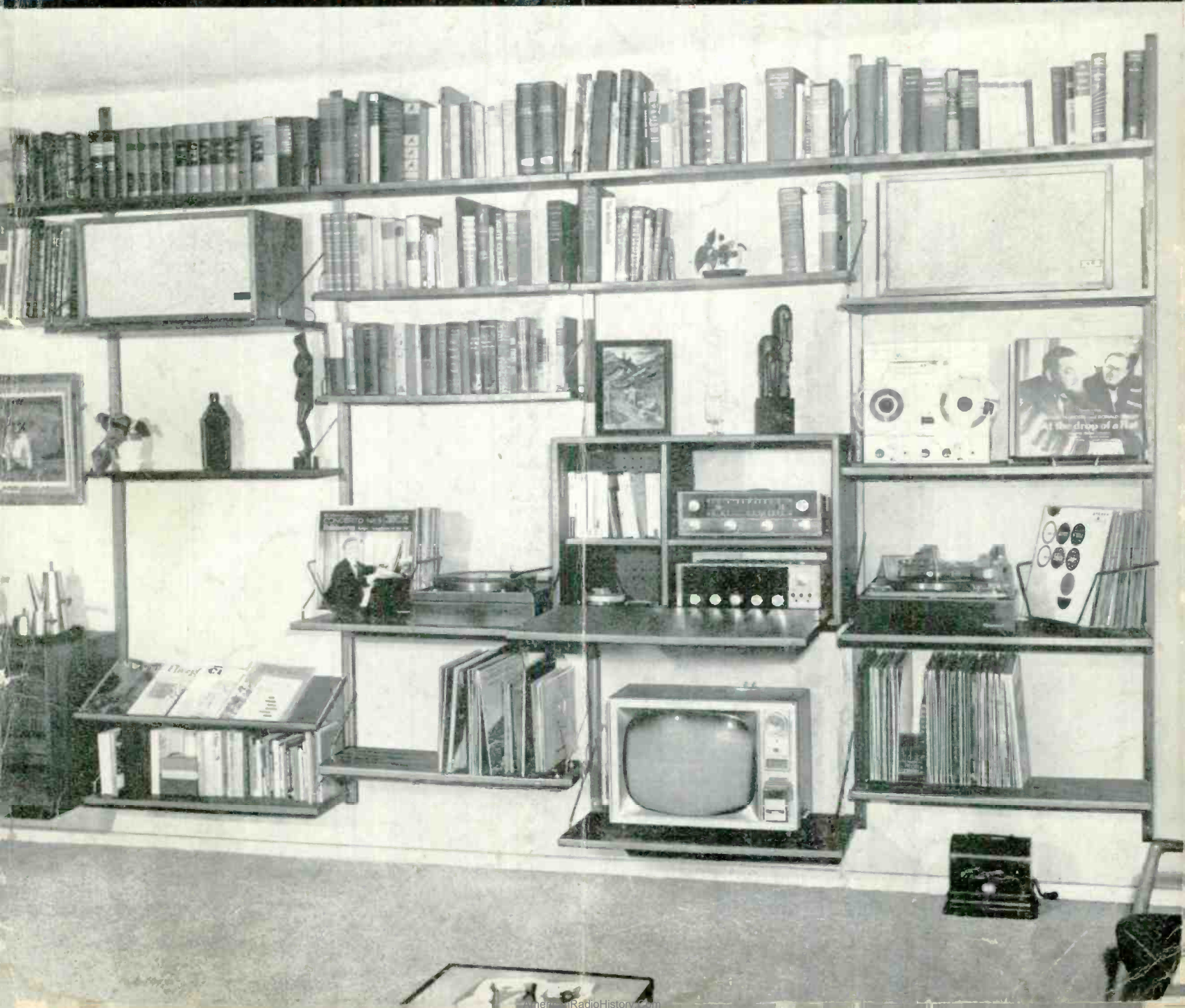


# AUDIO

MAY, 1961  
50¢

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# AUDIO

MAY, 1961 VOL. 45, No. 5

Successor to **RADIO**, Est. 1917

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AUDIO (title registered U. S. Pat. Off.) is published monthly by Radio Magazines, Inc., Henry A. Schober, President; C. G. McProud, Secretary. Executive and Editorial Offices, 204 Front St., Mineola, N. Y. Subscription rates—U. S., Possessions, Canada, and Mexico, \$4.00 for one year, \$7.00 for two years; all other countries \$5.00 per year. Single copies 50¢. Printed in U.S.A. at 10 McGovern Ave., Lancaster, Pa. All rights reserved. Entire contents copyrighted 1961 by Radio Magazines, Inc. Second Class postage paid at Lancaster, Pa.

RADIO MAGAZINES, INC., P. O. Box 629, MINEOLA, N. Y.  
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# AUDIOclinic



JOSEPH GIOVANELLI\*

## The compatible record?

*Q. Stereo records have been with us for quite some time now, and yet I have heard recently of a disc which is called a compatible stereo disc. I thought that the discs we are already using are compatible with monophonic requirements. What is this new disc? Nario Brenes, New York, N. Y.*

A. You are, of course quite correct in saying that the present stereo disc is compatible with monophonic discs, at least in that the stereo cartridge can, merely by strapping its two outputs together, reproduce a monophonic recording as well as the standard monophonic cartridge.

Of course, record dealers and manufacturers would like to make a record which could be played equally well with standard monophonic or stereo cartridges. This should be done with no degradation to the sound quality or of record life, regardless of which cartridge is being used. As I have stated previously, the monophonic disc can be successfully reproduced by a stereo cartridge, however the stereo record cannot be reproduced so satisfactorily by a monophonic cartridge because the monophonic unit is likely to have poor vertical compliance. Further, the poor vertical compliance of monophonic cartridge leads to reduced record life.

After considerable experimentation, Design Records came to the conclusion that it was the vertical signal at low frequencies which caused most of the wear. They further believed that it would not make much difference to directionality or spaciousness if the lows were removed from the vertical component of the stereo disc. The bass would still appear in the lateral component which represents the sum of the two channels, and hence, would be reproduced as well as on the conventional stereo disc. (Remember that the vertical information represents the stereo information, equal to the difference between the signals of each channel. This is the same sort of thing which is encountered in multiplex broadcasting where the stereo information is represented by the difference subchannel and the monophonic component is represented by the main carrier signal.) Recordings have been made using this principle, and some reports indicate that these recordings have good wear characteristics on monophonic equipment.

However, some studies indicate that some stereo information is carried by the bass component in the music. This would indicate that removing the lows from the vertical component of the record would lead to some degradation of quality in terms of special realism.

This, then, is the design philosophy behind the compatible disc. It seems to me that we should really call this recording technique the "more compatible" record. After all, we already were talking about compatibility, and this system brings us, so some say, more compatibility than merely compatible. It is something like the idea of high fidelity, and as Edward Tatnall Canby often writes. "How high the fi?"

## Solid-State Tube Replacement

*Q. I have read recently about solid-state tube replacements. Are these units transistors? Arthur Darrow, Albany, New York.*

A. I believe that what you have in mind is the replacement for standard tubes. What this is is merely some diodes placed in an ordinary octal base. These are silicon diodes so wired that the unit is directly interchangeable with the tube it replaces.

The purpose of such a unit is to improve voltage regulation of the power supply and to permit cooler operation of the equipment with which it is associated. You see, silicon diodes have a considerably lower forward resistance than vacuum tubes have, and this means that the voltage drop within the solid-state tube replacement rectifier will be less than that for the standard vacuum tube. I measured the difference in performance myself, using an amplifier with a pair of 6L6's in the output. The circuit called for a 5Y3 and I measured the voltage appearing on the cathode of this rectifier. When I substituted the solid-state tube replacement, I found that the voltage was higher by some 50 volts.

This fact should indicate caution in substituting these units in a circuit. Suppose that you have an amplifier which has a capacitor input filter and which has 425 volts appearing between the cathode of the rectifier and ground. If you substitute the solid-state device, this voltage can rise to 475 volts or higher, depending upon the amount of current taken by the external load. This added voltage may be sufficient to break down the electrolytic filter at the cathode, especially when the filter is rated at 450 volts. It may not break down when

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



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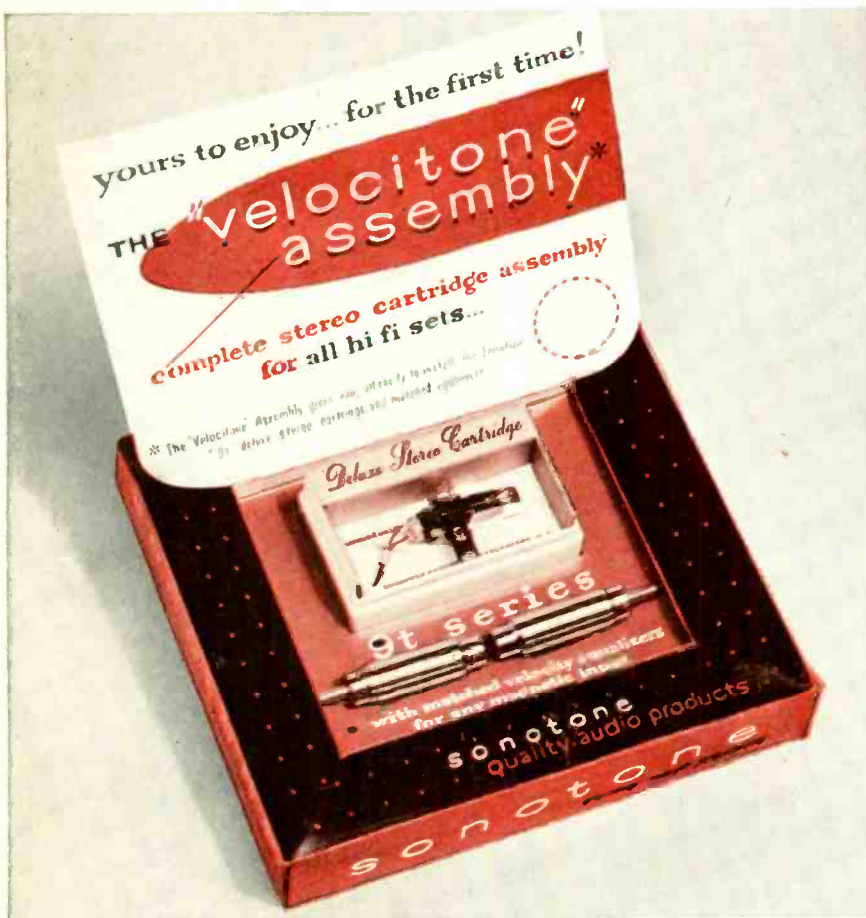
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the unit is first installed, but it may break down after a day or a week.

Because of the higher voltage and the better regulation, it is logical to expect that the equipment will perform better than it did with the ordinary rectifier in the circuit.

However, there is another advantage to this arrangement; the solid-state rectifier will run cooler than its vacuum tube counterpart. The heat from the rectifier is a major source of heat, and since solid-state units run cold, it is easy to see that this factor can be important, especially in those installations in which good air circulation around the equipment is difficult to achieve.

There are two reasons why the rectifier of the solid-state variety should run virtually at room temperature. First, the solid-state rectifier does not have a heater to stimulate electronic emission. Second, the internal resistance of such a device is quite low, and this, in turn, results in a low internal voltage drop across the rectifier. This means that the power dissipated within the rectifier in the form of heat will be greatly reduced.

Another minor factor toward the maintenance of a cool-running amplifier which these solid-state devices afford is that the absence of a heater means that less power will be taken from the power transformer, which in turn will also run slightly cooler.

One disadvantage of this kind of rectifier is that it will not stand for much in the way of long-sustained overloads created by shorted filter capacitors and the like. The conventional vacuum tube has a high internal resistance as has been pointed out, and this helps to protect the tube and other power supply components in the event of overloads. Since the solid-state device does not have this protection, both it and the power transformer can be subject to damage. I would recommend, therefore, that in addition to the normal fusing of the equipment, that a fuse be placed in the hot "B" lead of a solid-state rectifier so that it can blow before the rectifier and other associated components blow out.

### D.C. Transient Response

*Q. I have heard that amplifiers are tested sometimes for a parameter known as "d.c. transient response." I don't understand this because d.c. does not contain transients so far as I can see. Would you please explain this test and its significance? Name Withheld.*

*A. The test to which you are referring is one which often is used for performance criteria of a particular piece of apparatus for use in home music systems. I am sorry that this is not a more widely known test.*

Suppose that we have an amplifier which delivers its maximum power with an input signal of a volt. (By maximum power I mean that power which is within one per cent intermodulation distortion.) A suitable load resistance is connected across the output terminals of the amplifier in the usual manner. An oscilloscope is connected across the same terminals as the resistor. Then a d.c. voltage is adjusted to give the one volt corresponding to maximum input signal required by this particular amplifier. This

(Continued on page 73)



\*from the leading magazine  
in the jazz field:

<b>CLASS OF SERVICE</b> This is a fast message unless its deferred character is indicated by the proper symbol.	<b>WESTERN UNION</b> <b>TELEGRAM</b> W. P. MARSHALL, President 1201 (4-60)	<b>SYMBOLS</b> DL = Day Letter NL = Night Letter LT = International Letter Telegram
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<small>THE COMPANY WILL APPRECIATE SUGGESTIONS FROM ITS PATRONS CONCERNING ITS SERVICE</small>		

We will be glad to send you a reprint of down beat's\* "Picks of the Year" for 1960, listing the magazine's choice of components for three hi-fi systems (economy, medium-priced, and luxury).

The AR speakers referred to above may be heard at AR Music Rooms, on the west balcony of Grand Central Terminal in New York City, and at 52 Brattle Street in Cambridge, Massachusetts.

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## The Pro's Nest

Saul J. White  
Chief Engineer, Audax, Inc.



### NO. 3 — TESTING OF LOUDSPEAKERS

Back in 1917, listeners described the phonograph as "Hifelike" and "splendid in sonority." If we continue to evaluate speakers by means of listening tests, we stand in danger of forgetting the real thing.

Some thirty years of listening evaluations have convinced me of the unreliability of subjective testing. I would state further that listening tests are completely unrealistic, abound with personal taste, are influenced by the emotional character of the program and are affected by the musical conditioning of the listener. Taste in speakers, as in music, is woven into the total fabric of our experiences. There is a significant difference of choice between age levels. Preference in loudspeaker response is affected by the physiology of the individual listener. Further unreliability resides in the surroundings in which the tests are performed.

The listening panels used by Consumers Union in its report on speakers show merely that it is the illusion of satisfaction under one particular set of conditions that matters — not the objective scientific values. The result of listening is a qualitative statement in linguistics.

In spite of an excellent laboratory, Consumers Union's subjective testing, particularly their report of December, 1958, was neither formal nor logical, because it was not the loudspeakers *per se* that were undergoing tests, but the sensory nature of the audience. In these remarks I am eliminating the obviously bad speakers and I am only considering a large group of decent speakers manufactured by a considerable number of reputable manufacturers.

I feel compelled to conclude that each listener wants different unrealities. It is a matter of how you like your music distorted. We are ruining our auditory response to reproduced music. More than one entrepreneur has asked me to design a *woman's loudspeaker*. By this was meant any old, muddy bass and highs which slough off above 4 kc, rendering what some call mellowness. Such are the demands of subjective appeasement.

There is no approach for engineers or qualified workers in the audio field except through objective measurements.

By measured instrumentation of a mechanical linkage we can have a clearcut quantitative statement in machine communication. An audio reproducing chain, including the acoustic environment, is open to measurement and comparison against the original source. The essential fidelity of a speaker will be nothing but its conformity to realism as indicated by laboratory tests. We do not have perfection in the best of our loudspeakers but we are somewhere on the road, as we have been for fifty years. It takes objective measurement by the best of instruments and best of technicians to determine our position on that road.

Both C.U. and myself have a common concern, namely, the validity of testing techniques, i.e. the principles of reliable inference. C.U. needs a better understanding of factors affecting subjective evaluations. They should recognize that there are no scales for measuring sensations or discrimination. Let C.U. read the following parable of "The Blind Men and The Elephant."

Six blind Hindus approached an elephant. The first touched the elephant's broad side and said it was a wall; the second, feeling the tusk, said it was a spear; the third took the swirling trunk and was sure he had seized a snake. The fourth felt the leg and concluded it was a tree; the fifth touched the ear which felt like a fan; the sixth, seizing the tail, said, "How like a rope is an elephant."

"The each was partly in the right, yet all were in the wrong."



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# LETTERS

## Artificial Reverberation

Sir:

The article on artificial reverberation was very interesting. However, I would like to take exception with the statement, and I quote—"there is practically no reverberation in the concert hall for frequencies below 250 cps." A little investigation will immediately show the fallacy in this remark.

First, consider that reverberation consists of nothing more than sound reflecting back and forth from the walls (and floor and ceiling) of the concert hall. If the walls are good absorbers, then the sound is attenuated considerably at each reflection and we can say there is a small amount of reverberation. If the walls are poor absorbers the sound suffers many more reflections before being reduced to inaudibility. In this case we can say there is a large amount of reverberation.

On page 502 of Olson's "Acoustical Engineering" there is a chart of absorption coefficients for architectural and acoustic materials, including values for the audience. For every material listed the absorption coefficient decreases at low frequencies. The crossover point seems to be in the region of 500 cps. On page 507 there is a curve showing decreasing absorption down to 120 cps (which is as far as the curve goes) with no sign of leveling off.

