open with familiar Bach, the Toccata and Fugue in D Minor on one and the C Minor Passacaglia on the other; Mendelssohn follows on both, and in Volume 1 there's room for a Chorale by César Franck, ending quite gloriously.

The actual differences all along the line—from the organ and the acoustics to the performer, the mike-set-up and the processing—

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aren't easily pinned down between this and the Concertape organ recital, but the over-all effect is remarkably better here. Who was it said genius is an infinite capacity for detail? The details here add up impressively, however minor they may be in actuality.

I note a slight coming-and-going of highs here, as though the tape were not aligned securely in the driving. Also occasional slight drop-outs. Could be my playing machine, but better check your copies.

The Music of the Bach Family, vol. 1. (Joh. Bernard Bach: Suite in D; Joh. Christoph Bach: Suite "Amadis des Gaules.") Zimbler Sinfonietta, Burgin.
Boston (Livingston) BO 7-6BN
Stereo Rating: 3-4

(A lowish stereo rating here merely means that the music, mostly for string orchestra, sounds fine with ordinary recording. Stereo adds a modest but not startling extra realism.

The several sections with solo instruments come through with better stereo advantage—hence the double rating. The sound is lovely—stereo or monaural.)

This is a most worthwhile series, sponsored by Boston University, investigating the numerous members of the great Bach family with the Zimbler Sinfonietta, made up of Boston Symphony men. Here we have first a perfectly lovely suite by Christoph Bach, who was a few years older than old Bach himself (Johann Sebastian)—and who writes music much like Bach's own Suite in D, tempered with a bit of Handel's sweetness. A really first-rate work and a joy to listen to, if somewhat on the feminine side compared to J. S. himself.

Somebody has bollixed up his Bachs on the second item here recorded. Notes say that this Christoph was born some forty years *before* our Bach and died in 1703—the big Bach died in 1750. Well, the music on the tape is a lovely suite that I'd say dates from after Bach, at the earliest the middle 1700s and more likely, by the sound, from the French Revolutionary period, or in Mozart's time. A mere century out of step

Whoever this Bach is—I don't have a dictionary handy to begin a search—he wrote very melodious, Mozarty music, somewhat like Gluck's, with a mixture of Gretry, the bumptuous revolutionary composer of France. Most listeners won't worry too much about which Bach is which among these less known tribesmen, and this music, Bach or no, will sell itself nicely.

Music of the Bach Family, Vol. ii. (K.P.E. Bach: Symphony in E Minor; W. F. Bach: Lamentabile and Presto, Sonata for Two Flutes; W. F. E. Bach; Sextet in E Flat.) Soloists, Zimbler Sinfonietta, Burgin.
Boston (Livingston) BO 7-7BN
Stereo Rating: 3-4

This volume features two of Bach's sons and a later Bach, about the last, who didn't die until 1845. Karl Philipp Emanuel Bach was the most gifted and influential of Bach's sons, of a deeply serious and introspective nature yet a man who became the leader of the world of music in the mid-1700s, famous throughout Europe. His very expressive music is now coming back into fashion. This symphony is Gluck-like except for its serious, personal character. A fine sample of this cultured and sensitive great musician at his best.

Wilhelm Friedemann Bach, the old man's oldest son, was relatively a shiftless soul though plenty gifted when he got around to composing. His duet for two flutes sounds more like papa Bach than any of the younger sons' music; it is played here in such huge miked liveness that you'll think there are dozens of flutes playing. Only two, and stereo has them just slightly separated to right and left, off in the huge auditorium space.

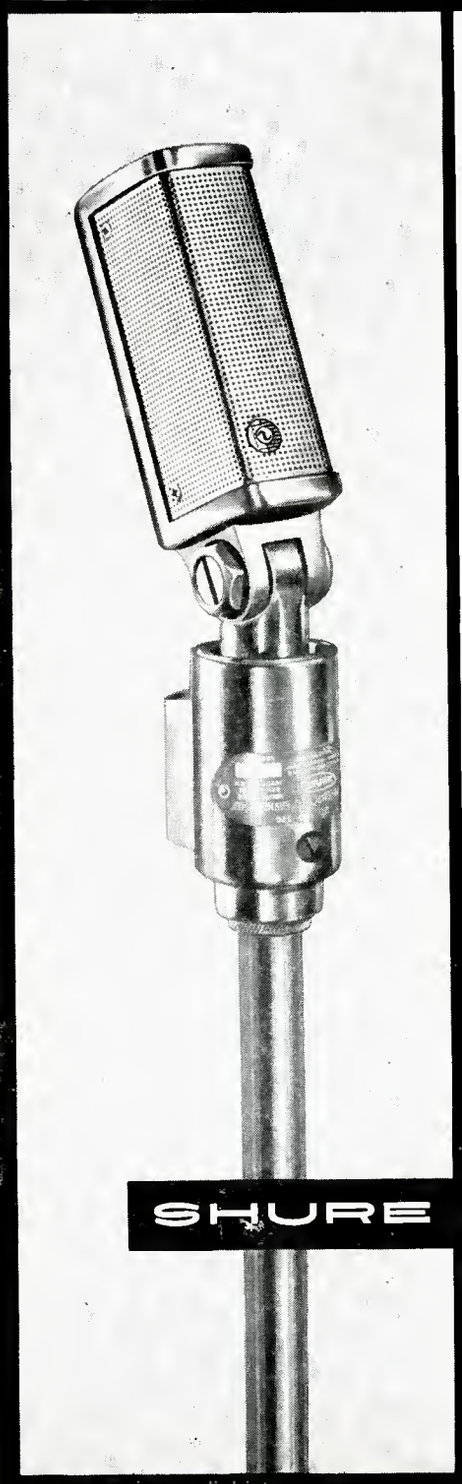
Finally, there's the little known Wilhelm Friedemann Bach who lived on into the mid-Nineteenth century. His sextet will remind you of the Beethoven Quintet Op. 20, with nice, simple, bouncy tunes and plenty of close-up woodwind and horn color. Rather sappy stuff but well written and entertaining in sound. •

feedback . . .

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Stole a pig and away he run.

He ran to a town near Baltimore
and sold the pig to a butcher store.

The pig changed hands
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A twin-coned Norelco – F.R.S.

His father was piping
when Tom returned home
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the music was weak
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The reason – Norelco!
The speaker – Twin-Coned!
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Are now fully grown."



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soon held full sway

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The pig was forgotten –
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By the beautiful music that soared,
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There is a moral to this tale
Which we are pleased to give
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ABOUT MUSIC

HAROLD LAWRENCE*

It Pays to Applaud

THE SIDEWALK PEDDLER who can afford it seldom works alone. An accomplice, pretending to be a customer, listens to his sales pitch in seemingly rapt attention. When a sufficient number of passersby has gathered around, he digs into his pocket, makes his purchase, and leaves. But he'll return in a few minutes for a repeat performance, unless the policeman on the beat is unfriendly and the peddler has to fold up his stand and silently steal away. In the language of the trade, the phony buyer is known as a "shill." His job is to stimulate bona fide purchases, working on the time-honored principle that an unattended stand, like an empty shop, is bad for business.

In the world of music and drama, the shill's counterpart is found in the "claque." Derived from the French, *claquer* (to clap), the claque's function is to prime the pump of audience acclaim, even when the well is dry. One of the first historical examples of the use of the claque dates back to the Roman Empire when Nero hired 5000 soldiers to cheer his own performance as an actor—hence the early name for claques: "Romans."

During the past three centuries, claques have ranged in quality from the crude (if less extravagant than those of the Emperor-fiddler) to the more sophisticated varieties. A sixteenth-century French poet bought up quantities of tickets in advance for all productions of his play and handed them out to interested friends. Operatic performances in eighteenth-century Italy were generally noisy affairs. At the conclusion of an aria in a Milan production in 1729, the claque (divided between the pit and the gallery) set up a din of shouting and applause. Then the pit corps began to strike their benches with sticks while their gallery cohorts showered the parquet audience with thousands of printed leaflets containing sonnets in praise of the singer. It was not until the nineteenth century that the art of claquery reached its zenith.

The father of the modern claque was a French theatrical entrepreneur named Sauton. Having put considerable amounts of money into operatic and theatrical enterprises, he was determined to protect his investments. Since opening night applause was an essential part of success, he employed claques to provide the necessary stimulus. It then occurred to Sauton that he might organize bands of claques and rent out their services. This resulted in history's first claque concern whose slogan was: "Dramatic success guaranteed." The critics unofficially dubbed Sauton's firm: "Claques' College."

Although intended as a slur, the designation "college" was not altogether fantastic. Trained claques performed many subtle and varied tasks under the expert direction of a *chef de claque*, or claquemaster. Prior to opening night, chefs de claque attended rehearsals and made copious notes. If it was an important and lucrative production, an elaborate network of claques was put into operation. Inside the theatre, one group was assigned the job of clapping, stamping feet, calling for encores, and crying "bravos." Another squad was deployed throughout the audience with instructions to laugh or weep at appropriate moments. One member of the team was usually made to hiss from time to time, provoking violent shushing and arousing the audience's sympathy for the playwright or the composer. The élite of the claque, the well-dressed 'spectator,' was placed in the boxes or other expensive seats where he could whisper flattering remarks about the performance, meant to be overheard by his affluent neighbors.

During intermission, claques transferred to the lobbies to disseminate superlatives. Outside the theatre, they would stand in front of the box office or placards and exchange such comments as "What a magnificent performance!" or "Did you ever hear that role sung better in your life?" Naturally these observations were made for the benefit of innocent strangers. When a large purse was involved, claques fanned out into the city, spreading the 'word' in cafés, bars and restaurants.

Claquers' professional fees were carefully itemized, even for mere applause, as the following list of services of an Italian firm in 1919 indicates:

For applause on entrance, if a gentleman	25 lire
For applause on entrance, if a lady	15 lire
Ordinary applause during performance, each	10 lire
Insistent applause during performance, each	15 lire
Still more insistent applause	17 lire
For interruptions with "Bene!" or "Bravo!"	5 lire
For a "Bis" *at any cost*	50 lire
Wild enthusiasm—A special sum to be arranged	

From the outset, people sneered at the very mention of the word, claque. Yet claques have served useful purposes. A character in Guy Endore's biographical novel about Alexandre Dumas, "King of Paris" (Simon & Schuster), speaking in defense of the claque, says: "Imagine some evening, when it is raining and a cold wind is blowing, that you come into the theatre. Imagine that you sit here wondering whether your feet are wet, whether you will be sneezing tomorrow, whether you wouldn't have done better to have stayed

* *26 W. Ninth St., New York 11, N. Y.*

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home . . . the actors and actresses do their best, but it is a cold, damp house, and the cast cannot put its heart into its work, and the play fails not because it isn't a good play but simply because in wet tinder the best flint and steel can only fizzle out. Now do you see where the claque fits in? Do you see how they warm things up, start the ball rolling and create at first an artificial enthusiasm but which soon becomes the real thing as the audience quickly loses itself in the play, forgets the weather outside, and has a good time?''

Likewise, the absence or presence of a skilled opera claque at times meant the difference between success and failure. When Caruso first sang in Gluck's seldom heard opera, *Armide*, at the Metropolitan Opera House, his big arias were greeted with stony silence. In desperation, he appealed to Gatti-Casazza who in turn asked tenor Alessandro Bonci for advice. Bonci said that his own valet knew every note of the opera. Thus, with Bonci's man Friday on hand, the audience applauded frequently and in the right places.

When the claque's job is to stimulate applause for the opera as a whole, the effects of their work can be beneficial. Personal claques however are something else again. In the fall of 1955, a New York *chef de claque* was sent to San Francisco to stimulate an ovation for Renata Tebaldi in a performance of *Tosca*. The demonstration led to a precedent-shattering encore of ''Vissi d'Arte'' which both the critics and public found repugnant.

The Tebaldi-Callas feud has resulted in supporters of one singer attending the other's performance in order to hiss an unsteady high note or muffed phrase. So far, neither star has dared to go as far as a certain Mme. Tofts in 1704. This English singer was said to have sent her servant to the theatre where her chief rival was appearing in order to pelt her with rotten oranges.

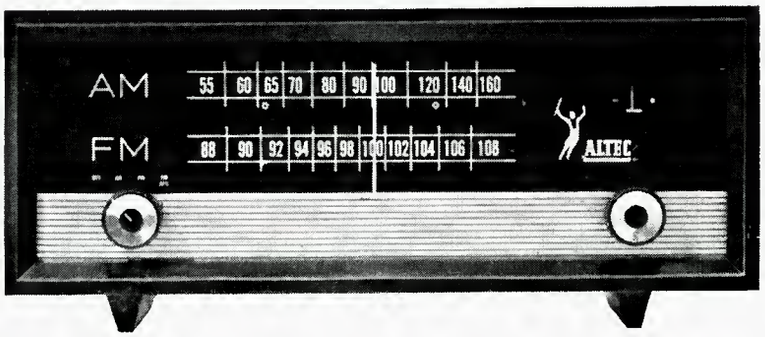
According to John Bennett, an Italian from the Bronx who became a professional claquer under Bonci, and is now unofficial *chef de claque* at the Metropolitan Opera House, a good claquer never draws attention to himself; he merely ''cues'' applause. •

COMING HI-FI SHOWS

Institute of High Fidelity Manufacturers:
Sept. 17–21—Chicago: Morrison Hotel
Oct. 7–12—New York: N. Y. Trade Show Bldg.

Rigo Enterprises:
Sept. 6–8—Cincinnati: Sheraton-Gibson Hotel
Oct. 18–20—Miami: McAllister Hotel
Nov. 1–3: Portland, Ore.: Multnomah Hotel
Nov. 8–10—Seattle: New Washington Hotel
Nov. 22–24—St. Louis: Statler Hotel

Independent:
Sept. 12–15—Portland, Ore.: New Heathman Hotel
Oct. 25–27—Mexico City
Oct. 31–Nov. 3—Habana, Cuba: Copocabana Hotel
Nov. 8-10—San Juan, Puerto Rico: Normandie Hotel



What makes this tuner outstanding?

One of the nation's leading electronic testing laboratories has reported that, to their knowledge, the new Altec 306A is the most sensitive tuner ever manufactured. At the Chicago High Fidelity Show, one of these tuners equipped with only 23″ of 300 ohm antenna lead provided perfect reception on twenty-four FM stations, including one in Grand Rapids, Michigan. This is a performance which we believe approaches the theoretical limit of sensitivity that can be obtained at the present stage of electronic science.

But why is it so good? Its basic circuitry is quite conventional, using the latest Foster-Seeley (Armstrong) detector circuit. The difference lies in the application of these basic circuits; in the careful selection of the finest components regardless of cost; in the hundreds of hours spent designing a chassis with the shortest possible wiring distances between components; in the development and application of circuits to achieve their full performance capabilities.

Among these *extra* points of superiority are a fully shielded six gang tuning condenser, complete isolation between the transformer and power mains, and a dry rectifier of very long life and stability. Besides the Foster-Seeley detector, the FM section features a "cascode" low noise RF stage, a triode low noise mixer stage, AFC and *two* limiter stages. The AM section has three IF transformers with optimized coupling for flat pass band and maximum noise rejection and a special high Q ferrite rod antenna. Naturally, the 306A far exceeds FCC radiation requirements and is approved by Underwriters Laboratories for safety in the home.

The specifications given below reflect fully the quality inherent in the Altec 306A. Compare them with any other tuner specifications, the superiority of this latest Altec product will be obvious. See it at your nearest Altec dealer's showroom. Its quality is fully evident in its beautiful appearance and craftsmanship.

NOTE: Sensitivity figures are given for the standard 300 ohm antenna, and can not be compared with figures derived from special 75 ohm antennas. To convert 75 ohm antenna sensitivity to standard 300 ohm sensitivity, double the published figure. For example: a 2.5 microvolt sensitivity on 75 ohm antenna is a 5.0 microvolt sensitivity on 300 ohm antenna.

Frequency Modulation – antenna: Standard 300 ohm • maximum sensitivity: 1.1 microvolts • quieting sensitivity: 2.5 microvolts for 20 db*, 4.0 microvolts for 30 db* • selectivity: 6 db band width 185 kc, 20 db band width 300 kc • frequency range: 87–109 MC • image rejection: 48 db • IF rejection: 72 db • frequency response: ±0.5 db, 20-20,000 cps • distortion: Less than 1% at 100% modulation, Less than 0.4% at 1 volt output
**standard 300 ohm antenna*

Amplitude Modulation – antenna: Built-in Ferrite Rod "Loopstick" plus external antenna connections • maximum sensitivity: 3 microvolts • loop sensitivity: 50 microvolts per meter • selectivity: 6 db band width 11.0 kc, 40 db band width 27 kc • frequency range: 534 kc–1675 kc • image rejection: 66.5 db • IF rejection: 58.5 db • distortion: Less than 1.5% at 30% modulation • output: 1 volt cathode follower matched for 440 and 339 • power supply: 117 volts; 60 cycles; 65 watts • tubes: 2-6BQ7A, 1 each 6AB4, 6BA6, 6AU6, 6AL5, 6BE6, 12AU7 • controls: Tuning; on-off, AM, FM-AFC

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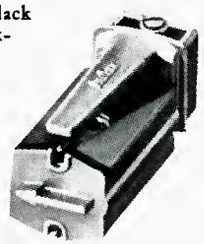
KT-16 $17.55 NET factory-assembled $30.00 NET

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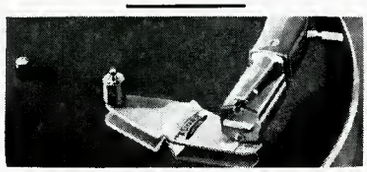
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AUDIO ETC.

Edward Tatnall Canby

1. STAGGERING

Well, the cards seem to be increasingly stacked against the staggered-head stereo system, admittedly the easiest to work with when it comes to low-priced stereo home equipment production. As already mentioned hereabouts, the stacked head is this department's choice for all stereo, and I'm hoping that pretty soon the necessity to make two types of stereo tape will have gone by the boards—all machines will play stacked-head. In addition to the new RCA Victrola, described here last month, there is already another inexpensive stereo system out with the desirable stacked heads, from Bell.

It would seem to me that the usual laws of manufacturing economics will operate here. Stacked heads have been trickier and more expensive, to date, but as the know-how in their manufacture increases and as their use spreads, the cost will drop and drop. It won't be long before a stacked head stereo player is no more expensive to put together than a staggered head set-up —maybe it's so already.

However, the laws of model-changeover also operate and so there will be a time delay until present staggered-head equipment drops out of production in the normal course of events. Decisions already taken today may be a year or more in reaching down to the public level. So staggered stereo is bound to stagger on for awhile, under any circumstance.

But as I say . . . the cards are stacked against the offset heads and they are clearly in line for eventual retirement, though the changeover will be staggered to offset any hasty obsolescence, in line with public interest. Stacked up against staggered, the in-line system is bound to win in the end, even if the victory is something less than staggering. . . .

2. Earphone Binaural

Incidentally, my once-ardent interest in what could be called "true binaural"—that is, two-channel recording reproduced via earphones—was given a new lift by a recent Bogen ad (See AUDIO for June, inside front cover) depicting a gentleman in Japanese stance—sitting with his legs crossed in horrible discomfort—listening via *earphones* to what purport to be two channels, one for each ear. (Anyhow, there are two wires soaring off in opposite directions.) The ad is for a 2-channel amplifier which, of course, could be used either for standard stereo, with loudspeakers, or for two-channel earphone playback as illustrated, though stereo was obviously intended. Just an ad-man's quirk.

Yes, earphone binaural remains rather dismally impractical in any commercial sense but, as those who have experimented will know, it can produce sound effects so utterly startling and different that stereo can't hold a candle to it, by 95 percent. True, the directionality, though very definite, is apt to be addled with earphones (music sounds as though it were overhead or behind you sometimes) but all other effects are incredibly realistic. Only with earphones can you re-create the actual two-eared acoustical conditions of true listening; speakers can never do it. With binaural earphones on your head your ears are in one place and the rest of you in another—quite literally. You hear somebody talking to you a few feet away and you whirl around—to find nobody there. You repeatedly fail to distinguish between the actual, happening sounds and those recorded—especially when the recording has just been made on the spot. An eerie, uncanny effect!

But don't think that any stereo tape will do for earphone listening. Results will vary, literally, as widely as the spacing of the mikes. For proper "true binaural" listening with phones your mikes must be reasonably close to ear-distance apart though a slight exaggeration, say two or three feet, adds extra punch and, so to speak, touches up the sound highlights.