From these facts it is obvious that reverberation in a concert hall is greater at low frequencies. This is readily apparent to anyone who has ever attended a live concert (and I fear that too few audio engineers have ever done this). The richness of sound and impression of tremendous bass so characteristic of a live performance listened to in the concert hall, is due almost entirely to low-frequency reverberation.

Werner G. Zinn Jr.  
2025 Golf Vista Ct.  
Orlando, Fla.

## No Tone Controls, Anyone?

Sir:

In your April "Editor's Review" under the above heading you say: "But in general there never seems to be any need for operating the tone controls anywhere except 'flat.'" I wonder whether this really represents the majority view among serious listeners?

I have a large record collection of classical orchestral music, and, having an exceptionally flexible system of tone control (and plenty of time to play with it), I have coded the tone settings for each record which, to me, give the best balance in each case. The variations in these optimum settings are so great that it seems to me that anyone who plays everything on the straight RIAA setting (or any fixed modification of it) must be missing a great deal. Although the optimum setting is no doubt a matter of great personal taste, the degree of variation between different records must be substantially the same for everyone.

Quantitatively, these optimum deviations are mostly within 5 db on either side of the RIAA curve, but the trouble is that they seldom conform to the shapes imposed by the average tone-control curves, which usually "hinge" at around 1000 cps. For instance, one record may be deficient in "presence" and require a 5 db boost in the 250-750 cps range, and at the same

time have an exaggerated bass requiring sharp attenuation below 150 cps. The next one may have an objectionable violin screech in the tuttis, and require a sharp rolloff at around 5000 cps. And so on.

What is wrong with our present tone controls is not that they are unnecessary, but that they are not sufficiently flexible. What is wanted is a device that could produce any curve within plus or minus 5 db of the RIAA line, and be operated by not more than three knobs, or preferably less. Surely it should be possible in this age of "electronic miracles"?

Reid A. Raitlon  
241 The Uplands  
Berkeley 5, Calif.

## Electrons Flow Again

Sir:

Mr. Goeller and I on this one point agree: It's tough to challenge authority. It's so cozy and clanny in that ivory tower To disturb them at all takes a sizeable power.

But don't underestimate us engineers: We relish all progress, in spite of our fears. My counsel to those who would enter the field

Is: Never to doctrinaire theories yield.

Mr. Goeller would rather be righteous than right. *Argumentum ad hominem* is his guiding light.

Electrons and ions, impervious to scare, They don't give a damn *who* says they go where.

Please tell me, kind sir, since the facts you resist, Of what does this stuff you call current consist, That slips like a snake through the innocent wire, From the plus to the minus, as the moth to the fire?

"Though the fiction might be a convenience to use, To forget that it's fiction is truth to abuse. If you prove its existence I'll be first to arise And congratulate you on your Nobel Prize!"

Robert J. Nissen  
525 Fourth St.  
San Francisco, Calif.

## Tapesponding

Sir:

I have been interested in high fidelity and electronics for a long time. For the past five years I have had a hobby which has given me, as well as thousands of others, a great deal of pleasure. It is tapesponding with people throughout the world. As well as talking about our hi-fi equipment and listening to music, one can "talk" about anything in general.

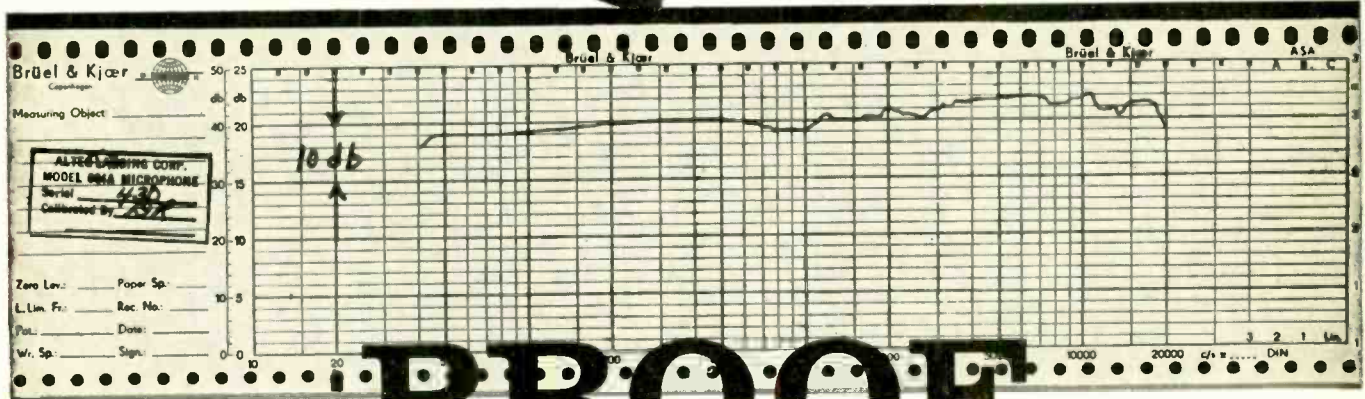
Although there are a number of tapesponding clubs, there are still some people who may not know enough about it. I would be glad to help anyone get started. Those interested, reply by letter giving me their "tape speeds." It is customary to start off with a 3-in. reel at 3 3/4 ips and then later on switch to a 5-in. reel at 7 1/2 ips, if desirable.

Thomas A. Bradford  
427 Beach 69th Street  
Arverne 92, N. Y.





**Frequency Response:** 35 to 20,000 cycles  
**Output Impedance:** 30/50, 150/250 and 20,000 ohms (selection by connections in microphone cable plug)  
**Output Level:** -55 dbm/10 dynes/cm<sup>2</sup>  
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**Weight:** 8 oz. (not including cable & plug)  
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**Mounting:** Separate "Slip-On" adapter No. 13338 furnished. Adapter has standard 5/8" -27 thread.



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Concrete visual proof of performance is now supplied by ALTEC with each 684A Omnidirectional Dynamic Studio Microphone. This proof—a soundly scientific and coldly unemotional statement of exact performance capabilities—is an individual certified calibration curve that you receive free with each 684A Omnidirectional Dynamic Microphone.

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## SUPERIOR PERFORMANCE, SUPERIOR VALUE — THE ALTEC DYNAMIC MICROPHONE LINE:



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**ALTEC 682A—\$49.50 net**—Featuring uniform frequency response from 45 to 20,000 cycles, the 682A Omnidirectional Microphone incorporates the new ALTEC "Golden Diaphragm" and exclusive sintered bronze filter. Output impedances of 30/50, 150/250, and 20,000 ohms easily selected in microphone plug.



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**ALTEC 685A STUDIO CARDIOID—\$96.00 net**—This dynamic microphone offers flat frontal response from 40 to 16,000 cycles with average front-to-back discrimination of 20 db. Design incorporates the new ALTEC "Golden Diaphragm" and exclusive sintered bronze filter. Output impedances of 30/50, 150/250, and 20,000 ohms selectable at cable plug. Individual certified calibration curve is supplied with this model.



**ALTEC 686A LAVALIER—\$54.00 net**—Unobtrusive 3-ounce Omnidirectional Lavalier Microphone. Incorporates the new ALTEC "Golden Diaphragm" and exclusive sintered bronze filter for an exceptionally smooth frequency response from 70 to 20,000 cycles, equalized for chest position. Selectable 30/50 and 150/250 ohm impedances.

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# Light Listening



CHESTER SANTON\*

The symbol  indicates the United Stereo Tapes 4-track 7 1/2 ips tape number.

## Gus Farney at the Wurlitzer Pipe Organ Warner Bros. WSTC 1409

It would have been nice if this reel had been available a month ago when the merits of a recent two-track tape were discussed in this space. Here's one four-track release that can just about hold its own with the two-track jobs. Although its predecessor was no slouch ("Colossus," Warner WSTC 1359), this Farney release is an even better recording. The musical program is somewhat more attractive too. The tape is obviously a product of a master made under optimum conditions. The physical layout of the recording locale, the Bray Organ Loft in Salt Lake City, boasts some logically-spaced pipe chambers. The engineering is such that, at higher than normal volume, there are none of the mechanical thumps that sometimes accompany an organist's switch of tonal colors. The spread of sound is gratifying in scale yet full stereo is achieved without moving the mikes back to a point where the typical warmth of a well-maintained Wurlitzer begins to cool in the monitor speakers. The signal-to-noise ratio is certainly conducive to genuine relaxation. Even in the lowest-level passages in the sentimental ballads of the Twenties, the signal easily overrides the tape background. If you're adequately endowed with amplifiers and speakers of true low-end response, one of the more fascinating attributes of this tape is the easy definition of the pedal notes at low volume. With enough increase in gain, it's no outstanding feat to bring out the harmonics of pedal notes in recordings that go down part of the way. What I like about this tape is the bass definition without boost in the curve.

Gus Farney, who at one time was a staff demonstrator for Wurlitzer in the days when the unveiling of a new theatre installation was a great event, concentrates on music popular in the Twenties. Novelties of that era include *Doll Dance* and impressions of a piano in *Pickle Rag*. The ballads have real meat on them. There's *Peg of My Heart*, *Auf Wiedersehen*, *My Dear* and a favorite of mine you never hear these days *How Am I To Know?* The grand finale, *The National Emblem March* releases a tide of sonority in drum and low brass effects that few marching bands could ever hope to match. If I may be permitted one rave a month in the tape field, this reel is the current choice.

## Marty Gold: It's Magic

RCA Victor LSA 2290

When the stereo disc was first left on the door step of the record industry, unwanted movement of instruments in the stereo listening area was considered a problem. Now RCA has decided to make a selling point of what was once considered a fault of the stereo process. In their "Stereo Action" series, the sound source is deliberately moved as the singer or instrumentalist performs in a stationary position. This trick goes one step beyond the

\* 12 Forest Ave., Hastings-on-Hudson, New York.

shift of sound brought about by switching of soloists from channel to channel. Now we are able to follow a performer as he is pulled across the width of the listening area. At best, this is only a moderately interesting stunt the first time one hears it in this chorus and orchestra recording. The sound effects used to introduce some of the tunes lend themselves to movement with better logic. *Shuffle Off to Buffalo* starts with a locomotive lumbering through from left to right. *High On a Windy Hill* moves the sound of a small gale across the room as though it were a pre-packaged little hurricane.

The amount of electronic gear required to pull off these tricks definitely affects the nature of the sound. The singer's voices, in particular, sound quite hollow and artificial. Normally I suppose I would take some interest in whatever steps will be necessary to clear up such a problem. In this case I must say I fail to see any point in the entire project. After a half hour of sliding around, the steadiness of a normal stereo record felt mighty good.

## Frederick Fennell Conducts Gershwin Mercury PPS 6006

At least one trend under way in the treatment of light music should hearten anyone tired of the strictly Broadway approach. Could it be that some of the musicians who have operated solely within the sphere of Tin Pan Alley are losing some of their influence in the record industry? In its latest pop releases, Mercury is placing more and more responsibility in the hands of Frederick Fennell whose conducting career has rolled along far from the tinsel of Broadway. Fennell, in turn, has turned over the arranging assignment for these Gershwin orchestral favorites to an Eastman School associate, Rayburn Wright, who is presently chief arranger for musical productions at Radio City Music Hall. Consequently there is a wholesome and cozy "Sunday Matinee" feeling in the approach. The personnel of the orchestra are fully at home in Carnegie Hall as well as New York recording studios. The two pianos and harp play a vital role in the setup of the orchestra, preserving the distinctive characteristics of the Gershwin era in *S' Wonderful*, *Liza*, and *I've Got Rhythm*. The strings and woodwinds have their subtly-colored innings in slower favorites such as *Love Walked In* and *The Man I Love*.

From a technical standpoint, this record may shed some new light on a longstanding argument concerning the number of microphones to be used in a conventional session. Mercury decided on a total of nineteen mikes for this orchestra of 47 players. In the past, I've sided with those who contend that, beyond an irreducible minimum needed for stereo "fill in," the fewer the number of mikes used in any given situation, the easier it is to get clean sound. It has been pretty easy to spot Mercury sessions employing six or more microphones, but they fooled me in this one. Advocates of microphone forestry may be pleased to learn that I was not aware of nineteen mikes as I listened to the record. I had to read the liner notes to discover the fact. The secret may lie in the fact that all instruments of the orchestra were allowed ample breathing space without unsettling the pickup of their neighbors.

## Eileen Farrell: I've Got a Right to Sing the Blues

Columbia  CQ 343

Is Columbia applying to its line of current 7.5 ips tapes some of the theories developed while working on a much slower-speed tape system? How else does one explain the recording curve used on this reel? Of course the highs on this tape will not be excessive under all playback conditions. Some listeners, without realizing it, may have a playback head that has taken on a magnetic personality. On normal equipment, rolloff at the high end will have a beneficial effect. Anyone familiar with the disc version of this release will agree that a little knob twirling is well worth the effort. Tape explores with new veracity the excitement of this extraordinary pop session by one of our leading concert and opera stars. This is the Eileen Farrell some of us used to hear when she was a CBS staff vocalist many years ago. Although a current attraction at the Met, the album should not be confused with stunts along the lines of the recent Gala Performance recording of "Die Fledermaus" issued by London Records. There, a collection of guest opera stars quite self-consciously tried their wings in the lyrics of popular tunes. Every resource of the stunning Farrell vocal arsenal is applied with complete conviction and gusto in perennials (*On the Sunny Side of the Street*, *September Song*, and the album's title tune) as well as relatively esoteric ditties. Among the latter are a flawlessly-paced *Ev'rytime* from an old musical "Best Foot Forward," *Supper-time* an Erhel Watels tune in Irving Berlin's "As Thousands Cheer," and the almost forgotten Ruth Etting favorite *Ten Cents a Dance*. The album is sure to be a conversation piece wherever tape is played.

## Bob Eberly and Helen O'Connell

Warner Bros.  WSTC 1403

Here's a stereo salute to Jimmy Dorsey by the vocalists once featured with his great band. In recalling the sound of the Thirties, the studio orchestra led by Lou Busch is fortunate in having the services of Skeets Herfurt. A member of the original Dorsey Brothers band, Herfurt revives the famous Jimmy Dorsey alto sax and clarinet style in the Busch adaptations of the old arrangements. *Contrasts*, the band's theme, is the only instrumental in a program concentrating on the vocal hits made famous by Helen O'Connell and Bob Eberly. Each vocalist has ample chance to take the solo spotlight but the duets (*Green Eyes*, *Amagola*, *Yours*, *Tangerine*, and *Time Was*) are heaviest in nostalgia. Habitués of the band's favorite hangouts—Meadowbrook and what was then the Hotel Pennsylvania—will be amazed to hear how little the perky O'Connell style has been affected by the passage of time. *Green Eyes* still has that patented break in the voice toward the end of the chorus. Her unique rapport with the listener still lights up *All of Me* and the new lyrics written by Johnny Mercer for *Arthur Murray Taught Me Dancing in a Hurry*. Bob Eberly's voice has deepened without affecting the smoothness of his manner. Despite the fact that vocals predominate in this recreation, Dorsey fans will find the tape extremely handy in clarifying arrangements of exceptional taste and perception.

## Les Grandes Chansons Vol. 4/Jacqueline Francois

Columbia WS 326

Not the least of France's exports is the chanson—and the people who sing it. This release is part of an especially useful project that has already presented definite collections by such luminaries of the French popular song as Patanchou, Yves Montand, and Juliette Greco. Mlle. Francois, whose voice is the most luxuriant of the group, has under her jurisdiction some of the smoothest tunes Paris has made famous. A good indication of the care that has been lavished on this series is the orchestral accompaniment. Here the assignment went to composer-conductor Paul Durand who supervised Jacqueline Francois' first prize-winning recording. His

(Continued on page 81)



# Langevin

## Equalizing for Spectral Character

### MODEL EQ-251-A PROGRAM EQUALIZER

#### FEATURES

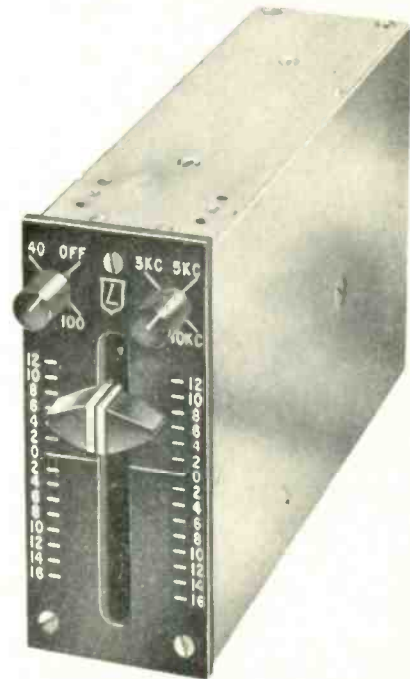
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The Model EQ-251A Equalizer is Langevin's miniaturization of an instrument that has long been standard for corrective equalization in recording and reproduction of sound. The diminutive size of this precision instrument permits mounting adjacent to mixer controls, thereby making possible multiple installations of several units in close proximity.

The Model EQ-251-A Equalizer's improved design features two sliding levers for equalization and attenuation. The perpendicular sliding action is more functional than rotary action, and facilitates reading of knob positions. Adjustable in 2 db steps at specified frequencies, with a range of 12 db maximum equalization to 16 db maximum attenuation, this instrument is an ideal tool for dubbing and frequency response corrections.