Beyond about three feet, mike to mike (ear to ear) the two sounds begin to lose fusion, just as a too-widely spaced stereo picture slips out of register and becomes two pictures—you see double. With a wider spacing of mikes, the two ears begin simply to hear two different takes of the same sound from separate locations; the effect, to put it another way, is like a composite photograph where the foreground is the same but the background detail differs and does not coincide. This you can actually hear, this effect of two recordings heard as separate entities by each ear. Not good and not binaural.

Since most stereo recordings are made with mikes widely spaced apart—anywhere from 20 to 60 feet—the earphone fusion into one natural two-eared sound is not likely to take place. The ears can accommodate only a slight difference between the recordings, a difference that can be taken as ear-difference. Three feet is about the limit of tolerance.

Never forget that earphone two-channel listening reproduces the original liveness, as of listening on the spot, absolutely literally (except for some confusion in direction), and that therefore earphone binaural recordings can be made, and should be made, at the spot where the sound is normally heard. No close-up mike techniques, and you can make a recording of a concert hundreds of feet from the stage and still it will sound exactly as good as it does "in the flesh." Similarly, speech recordings can be made at normal listening distance, in any old acoustics, with re-

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sults precisely the same as the actual listening at the same point. This, when you begin to think about it, is a fabulous difference.

In fact, if you are talking about *literal* sound reproduction, this is the only known way in which it may be achieved. It dispenses in one fell swoop with the entire business of mike technique, removes all liveness troubles (other than natural ones, as heard by two ears), makes intelligible recorded conversations possible in crowds, at distance, in noisy places like restaurants and baseball games . . . Well, try it yourself and see. A fascinating hobby, and if you can afford to hook up five or six earphone sets, you can have an audience for your fun.

3. Sight Unseen

Quite often an item comes to my notice that hits me instantly as a good idea, an important one—even sight unseen and bugs untested. Such items remind me of our familiar legal principle that persons are innocent until proved guilty. In these cases of which I speak the principle involved is, on the surface at least, so good that the idea is just plain automatically excellent until proved bad, or unworkable, or full of bugs.

Fairchild's newly announced Electronic Drive turntable is one such. I haven't seen it and I have no idea, at this writing, what sort of long-range performance this table may turn out, nor what bugs—if any—have yet developed, what disadvantages the table may have in comparison with others. But the *idea* of it is just superb, one of those things that make you say, "Why didn't someone think of *that* before?"

What's so good? Electronic Drive. The Fairchild gets its speeds by using a hysteresis motor, which responds accurately to the frequency of an alternating current but is mostly unaffected by changes in voltage. Ordinarily these motors are used to keep the speed uniform and exact according to the controlled frequency of our house current. In this new design an electronic power source generates its own separate power, using the house current as the primary power, and this newly created current is adjustable in frequency—thereby running the motor at varying speeds. Brilliant idea!

Bugs? I'll bet there are some, and I wonder how stable the frequency is, over long periods. But I'll also bet that the major bugs in the idea have already been squashed pretty flat, or else the unit would not have been launched.

The really brilliant usefulness of such a table is that it is independent of both voltage *and* frequency variations in the line current. It not only can maintain its own speeds, at least in theory, regardless of changes in the source current over a considerable range, but—perhaps trickiest of all—it will run on any old cycle rating, more or less. That is, this unit will give *the same speed from a 50-cps house outlet as from a 60-cps one.* It will run a steady speed when frequency changes, as well as when voltage changes.

I can just see the eyes of those who have tried to play records in foreign countries beginning to pop! WHAT? You mean a table that doesn't care what happens to the line in the way of variations, that will play on 50 cps as easily as 60 without that dismal change in pitch (a minor third) that catches the unwary so often? Yep, that's it.

You see why I fall for this idea, sight unseen. For many people, who have suf-



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Chassis, **$99.50**

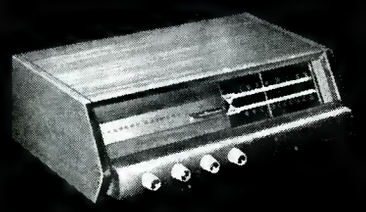
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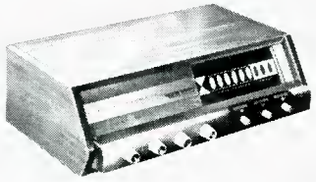
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fered no end from variations in current, the bugs will have to be formidable before they will pass up such an item as this.

Two models, a one-speed version operated directly from the line, but in which the Electronic Drive can be installed later if desired—and the four-speed model (that silly 16⅔ rpm again), which, as you'll now understand, is driven directly from the motor without any of the usual gear-shift arrangements, since the motor itself changes speed. Really something—again as I say, in theory since I haven't tried it. I advise all those who have problems of fluctuating pitch to investigate immediately. Oh yes, the table also can be varied or "tuned" at each of the four speeds, for exact pitching, as in a few other tables—Garrard and Connoisseur, for instance. An added utility.

* * *

The other sight-unseen item is simpler but even more fundamental—Audio Devices' new low-print-through tape.

We live in such a short-term world in recording! The old 78 disc masters have managed to last a half century already in some cases; but the vast library of recorded tape built up during the last short decade has been horribly threatened above all else by that ominous magnetic phenomenon known as print-through, where the recorded signal gradually prints itself from one layer of tape onto the next to produce a slowly increasing "echo" that eventually makes hash of the recorded sound. Tape itself might seem flimsy enough, from the historical point of view—and we do hope that our descendants a few hundred years from now will have *some* records of our many activities still in existence—but, if I am right, the physical flimsiness of plastic is as nothing compared to the threat of print-through.

In the face of this menace, many recording companies and broadcasters have instituted vast programs of regular copying, renewing their entire tape library every four years or so. An incredible operation, and a despairing one as well, for over the centuries the copies will inevitably become less and less good in quality of sound and in no time at all, relatively, the sound will have deteriorated to the point where the print-through is no longer worth fussing about! Any way you look at it, the future for taped material has looked pretty grim up until now.

I quote only one sentence from Audio Devices' announcement. "*From measurements made over a period of years, it presently appears that stored "Master Audiotape" (the new brand) will take more than 100 years to reach the print-through level that now mars standard tape in one week.*"

Now if that is true, if it is borne out by longer tests (up to 100 years, let's say), then this is truly a revolution in tape, though the results will be virtually nil—for a few weeks. I suspect that there will be a wholesale conversion to this tape in the professional world in spite of a higher price and that even the home tape user will find the new material a good idea for his own concept of recorded permanence. Maybe it will soon become a new standard for the industry. I hope so—if all of these claims are substantiated. It's a great relief to know that maybe posterity will hear our tapes after all. That is, if they feel like it.

4. The Fi in Toyko

My long-time correspondent in Tokyo, now Bureau Chief of the Associated Press there, wrote me the usual newsy letter back at the turn of the year which, as usual, I haven't got to answering yet. You'll remember when, awhile back, I passed on his tips about Japanese hi-fi equipment, a short time before it began to appear in our own ads in this country. He had then been making RJ cabinets-de-luxe for his Tokyo friends and I suggested, rather mildly, that perhaps a word or two with the designers of that small cabinet would have been a polite gesture towards chivalry, even if a royalty arrangement would be impractical for his very small output, strictly not as a business.

Well, he took me at my word, consulted with Bill Joseph ("J") and made up a pair of the superest super-RJs you ever saw, hand-designed and individually constructed by Japanese craftsmen. These he shipped over to Joseph as a gift, and everybody is very, very happy.

I've seen the gadgets and heard them briefly in a stereo set-up—excellent. They are made of *12-ply* Philippine Mahogany with a genuine black lacquer surface, 1¼-inch corner bracing inside for solidity. The speakers are hand-picked for low resonance, the Japanese model sold in the U.S. as the "Panasonic" (so he tells me), the Matsushita Denki "National" 8-PW-1, and they sound not unlike the Wharfedale Super 8/CS/AL. A set of cables with mike-type polorized connectors was included in this fabulous gift, arranged so that the speakers can be switched in an instant from stereo set-up to single track two-speaker. (That is, assuming you don't have a tape player that makes this circuit shift internally.) Joseph carts them around in his Buick, for all to see and hear.

This Tokyo American, by the way, has assembled something like 35 hi-fi systems to date for friends and associates over there, all in his scant spare time, as a hobby that takes his mind off the eternal news and its eternal tension. A hi-fi fan if there ever was one. His own speaker systems weigh 200 pounds apiece, also in 12-ply mahogany and lacquer, a "beefed up" Klipsch design (with permission from Klipsch himself), and the components inside are all Wharfedale. He says he's broken many a hi-fi heart with the outfit. Hi-fi is booming along in Japan, it seems, and if they have merely reached what he terms "first-class second class" levels of excellence in their equipment at the moment, they are getting the hang of the business and should be topping the best anywhere before long.

Music? The man doesn't say a word about *that*, like a good hi-fi man. What I wonder is, what do the Japanese play on their hi-fi systems? If it's the standard line of American-European music—pops, classical, folk and plain zany—then the Japanese must really be well on the way to cultural Westernization! I have no doubt that jazz has penetrated there as powerfully as it has in most of the world; it is our greatest cultural ambassador right now, whether you like it or not. But Beethoven and Haydn and Brahms, out of Europe, and maybe "My Fair Lady" from hereabouts—plus a hunk of Musique Concrète from France. . . . wonder what a Japanese hi-fi library *would* sound like? I'll probably find out in the next letter from Tokyo. •

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AUDIOCLINIC

(*from page 2*)

of the circuit. Since the zero level indication of a standard VU meter (which is actually only an a.c. voltmeter) is 1.228 volts, this indication would represent .096 watts in a 16-ohm circuit, 0.19 watts in 8 ohms, or 0.38 watts in 4 ohms. Any power output above this could be read at the zero level indication on the meter by adjusting the potentiometer. In practical use, the potentiometer would be set at zero and the level adjusted on a typical record so as to satisfy the requirements of the hall. Then the potentiometer would be turned up to obtain proper VU meter swings, and left at this setting. By adjusting the volume of all other records to obtain the same meter swings, one could be sure that the sound output was the same. While this method of connection is not the professional way, it is relatively simple and will give satisfactory results.

Echo Effects

Q. I have a tape recorder, and I am wondering how I can create the echo effects which are so common. I know that tape recorders are used for this purpose. E. Williams, Brooklyn, N. Y.