This assembly is a passive, L/C/R, bridged T network, and does not require power supply, tubes or additional connections. It can be inserted directly into a transmission line with only input and output connections.

Two rotating cam switches are provided on the face panel. The switch at the right gives high frequency equalization peaks at 3 kc, 5 kc, 10 kc or 15 kc. The left switch provides low frequency equalization peak settings of 40 cps or 100 cps.

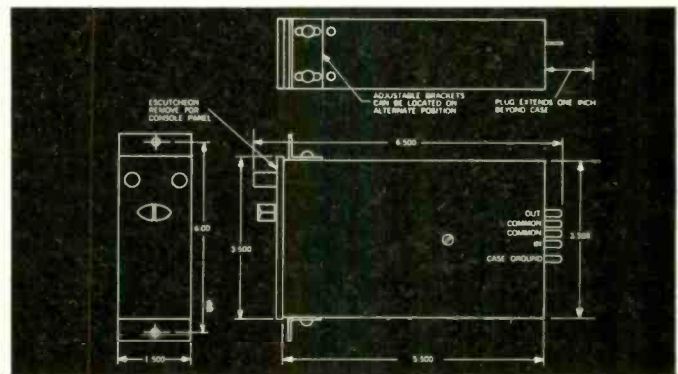
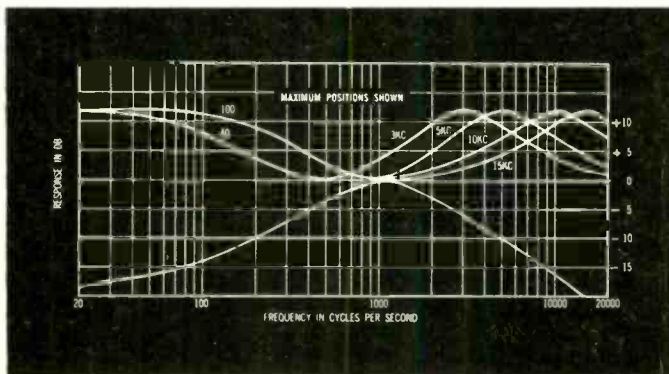


#### TECHNICAL SPECIFICATIONS

Circuit, Bridge T; Impedance, 600/600 ohms; Insertion Loss, 14 db; Input Level, minimum: -70 dbm, maximum: +20 dbm; Phase Shift, negligible; Power Requirements, none; Terminals, plug-in; Finish, black non-halation, satin finish, anodized aluminum with engraved markings. Chassis parts are nickel plate on brass. Dimensions, panel: 1½ inches wide by 3½ inches high; 5½ inch depth behind mounting panel.

#### ORDERING INFORMATION

MODEL EQ-251-A PROGRAM EQUALIZER, complete with female plug receptacle, mounting hardware and instructions; Weight, Net, 1¼ lbs., shipping 3 lbs. Price, Net, \$260.00



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# AUDIO ETC.

Edward Tatnall Canby

## WHAT NEXT?

Last week I had a pleasant lunch with two representatives of Allied Radio, the "biggest" big outfit in the electronics-and-hi-fi-by-mail business. (There's Lafayette and Radio Shack and more too, but I didn't happen to have lunch with them.) The first question these two threw at me was a poser. I had to order a cocktail first, before I tried to answer.

"What's going to be the next sensation in audio and hi fi?"

This from a sales outfit that has its fingers on every hi-fi pulse in the country!

Well, I said, I dunno. I've been wondering myself; I need material for articles. If the industry will oblige, I'll be all set to discuss whatever comes along next. But what?

Well, let's see. There's reverb. I'd say reverb is maybe here to stay (stay, stay, stay), but it's not exactly any longer a new sensation. Besides, I've written about that already. Nope, reverb isn't it. Not for next year, anyhow. So what else looms?

Let me think . . . how about stereo broadcast? Now there's something really hot. Well, yes, but . . . It might break any time, but that's what I thought a couple of years ago. I've stopped thinking about broadcast stereo, at least until the reconstituted F.C.C. digs its heels into the ground and begins pulling hard at the traces.

As everybody knows, stereo radio has been in the F.C.C.'s hands for these many months and until a decision is arrived at not a thing can be done other than the now-usual provision of optional plug-in multiplex facilities on FM tuners. Optional, when and if. Until the basic conflict is resolved between the background music services that use multiplex (and send out "good music" on their main channel, paid for by the background corn) and those who want no-compromise, all-out high-quality multiplex stereo, we all are going to have to wait. Even, the helpful industry panels on the subject, set up to aid the F.C.C. in the electronic jungle, can't precipitate the final decision. They, too, must wait, and perhaps it was just as well they were given plenty of time for their very complex and contentious fact-finding jobs. The whole area of discussion is one of genuine complexity and of reasonable and legitimate interests that are in technical competition. The F.C.C. decision is going to be a tough one, any way it comes. So—

If stereo radio breaks this year, it will surely be our main hi fi and audio sensation. There's enough right there to keep hundreds of thousands of us busy, from manufacturers right through to stereo programmers on the air.

If not that, then what? Well, there's that Columbia-3M miniature tape "cartridge" still on the books, an unknown quantity that will not appear at least until

this summer, if then. It still packs explosives, if only by being revolutionary in technique. New speeds, new tape size, new heads, new tape (yes, even the tape is being overhauled), a whole new step towards new ratios between mechanical tape speed, track-size, and available sound quality.

Maybe the little cartridge won't bowl over hi fi, and in any case it is inherently a mass product, I'd say, rather than a component hi fi item. But wherever it goes, its technological implications are bound to be great.

Perhaps any sensations resulting from this development will be for year-after-next.

So then—what? I've already suggested that this year's tape sensation ought to be—and may well be—two-channel home recording, via four-track tape machines.

The machines are now out in force and more are coming. The bugs will blossom and fade, the public will begin to catch on, and two-channel-in-the-home should soon be worth talking about, too. But as of right now there is merely the machinery, not the understanding of home possibilities.

Take, for example, a notable European four-track recorder now widely sold that offers full stereo recording in the home on two channels—via a single joined mike, its dual units permanently fixed at a given angle within the same case. This seems to me a singularly unimaginative approach in view of the immense versatility in the home offered by two mikes, separate, free, movable, for close-up dual recordings of dozens of sorts. See the February issue.

And so, what else?

Well, you've got me. The old rumor trail, the department of Scuttlebutt, hasn't brought me a thing of real note lately—but then I didn't get out to the West Coast for the big shows, nor am I a Chicago fan. So maybe I'm just a week or so out of date.

By next week, I'll bet, the 1962 sensation will hit me full in the face. Wonder what it'll be?

P.S. 1964? Well, that's easy. How about some really miniaturized components, out of Space Technology, on the order of those match-head component assemblies and matchbox modules now being turned out under governmental auspices? Tremendous possibilities here for us in audio and home hi fi, though I hastily add, in forms much modified from those useful in space vehicles and missiles.

We can use the tiny components, but our space requirements are relatively light and we appreciate low cost where the government can't even think about it. Just where the match-head devices will be useful in home audio will have to be determined—with a lot of imagination and plenty of planning. But the mere sight of a pair of binaural glasses with a complete audio system built into each arm of the spectacles is enough to make my mouth water—for a stereo amplifier in a cigarette case.

How would you like to own a portable stereo playback system for tape recorders that would, perhaps, incorporate (here's a free suggestion) a KLH-type miniature-speaker system, two shoe-box cabinets, separate (for necessary separation), in each of them a built-in power amplifier of generous wattage and about as big as that cigarette case? I'd like it. I need it.

No point in going into further possibilities at this stage, but let's keep eyes and ears open for useful miniaturization in audio. There'll be a lot of it, sooner or later.

## "ELECTRONICS"—

### A SIDE-REVIEW

Elsewhere in this issue Harold Lawrence has written at length on a new all-electronic taped piece of music by Remi Gassmann and Oskar Sala, on which the recent and sensational ballet "Electronics" was based—the ballet choreographed by Balanchine and "created" in actual sound via Stu Hegeman's equipment. I was not privileged to hear the electronic preview of the music, but I did go to the premiere of the ballet itself. I found it so tremendously important, from many viewpoints, that I am appending here some first-off comments on my own, to supplement Mr. Lawrence's authoritative article.

Let me divide my reactions into two categories. They'll overlap, but no matter. Aesthetic. Technical. Aesthetics will come first.

This ballet score was "composed" in Germany, at the sound studio of Oskar Sala in West Berlin, assembled from sounds produced wholly electronically via an instrument called the "Studio Trautonium," which I gather is the equivalent of the American RCA Music Synthesizer in its Mark II version. No "concrete" or actual sounds were used; all was synthesized and directly recorded on tape. The end-product was presumably produced, from Mr. Gassmann's directions, via complex mixing and rerecording. The music at the ballet premiere was obviously heard via at least two tracks (*Ah!—so I thought at the time.*) but could have been on many more, maybe five or ten, for all I could tell in the actual performance. That was one of its intriguing aspects. A whale of a sound-curtain.

### Trombones and Trumpets

My first point is that in spite of its all-electronic nature, this electronic score struck me in the listening as more like the sound of "live" music than any "tape music" I've heard to date—in fact I was astonished and a bit nonplussed. I'm not entirely sure this is what I would have expected.

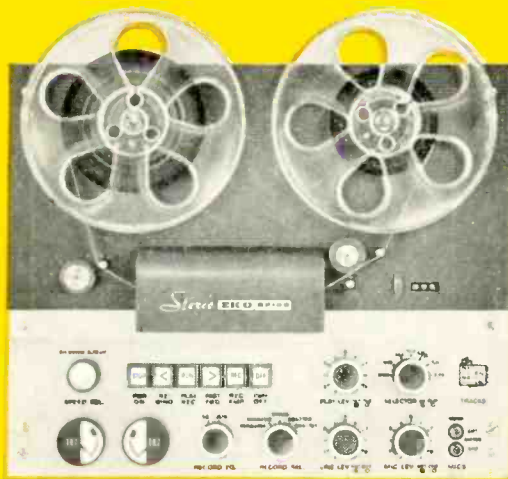
I'm always leary of imitation in taped sound. The most important attribute it has is its very freedom from the effects and sounds of "live" music, so why "imitate" them? An interesting question.

Anyhow, in this ballet "Electronics" I was really amazed to hear—or seem to hear—a sort of supernatural "super" orchestra. Darn it, you could hear trombones and trumpets, oboes and strings, triangles, percussion!

Not literally, of course. Most of these sounds were actually a kind of suggestive cross between four or five instruments; only the trombone noises really seemed almost literal, every so often. I don't mean that you would confuse this taped sound for that of an actual orchestra. But somehow, the sound of an orchestra, the sound of live music, was incorporated in it. And



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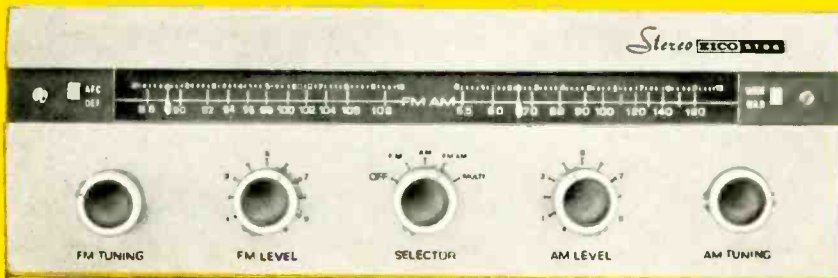
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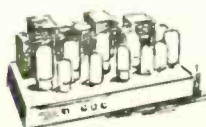
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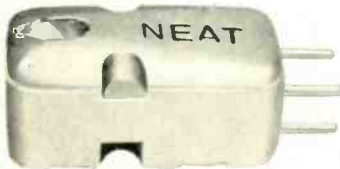


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# NEAT

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this, I felt, was in radical contrast to that dead, synthetic, "loudspeaker" sound that we are already much too familiar with in many an earlier example of taped "music."

This sound was extraordinarily un-electronic, then. But it did, without any question, serve as a glorious imitation of many an aspect of literal, acoustic music. And this poses some vital aesthetic questions. Should electronic music sound like regular music—even merely by suggestion?

Well, by doing so it insures a big impact on a present-day audience. No question about it, this music was immediately impressive because to the audience it sounded like music, not like electronics. I mumbled to my companion, in a brief lull part-way through, that I'd bet the ballet would be a hit—it was so "conventional." It was a hit. At the end, the audience yelled and stamped and shouted bravo, until the lights went up in its face.

### The Built-in Concert Hall

There's more to this. Yes, the score for my ear did have a peculiarly orchestral sound and was in that sense conservative. If you doubt it, just try a really radical electronic work, say, one by Edgard Varèse. There is not the slightest suggestion of any "orchestra" or any ordinary musical sound! He works in a wholly new world, doesn't even use the word "music" but prefers (in order to bypass arguments) his own term, "organized sound." In contrast, "Electronics" is much closer to normal, standard, "regular" music. Other elements of the score reinforce this conservative pattern. Notably, *reverberation*.

Now here is a fine aesthetic poser: We all know that reverberation, as of an enclosed large hall, seems to add a lustre and realism to music. The proper amount of liveness varies greatly from one type of music to another, from one person's taste to another, from one *period's* taste to another. (In the 1930's, recordings were far less live than they are now.) But with all this variation, liveness remains as an essential in "ordinary" music and in recorded sound, because in the last analysis music was composed to be played in an enclosed space—most of it, anyhow—and we are therefore accustomed to reverberation as a normal attribute of musical sound.

But all-electronic sound is something else again. Should it be "reverberated"? Is there any aesthetic reason at all for creating a "space" in which a purely synthetic sound seems to be occurring—except the same old reason, to make it sound like familiar music, to make it resemble what it is not?

I was impressed, when "Electronics" got under way at the ballet premiere, to discover that the huge sounds we were hearing were not only spread out, via an array of big speakers, but were merged solidly into an unbroken sound-curtain that extended far beyond each side of the stage. (Two pairs of speakers were located beyond the proscenium arch, out on the sides. There must have been others, either backstage or in the orchestra pit out of my line of sight.) No pinpointing of the sound, at "speaker A and speaker B." No ping pong. This was genuine superstereo, synthesized.

And moreover, as the ballet continued I was startled to realize that the entire music occurred within a huge space that, to the best of my observation, was far larger than the actual space within the City Center theatre—a second "space" created for the ears within and beyond an already-large listening hall. A huge "hole in the wall."

This must have been achieved by re-

corded reverberation, multi-track. That was my conclusion. It's possible, I thought, that I'm hearing merely the normal reverberation in this quite-large auditorium. But experience with the relatively picayune live orchestra (only a few moments before) seemed to deny this strongly. Live music in that theatre is relatively unreverberated, theatre-style rather than concert-hall. My conclusion—without factual evidence—was that this electronic score had its own built-in concert hall, via added reverberation.

### Neo-Post-Romantic

You see what a nice aesthetic problem this poses. Here is a score that: (a) sounds like a sort of "super" orchestra, an imaginative recreation of live musical sound, and (b) sounds as though it were being "played" in a hall like real music. Two strongly conservative tendencies. And there's a third, even more fundamental. How about the actual "music" itself, the so-called "score"? What is its musical language, its structure, themes if any, harmony if any? Radical? Not so radical?

As a music critic I can answer this quite positively. Not so radical. In fact rather strangely conservative. To tell the truth, I thoroughly enjoyed the pseudo-orchestral effects and marvelled at their lively and convincing complexity. I was really thrilled by the expertly managed effects of reverberation, whatever my doubts about its ultimate suitability in the music of the electronic future. But when it comes to the music itself, I was less happy.

Indeed, in view of such extraordinary technical virtuosity, I heard this score as oddly conventional, even old-fashioned. Skillfully, imaginatively so, without a doubt, but still a re-make in electronic terms of ideas, musical ways of thinking, that could, almost be called time-worn. Hard to believe, but it's not the first time I've run into this.

You won't believe me, of course. *Conservative*—that screaming, booming whirlwind of taped sonics? Yes, I say. It was specifically conservative: the general impact was not so much of the present as of the post-Romantic period centering on the early 1900's. I thought first of Respighi, then of Richard Strauss (in his early works). The sounds were big, lush, overblown, as of that period in the past.

There was even a "motto theme"—it was gently borrowed, note-for-note, from some ultra-familiar big piece that for the moment I can't put my mental finger on; I was humming it for hours afterwards trying to locate the "original" in my mental filing cabinets. No matter—this "motto" was right out of the late 19th Century and early 20th, in sound, in its treatment.

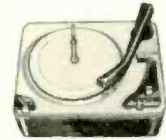
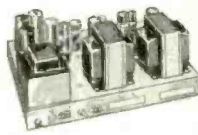
There were not only electronic trumpets but rather conventionally fanfare-like big trumpet calls. There were "choirs" of pseudo-instruments, acting much like the elements in a large orchestra—that is, a somewhat old-fashioned large orchestra. The whole "orchestration" was strongly suggestive (again, with much imagination) of a particular sort of "live" music, a particular period, as opposed to many another period-style. (Definitely not Mozart, and not at all Stravinsky, for instance.) And this in spite of plenty of outward "dissonance" and sonic complexity.