A. Unless your tape machine is one having separate record and playback heads, you will be unable to create this effect without adding another head, which might be difficult if your motorboard is as crowded as many are today. It would be especially difficult because of the requirement that this additional head should be placed as close as possible to the record head. Regardless of whether you added a playback head with its accompanying preamplifier or whether all this equipment was already contained within the unit, the procedure is the same. It would require a two-channel mixer whose output is connected to the input of the recording amplifier. One channel is connected to the signal source. Adjust the level of this channel, which we shall call channel 1, for proper level indication in the conventional manner. Next, connect a pair of headphones in the monitor position and set its selector switch to the playback position. Next, connect channel 2 to the output of the playback preamplifier. Leave the gain of channel 2 at zero and start to record. Gradually advance the level of channel 2 until the desired effect is achieved. If the level is made too high, the level of the signal from the playback source will exceed that of the direct source from channel 1, and the result will be feedback and tape overload. This echo effect, no matter how skillfully set up, cannot duplicate natural echoes, because there are only two heads involved. The effect created with this simple system is more of a vibrato than a true echo, although, because of the time delay and phase angle changes, some illusion of echo is created. In order to create a more realistic echo, additional playback heads are often used. For good results, as many as five or six such heads are employed, and are arranged on slides, so that the spacing between them may be varied for different kinds of effects. For the echo effect of the mountains, for example, you would need a fairly large space between the record head and all the other heads. These heads should be spaced so close that the ear cannot perceive the break between them. Each must have its own channel, with the level of each succeeding channel set just a little lower than its predecessor. •

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CHARLES A. ROBERTSON*

Coleman Hawkins: A Documentary
Riverside RLP12-117/18

A good three decades of jazz history in this country and in Europe are touched upon in this two-disc informal talk with the man who did the most to make the tenor saxophone the expressive instrument it is today. An evening of reminiscence and anecdote in Bill Grauer's living room has been edited into two hours of narrative, tracing Coleman Hawkins' story from his birth on an Atlantic liner to the present day. As the first such interview designed for LP, it is illustrative of the adventuresome spirit of the young men at Riverside and invites a short sketch of this growing company.

Formed less than five years ago by two Columbia College classmates, it now boasts a catalogue reaching from the early days of jazz to the more advanced modernists. It is venturing into the field of folk music, the spoken word, and the documentation of sports car racing. With the move late this spring to a three-story building at 553 W. 51st St., in the center of Manhattan's record row, it is in a position for continued expansion. Its beginning was somewhat less pretentious, as told by Bill Grauer: "It is true we started with a capital of $500. I don't know how far it would take us today when Paul Weller's photography and the artwork on one album runs to more than that."

"Orrin Keepnews, my partner, and I have never lost the love for jazz we formed in college. Soon after graduation, I began to publish *The Record Changer* in 1948, while making a career in advertising, and Orrin took on the duties of assistant editor in addition to his work at Simon and Schuster. With the development of the LP record, we saw the possibilities for economically reissuing rare jazz items. Rights to the Paramount label were leased and we set up shop on LaSalle St., in one room rented from the New York Theosophical Society. When the floor fell three feet and rats began coming up from the cellar, we took over a store on West 49th St., which was overcrowded long before the move to our present premises. Since then we have acquired a long list of defunct companies and rights to player-piano rolls. Among them are Black Swan, Gennett, Solo Art, and Circle."

The new quarters afford ample space for the staff of ten employees. Instead of paper-laden desks, the executives have private offices. "It has been reported that we own the building," said Grauer. "We are not that affluent yet. But the ground-floor shipping room does include a garage and workbench for the assorted sports cars of the staff, any one of whom is apt to end the day in overalls on a tune-up job. Barrett Clark, a former C.B.S. writer in charge of our spoken word, is chief mechanic and owner of a Jaguar XK. Paul Bacon, art director, has a Porsche. Harris Lewine, promotion director, rides in a modified MG, and Ray Fowler, engineer, has a Renault. I drive a Maserati, and Orrin still prefers to walk.

"With such a staff I have plenty of support for the sports car series—my pet project. Our trips to Sebring and Nassau brought about some interesting engineering problems, especially as our approach was different in each instance. At Sebring, we laid wires to various points of the track and used a parabolic cone to catch the race sounds. At Nassau, we depended upon portable equipment. The experiences of some of the drivers are being taped for documentaries."

Asked about future plans, Grauer stated: "They include full-length plays and other projects for the spoken word department. Ken Goldstein produces our folk music. He has done work for Tradition, Folkways and Elektra. We are not in the classical or children's field yet, but will be soon. About the only things we are not interested in are name bands and pop singers. They require the issuance of single records for proper promotion and we have no intention of doing that. Our first month in business netted $275, now we are up to half-a-million a year. Ours is the largest distributor setup of any independent. We have thirty-seven, and English Decca handles us abroad.

"The reprocessing of classic early jazz recordings is continuing. We started the year with the five-disc History of Classic Jazz. When we spot something in the traditional field that needs to be done, we are ready to take it to the studio. Odetta, a fine young folk-singer, does some early blues in a manner which calls out for a down-to-earth band. She will have one when she records for us. Right now, there is more activity in the contemporary field."

Riverside is alert to the need to keep up with the latest developments in sound. The early reissues which built the company have been remastered in the past year and given better surfaces. "Up to now," said Grauer, "we have not pushed our product in the high fidelity market. From the beginning, we used Reeves Sound Studios and have been willing to pay more than most independents to get good engineering. It is not that simple though. The results we want only came with experience. The "Spectrosonic" label is not a meaningless gimmick. It is used only on those albums with quality sound and is needed to avoid confusion with our reissue series.

"To facilitate production, twenty-six-year-old Ray Fowler was brought over from Reeves to become our staff engineer. He was trained for four years by Jack Higgins and has charge of quality control from tape to finished record. We have four machines for tape editing and turn out two LP's every three days. The acetates are made by Reeves and checked before being sent to Mastercraft Record Plating. Masters are checked before they are flown to California. Our search for a satisfactory pressing plant ended in Los Angeles. Considerable air travel is involved as a test pressing must be approved before the completed product is flown back.

"On-the-spot sessions have been made at the Cafe Bohemia of Randy Weston and Cecil Payne. Also some folk items in Cuba. I don't know how much of this we will do. They can be great and they can be awful. We like to work with a purpose and sound in mind and find it can be best accomplished in a studio." With the release of a Hawkins' instrumental album next month, I will conclude the Riverside story in an interview with Reeves' engineer Jack Higgins.

The only previous use of the phonograph record to document the career of an important jazzman was meant for the archives of the Library of Congress. The public was able to hear the irrepressible Jelly Roll Morton's colorful tale of his eventful life when Circle Records put it on a series of early LP's. A word was enough to start a fluent discourse on his contributions. Coleman Hawkins had a later, but no less vital role, and is much more modest. When he met Fletcher Henderson in 1923, the tenor saxophone was a stiff, unwieldy instrument of little jazz consequence. In his decade with Henderson, he is credited by critics for singlehandedly making it a warm, full-blooded voice, charged with rhythmic feeling.

Just how this was done is one of the first questions that might come to mind, and interrogators Bill Grauer and Paul Bacon do not slight it when it comes up in proper sequence. But Hawkins is unassuming in his claims and insists he was kept busy staying ahead of a number of good men. That he constantly listened to other musicians is as much of the secret of his genius as he is able to disclose. The forging of various elements into his distinctive style is described as "spontaneous," and that may be as much as any jazzman can tell about what happens between himself and his horn.

It is a question best answered as the interviewers keep the discourse in a chronological channel and the whole picture of the man gradually emerges. Too often chance remarks of musicians are taken out of context to gain wide circulation before they can be clarified. Other interviewers like to ask the sort of leading question which predetermines the answer. Neither is possible before the eavesdropping tape recorder. Here some remarks which might seem controversial in cold print are immediately understandable by the inflection of the voice. Other documentaries are in preparation, and in some cases it might be wise for the questioners to be more forward, following the informal portions with some questions in the Mike Wallace manner.

Hawkins tells of the day when Jack Teagarden and Jimmy Harrison met, of his experiences in Europe and with the

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

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new generation on his return home. Many jazz greats are mentioned, but the listener is likely to wish he could inject a few names of his own choosing, such as Benny Carter, Lester Young, and Stan Getz. It is perhaps significant of today's jazz scene that the Hawk ends by casting a wishful look toward a large band with French horns and strings, and a more realistic glance toward rock and roll. But he shows he is still listening.

The Dukes of Dixieland, Vol. 3
Audio Fidelity AFLP1851

Audio Fidelity usually times a new Dukes of Dixieland release for display at one of the High Fidelity Shows. For the third volume the procedure was reversed, and it was made last February in Los Angeles when the crowds were packing the Ambassador Hotel. It represents a desire on the part of producer Sidney Frey for a program rich in rousing march tempos, with ringing brass and singing clarinet well to the front. Since the success of the first album, he and Papa Jac Assunto have planned the special effects and arrangements which make this an outstanding sound and musical treat.

Some familiar tunes, and others not as well known, are refurbished by ears attuned to modern recording techniques. The sound of the band is more like those of the days before dixieland went indoors. On some numbers, Stanley Mendelson's piano is kept in the background, and the musicians play as though they were back on the horse and wagon with the tail gate let down. Newly added drummer Stanley Ferrara sets a jaunty beat, to be reinforced by Bill Porter's walloping tuba, and they are off.

Each Dukes' album shows an improvement over the last. *Tromboneum* and *Lassus Trombone* are brash exercises for the instruments of Jac and Fred Assunto. *My Home Town, Scobey Strut* and *Dukes of Dixieland March* are fresh material, but *McDonough Let the Trombones Blow* is *Maryland, My Maryland.* In the best tradition are *Just a Closer Walk* and *Bourbon Street Parade.* For the most suspenseful sound there is *When Johnny Reb Comes Marching Home,* with Frank Assunto's galvanic trumpet solo. Clarinetist Harold Cooper shines on *With a Pack on My Back. Eyes of Texas* and *Glory to Old Georgia* fill out the bill. A stereophonic tape is available.

Art Blakey: Orgy in Rhythm, Vol. 1
Blue Note 1554

An exuberant drummer who chafes under the restrictions of the ordinary session, Art Blakey is given the opportunity to express his rhythmic fancy without danger of splitting the seams of a small group. Gathered about him are ten talented rhythm men and Herbie Mann, who on this occasion brings out his collection of African wood flutes, to accompany the vocalists and set a mood. Working without a score and with no more rehearsal than a short warmup period, the percussionists use their own language to improvise four numbers in the first volume for a unique addition to jazz annals.

From his drum-seat throne, Blakey acts as overseer, sings and leads jazz drummers Arthur Taylor, Jo Jones and Specs Wright, the last two alternating on tympani. He also directs bassist Wendell Marshall, pianist Ray Bryant and the flute. Sabu is in charge of the Latin rhythm section, playing bongos and timbales besides delivering the vocal to the eerie *Buhaina Chant.* Potato Valdez and Jose Valiente handle the congas. Machito's Ubaldo Nieto is on timbales, and Evillo Quintero triples on cencerro, maracas and tree log.

Blakey first broached the plan for such a session in 1954, but it could not be set until this spring. And not because of any trepidation on the part of Blue Note to let a dozen musicians loose on an untried idea, for Al Lion had confidence in his house drummer from the start. The result is the most exciting drum record ever made. Most such productions emphasize the role of the composer in displaying the timbres of the percussion, or feature well-rehearsed groups such as the Steel Bands and the Gamelan Orchestra of Bali. Here the communication is instantaneous, propelled by the inspirations of the section leaders and the daring interplay between them.

Toffi, described as a song of hope, is sung by Blakey in African dialect, backed by a chorus organized from among the musicians. In the descriptive piece *Ya Ya,* a youngster's feelings when kept from going out to play are amusingly detailed in a manner to give a child psychologist pause. Confined to the jazz drummers, *Split Skins* places Blakey, Taylor and Jones on their mettle as they trade solos. It would be hopelessly redundant to comment on individuals, but former Ellington bassist Marshall must be mentioned for the way he copes with a difficult assignment.

The brilliant recording was made in an undisclosed Manhattan hall by Rudy Van Gelder in an excursion from his Hackensack studio. It presented the problems of a concert hall performance before an audience, without allowing the engineer that excuse for any shortcomings. Besides recording countless jazz drummers, Van Gelder is responsible for Vox's Spotlight on Percussion and in reply to my request for a few comments on the date said: "As we decided the first take would be used on all tunes to capture the feeling of immediacy, I had to do my planning in advance and make my recording techniques fit the music. I was caught up in the enthusiasm for the project from the start and took a good part in the discussions involved. The hall was selected for size and shape to fit the requirements. My main problem was in picking up the singing while the musicians remained at their drums. Luckily, these aren't ordinary vocals so the result is one of added depth and spaciousness. It is based on my understanding of how drums should sound on records. Personally, I am most happy about it. It is also Blue Note's first stereo tape."

A reduced edition of the Blakey percussion group in more popularized exercises is on one side of Columbia, CL1002. That the voices are dubbed in, after being strained through an echo chamber, removes it from consideration.

Freddie Kohlman: Jazz in New Orleans
M-G-M E3493

Municipal Auditorium in New Orleans is the scene of this concert by the Mardi Gras Lounge band, led by the veteran drummer Freddie Kohlman. It combines the gusto of Bourbon Street dixieland with some uninhibited swing-era soloing. Traditional numbers are *Just a Closer Walk, Milenburg Joys,* and *High Society,* with Willie Humphrey taking the clarinet chorus. Sid Davilla, clarinet, is featured in his original *Mardi Gras Blues,* and Sam Butera, tenor, is added for *Christopher Columbus.* Thomas Jefferson takes the trumpet part in *I Can't Get Started,* and Waldron Joseph's trombone is spotted in *Stompin' at the Savoy.* Kohlman's vocalizing is badly out of balance, but the rest of the band comes through fairly well.

Dave Brubeck: Jazz Impressions of the U.S.A.
Columbia CL984

The eight impressions are the result of notebook scribblings made on tour with the Quartet, and were recorded in New York, Hollywood and the pianist-composer's home in Oakland, California. The sketches range cross country from Broadway's *Curtain Time,* to the piano-solo *Home At Last. Plain Song,* a description of a bus journey, and *Ode to a Cowboy* are westerns. *Yonder for Two* is an essay in New Orleans two-beat, and *Summer Song* is a cute vacation bit.

Joe Morello, former Marion McPartland drummer, is heard on record with the group for the first time. He is a compelling addition and makes *Sounds of the Loop* a percussionist's holiday on the El train. Altoist Paul Desmond is his usual anemic self. Norman Bates plays bass.

A comparison with the Jimmy Guiffre 3 album is rewarding. Where one West Coaster finds his way back to origins, Brubeck seems to have stumbled across the pen of Ferde Grofe in his travels. The vicissitudes of the road are great, but hardly that hazardous.

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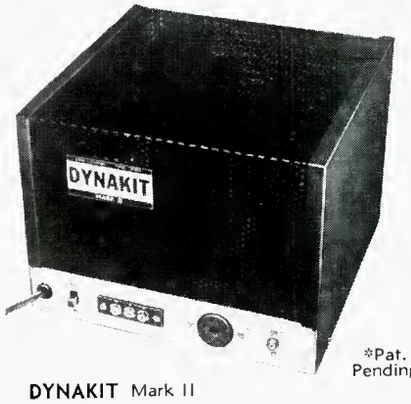
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And it would be difficult to find a publicity man willing to write a more pretentious set of liner notes than penned by the composer. The juvenile *History of a Boy Scout* is billed as a bow in the direction of Stravinsky's *Histoire Du Soldat*. It is more on the level of *Parade of the Wooden Soldiers*. The sound ranges from good to a poor recording of the solo.

Jazzville, Vol. 3 — Dawn DLP1114

The aim of this series is to report the rapidly evolving jazz scene in terms of outstanding performances by some of the younger jazzmen. Vol. 3 is split between the Charlie Smith Trio and the Aaron Sachs Sextet. Smith is a percussion specialist peculiar to the present day. He has always drummed with a trio or small group, rarely with a big band. Erroll Garner, Oscar Peterson, Artie Shaw, and Joe Bushkin head the long list of name performers he has backed with his impeccable technique. Now he works with Dorothy Donegan, but is joined here by Hank Jones, piano, and Oscar Pettiford, bass. He takes only one solo, in *Flying Home*, being content to provide a colorful backing to such delicacies as the Jones' treatment of *Have You Met Miss Jones*, and Pettiford's improvisation on *Body and Soul*. Also heard is *Blues for Sal*, by Thad Jones.

Sachs is a clarinetist who grew up in the shadow of Benny Goodman, but has successfully developed an original style. Though he alternates on tenor, his heart is with the clarinet, as expressed in the ballads *You're My Thrill, Why Shouldn't I*, and *Ah, The Pain*. His sharper tenor is heard on his originals *Aaron's Blues* and *Platter Pie*. In the sextet are the rapid-fire trombonist Jimmy Cleveland; Dick Garcia, guitar; Joe Roland, vibes; Aaron Bell, bass; Osie Johnson, drums.

The Jimmy Guiffre 3 — Atlantic 1254

Jazz instrumentation has become so varied that there is little left in the way of surprises. Still, it may take considerable trial and error before a combination is found to suit the special talents of a musician. In the past few years, Jimmy Guiffre has developed a highly personal clarinet style, marked by a breathy tone and a subtlety of vibrato and dynamics, the values of which are easily obscured in the wrong framework. He seems to have found the right setting in this trio, where he has the good fortune to be complemented by a lyric guitarist in Jim Hall and a rhythmically secure bassist in Ralph Pena. All speak with an equal voice.

Further, thirty-six-year-old Guiffre uses his growing talent as arranger-composer to aerate some murky corners of jazz. Seven of the nine selections are of his own composition, and are mostly a refreshing treatment of blues themes. The West Coast school is notable for the refinement of such materials into a bland, cerebral mixture. Guiffre reverses this trend by going back and re-examining origins, allowing the springlike breeze of folk music and spirituals to blow an old-time flavor through his tunes.

The train theme is a recurrent one in folk music and jazz, from Meade Lux Lewis' *Honky Tonk Train Blues*, through *Alabamy Bound*, to Nancy Whiskey's skiffle-group rendition of *Freight Train*. In his *The Train and the River*, he plays baritone, tenor and clarinet over the high-wheeling rhythms to make a lasting contribution to this literature. In *Crawdad Suite* and *Two Kinds of Blues*, he uses the device found in some spirituals of contrasting two different moods. In sum, the album is an appealing compilation of moods, arising from the fundamentals of jazz and permeating even the ballads *This Is You, My All* and *That's the Way It Is*. Guiffre pencils a laconic set of liner notes, as direct to the point as one of his solos.

Hank Mobley and His All Stars — Blue Note 1544

In one of his infrequent holidays from the Modern Jazz Quartet, Milt Jackson gives his vibraphone a vigorous workout with an imaginative rhythm section. And he swings from his first unison chorus with tenor man Hank Mobley in the convivial uptempo *Reunion*. The program consists of five Mobley originals. The diffuse *Ultramarine* and the gay *Don't Walk* are warmups for the fine blues *Lower Stratosphere*, which has the most expressive solos and would benefit from a few more choruses.

Mobley is heard to best advantage in the sensuous *Mobley's Musings*, a mellow, romantic showcase for his horn. On drums, Art Blakely is more subdued than usual and Doug Watkins, bass, deserves more solo space. Pianist Horace Silver's performance is happy and spontaneous. Given a chance to stretch out, Milt drives his vibes with an intensity less productive of the best sound than of a throbbing rhythmic line.

Buddy Collette: Nice Day — Contemporary C3531

For the past seven years Buddy Collette has lent his talents to the Groucho Marx radio and television shows, enjoying a freedom to play jazz with his own groups and as a sideman for recording sessions. He exhibits a flawless lucidity on four instruments, projecting an aura of effortlessness which might pall without a creative flair for the unexpected. He plays clarinet on four numbers, alto on three, flute on two, tenor on one. Different rhythm sections support him on three separate dates.

Five originals show his gift for simple impressionistic sketches. His clarinet on *A Nice Day*, his alto on *Change It*, and his flute on *Fall Winds*, makes them things of growing beauty. Collette avoids the misstep or meaningless complexity which could destroy them. Pianist Dick Shreve is credited with *Minor Deviation*, a blues for clarinet, and contributes a telling solo to *Blues for Howard*. Other rhythm men include Calvin Jackson, Don Friedman, Leroy Vinnegar, and Shelley Manne in a fine recording by Roy DuNann.

Solo Flight — Jazz West Coast JWC505

Eleven musicians are given ample solo space on ten numbers in this well made package by an offshoot of Pacific Jazz. The sampling ranges from the veteran Harry Edison's trumpet on *September In the Rain* to the newcomer James Clay, whose tenor is introduced on *In a Sentimental Mood*. This twenty-one-year-old discovery from Dallas, Texas, has an uncompromising, muscular style of great promise. Ballads comprise the bill of fare, offering such diverse talents as Art Pepper and Lee Konitz on altos. Also Bill Perkins, Richie Kamuca, Chet Baker, Bob Brookmeyer, Bud Shank and Phil Urso with compatible rhythm sections. A pastel drawing by the Los Angeles artist John Altoon is on the cover.