There were themes, musical motives; there was even much distinct harmony and occasional key-sense, in the post-Romantic manner. And this in a medium that was heavily promoted, you see, as having no connection with any actual, living, acoustic sound, let alone any musical sound.



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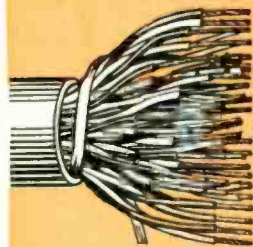
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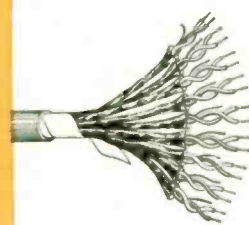
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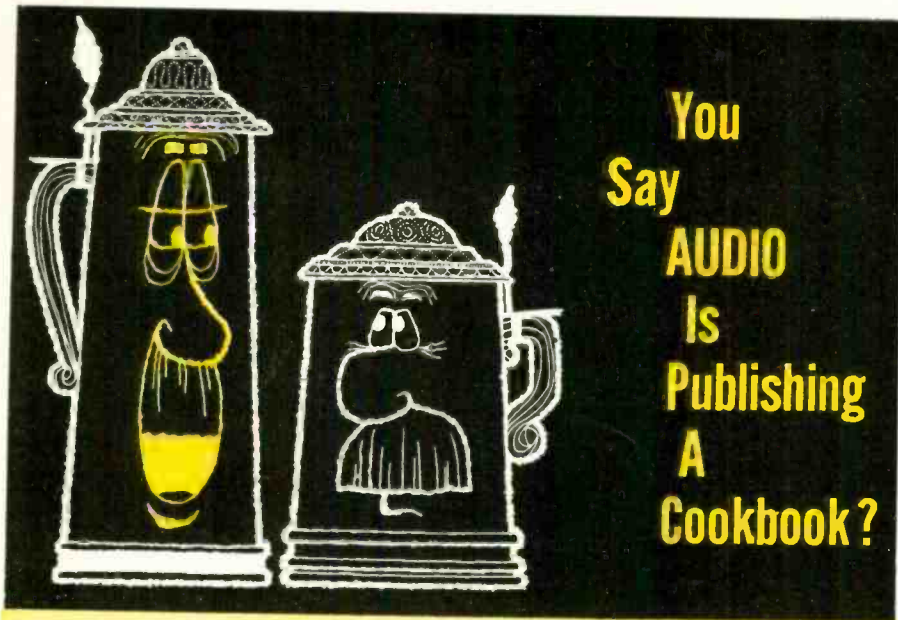
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You Say  
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Publishing  
A  
Cookbook?

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

You may ask...why?

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

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

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

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

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

push himself away from the table before upsetting the daily calorie count."

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

LAKE TROUT BAKED IN WHITE WINE

Remove heads and tails from a 2-pound fish. Split open down back and rinse well. Remove backbone and rub inside with lemon salt, pepper and thyme to taste. Knead 1 tablespoon of butter and anchovy paste the size of a large pea, placing mixture inside fish. Place fish in a greased baking pan and cover with 1/4 cup of white wine. Bake 25 to 30 minutes in moderate oven, 350 degrees. Baste frequently. Garnish with parsley and lemon and serve with plain boiled potatoes.

ADIRONDACK APPLE PIE

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

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

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



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Thus I suggest that this "Electronics" is a work of virtuoso conservatism. And I predict that it will be successful on these very grounds, constructively, usefully so. After all, conservatism means the conserving of things judged worth keeping. "Electronics" is a forward-looking conservatism. It makes highly imaginative and very skillful use of the familiar elements that most music listeners (and ballet-goers) find natural and satisfying. If it is a compromise, then it is a currently practical compromise. By now it is about time somebody showed that electronic sound is versatile enough to rival real orchestral sound! This does it.

If reverberation is an essential for practically all our present music, if liveness makes the ear grow fonder—if a reverberated sound seems somehow more "natural" to us than a non-reverberated electronic creation—then let's use reverb. At least for the present, until it can be retired as a transition substitute, or integrated finally into electronic music as one of its technical sound resources. And if post-Romantic music à la Respighi is at the moment a suitable base-idiom for demonstrating the skill and the scope of electronic sound, then by all means let's use it. For the present.

Only one more comment under aesthetics. The ballet. This music was "composed" first; the ballet came later, choreographed by that old ballet pro, Balanchine. (Indeed, rumor told me that the ballet production was actually put together at the last moment in typical artist fashion.) To the electronic score Balanchine added an "electronic" ballet, danced however by strictly non-electronic human beings, every one of whom had two recognizable arms and a pair of legs, dressed up in white undies (white skin-tight leotards). Towards the end, black human figures came on briefly. The stage setting was highly "synthetic"—a forest of huge cellophane-like stalactites vaguely waving in the breeze, plus weird, interplanetary lighting. But the dancers, were just dancers, so to speak.

How did the visual ballet go with the audible sound?

Well, for the first few minutes I was bothered by these quite obviously un-electronic dancers. They should have been spacemen or something, with five legs and six antennae apiece. Not far-out enough, I thought.

But before long, as I began to digest the electronic music itself, I felt very differently. Old Balanchine, that infallible choreographer of new music, had hit it exactly right. He combined "electronic" innovation in the dancing with standard, human-like movement, in proportions just right for the music. It was a conservatively modern dance sequence, in a violently modern stage set—precisely as the music was conservative in idiom in a violently modern setting, electronic sound. Balanchine, I thus suspect, heard what I have heard, that there were many conservative elements in this mainly radical score.

Maybe the French weren't as illogical as they seemed when they named a political party the "Radical Conservatives." In electronic music I'd say there was a big place for radical conservatism.

Audio's Baby

On the technical side, I can sum up my personal reactions to "Electronics" on points, and I'll bet they agree with most other opinions you'll run into. I'll do it in number-style.

(Continued on page 78)





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AKG's D 19 B Dynamic Cardioid, shown here in three enviable situations. It meets every mood of the serious tape fan, from Liebeslieder to "le Jazz hot" — from family-party recordings to tape letters. In the hand or on a stand, D 19 B is truly a maid-of-all-work, ready for any challenge.

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# EDITOR'S REVIEW

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## SHOW COMMENTS

**B**y the time this issue is in the hands of readers, the two West Coast High Fidelity Shows—San Francisco and Los Angeles—and the 1961 International Audio Exposition, which is the new name of what has heretofore been known as the London Audio Fair, will be past, and the memories they invoke will remain with most of us during the rest of the year. We trust that those who attended these three shows will have pleasant memories and will feel that they spent a few worthwhile hours in the halls of sound.

One of the greatest dividends accruing to the manufacturer—either of equipment or of magazines and books—is the opportunity to discuss with customers those problems which may have come up since the last time we saw them. Some of these problems may be the result of some deficiency in the products themselves, while others may be the result of some constructive thinking on the part of the customer as to how he may use the products to his own advantage. We know, for example, that as “manufacturers” of magazines we are able to keep a “finger on the pulse” of the reader to a better degree than if we simply sat in our ivory tower and dreamed up our articles or picked them indiscriminately from those which are proffered by enthusiastic experimenters and home constructors. We learn, among other things, what readers want in their magazine, how they want the material presented, and where we may have been remiss in past months. And in addition, we glean glimmerings of ideas which lead to a still more interesting editorial content. On the whole, we feel that shows are well worth the time and expense to us for these reasons.

By the same token, manufacturers of equipment can also gain a lot from direct contact with their customers. It is quite possible that the relatively high quality of component high fidelity equipment is the result of a closer contact between manufacturer and user than can possibly exist in industries where the customers never get an opportunity to talk over their likes and dislikes with those responsible for the product.

In San Francisco, the event combined the high fidelity show with a home show, with a reported turnout of some 37,000 people. Undoubtedly many of them came on account of the home show, but while they were there they walked through the high fidelity section, and this is one method of introducing component high fidelity to people who didn't think they were sufficiently interested in hi-fi to go out for that reason alone. The arrangement of the booths was essentially the same as that employed in the 1960 Show, and for a non-permanent set-up it was excellent. Unfortunately, when most buildings large enough to house a hi-fi show were built, no one had the foresight to envisage the type of structure which would be required. Think what we could do if we were to design

a building exclusively for this purpose today. In the meantime, we must continue to use the best available facilities, present our products in the best way we know how, and then hope that we may engender sufficient interest that the attendees will visit their dealers for a more thorough demonstration in more suitable surroundings and in a more leisurely manner.

In Los Angeles, the IHFM-presented show returned to the cottages at the Ambassador Hotel—which in our opinion provide the best facilities of any we have attended in the United States. Taking its cue from the excellent facilities, the weather provided a perfect setting during the show. From the preliminary reports we have received, audiofans welcomed the fortuitous combination of weather and location in sufficient numbers to produce an optimistic attitude in the exhibitors.

## AWARDS

While we are mentioning attitudes, we would like to extend our humble thanks to the IHFM for the award presented to us during the Los Angeles show “for outstanding contribution to the high fidelity industry.” We take this method to thank them because we were not in Los Angeles when the award was presented—and, as we noted before, editorial policy evolves as an interaction between the readers and the editorial staff. Consequently we offer our own award to the readers of *AUDIO* “for outstanding contribution to the high fidelity industry.”

## NEW SHOW FORMAT?

There are always some who feel that Shows as we now know them have served their purpose. We are not among this number. Shows are undoubtedly expensive for the exhibitor, and since no equipment is sold directly at the shows, it is very difficult to assess the over-all advantage of the show until perhaps several months have elapsed. Possibly some modification of the show format could be adopted which would permit the on-the-spot sale of equipment, either by having dealers' salesmen on the floor to help out manufacturer personnel in closing sales right then and there, or by making direct sales by the manufacturer to the pro-rata credit of the dealers in the area. In the days of the automobile shows, there were always salesmen on the floor—not just demonstrators or the actual designers—and each one had a pad of order blanks in his pocket.

We might just take a few hints from the automobile industry—after all it doesn't do too badly.

## LONDON

We *did* finally find an excuse to go to London for the show, and a full report will follow in the June issue.



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## WE'RE REACHING INTO SPACE

Bell Laboratories research with chilled ruby amplifiers speeds the day we may telephone via satellites

A strange combination of Nature's forces at Bell Laboratories foreshadows the day when world-wide phone calls may be relayed via man-made satellites orbiting the earth. It is a union of synthetic rubies and extreme cold, making it possible to amplify microwave signals from these satellites clearly.

Synthetic rubies possess an extraordinary property when deeply chilled and subjected to a magnetic field. They can be excited to store energy at the frequencies of microwave signals. As a signal passes through an excited ruby, it releases this energy and is thus amplified a thousandfold.

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cathodes or hurtling electrons that generate noise in conventional amplifiers. It is so quiet that only the noise made by matter itself in heat vibrations remains. But at a temperature close to absolute zero, this also is silenced. Even very faint signals from satellites can be clearly amplified and studied for their possibilities.

Bell Laboratories scientists were first to discover that matter itself generates electrical noise. They also discovered that stars send radio waves, and thus helped found radio astronomy. It is particularly fitting that the same scientists, in their endless research on noise, should now battle this number-one enemy of telephony in the dramatic new field of communication via satellites. The ultimate goal, as always, is the improvement of your Bell System communications services.

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# Feedback Techniques in Low-Level Amplifiers

DONALD L. SHIRER\*

Although more widely used than in previous years, feedback in low-level amplifiers is still not used as widely as its' advantages would indicate. For those "on the brink," here's as persuasive argument for—plus a large helping of how.

IT IS CURIOUS in this day when the principles of negative feedback are almost universally used in audio power amplifiers, to find that there seems to be some reluctance to apply them to the lower-level stages of the amplifier chain as well. Perhaps there may be some justification for this, since one of the principal uses of negative feedback is to reduce distortion, and low-level stages do not distort the signal as much as amplifiers which must handle large signal voltages, but this is only part of the story. By judicious choice of the feedback paths and components, not only can distortion in the output signal be reduced, but the frequency response can be controlled, the effective input and output impedance of the amplifier may be changed and *at the same time* the circuit may be adapted to other functions such as mixing or tone control. The price that must be paid for this flexibility is a reduction in amplifier gain, which sometimes (but not always! . . . see the discussion on equalizers) necessitates an additional amplifying stage at a slight increase in cost and complexity. However, this is usually far less significant than the advantages gained through the use of feedback.

Only so-called negative feedback will be discussed here, and its application to units which are primarily low-level current or voltage amplifiers. It is assumed that these units either themselves accept an audio-frequency signal from a microphone, pickup, or other transducer and deliver an amplified (and perhaps modified) signal at a higher level that can be fed to a power amplifier, or else that these separate units may be combined into a more complex preamplifier which performs this function. We thus regretfully ignore here the many interesting applications of feedback to oscillators, relaxation circuits, and to amplifiers designed to handle extremes of frequency at either end of the audio range, which are best treated in a more rigorous

manner. At audio frequencies, we can gladly simplify our calculations to neglect such complications as circuit and tube capacitances, and treat transistors and vacuum tubes as "perfect" amplifiers having a gain independent of frequency. Although the consequences of such a sweeping assumption would

usually be drastic in power amplifier design, I have rarely encountered stability troubles from this particular simplification in preamplifiers, and even if they arise, they may generally be eliminated without radical redesign of the circuit.

## Basic Feedback Circuits

Two feedback circuits are shown in Fig. 1, in which the triangular block represents a "perfect" voltage amplifier whose voltage output is  $A$  times the input signal voltage,  $v_i$ , over the entire audio frequency range. This amplifier may be a single vacuum tube, several R-C coupled tube stages or even a "black box" exhibiting the specified raw gain  $A$ . In (A) of Fig. 1, a certain fraction  $\beta$  of the output voltage,  $v_o$ , is fed back to the input of the amplifier through the voltage divider indicated by the rectangular box which is assumed to have an impedance much greater than the load resistor,  $R_L$ , so as not to overload the amplifier. The feedback voltage,  $v_f$ , is then inserted in such a manner that  $v_o = [A(v_i + v_f)]$  is less than the output ( $A v_i$ ), which would occur if the feedback path were broken. It is clear that you should not connect the feedback voltage so that it *increases* the output, or the increased output would cause a larger feedback voltage, which in turn causes a still larger output, which causes a bigger . . . , etc., and you soon have a dandy oscillator instead of an amplifier. With the proper connections, though, the amplifier soon settles down at its lower output voltage. Now  $v_f = \beta v_o = \beta A v_i + \beta A v_f$ , so evidently the condition that  $v_f$  oppose  $v_i$  (that is, be out of phase with  $v_i$ ) requires that  $\beta A$ , the gain "around the feedback loop" be negative—thus "negative" feedback. If the voltage divider,  $\beta$ , consists of passive elements (resistors, capacitors, inductors, etc.) only, inversion of the signal cannot take place there, so either  $A$  must be negative, which is the same as saying that the amplifier contains an odd number of phase-inverting stages, or

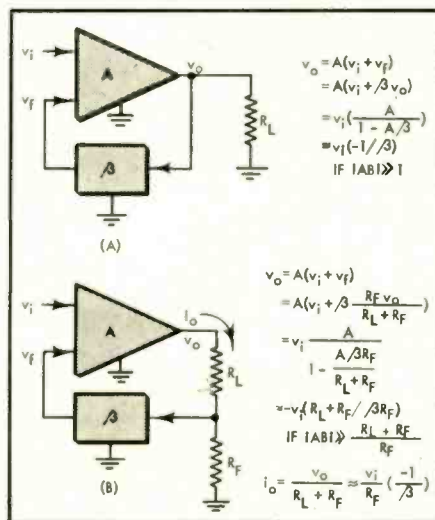


Fig. 1. Voltage amplifier.

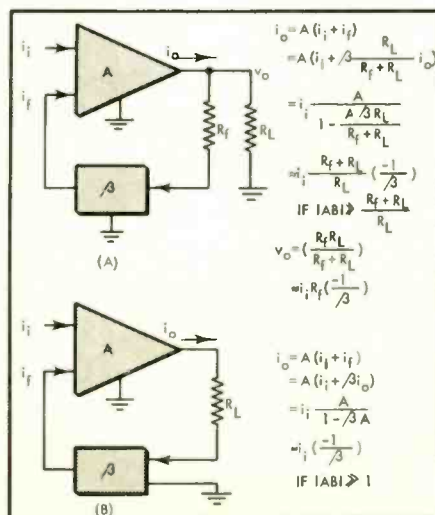


Fig. 2. Current amplifier.

\* 1309 Fairlane, Valparaiso, Indiana.

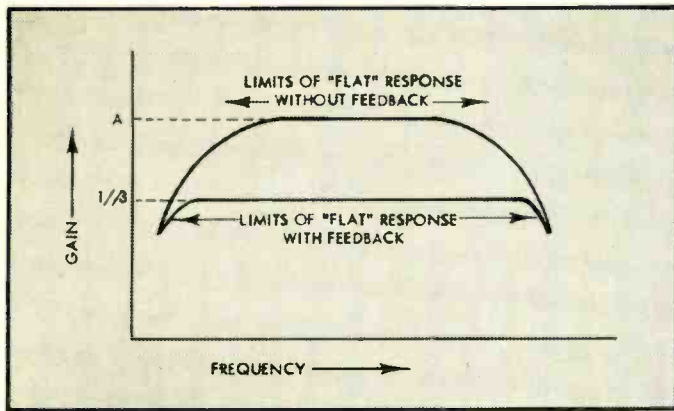


Fig. 3. Extension of frequency response with negative feedback.

else if an even number of stages are used, the feedback signal must be inserted at a point where it will produce the effect of an input signal of opposite sign, usually at the cathode of the first stage. (For this criterion to be applied, remember that cathode followers and grounded-grid amplifiers do not invert the signal.) Examples of both types of amplifiers will be given later. This connection is known as parallel, shunt, or voltage feedback.