Jonah Jones: Muted Trumpets — Capitol T839

As one in the vanguard of the visitation of swing to 52nd Street, Jonah Jones made his stand with Stuff Smith at the Onyx Club. A good twenty years later his smart, updated swing is to be found a few blocks across town at the less boisterous Embers. His muted shading of a tune and his brassy trumpet accents make him an enduring figure. The ten numbers span the years from *Royal Garden Blues* to *On the Street Where You Live* and the main theme from *Man With the Golden Arm*. His vocal on *Mack the Knife* is in a class with Armstrong's. George Rhodes, piano; John Browne, bass; and Harold Austin, drums; remain in a tasteful balance which must have made the engineer's task a pleasant one.

Mat Mathews: Four French Horns — Elektra 134

That the French horn does not enjoy a more prominent position among jazz musicians is not because of any reluctance on their part to further its growth. They admire its sonorous sound and rounded tone, but are aware of the difficulties of making it move with jazz feeling. Julius Watkins, co-leader of Les Jazz Modes, and Dave Amram are among the few who have surmounted this obstacle and can convey the urgency of swing on the instrument. So they were the first to be called upon when Mat Mathews re-

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solved his desire for a date with four French horns, supported by his accordion and Joe Puma, guitar; Milt Hinton, bass; Osie Johnson, drums. Studio men Tony Miranda and Fred Klein complete the horn section.

Mathew's conception proves to be a stunning use of the contrasting tonal qualities of the horn, plus the harmonic and unison values of the section as a complement to the soloists. He avoids the pretentious in his playing and in his arrangements of *Come Rain or Come Shine*, *On the Alamo* and *I Want To Be Happy*, stressing brightness and mobility. His two originals featuring Hinton on a blues theme, and Puma on Spanish guitar, further secure his status as a tasteful writer. Watkins, Amram and Puma each supply one tune and are superb as soloists. Recorded by Dave Hancock and Leonard Ripley, the timbres of the horns make it the most satisfying item soundwise in the label's new jazz catalogue.

Sonny Rollins **Blue Note 1542**

When a jazz musician consolidates his influences and begins to move ahead on his own, he enters a stage of his development of most interest to the student of jazz. Since he left Chicago in early 1956 with the Max Roach group, twenty-seven-year-old Sonny Rollins has gone through such a phase to become the most important new voice on the tenor saxophone. And there is no indication in this representative album that his growth is not going to continue. The four originals display his restless, incisive style at length. *Decision* is a minor blues theme, 13 bars long instead of the traditional 12, and is followed by the medium-tempo *Bluesnote*. *Plain Jane* and *Sonnysphere* are fleet exercises, the latter containing bits of *I Got Rhythm* and *Honeysuckle Rose*.

His slowly unfolding treatment of the ballad *How Are Things in Glocca Morra* is another part of his personality. In the close recording, he broods over it as searchingly as Coleman Hawkins might, wringing out every drop of sentiment. When some company prevails on him to embroider enough ballads for an album, he is certain to reach a commercial success that will dismay his jazz fans. In the admirable quintet, Donald Byrd plays trumpet; Gene Ramey, bass; Wynton Kelly, piano; Max Roach, drums.

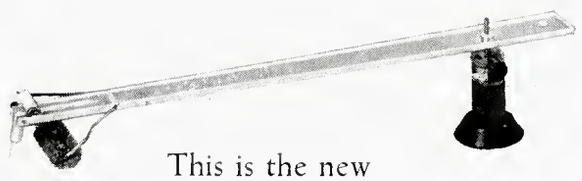
The Gerry Mulligan Quartet **Pacific Jazz PJ1228**

A pause in the travels of the Gerry Mulligan Quartet permitted this potent recording last December in the precincts of Boston's Storyville. Though there are some introspective moments, any lassitude on the audience's part is dispelled by the holiday gaiety of four of the originals. Bob Brookmeyer's *Rustic Hop* is a bucolic romp and, on his *Open Country*, his valve trombone would rejuvenate a flagging Broadway chorus line. Mulligan's *Bweebida Bwobbida* is a stimulating excursion for his baritone sax, and *Bike Up the Strand* is a memento of his recent European tour.

Another facet of the Mulligan personality emerges as he utilizes the piano in the revealing blues study *Storyville Story*. The standards *Birth of the Blues*, *Baubles, Bangles, and Beads* and *That Old Feeling* are projected in the concentrated form of communication that makes for the best chamber jazz. Rhythm men are Bill Crow, bass, and Dave Bailey, drums. Father Norman O'Connor examines the emotional ties between jazz and modern art in the liner notes.

Quintet of the Hot Club of France: Swing From Paris **London LL1344**

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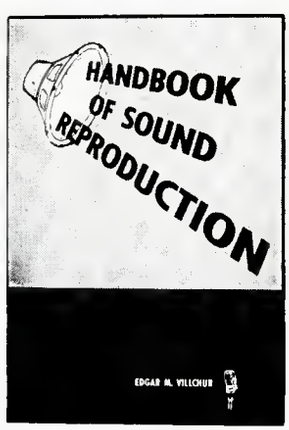
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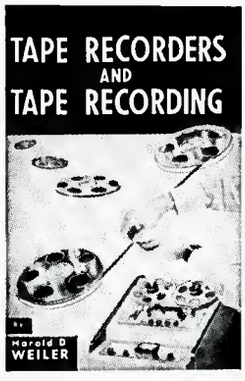
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INTERMODULATION

(*from page 25*)

would narrow down the intermodulation distortion components considerably. These components can be further narrowed down when it is observed that higher order sidebands and harmonics are outside of the audio range of 20 to 20,000 eps. For this discussion, it will be satisfactory to use the two fundamentals and their sidebands as the sole factors contributing to intermodulation distortion. In the meantime, it should not be forgotten that this all encompassing feature of IM is that it gives excellent correlation with listening tests.

The exact process for the creation of a variation in the amplitude of the high-frequency wave due to the modulation by a lower frequency can be seen in *Fig.* 4. Here, the high frequency is superimposed on the lower frequency in the grid input circuit. Due to the nonlinearity of the grid input voltage to plate output current characteristic, there is a variation in the high-frequency amplitude in the plate circuit of the tube. The resultant amplitude of the high frequency component is shown below the output wave as a modulated signal. The analysis of this signal is indicated under MODULATION above.

Testing for Percentage IM Distortion

There are two general standard methods used for measuring intermodulation distortion. The first, known as the SMPTE method (Society of Motion Picture and Television Engineers) mixes two sine waves in an amplifier. A low frequency, ranging from 50 to 100 eps is mixed with a high frequency of about 7000 eps, and fed together into an amplifier. The ratio of the amplitudes of the lower frequency to the higher frequency is fixed at 4 : 1. The resulting degree of modulation determines the percentage of intermodulation distortion present in the amplifier under test.

A second method in use is the CCIF test (International Telephonic Consultative Committee). Here, two signals of equal amplitude are fed into the amplifier under test. The two signals have a small difference frequency such as 100 eps. Thus these signals can be 7000 and 7100 eps or 8300 and 8400 eps, and so on. The resulting difference frequency of 100 eps due to non-linearity is the measure of the percentage of intermodulation distortion.

Both methods of measurement are useful in their own spheres.

Amplifiers exhibit different amounts of nonlinearity at different parts of the frequency band. Since the CCIF method measures the low-frequency distortion component due to the distortion in the higher frequencies, the nonlinearity at

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these higher frequencies of the audio spectrum is observed here.

The SMPTE method utilizes a strong low-frequency signal and a weak high-frequency component. The difference frequency is of a high order of magnitude. Thus, this method will indicate the effect of low-frequency nonlinearity on a high frequency.

Equivalent Sine Wave Power

This derivation assumes the use of the SMPTE method where two signals with amplitude ratios of 4 to 1 are used.

Assume a signal of 1 volt is superimposed on a signal of 4 volts. The peak voltage applied would then be 5 volts. (See *Fig.* 5.) Since power is proportional to the square of the voltage ($P = E^2/R$), the equivalent power output is

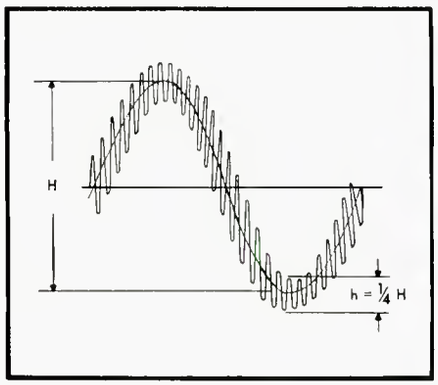


Fig. 5. Waveform of a 1-volt high-frequency signal superimposed in a 4-volt low-frequency signal. This is the usual form of intermodulation test signal.

proportional to $(5/4)^2$ times the power at the 4-volt output.

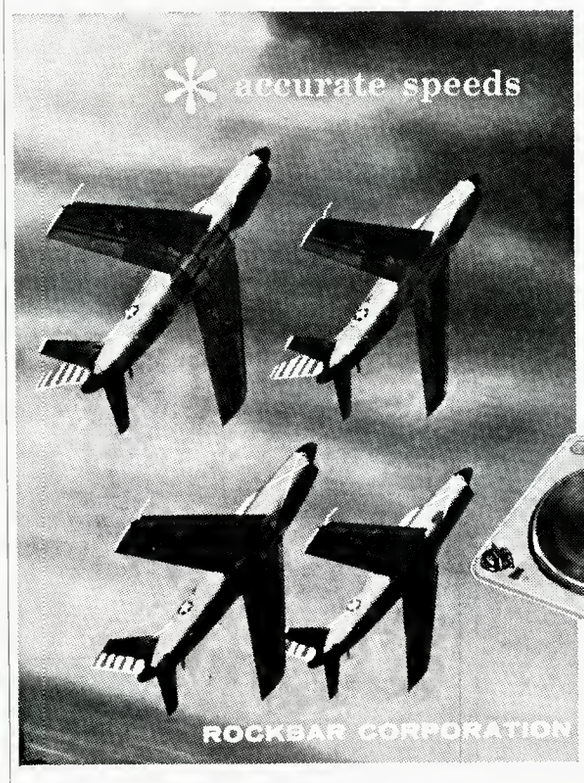
The real power output is not the peak power. Both frequencies deliver their individual amounts of power to the amplifier's output. The true power output is actually the sum of the powers delivered by each frequency component. In this case, the output power is proportional to $(4 \text{ volts})^2 + (1 \text{ volt})^2$.

However, distortion refers to the peak power output which is proportional to 5^2. The ratio of the peak power to the actual power is $5^2/(4^2+1^2) = 25/17$, or 1.47. Thus to find the peak power, the actual power indicated on the meter when making the intermodulation test is multiplied by 1.47. Amplifiers are rated at this peak power, commonly called "Equivalent sine-wave power." This refers to the power in a sine wave signal whose peak voltage equals the peak voltage of the IM signal.

Typical IM Analyzer

Figure 6 shows a theoretical schematic of an IM analyzer and the method by which it operates.

(A) shows two signals having an amplitude ratio of 4:1 combined and fed into the audio amplifier. Coming out of



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the audio amplifier are the two signals modulated, with the amplitude of the high-frequency signal varying in accordance with the low frequency. The high-pass filter in the analyzer eliminates the low-frequency component and passes only the high frequency which has a low-frequency amplitude variation caused by the distortion in the amplifier. This modulated signal is used to set the reference voltage level for a vacuum-tube voltmeter. The modulated signal then passes through a detector similar to that found in a radio receiver. The resultant signal is the low-frequency component which originally modulated the high frequency. The low-pass filter bypasses any of the high frequency left after detection, with the result that only the modulating low-frequency component is left. This component is a measure of the actual amount of intermodulation distortion created by this amplifier. Feeding this signal to the VTVM, and comparing this with the original amplitude of the modulated signal, indicates the percentage of intermodulation distortion.

To specify IM distortion by itself is not enough. The method used for testing is significant. IM distortion measured by the SMPTE method below about 2 per cent cannot readily be detected by the ear. Valves measured by the CCIF method can not be related directly to those obtained by the SMPTE method. To describe fully the distortion present in an amplifier, both harmonic and IM distortion tests should be made.

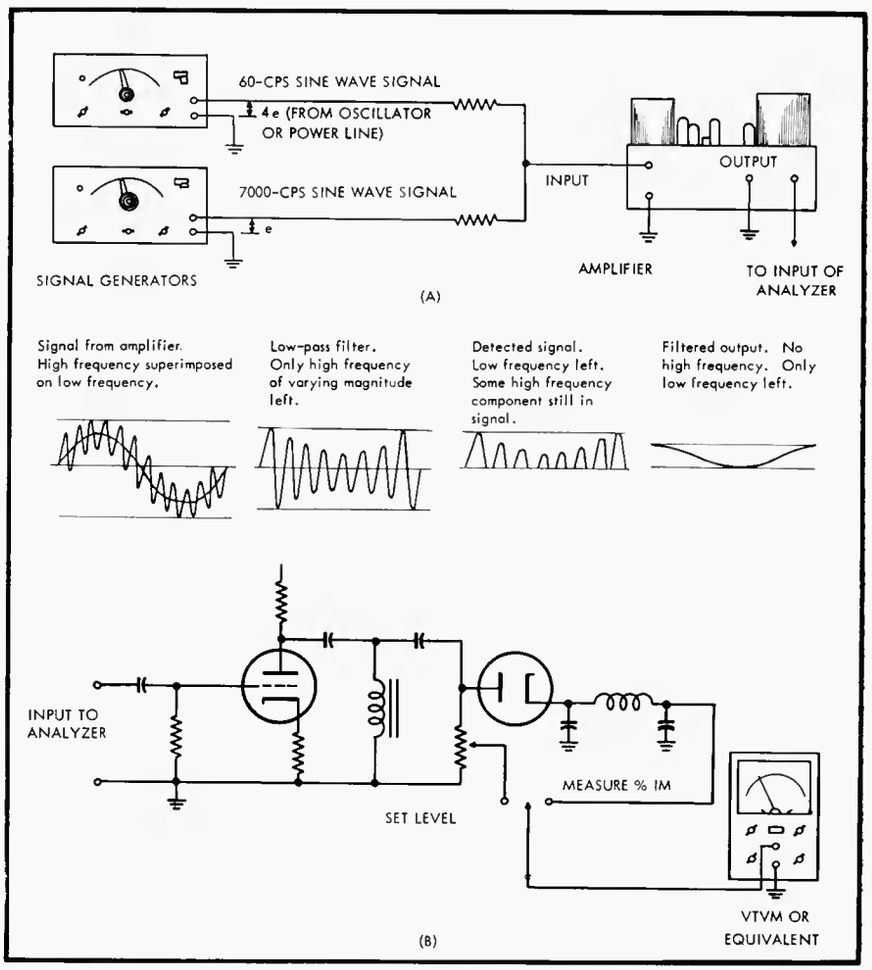


Fig. 6. (A) Arrangement of generators and amplifier for making IM tests. (B) Simplified schematic of IM analyzer. The percentage of IM distortion is equal to 100 x (output voltage/set-level voltage).

TREBLE AMPLIFIER

(*from page 16*)

marginal rating for a given job will be overloaded when RC filtering is employed.

The resistor labeled *R* in *Fig. 5* must be chosen so that 260 v.d.c. is delivered to the amplifier. One may not be required. Positive heater bias of one-tenth the plate voltage is provided by the bleeder network. The bypass capacitor grounds the center-tap of the 6.3 v.a.c. winding to audio frequencies and must not be omitted if hum is to be minimized.

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Conclusion

The writer is of the opinion that a high-quality playback system requires the employment of a dual-channel amplifier. A high-level dividing network cannot operate satisfactorily unless each filter section is terminated in a pure resistance of appropriate value. The driving-point impedance of a speaker is complex and functionally related to frequency. It may be predominately reactive at some frequency in the pass band. This accounts in part for the fact that dual loudspeakers employing high-level dividing networks do not always sound right. Constructional details covering an excellent dual channel amplifier were presented in reference 1. The use of the treble amplifier described in the present article will reduce the cost of the system with no sacrifice in performance. When used to drive the writer's speaker,[4] which is located in a room of modest size, the obtainable sound intensity level approaches the threshold of pain over the entire frequency range of the speaker.

The availability of a high-quality single-ended transformer makes it desirable to re-examine the utility of single-ended amplifiers for high-fidelity applications when high power output it not a requirement. The advent of tubes with high transconductance, such as the Mullard EL-34 and Tung-sol 6550, which result in high power sensitivity and low drive requirements, makes it highly desirable for transformer manufacturers to produce a line of transformers capable of carrying the plate current in the primary winding and that are comparable in performance to those manufactured for push-pull application. It should be possible to obtain easily 10 watts of power output from a single-ended amplifier employing only two stages. The circuit is not complicated and there is no requirement for a phase splitter. Large values of negative feedback may be applied and the amplifier will remain unconditionally stable if the output transformer is properly designed. Admittedly, it is somewhat more difficult to design a good transformer for single-ended output stages than for push-pull application. But the Triad Transformer Corporation has made a good start in producing the model HSM-79 transformer, and this should serve as a challenge to other manufacturers in this field. ●

[4] Charles W. Harrison, Jr., "Coupled loudspeakers," 3rd Audio Anthology, Radio Magazines, Inc. (1955) pp. 101–105.

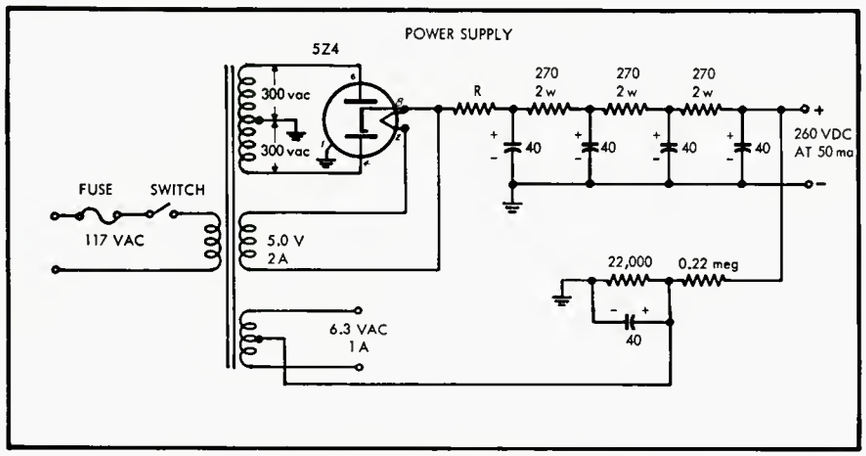


Fig. 5. Power supply featuring RC filtering.

AUDITORY PERSPECTIVE

(*from page 21*)

loudness difference into a given angle, even though the difference is produced by a combination of similar sounds from several directions, the angle from which the reproduced sound seems to come can be obtained from the computed loudness difference by reference to *Fig.* 3.

To verify this theory for a two-channel system, lines were drawn on the pick-up stage representing a constant distance ratio to the two microphones. These curves are shown on *Fig.* 4. Since the ratio of the distances to the two microphones along any one of these curves is a constant, the difference in level at the microphones of a sound produced along on any one curve will also be constant. This difference in level, which is marked on the curve, will be carried through to the loudspeakers and will cause a difference in loudness in the two ears of a listener.

These differences of loudness in the two ears of a listener were calculated for a listener position along the center line of the auditorium and a distance in front of the stage equal to the separation of the loudspeakers. From these calcu-

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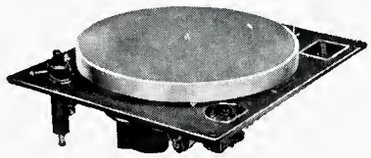
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lated differences in loudness in the two ears and *Fig.* 3, the angle from which the sound should apparently come was obtained, and these angles are also marked on the curves. A person speaking anywhere along the curve for a 6-db level difference, therefore, should appear to the listener to be at an angle of 15 deg. Actual tests bore out this relationship fairly closely. Moreover a speaker on the 6-db curve, appearing 15 deg. off the center, would appear to the listener to move to an angle of 8 deg. if the difference in level was decreased to 3 db by a manipulation of the amplifiers. In fact many of the effects of walking about the stage can be duplicated by volume manipulation as the person speaking walks back and forth along the center line of the stage. Although the observed and calculated angles agreed fairly well for central observing positions, the apparent source shifted more rapidly toward the nearer loudspeaker than computation predicted, as the observer moved toward the side of the auditorium.

Similar curves were calculated and tried out for a three channel system, and a similar correlation of observed and calculated positions was found.