Series or current feedback is shown in (B) of Fig. 1. Here the output current passes through a resistor  $R_f$  which converts it to a voltage signal (usually  $R_f \ll R_L$ ), then through the voltage divider,  $\beta$ , to a point in the amplifier which will provide the proper negative feedback polarity. In either case, if the amplifier gain is sufficiently high, it drops out of the equation for the total gain when feedback is included, as does any mention of the load resistance, so that we have "stabilized" the gain against changes in vacuum tube  $\mu$  or changes in the load resistance. The factor  $\beta$  can be rather small (if  $A$  is large enough) without violating the simplifying condition  $A\beta \gg 1$ , so that the gain, including feedback, which depends on  $1/\beta$ , may be quite large. The difference between the two cases appears in the equations below each figure. It is evident that for (A) of Fig. 1 it is the output voltage which is a stabilized function of the input voltage. Voltage feedback has thus made it appear as though this amplifier has a very small effective output impedance, so that  $R_L$  may be varied without affecting  $v_o$ , as long as it is not so small that greater output currents are demanded than the output stage in the amplifier can supply. On the other hand, the current feedback in (B) of Fig. 1 stabilizes the output current, so that now the amplifier behaves as though it had a very large output impedance. The change in output impedance in each case is in about the same ratio as the reduction in gain caused by the application of feedback. (See Appendix I.)

The same two feedback configurations

can be applied to amplifiers incorporating transistors, or any "black box" in which the current output  $i_o$  is  $A$  times the current input  $i_i$ . In (B) of Fig. 2, a certain fraction,  $\beta$ , of the output current is extracted by means of the low-impedance current divider indicated by the rectangular box, and fed back to the amplifier in such a manner as to oppose the input current.

In (A) of Fig. 2, the output voltage is converted to a current by placing  $R_f$  between the amplifier output and the low-impedance input of the current divider, then a fraction,  $\beta$ , of this current is fed back to the input. Again voltage feedback stabilizes the output voltage ((A) of Fig. 2) and lowers the output impedance of the amplifier; current feedback stabilizes the output current and increases the effective output impedance as in (B) of Fig. 2.

#### Stability Considerations

If the divider network,  $\beta$ , contains only resistive elements, the adjusted gain of the amplifier including feedback will be flat over a range greater than that of the amplifier itself. This is so because even though  $A$  is decreasing at the extremes of the frequency range, the adjusted gain will not seriously decrease until  $A$  becomes comparable to  $1/\beta$ . The adjusted gain will then drop off with further fall in  $A$  itself somewhat as shown in Fig. 3. Phase shifts in the output voltage always accompany this de-

crease in  $A$  at high and low frequencies, but should not contribute to instability in properly-designed amplifiers. Proper design in this case usually amounts to little more than making only one R-C coupling element contribute to the amplifier droop at low frequencies and one other network cause the high-frequency rolloff.

In the typical flat amplifier shown in Fig. 4 for instance, the time constant  $R_3C_3$  is made, say, five times less than  $R_1C_1$ ,  $R_4C_4$ , or  $R_5C_5$ , so that the first coupling network contributes most of the low-frequency droop in the amplifier response. The high-frequency loss is limited here by all the tube and circuit capacitances. To ensure its proper "ruin" by only one R-C network, a small capacitor,  $C_2$  may be tied across  $R_2$  to start drooping the amplifier's gain above 20,000 cps or so. These simple expedients will generally suffice in the great majority of preamp circuits.

Adding capacitances or inductances to the current or voltage divider,  $\beta$ , will enable you to produce an amplifier having a frequency-varying gain which is dependent only on the feedback network. Several voltage dividers are shown in Fig. 5, accompanied by sketches of the behavior of their division ratio,  $\beta$ , and the total amplifier gain,  $1/\beta$ , as a function of frequency. Remember that in order for the adjusted gain to be given by  $1/\beta$ ,  $A$  must be several times the highest value of  $1/\beta$  over the desired frequency range (if you measure gains in db,  $A$  must be approximately 6 db more than the maximum value of  $1/\beta$  for the approximation to hold). Since the impedance of the divider circuit will probably also change with frequency, be sure that your voltage dividers have high impedances and the current dividers low impedances compared to the impedance level of their associated circuits. A single R-C network will give slopes up to 6 db/octave on the gain curve, and the responses can be easily sketched by joining the flat portions and the 6 db/octave slopes with smooth curves near the crossover frequencies.

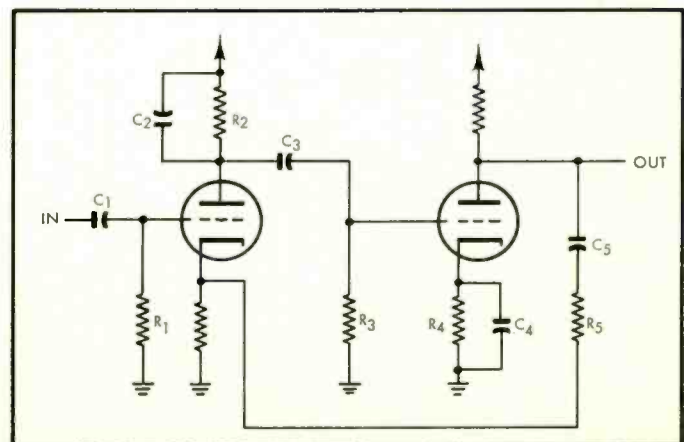


Fig. 4. R-C coupling networks in typical feedback amplifier.



Networks of this type can obviously be combined to form quite complicated frequency response curves which are useful in equalizers and tone-control networks. Inductances are not usually used in feedback networks because of their size, weight, cost, and tendency to pick up hum if not well shielded, but R-L-C circuits can give much sharper slopes than a single R-C network. For instance, the feedback divider shown in (D) of Fig. 5 was found to be useful in designing an equalizer for a tape recording amplifier needing considerable treble boost around 15,000 cps. Several other types of feedback networks are considered later.

So far, nothing has been said about distortion reduction, though it is fairly

easy to show (see Appendix II) that the distortion produced by the amplifier without feedback is reduced by the same factor  $(A\beta - 1)$  as the gain when negative feedback is applied. It is true that some additional higher-order harmonic distortion may arise because the feedback allows the initial distortion products to pass back through the amplifier, but the usual low-level amplifier has only a small degree of distortion to begin with, until overloaded, so that the higher-order distortion products are nearly always negligible.

#### "Flat" Amplifiers

Dynamic microphones and many types of vibration transducers produce signals in normal use of about 1 mv or smaller,

and demand "flat" amplification up to a level of at least 0.2 volts before the signal can drive most power amplifiers to full output. While part of this amplification may be provided later, generally it is wise not to insert level or tone controls until the signal level is brought up to 0.1 v or so, to avoid hum and noise pickup in an excessive number of low-level stages. It is usually worthwhile to expend considerable effort to avoid noise in the input stages so that the amplifier may handle as wide a dynamic range as possible.

A transistor circuit which has shown considerable adaptability as a low-level amplifier for medium-to-low impedance inputs is shown in Fig. 6. Without the feedback path (F-F in the figure) it has

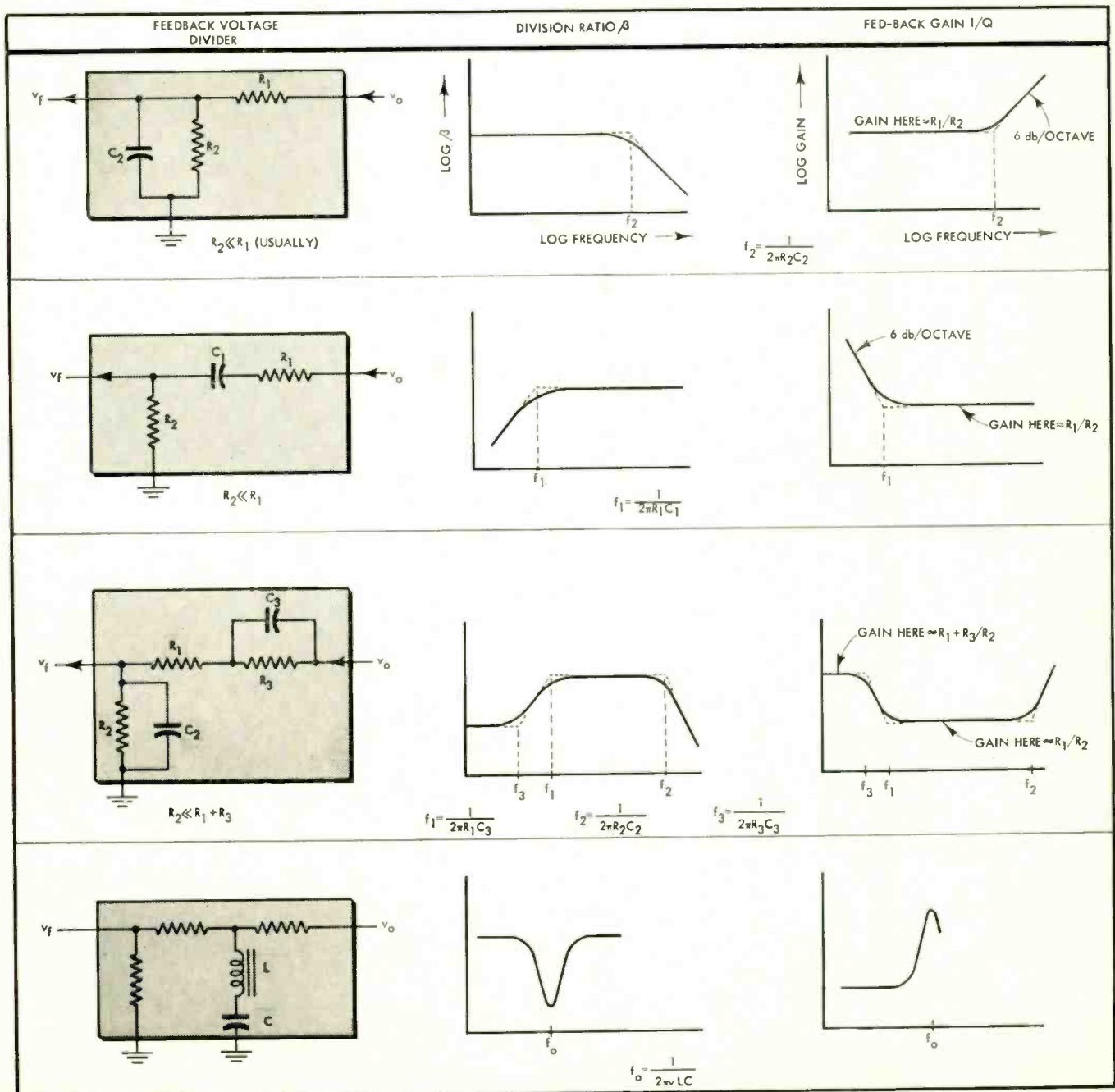


Fig. 5. Gain curves produced by sample feedback dividers.

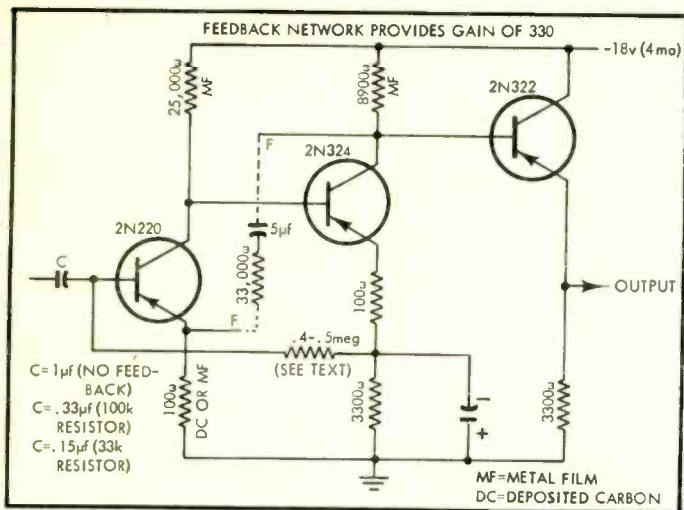


Fig. 6. Low-level transistor pre-amplifier.

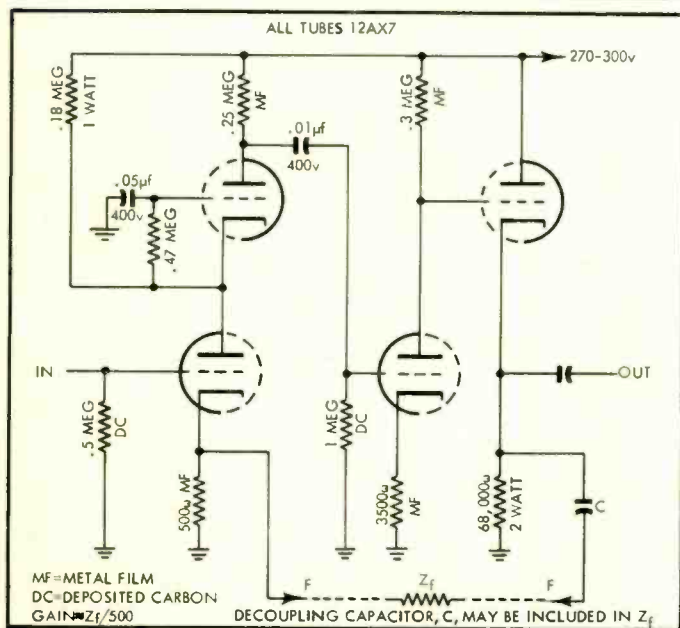


Fig. 7. Low-level vacuum-tube pre-amplifier.

a gain of 69 db. About 6 db of this is used for local feedback, by means of the unbypassed emitter resistors in each stage, which acts to improve the stability of the bias levels as well as providing some distortion reduction. D.c. coupling after the input capacitor leaves only the R-C time constant in the second emitter circuit to provide the low-frequency cutoff, but also demands an inner d.c. feedback path back to the first base to stabilize the bias potentials on the two grounded-emitter stages. The inclusion of three local feedback paths in addition to the over-all feedback loop makes this circuit rather insensitive to different transistors, although for optimum results the first base bias resistor (marked 0.4-0.5 megohms) should be adjusted to provide exactly 0.58 ma emitter current in the input transistor. The operating points are chosen for low transistor noise, although this will also depend on the impedance level of the input signal. An input impedance of 1000 ohms will produce the best signal-to-noise ratio in the 2N220 stage, but a 250-ohm microphone can be di-

rectly connected to this stage with a loss of only 2.5 db in signal-to-noise ratio. This will entail no loss in gain since the effective impedance of the first base will be raised by the over-all feedback up to a value in the range 10-50,000 ohms. This amplifier can provide an output for almost four volts into a 10,000-ohm load without clipping, giving a great overload reserve and eliminating the need for a volume control at the preamp input. The frequency response is flat from below 15 cps (which is "all the further" my oscillator goes) to 15,000 cps, where it is 3-db down without the over-all feedback path—supplying as little as 6 db or more of over-all feedback produces flat response to beyond 20,000 cps. The emitter follower is not strictly needed for most purposes, but serves to keep the output impedance low over the entire frequency range if the preamp is used as an equalizer, and can drive output circuit impedances down to about 3000 ohms without too much restriction on the output level. Low-noise metal-film and deposited-carbon resistors are used in strategic

locations, and the power supply was designed to be taken either from two 9-volt batteries in series, or dropped through a decoupling network from a higher-voltage supply.

Connecting a 33,000-ohm resistor between the points F-F effectively converts this amplifier into the circuit of (A) in Fig. 2. The divider consisting of the 33,000-ohm and 100-ohm resistors provides the negative voltage feedback which is properly applied to the first stage emitter since there are two (an even number) phase-inverting stages in the feedback loop. Neglecting the shunting effect of the first transistor's base resistance, the dividing ratio,  $\beta$ , is approximately  $100/33,100$ , giving an adjusted gain ( $1/\beta$ ) of 330, or about 50 db. The gain reduction is thus 69-50, or 19 db, a factor of 90 times, which serves

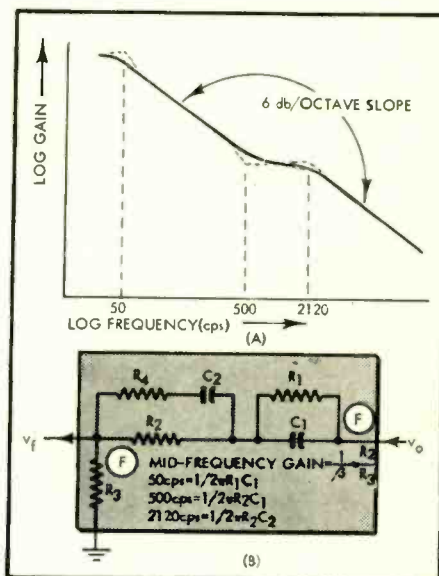


Fig. 8. RIAA playback curve with required network.

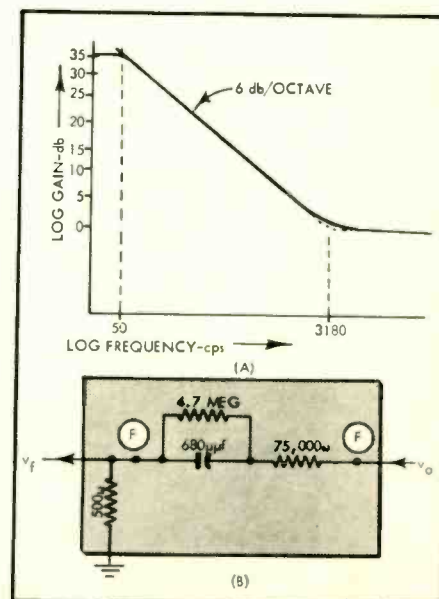


Fig. 9. NARTB playback curve and required feedback network.



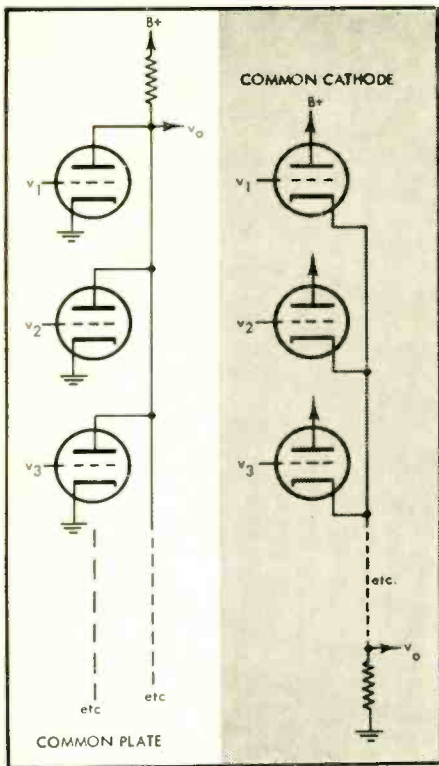


Fig. 10. Summing chains.

to reduce the output impedance and harmonic distortion figures by the same ratio. Many people will refer to this as "19 db of feedback"—a convenient shorthand phrase. In this amplifier it makes the harmonic distortion unmeasurable if the output is below 1 volt. Exceptionally low-level microphones may demand a gain of 60 db, which may be obtained by a division ratio of 1/1000, that is, by replacing the 33,000-ohm resistor with one of 100,000 ohms. There is still 9 db available for distortion reduction, although now the input impedance has come down to about 6000 ohms. This variation should not be used with high-impedance microphones without a step-down transformer.

A vacuum tube preamp which may be used with crystal or other high-impedance microphones is shown in Fig. 7. A double triode is connected in the grounded-cathode grounded-grid cascode arrangement to provide a low noise level and at the same time a considerable gain in the first stage. One unusual feature is the 120,000-ohm bypass resistor to the plate of the grounded-cathode half of the cascode tube. This increases the current drawn by this section, raising its  $g_m$  and giving an extra 5 db of gain over an ordinary cascode circuit. The second tube is R-C coupled with a cascode follower direct-coupled to its plate to provide a low impedance output. The slightly higher raw gain of this circuit (84 db) permits a higher effective gain than the amplifier of Fig. 6 with the same amount of distortion-reducing feedback. For instance, a 0.5 meg feedback resistor will provide a 60-db gain (the

division ratio is 500/500,000) with a comfortable 24 db of feedback reserve. The feedback voltage is correctly applied to the cathode of the cascode stage since there are only two phase-inverting stages—the grounded-grid and cathode-follower tubes producing an output in phase with the input signal. To realize the low-noise possibilities of this circuit, it should be well decoupled from the power supply and d.c. should be used on the filaments.

#### Equalization

The previous amplifiers can easily be converted to phono preamps by adding frequency-sensitive elements to the feedback path to make the gain follow the RIAA playback curve, shown in (A) of Fig. 8. This has a 6 db/octave rise in the bass region with a turnover frequency of 500 cps, a treble turnover at 2120 cps followed by a 6 db/octave droop, and a bass plateau at 50 cps.

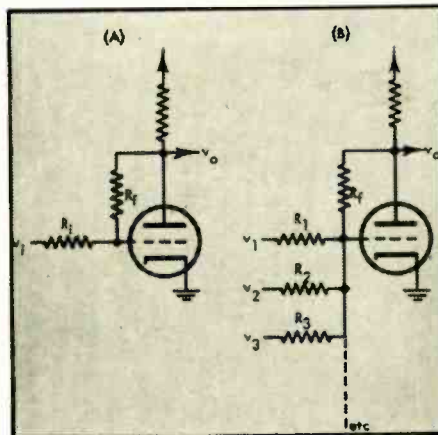


Fig. 12 Mixing amplifiers.

The divider network shown in (B) of Fig. 8 will produce this characteristic in a circuit with voltage-feedback. The elements between F-F would be inserted in place of the simple feedback resistor in Figs. 6 and 7.  $C_1$  and  $R_2$  produce the bass boost below 500 cps,  $C_2$  shunts  $R_2$  at high frequencies to produce the treble rolloff, and  $R_1$  limits the rise of the impedance in series with  $R_2$  to produce the shelf below 50 cps.  $R_3$  is a safety factor to reduce excessive phase shift and possible oscillations at very high frequencies. If it is chosen about  $R_2/20$ , then it only affects the treble response above 40,000 cps, well out of the audio range. Values for these components which seem to work well in the transistor amplifier of Fig. 6 where  $R_3$  is the 100-ohm emitter resistor, are, for a mid-frequency gain of 40 db:

$$\begin{aligned} R_2 &= 10,000 \text{ ohms} \\ R_1 &= 0.1 \text{ megohms} \\ R_3 &= 500 \text{ ohms} \\ C_1 &= 0.0032 \mu\text{f} \\ C_2 &= 750 \mu\text{f} \end{aligned}$$

It is easy to buy one per cent, deposited carbon, low-noise resistors in

these values, but capacitors may be as much as 20 per cent off their nominal ratings. To produce accurate equalization then, you must buy several capacitors of the nearest EIA tolerance and select the ones reading closest to the desired value on a capacitance bridge.

The specified amount of gain (40 db at 1000 cps) will only bring extremely low-level signals from the stereo cartridge up to about a 0.2 volt level, but additional gain may be provided in the following stages. The gain at low frequencies is approximately 60 db, since the rise in impedance of  $C_2$  makes the effective feedback ratio 100/100,000, but the amplifier still has about 9 db of reserve which is useful in reducing distortion. Do not worry if you remember that the input impedance is not as great with less feedback; magnetic pickups have inductive reactances and so their impedance only becomes large at high frequencies where the feedback is much greater, thus providing the droop in the RIAA curve and at the same time increasing the effective input impedance.

You can obtain more gain with the circuit of Fig. 7 if you are willing to put up with a slightly worse signal-to-noise ratio. If we pick

$$\begin{aligned} R_2 &= 0.15 \text{ megohms} \\ R_1 &= 1.5 \text{ megohms} \\ R_3 &= 7500 \text{ ohms} \\ C_1 &= 0.0031 \mu\text{f} \\ C_2 &= 500 \mu\text{f} \end{aligned}$$

(Continued on page 74)

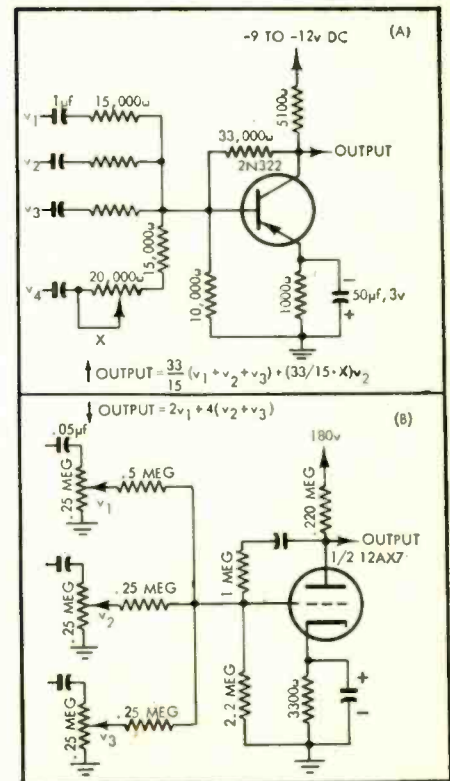


Fig. 11. Plate-to-grid feedback and feedback summing circuits.

# Confessions of a High-Fidelity Widow

TRANSCRIBED BY CHRISTOPHER FAYE\*

*This manuscript was found in the charred ruins of a large home near Tanglewood, Massachusetts. The officials who investigated the disaster were puzzled by the finding of such apparently unrelated items as several skeletons of deformed rhinoceroses, a colony of a rare species of African wasp, a Santa Fe engine that had been reported stolen during 1953, and what experts proclaimed to be the full dress regalia of a long extinct Zulu tribe.*

*While this manuscript connects and explains the presence of these bizarre remnants, it is now being brought to the attention of the public for a far more important reason. It is hoped that its publication will alert our readers to the menace of a most dangerous and resourceful group that has apparently attained a large following within the last few years.*

*The manuscript follows.*

**A**T LONG LAST it is possible to present a written report on the "top-secret" stratagems to be employed by those unfortunate enough to be "high-fidelity widows" (hereafter referred to as victims). As the methods about to be described represent the culmination of many years of study of this heinous problem, it is fervently hoped that their application will be marked by devout attention to detail and also such as to preclude their falling into unscrupulous male hands.

We shall begin by explaining the malady of "high-fidelity widowhood" in such a manner as to enable you to recognize the degree of severity of your individual case. We will then outline the various combative and remedial steps to be taken during each stage of the disease. As is well known, even perfectly normal and uninflicted males, while undeniably useful members of society, are generally incapable of sustained periods of rational behavior or continuous progress toward any goal. Therefore armed with the knowledge about to be imparted, the victim of even the most advanced case can be reasonably sure of the ultimate cure.

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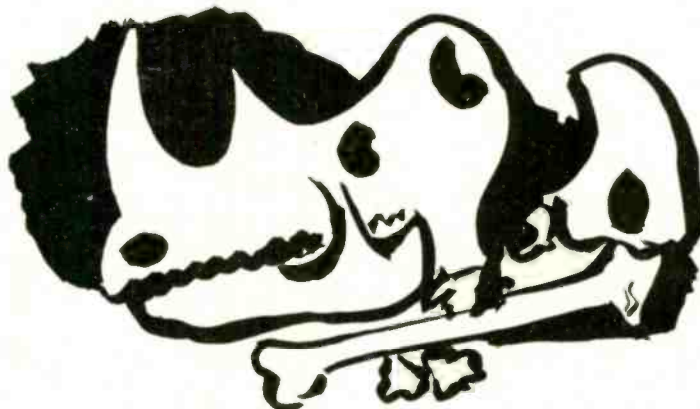


Fig. 1. Deformed rhinoceros skeleton, one of several found in charred ruins.

A home containing a victim of Stage I (or mild) "high-fidelity widowhood" is readily recognizable by the daily descent thereon of a deluge of propaganda, manuals of edification, and an interminable series of current and back issues of so-called magazines dedicated to a number of propositions that are of considerable interest to the unbalanced mind. The husband (hereafter referred to as the addict) in these homes has just been stricken and is actively engaged in a futile attempt to catch up on all high-

fidelity literature published for the past five years, and an equally futile attempt to read all the current outpourings on the subject. These pathetic efforts always result in a state of virtual cataleptic obsession. As the disease in this stage is highly contagious, great care must be taken to insure the addict's isolation from all his male friends so that the problem does not assume epidemic proportions. As all efforts at oral communication during this phase are useless, several of the larger distributors are marketing blank folders bearing such typical high-fidelity titles as—

"What Frequency Causes Resonant Brain Tissue Disintegration?"

"A Study Concerning the Inverse Relationship Existing Between the Amplifier's Wattage Output and Contiguous Property Values"

"Recent Statistically Significant Results Obtained by Applying Binaural Techniques to Schizophrenic Therapeutics"

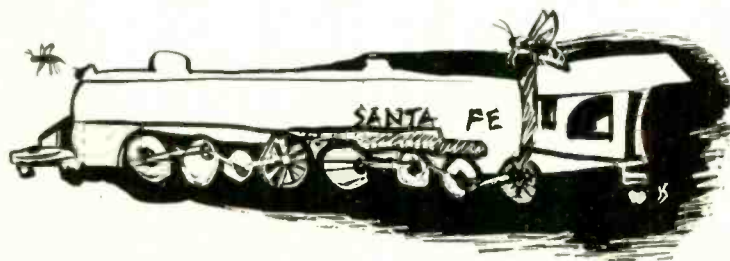


Fig. 2. Stolen Santa Fe engine and African Wasp colony also found in burned-out home.



You should purchase a complete set of these folders. Whenever you find it necessary to communicate with the addict, you should insert a set of typewritten pronouncements in one of these folders and place it on top of the literature to be read. Your typewritten statements are to be in edict form. They should contain unequivocal commands such as:

1. Stand up.
2. Walk into the kitchen.
3. Sit down at the table.
4. Eat your dinner.

It will be found that the addict's state of trance-like concentration due to uninterrupted technical reading will be such as to insure absolute and unquestioned obedience to any literature given him bearing a high-fidelity connected title. Some wives have been known to amplify their typewritten statements to include commands more than those necessary for continuing the addict's physical existence. For example:

1. Mow the lawn.
2. Wash the dishes.
3. Hang the storm windows.
4. Give me \$500.00.

During periods of bargains in furs, diamonds, and other necessities, Stage I widowhood is not without certain advantages. However, this is purely a transitory stage. No oppositional or corrective actions should be attempted during its brief span.

Generally within three months, the addict will attain a state of pseudo-consciousness or Stage II existence. During this stage, addicts have occasionally



Fig. 3. Equipment for dealer and addict shock therapy.

been known to give intelligible answers. Normal conversation is, needless to say, out of the question; all attempts to elicit replies must be at an extremely elementary level or couched in high-fidelity terminology.

Care of the addict during this stage proves simpler. The same diligence of supervision need not be exercised. The typical Stage II addict can be depended upon to take care of his fundamental needs. They are, generally, able to dress themselves, eat their meals without too much help and occasionally even venture

into everyday society. The main problem encountered, and indeed the distinguishing characteristic of a Stage II addict, is his highly vexing and completely irrepressible desire to visit establishments (hereafter more simply referred to as dealers) which specialize in the sale of the various instruments involved in the nebulous pursuit of high fidelity. After spending a pupa-like period of some three months encased in the chrysalis of the subject's literature, the addict now is driven by an elemental urge to emerge and revel in the environment for which he has been preparing. This environment is to be found at the dealers. While this author has no wish to criticize the dealers—after all, they are a group of well-intentioned men who are highly capable in a very specialized field—it should be pointed out that they are simply out of their minds. Somehow that does sound like criticism. Let's reword it. The dealer, through no fault of his own, was left to his own devices when he was in the early stages of addicthood. The fact that he is now a dealer is only an inevitable consequence of lack of care during the disease's period of incubation. It could happen to anyone.

Undoubtedly, the dealer, thoroughly experienced as he is in the reprehensible art of goading the addict into a state of completely maddened insensibility, constitutes the second stage's greatest hazard. This is as unfortunate as it is needless. For it is during this stage that the properly forearmed victim can paralyze the dealer and so start the addict back on the road toward sanity.

What are the counter-tactics to be

employed by the victim? The prerequisite to their proper application is a realization that you are faced with the complex psychological problem of dealing with an addict suffering from a combination of a self induced state of stupor and an externally stimulated state of madness at the same time that you must engage a monomaniac (or dealer) in his specialty. Once this fundamental is grasped, the recommended counter-tactics stand revealed as a logically rigid structure.

As the addict needs aid in crossing

streets and general assistance in negotiating traffic, it will not be difficult for the victim to arrange to accompany him on his trips to the dealers. Whenever unenlightened victims (victims who do not apply this article's recommended procedures) go to a dealer with their addict, they find themselves relegated to a position of total insignificance. This is a consequence of total rapport which in-

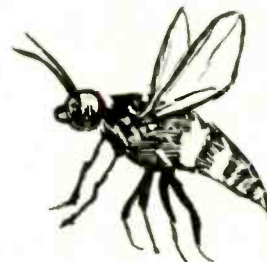


Fig. 4. Wounded Rhinoceros Wasp.

stantly arises between dealer and addict. Needless to say, during these periods of what appears to be complete communion of soul, great and possibly irreparable damage can be done to the addict. The victim must therefore take immediate, and due to the circumstances, attention-compelling action. While the overly fastidious may object to the picturesque, or even slapstick, aspects of the following method, it is emphasized that it actually works, and that extreme methods must be adopted in dealing with extreme cases. Regardless of the ethical implications of utilizing a pragmatic approach, here is the system in capsule form.

#### Dealer and Addict Shock Therapy

Purchase or otherwise procure the following items:

1. A police type of blast whistle.
2. Several squares of coarse grade sandpaper.
3. A jeweler's optical eyepiece.
4. A pair of long white gloves.
5. An African safari-type pith helmet.
6. Several yards of gauze (to attach as a veil to the helmet).
7. Several hives of wasps. South African "Wounded Rhinoceros Wasps" (noted for their unstable social behaviour and general attitude of hostile frenzy when confronted with unfamiliar humans) are highly recommended.