These curves were all calculated on the basis of sound of equal quality at the two microphones. If the quality differed materially—if one microphone picked up mostly direct sound and the other reverberant sound, for example—the localization by the observer would be quite different. It was found, for example, that if the right microphone picked up mostly direct sound and the left, reverberant sound, the sound would appear to come from the right loudspeaker until the level of the left speaker was raised 10 db. In general the localization tends toward the channel giving the most natural or close-up reproduction.

These tests proved conclusively that very good localization could be obtained by a three-channel system, and that two-channel reproduction gave good angular localization although the distance localization was not entirely satisfactory for central positions. In the application of auditory perspective to the reproduction of orchestral music, the satisfactoriness of the two- and three-channel systems is even greater than indicated by the accuracy of the localization. The enhanced aesthetic appeal obtained from an auditory-perspective reproduction of an orchestra is not due so much to an accurate localization of the various sounds as to a general effect of space distribution, which adds a fullness to the over-all effect. For this reason either two- or three-channel reproduction in auditory perspective is very satisfactory for orchestral reproductions.

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REK-O-KUT PURCHASES AUDAK. Two of the most respected names in the audio industry were joined recently when the **Audak Company** was purchased by **Rek-O-Kut Company, Inc.** According to George Silber, Rek-O-Kut president, production of all Audax units will be transferred to the new Rek-O-Kut plant which was opened in July. The trademark Audax, oldest in its field, will be continued and a new corporation to be known as Audax, Inc., will be formed as a division of Rek-O-Kut. Mr. Silber will be president of the Audax division, and Maximilian Weil, founder of the Audak Company, will act as consultant and creative engineer. The Audax division has developed a new cartridge of revolutionary design which will be marketed within the next few months.

AMPEX ACQUIRES ORRADIO INTEREST. A joint statement issued by George I. Long, president of **Ampex Corporation** in Redwood City, Calif., and J. Herbert Orr, president of **ORRadio Industries, Inc.,** Opelika, Ala., disclosed that Ampex has acquired a 25-per cent interest in the tape-making firm. Team effort by engineering and research facilities of Ampex and ORRadio will be directed primarily toward the production of highest possible quality magnetic recording tape for audio, video, and computer use.

AUDIO FIDELITY ANNOUNCES NEW LATIN LINE. In an effort to bring to the American market some of the best recorded Latin-American music, **Audio Fidelity, Inc.,** announces negotiations have been completed with Musart of Mexico for the production and release of the Musart label in the United States. Sidney Frey, president of Audio Fidelity, Inc., in introducing the new 12-inch album line, stated that the discs are recorded in true hi-fi and will be manufactured in this country to the same exacting standards as are Audio Fidelity records. The records, protected by glassine envelopes inside attractive 4-color jackets, are now being released through the firm's present roster of independent distributors.

G-E REORGANIZES HI-FI SETUP. **The General Electric Company** has reorganized its high-fidelity sound components operations. Responsibility for engineering, manufacturing, and marketing of hi-fi products has been transferred from the company's receiver department in Syracuse to its specialty electronic components department in Auburn, N. Y. The current G-E hi-fi line will be expanded in the near future, according to Edward L. Hulse, general manager of the department.

PERMOFLUX RE-LOCATES. L. M. Heineman, president of **Permoflux Products Company,** announces that all of the firm's engineering, manufacturing and sales offices are now concentrated in its new 31,000-sq.-ft. plant in Glendale, Calif. Permoflux manufactures high-fidelity loudspeakers, headphones, transformers, microphones, receivers, induction pickups, transistorized amplifiers, intercom systems and power supplies. Manufacturers and distributors are asked to direct their inquiries on Permoflux products directly to the attention of the sales department.

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AR-1

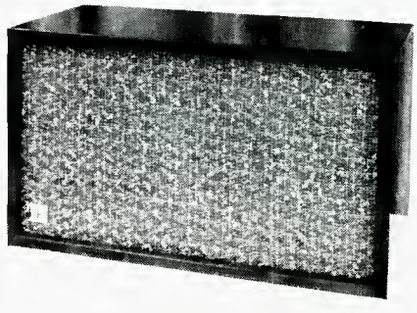
WHEN the AR-1 speaker system first made its appearance on the hi fi market, our published specifications were sometimes greeted with skepticism; for a speaker to perform as claimed, particularly in such a small enclosure, was contrary to audio tradition.

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The AR-2 is the first application of the acoustic suspension principle to a low-cost speaker system. Prices are $89 in unfinished fir cabinet, $96 in mahogany or birch, and $102 in walnut.

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Literature is available on request.

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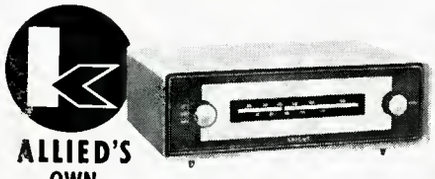
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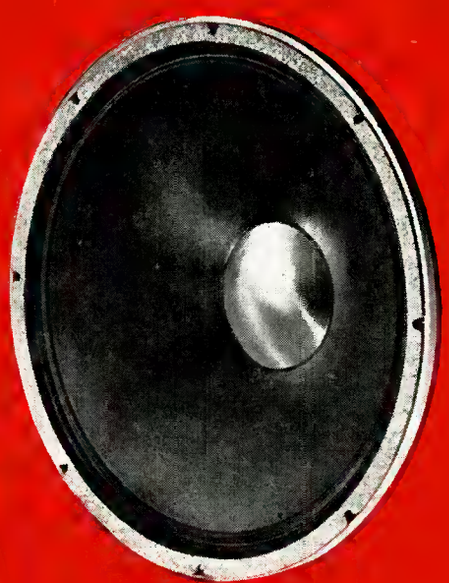
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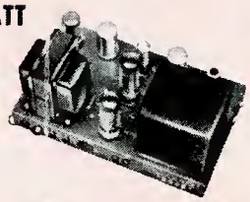
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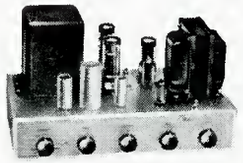
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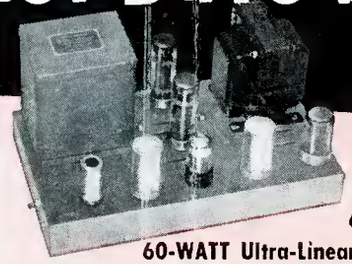
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60-WATT Ultra-Linear HIGH FIDELITY POWER AMPLIFIER #HF60 with ACRO TO-330 OUTPUT TRANSFORMER

KIT $72.95 WIRED $99.95

Superlative performance, obtained through finest components & circuitry. EF86 low-noise voltage amplifier direct-coupled to 6SN7GTB cathode coupled phase inverter driving a pair of Ultra-Linear connected push-pull EL34 output tubes operated with fixed bias. **Rated power output:** 60 w (130 w peak). **IM Distortion** (60 & 6000 cps at 4:1): less than 1% at 60 w; less than 0.5% at 50 w. **Harmonic Distortion:** less than 0.5% at any freq. between 20 cps & 20 kc within 1 db of 60 w. **Sinusoidal Freq. Resp.:** at 1 w: 35 kc at any level from 1 mw to rated power; no peaking or raggedness outside audio range. **Square Wave Resp.:** excellent from 20 cps to 25 kc, 3 usec rise-time. **Sensitivity:** 0.55 v for 60 w. **Damping Factor:** 17. **Inverse Feedback:** 21 db. **Stability Margin:** 16 db. **Hum:** 90 db below rated output. **ACRO TO-330 Output Transformer** (fully potted). **Speaker Taps:** 4, 8, 16 ohms. **GZ34 extra-rugged rectifier** (indirectly-heated cathode eliminates high starting voltage on electrolytics & delays B+ until amplifier tubes warm up). **Input level control.** Panel mount fuse holder. Both **bias** and **DC — balance** adjustments. Std octal socket provided for pre-amplifier power take-off. Size: 7" x 14" x 8". 30 lbs. Matching cover **Model E-2 $4.50.**



NEW

COMPLETE with Preamplifier, Equalizer & Control Section 20-WATT Ultra-Linear Williamson-Type HIGH FIDELITY AMPLIFIER #HF-20

KIT $49.95 WIRED $79.95

A low-cost, complete-facility amplifier of the highest quality that sets a new standard of performance at the price, kit or wired. **Rated Power Output:** 20 w (34 w peak). **IM Distortion (60 & 6000 cps/4:1) at rated power:** 1.3%. **Max. Harmonic Distortion between 20 & 20,000 cps at 1 db under rated power:** approx. 1%. **Mid-band Harmonic Distortion at rated power:** 0.3%. **Power Response (20 w):** ±0.5 db 20-20,000 cps; ±1.5 db 10-40,000 cps. **Freq. Resp.** (¼ w): ±0.5 db 13-35,000 cps; ±1.5 db 7-50,000 cps. **5 feedback equalizations** for LPs & 78s. **Low-distortion feedback tone controls:** large boosts or cuts in bass or treble with mid-freqs. & volume unaffected. Loudness control & separate level set control on front panel. Low Z output to tape recorder. **4 hi-level switched inputs:** tuner, tv, tape, aux; **2 low-level inputs** for proper loading with **all** cartridges. **Hum bal. control.** DC superimposed on filament supply. **Extremely fine** output transformer: interleaved windings, tight coupling, careful balancing, grain-oriented steel. 8½" x 15" x 10". 24 lbs.
Matching cover **Model E-1. $4.50**

NEW **COMPLETE with FACTORY-BUILT CABINET— 2-WAY HI-FI SPEAKER SYSTEM #HFS1 $39.95**



Genuine 2-way book-shelf size speaker system. **Jensen** heavy duty 8" woofer (6.8 oz. magnet) & matching **Jensen** compression-driver exponential horn tweeter with level control. Smooth clean bass & crisp extended highs free of coloration or artificial brilliance. **Factory-built** tuned bass reflex birch hardwood cabinet (**not** a kit) constructed to high quality standards. Neutral acoustical grille cloth framed by a smooth-sanded solid birch molding. **Freq. Resp.** measured 2 ft. away on principal axis in anechoic chamber with 1 watt input – **Woofer:** ±4 db 80-1800 cps; **Tweeter:** ±2 db 2800-10,000 cps; **Crossover Region:** 1800-2800 cps, shift in level over this region depends on tweeter level control setting. Power-handling capacity: 25 watts. Size: 23"x11"x9". 25 lbs. **Wiring Time:** 15 min.

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