These items are utilized in the following manner:

1. Within five minutes of the time that the dealer begins the seance which normally concludes with both the addict and dealer in a trance, blow several piercing blasts on the whistle.
2. As the state of trance has not yet been attained, the addict and dealer will



now casually give you their attention. Announce that you are interested in realistic recording and request that the dealer tape a performance of you and your whistle.

3. The dealer will condescendingly decide to do this, reasoning that you will thus effectively be eliminated from the seance that had been starting so promisingly.

4. As the dealer makes the arrangements necessary to record your selection, you clothe yourself in your long gloves and veiled helmet.

5. You now release one hive, or approximately 1200 "Wounded Rhinoceros Wasps."

6. The addict and dealer will now give you their attention and in a manner which can no longer be described as casual.

7. Explain to the dealer, who generally by this time has assumed a delightful shade of purple—the color may not be purple, however it always is a rich and vivid color altogether dissimilar from the flat pastels which render characterless so many of today's men—that since you are especially interested in the treble end of the sound spectrum you have brought along some of your insect friends (emphasize the word friends, it seems to heighten and otherwise intensify the dealer's color) so you can observe their reactions to the highs and can consequently better judge the quality of his various systems. Then explain to the dealer, in as great length as possible (so you can be sure that there is no misunderstanding) about the difficulty that humans have in hearing above 16,000 cps and how insects can hear up to or even higher than 45,000 cps. You will generally find the dealer to be in a state of visible agitation during your fourth or fifth repetition of this explanation. The exact reason for this often observed reaction is unknown, but the most likely cause is his natural gratefulness for having the matter of human and insect hearing explained with such thoughtful thoroughness.

8. By this time the wasps will have attained such a state of animated playfulness that your veil and gloves will seem a good thing. The dealer now generally occupies himself with some futile types of unorganized and primarily violent gesticulation. As this will only tire the dealer and further incense the wasps which by this time are laboring under the misguided impression that the dealer is their natural prey or wounded rhinoceros, you should divert the dealer's attention by discussing various aspects of high fidelity.

9. As the dealer's attention is likely to wander during your attempts to set his mind at ease, you again must take positive action to secure his undivided attention.

10. This is done by going to several of his highly polished mahogany enclosures and rubbing off some of the veneer with your sandpaper, examining the result with your jeweler's optical eyepiece in position, and then announcing in a clear voice that you question whether his enclosures will match your furniture.

11. It is now time to leave. Explain to the dealer that you enjoyed your visit, that you hope to come again soon, and since he is such a nice man you are going to give him the wasps. If the dealer seems to protest your generosity, say that it is no use, that you won't dream of taking his money for the wasps, and that you are giving them to him as one friend to another.

12. On your way out pick up the addict who will invariably have relapsed, due to all the excitement, into the cataleptic state associated with the disease's first stage. Gently pry loose whatever literature he is senselessly reading, patiently help him to his feet, and then guide him to home and bed for at least a week's recuperation.

At the end of this week, the addict is either cured or back in Stage II. It is quite easy to determine which is the case. If the addict is no longer interested in the subject of high fidelity, you are to be congratulated upon your effective administration of the cure. If the addict persists in his desire to visit dealers, you are faced with the alternative of continuing the form of dealer and addict shock therapy already outlined or permitting the addict to proceed to Stage III. In any event, the addict will have no conscious knowledge or remembrance of the shock therapy regardless of the number of times it is administered, due to his almost instantaneous defensive retreat into a somnambulistic state. However, it has been empirically determined that if six such treatments produce no measurable result, this form of therapy should not be continued and the addict should be permitted to proceed to Stage III. Stage III is the final stage and is the stage in which the addict actually purchases high-fidelity components.

It should be here noted that from a technical standpoint, the addict is not in Stage III until he actually is the owner of at least one high-fidelity component. Little is to be done during the actual buying periods. During these periods you should expect, and not be alarmed at, the addict's increasingly haggard appearance and erratic behavior reminiscent of Stage I's stupefaction. Upon ownership of high-fidelity components, the addict's insensibility gradually turns into Stage III's prevalent attitude of morbid dejection unless engaged in the obsessive pursuit of imperfection.

The addict, after purchasing equipment, devotes all his waking hours to

discovering and taking a delight in real, but more generally imagined, flaws in his equipment. In short the addict is only interested in seeking defects. All of the many problems posed by the Stage III addict are a direct consequence of this peculiar mental state. Fortunately the mental depression into which the addict invariably lapses when not engaged in the quest of aberration, is readily dispelled. Curiously enough, the addict can be easily roused from his despondency simply by commenting disparagingly about his components. The astonishing fact is that the more derogatory you are in your conversation, the greater becomes the addict's degree of animation and general liveliness. This knowledge can be put to good use whenever it is necessary for the addict to make a public appearance. If, immediately before the necessary appearance, the victim will devote thirty or forty minutes to a vilification of the addict's system, the addict's entire temperament assumes a good natured malleability which will be the subject of widespread envy. Indeed, many victims have concluded that this easily attained euphoristic state constitutes a considerable improvement over the behavior that could be expected should the addict be cured. These victims, of course, abandon their efforts toward a cure and instead content themselves with the fact that they possess complete control over their husband's emotional state. In all fairness, it must be admitted that many cogent arguments can be advanced in favor of this system; as a matter of fact, some of the addicts who have been permitted to continue without interruption in Stage III occasionally even present an almost human appearance. Despite the undeniable domestic advantages of having push-button emotional responses from the addict, the very real danger of permitting the addict to continue without remedial action lies in the possibility of his becoming a Super Stage III addict, or dealer. Should this happen, cure is impossible. Therefore, the victim should not succumb to the temptation of abandoning the curative process.

While over the past few years many methods of cure have been proposed, attempted, and even found reasonably successful, only one method stands out as being universally applicable and practically infallible. Its excellence is primarily due to the fact that it is directed at the heart of the problem. As in our discussion of the shock therapy recommended for dealers and addicts, one must judge the method solely by its results rather than by the stilted standards of behavior that society has imposed upon so many.

Before presenting the cure in a step by step form, it is necessary for the victim to master a few fundamentals



concerning the Stage III addict's behavior when a member of a group formed entirely of his own kind. While an addict in any stage is incapable of any form of social intercourse, nevertheless you will find that a number of Stage III addicts will nightly descend upon your home. These addicts are not visiting your home in a spontaneous demonstration of amicable neighborliness. Rather they are engaging in their grim pursuit of imperfection. These addicts will ignore you so completely that you will begin to doubt your own reality. Actually their inattention to you is not due, as many have thought, to their state of apparent continuous malevolence. Rather, it is a surprisingly little known medical fact that the Stage III addict's optical structure has difficulty in focusing on objects that are not directly connected with high fidelity. Since the administration of the cure depends upon your establishing yourself in a position of confidence, it is necessary for you to gain both the attention and cooperation of the addict. This is quite simply done by indicating in your conversation with these people that you have heard that they have a faulty amplifier, or tuner, or speaker system. It makes no difference that you have never seen these people before. Of course, they all have faulty amplifiers, tuners, and speaker systems. All of their components are faulty, and they know it. They consider you an extraordinary female for having the social grace to point out the fact that they own inferior equipment.

Once you have ingratiated yourself with all of the group's members, you may put the following plan into action—the plan which has rightly earned the title of:

#### The Ultimate Cure!

1. You must secure the services of a large municipal symphonic organization, the use of several assorted sizes of fire and locomotive engines, and the aid of an entire Zulu tribe complete with war drums. The following advice from the A.S.P.C.Z. (American Society for the Prevention of Cruelty to Zulus) is of interest here: "As young Zulu warriors, especially when armed with their assagais (or throwing spears) are not noted for stoic behavior, and since musicians are of a volatile and occasionally pyrotechnic nature, the indiscriminate mixing of these two groups should not be encouraged."

2. You should go through the addict's record collection and discard any disc that is not symphonic, engineering, or tribal. As the fantastic variety of currently recorded sounds is difficult to describe without resorting to transcendental numerics, you must resist any

temptation to retain any record that does not fall into these three basic categories. (One case is known of a victim who absolutely refused to eliminate any of the addict's records. This, as will later become apparent, imposed upon her the duty to secure the services of a number of organizations and agencies sufficient to duplicate the sounds of all the addict's records. The outcome of this interesting approach is unfortunately unknown due to the inexplicable disappearance of the victim, the addict, and, in fact, the very home in which they lived. While many have attempted to ascribe significance to the fact that the last record purchased by this particular addict was one entitled "Sounds of a Tidal Wave," this should merely be considered an amusing coincidence.)

3. Having made these advance preparations, you now present to the group of addicts a so called "table phonograph." (These table phonographs are manufactured by a number of large companies and come in ready-to-use form.)

4. This phonograph will delight the addicts. The scorn and ridicule devoted to these units will at times reach inspirational levels.<sup>1</sup> The addicts will be truly

operate a lighting system in an adjoining (and well hidden) room.

6. This room, which in addition to being well concealed, is to be of sufficient size to accommodate several-hundred people. This room and the room in which the addicts meet must be conjointly designed by an acoustic engineer so that sounds emanating from the hidden room reach the area of addict assembly without undergoing sonic distortion.

7. After the addicts have evaluated your phonograph for some 45 minutes, you should terminate the discussion by offering to play some records. This suggestion is accepted with unanimous eagerness. You place a prearranged series of discs on the changer. (Due to your earlier condensation of the addict's collection into three fundamental groups, the discs you place on the changer will seem quite representative.) Your performers, stationed in the hidden room, operating in conjunction with the signal lights, present a synchronized performance of each record as it noiselessly revolves on the turntable. The addicts now go into utter ecstasy. They acclaim this phonograph as, beyond a doubt, the most imperfect and thoroughly miserable that they have ever had the wonder-

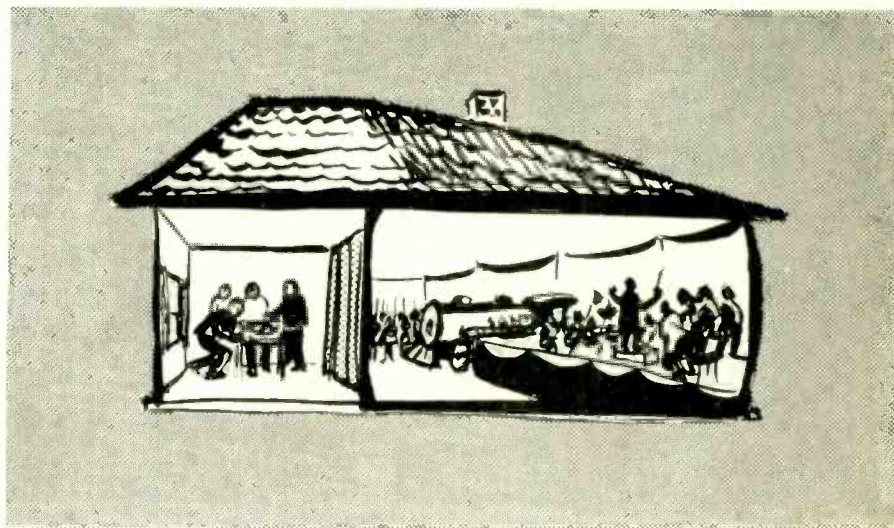


Fig. 5. Secret room for ultimate cure.

happy; they will believe that they have progressed toward their goal of imperfection.

5. This phonograph is to be secretly modified so that while seemingly engaged in the playback of records, the only function that it actually performs is to

ful fortune to audition. You will be interested to learn that chief among the defects of your phonograph is the fact that it lacks realism.

8. As soon as you can make your voice heard above the shouts of good  
(Continued on page 72)

<sup>1</sup> Apparently the most telling objections to this type of phonograph are the following:

A. They have an improper appearance. Instead of giving the pleasing visual impression resulting from the scientific exposure of wires, tubes, capacitors, transformers, etc., they resemble living room furniture.

B. They actually seem to work. As is well known among Stage III addicts, equipment in an operative condition is properly subject to intense suspicion. All addicts, naturally keep their components in a "torn-down" or unusable condition so as to expedite their program of continuous circuit refinement.



## Accolade for the Audiofan

**W**E BELIEVE the time is long overdue for recognition to be accorded to the men who, in reality, are principally responsible for the audio industry as we know it today.

No, we are not referring to the basic developments of Thomas Edison, nor the research accomplished in the field of audio and acoustics by such organizations as Western Electric Company and Bell Telephone Laboratories. Nor are we referring to the many advances in audio equipment developed by the numerous dedicated engineers who have worked in our industry. We are talking here about the individuals who are often referred to as audiophiles or "Audiofans"—the intense enthusiasts who are bound and determined, no matter the effort or cost, to have the best music system possible in their homes, studios, or workshops. These are the men intensely curious about all phases of sound reproduction, electronics, acoustics, physics, yes, and the esthetic aspects of music too.

Not very long ago, between fifteen and twenty years perhaps, most of the present manufacturers of audio component equipment who were in business at that time were making professional audio equipment for theatres, auditoriums, and stadiums, for radio stations and networks, for motion picture and recording studios. This equipment reproduced sound far better than anything available to the non-professional. There were people who heard it and wanted it for private use.

Some of this equipment could be secured through radio parts jobbers and distributors; some was literally "conned" from the manufacturer. Some enthusiasts got what they wanted through a friend in the business; others even went into the sound business just so they could put together a "dream system" for their personal enjoyment. In those early days, a truly dedicated "Audiofan" might work harder to get his hands on one coveted component than we do today in selling these products in an entire territory.

It might also be observed at this point that in their search for better ways to reproduce sound, the "Audiofan" most naturally gravitated to professional periodicals essentially edited for professional sound men. *AUDIO* magazine was certainly one of those that they found to their liking. Here they found discussions, descriptions, appraisals, and advertisements of amplifiers, preamps, pickups, tuners, turntables, and loudspeakers that gave many of the answers they were looking for.

With the introduction of the microgroove records and the advent of FM radio, it became absolutely essential to the "Audiofan" that he have equipment that would enable him to cash in on this newly-minted sonic wealth.

The ranks of the "Audiofan" and their influence spread until it became economically feasible for people to establish businesses supplying audio components of professional quality for use in the home. These people went by many names, but essentially they are the audio specialists that we know today.

Although there has never been a clear-cut definition to the general public of the meaning of component high fidelity — professional component audio equipment for home music systems — as contrasted to the "appliance type" radio-phonographs, this professional component business has continued to flourish and is today a thriving national industry.

And who was responsible for continuing developments in audio equipment? The "Audiofan," of course. He en-

couraged the manufacturers to try out ideas which he and his fellow fans originated. He spelled out the shortcomings of even the best available components at any given time; he rejected the spurious and kept all of us on the straight track to purer and more accurate sound reproduction.

The "Audiofan" is the true pioneer in the high fidelity industry! And, like all true pioneers, he has on occasion been subjected to ridicule. Cartoons by the hundreds have lampooned his alleged excesses. Comedians in all the popular media have made the "Audiofan" the subject of mirthful comment. He is called a "high fanatic" and a "bug," though not very often with any real malice. He is pictured in an exploded tangle of wires and vacuum tubes, or crouched in the mouth of an exponential horn oblivious to any external crises, foreign or domestic. He has been accused of seeking sound levels that would demolish all the picture windows in the neighborhood. They say that the cacophony his demonstration records create is guaranteed to deaden all normal social intercourse.

Through all of this ridiculing and needling, the "Audiofan" has never lost his urgent desire to come closer and closer to complete realism in music reproduction. He did more to influence his friends and neighbors and to whet their appetites and enthusiasms for professional component music equipment for their homes than, perhaps, the sum total of all of the advertising that has appeared on the subject thus far.

Many manufacturers in the professional component field today will readily admit that the criticisms and suggestions from the "Audiofan" and his urgent desire for something continually better has been responsible in a large measure for the fantastic improvements that have been made in listening equipment during the past fifteen years. Fantastic? We use the word advisedly. Remember how you used to work to get theatre equipment into your homes? Today the objective has rotated one hundred and eighty degrees; we are trying to get equipment into theatres and public places that sounds as good as the installations "Audiofans" have built into their homes.

There is no question that the "Audiofan" has been criticized by some members of our industry. This has occurred because they have neglected to appreciate the basic honesty of intention and the pursuit for perfection that these men exemplify. There are many "Audiofans" who were discouraged and disillusioned by the rapid-fire changes which took place with the introduction of the stereo record. Hindsight would certainly point out that the industry, as a whole, would have been benefited by taking counsel with this group. The confusion in the mind of the general public which resulted from the introduction of stereo has still to be clarified. I believe I am expressing the thoughts of the bulk of our industry when I say that you, the "Audiofan," can help us immeasurably in dispelling this confusion! Your efforts in this regard will most certainly result in the conception and production of equipment that will further fulfill your quest for perfection. The continuing progress of our industry, in large measure, lies in yours, the "Audiofan's" hands! We welcome your criticisms, your questions, your ideas, your experiments — and most certainly — all of your continuing enthusiasm! ! !

RAYMOND V. PEPE, *President,*  
 INSTITUTE OF HIGH FIDELITY  
 MANUFACTURERS

March 21, 1961





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**101 \$99.50** — Bantam transistorized precision dual-track monophonic recorder. Complete with F-7 dynamic microphone.



# The Tape Guide

## Questions and Answers

HERMAN BURSTEIN\*

*My series of articles under the heading of "The Tape Guide" have brought forth a number of questions from readers. With the thought that other readers might have the same questions, and to save both myself and these other readers the effort of writing individual letters, I would like to quote some of the questions and my answers to them. For the most part these are exact quotes, although some are slightly abridged for conciseness and clarity.*

Before turning to these questions and answers, I would like to note that not all the letters have asked questions. A few have taken me to task. For example, one reader dislikes my use of the term *prerecorded* tape; he feels that the term *recorded* tape would be enough. Compliments have been received from some readers, and I would like to take this opportunity to thank them. Modesty forbids quoting any of the latter. On the other hand, I fear, some of these may have been left-handed compliments. Following is one shot that traveled around the world on a postcard from the Far East; this is calculated to take the "esteem" out of any author: As a rather ignorant person in hi fi I have admired your articles."

While I have attempted to reply to every letter containing questions, not all have been answered with equal speed. The letter that asks numerous questions, particularly in a scrawl, tends to go to the bottom of the pile, waiting for the day when the author has the time and energy to cope with it. The letter that comes with a stamped, self-addressed envelope invites, in fact commands, a speedy reply. After all, there are only two parts to a letter: the envelope and the contents. If the envelope is already prepared, it seems as though the job is already half done. Besides, it seems

larcenous to appropriate the other fellow's stamp.

A substantial number of inquiries were received as to the name of a company making components, including bias oscillator coils, for transistorized tape amplifiers. The firm that gave this information to the writer is the Nortronics Co., 1015 South Sixth St., Minneapolis, Minnesota.

QUESTION: "I am a high fidelity enthusiast who is thinking of taking the plunge into 4-track prerecorded stereo tape. Two articles by Mr. \*\*\* have given me pause, however. He claims that as of early 1960 crosstalk between physically adjacent channels on 4-track prerecorded tape was an annoying effect for about 5 per cent of the playing time; and he asserts that the fault is in the design of playback heads. How free are the new heads from this type of crosstalk?"

ANSWER: "My experience has been that crosstalk is now inaudible in the best home machines. Vertical misalignment of the playback head can be responsible for crosstalk. It is also possible for crosstalk to occur in the playback amplifier rather than in the head."

QUESTION: "Do you personally feel that the best commercial 4-track prerecorded tapes are significantly better than the best stereo discs on symphonic or other demanding program material. I assume all the audio equipment to be first class."

ANSWER: "Until recently, I thought that stereo records on the whole were terrible from the distortion viewpoint. They were much harsher than stereo tapes. In the past months, however, I have come across some stereo discs that approach the quality of mono discs in terms of distortion. Still, I feel that the best 4-track stereo tapes today surpass the best stereo discs. But the situation

could change in fairly short time. I am mindful of the fact that at the end of the period when mono prevailed, the best commercial discs were as good as or better than the best commercial tapes. The same kind of thing can happen again in stereo."

QUESTION: "I am interested in buying a tape transport to be used with my preamplifier for playback. Will this be satisfactory?"

ANSWER: "If you plan to use a transport with a separate playback preamplifier, be careful about the cables from the head to the preamp. They should have low capacitance, be as short as possible, and be routed away from motors, transformers, and other possible sources of hum pickup."

The letter which asks for advice on specific brands of equipment is the most difficult to answer. The reader asks either for an opinion on certain brands, or he asks for the name of the "best brand of all." Following is a typical answer to one of these letters. "It is difficult if not impossible to give useful advice on specific brands because of the varying requirements of different users, and because the quality of products keep changing. I think perhaps the best course would be for you to visit a good audio salon."

Another reply was: "Some differences among brands of audio equipment can be heard and yet not measured, while other differences can only be measured but not heard. The best guide to what is suitable for you is to actually listen to various components. To an extent, equipment reviews can be helpful."

QUESTION: "I appeal to you for advice on a technical problem concerning the \*\*\* tape recorder. Can this machine be converted to 4-track stereo playback?"

\* 250 Twin Lane E., Wantagh, N. Y.

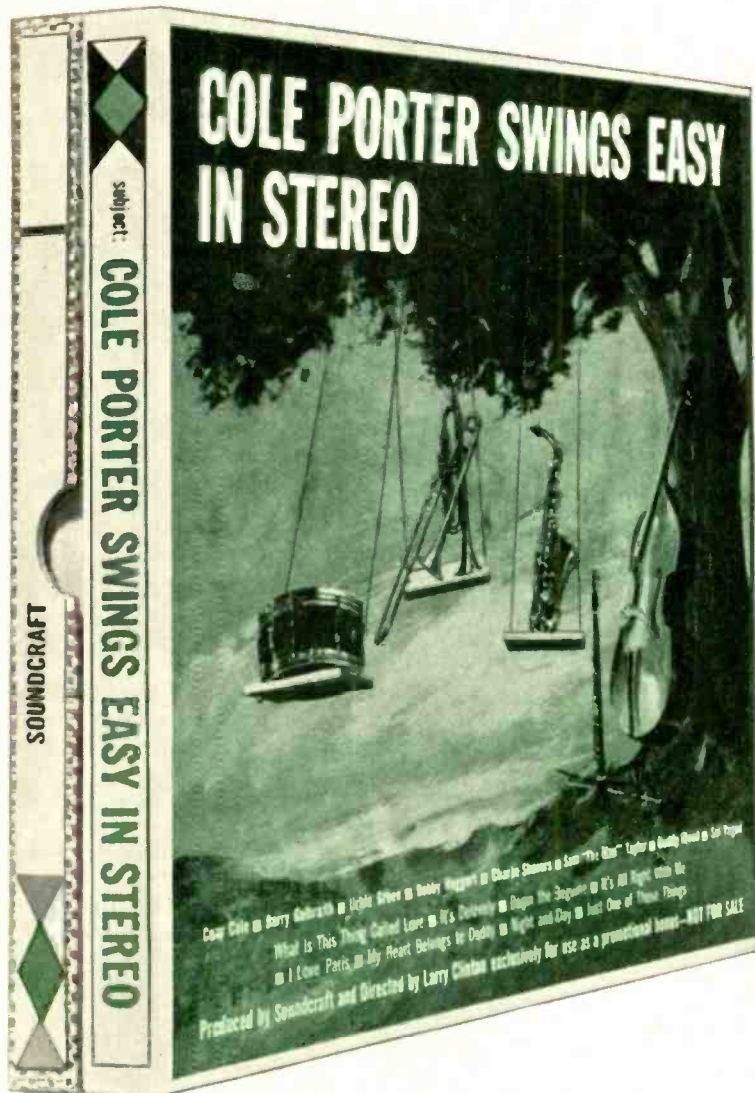


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Can you please advise which head replacements are available? Can my machine be panel mounted for use as a tape deck?"

ANSWER: "These kinds of questions are best addressed to the manufacturer of the tape recorder. However, for what they are worth, here are my answers: (1) Most tape machines made in the last couple of years can be converted to 4-track operation, and yours is probably among them. Perhaps the manufacturer can give you the desired information on how to go about this. (2) Companies offering 4-track replacement heads for most popular machines include, I believe, Shure, Viking, Nortronics, and Michigan Magnetics. (3) For panel mounting, I assume you intend to place the tape deck vertically instead of horizontally. Some machines will not operate properly in this fashion. Check with the manufacturer."

QUESTION: "You recommend a VTVM to check frequency response. Not being inclined to invest in this instrument at the present time, would you please tell me if the \*\*\* (a certain company's instrument similar to a VU meter, requiring 1.2 volts of drive) could work satisfactorily instead?"

ANSWER: "I have considerable doubt that the meter of which you write will be satisfactory for measuring record-playback response. Such a measurement should be made at least 20 db below maximum recording level. If maximum level corresponds, say, to 1 volt output from the tape machine, then 20 db down means only .1 volt output. The \*\*\* meter requires 1.2 volts to drive it to "0" VU. Accordingly, you would be getting readings at the low end of the scale, where they are difficult to read accurately."

QUESTION: "I have two tape recorders, and I find that there is a difference in equalization between the two. Tapes made on one are too "heavy" in the very low bass and "weak" in the high treble when played on the other. Tapes made on the second machine sound a little thin and shrill when played on the first one. How do you account for this?"

ANSWER: "The fact that tapes recorded on your first machine sound heavy and treble-deficient when played on the second results from the fact the first machine, being European-made, employs CCIR instead of NAB equalization. CCIR equalization involves less treble boost in recording and less bass boost in playback than NAB equalization. However, many of the European machines of recent vintage have been coming through with NAB equalization."

QUESTION: "I plan to purchase the \*\*\* tape recorder. I am undecided whether

to order it with quarter-track or half-track stereo heads. I have no intention to play prerecorded tape, and I am not concerned with the economy of saving tape through quarter-track recording. Would the quarter-track heads give as good performance as half-track heads?"

ANSWER: "My vote is for the quarter-track heads. Quarter-track stereo has become virtually standard, for one thing. For a second, some day you may want to play prerecorded tapes, even though you don't care to do so at present; many such tapes possess a quality that you will seldom or never obtain from off-the-air recording. Thirdly, continual progress in the art of making tape and tape heads has brought us to the point where virtually as good results can be had today with quarter-track heads as were obtainable with half-track heads yesterday. This does not mean that the quarter-track head is fully as good as the half-track one. But the former should be good enough for your purposes. A professional recording studio goes through three, four, or more generations of tape in proceeding from a live performance to a commercial disc or tape. Therefore they seek maximum signal-to-noise ratio by using a relatively wider track, because each generation of tape adds several db of noise. Besides, they could not edit quarter-track tape. But you are dealing with first-generation tape or, at the most, second-generation tape after dubbing. Therefore it is less urgent to use half-track heads in your case. Finally, azimuth alignment is less critical for quarter-track heads than for half-track ones."

QUESTION: "I am in something of a quandry. I have the opportunity to dub some stereo tapes and am desirous of obtaining the best possible results. I will not have an opportunity to re-copy any of the tapes that I might fluff. I have used several brands of tape with varying degrees of success. I'd be grateful for any suggestions you might have as to brand of tape."

ANSWER: "I doubt that you will have a real fluff if you use a top quality tape of a major brand. At your first convenient opportunity, you might collect four or five brands of virgin or bulk-erased tape, copy the same high-quality phono disc on each, and A-B each recorded tape with the disc. If there are noticeable differences as to frequency balance, distortion, and noise, in the future use that brand of tape which gave you the best over-all results."

QUESTION: "Bargain tapes are often advertised. How can I ascertain whether a particular tape of this sort is any good?"

ANSWER: "The chances are that you get what you pay for. Bargain-priced

tapes may or may not be inferior, depending upon the uses you make of them and your standards of performance. You might not find a difference between a \$3.00 tape and a \$1.69 one, or you might find a world of difference, depending on how revealing your equipment and your ears are."

A reader inquired why the tape deck he purchased failed to work properly in conjunction with the record-playback tape amplifier of another make. He complained that recordings were "weak" and distorted, and he sent along some particulars on the tape deck and its heads. It turned out that the erase head was a very low-impedance type, which drew so much current from the tape oscillator that there was not enough left in the way of bias current for the record head. Insufficient bias current resulted in a small amount of signal impressed on the tape, and severe distortion. In addition, though the reader did not mention this, there was probably substantial noise in recording due to the distorted bias waveform caused by heavy loading of the oscillator.

Another reader stated that he had revamped an old tape recorder, and to obtain bias control he had done the following: He fed a high frequency from an oscillator into a 60-watt audio amplifier, and fed the output of the audio amplifier into the record head. Despite this staggering arrangement, he could not get sufficient bias current into the record head. The diagram accompanying his letter revealed that he had placed a 16-ohm resistor across the power amplifier as a load. At the bias frequency, the impedance of the record head was about 10,000 times as great as the load resistor, which drew nearly all the current. Consequently, even if the power amplifier were able to deliver a full 60 watts at the bias frequency of about 50,000 to 75,000 cps the record head could get only about one-fifth of the needed bias current.

QUESTION: "Is there any way in which I can set the recording level, using the VU meter on my machine as a guide, so that I can be assured there will be no more than 2 per cent harmonic distortion? I have a friend in England who frequently checks his machine before recording, and he writes that his peak recording level is 2 per cent. His machine has a peak-level meter rather than a VU meter. His tapes are excellent."

ANSWER: "With a machine such as yours, which has separate record and playback heads and therefore permits simultaneous recording and playback, a good way to insure distortion-free recording on the basis of the VU indication is as follows: Take advantage of



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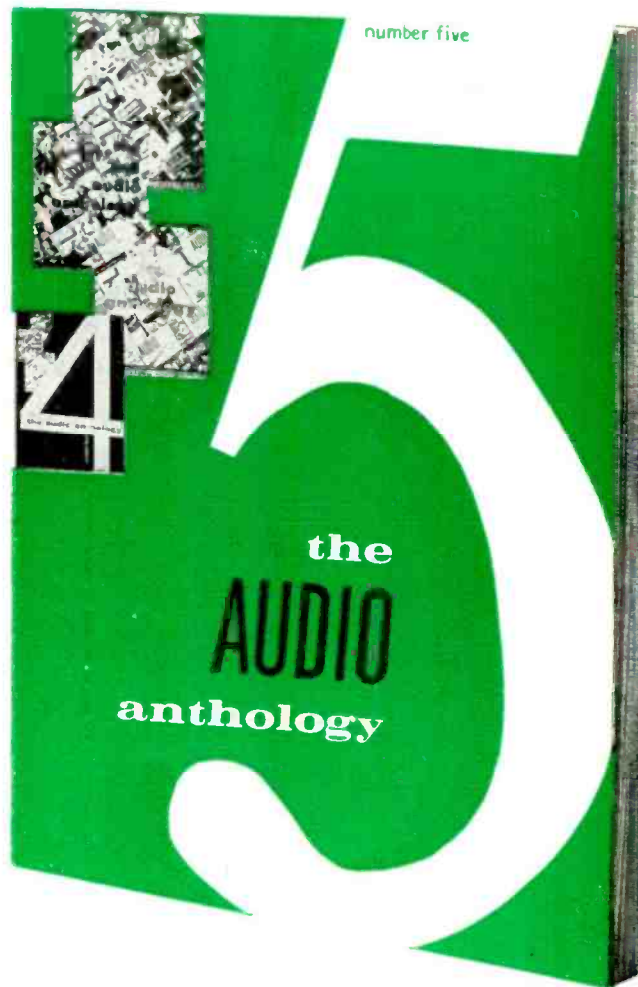
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| Rochester, N.Y.         | Craig Audio Laboratory               |
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| San Jose, Calif.        | Alco Paramount                       |
| Seattle, Wash.          | Commercial Appliance Center          |
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**Tandberg** of America, Inc., Pelham, N. Y.

the tape-monitor switch in your pre-amplifier and compare a tape that you are recording with the incoming signal. For this purpose, use a high quality mono disc with wide frequency range and wide dynamic range. See how high a recording level you can employ without noticeable distortion in playback. Note the maximum readings of your VU meter. Then, in making other recordings, do not allow the meter to exceed the maximum readings noted during the previous test. If the meter pointer tends to kick out of sight to the right when making the test recording, or if it always stays far below '0' VU, chances are that the meter is improperly calibrated. In your particular tape recorder there is an internal control marked 'rec. cal.' for calibrating the meter. Don't be afraid to trust your ears as the measuring instrument. The VU meter should begin to read above '0' VU on signal peaks just when the recording starts to acquire noticeable distortion."

**QUESTION:** "I would be very grateful if you would mark on the enclosed schematic of the sound section of my TV the point best suited for sound take-off to my recorder. The machine is located at a distance of about 20 feet from the TV. Should I use the high or mike input?"

**ANSWER:** "To answer your last question first, by all means use the high-level input. You can take off the TV sound at the high side of the gain control. But there are several problems: (1) The schematic shows a capacitor which provides bass boost prior to the gain control; this capacitor (marked by the author) can be removed if you want a flat signal in the bass region. (2) The 20-foot cable would cause a good deal of treble attenuation. (3) Analysis of the circuit make it appear that part of the FM deemphasis takes place after the gain control; in other words, the signal prior to the gain control has some treble boost. Fortunately, the treble loss referred to in point (2) and the treble boost referred to in point (3) will cancel each other, more or less. With good luck you will about break even, but you won't know until you try."

**QUESTION:** "My tape recorder uses a neon lamp as a record level indicator. I am planning to add a VU meter to use as an indicator instead. Can you please advise me on the proper procedure?"

**ANSWER:** "The VU meter must be driven from a low-impedance source, and probably the easiest way for you to do this is to install a cathode follower to drive the meter. A suitable circuit is enclosed (see Fig. 1). Connect the present signal take-off point to the voltage

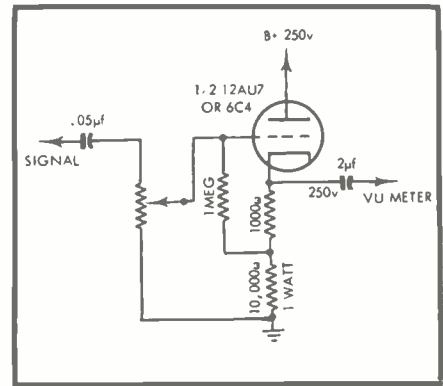


Fig. 1. Cathode-follower circuit for driving a VU meter.

divider preceding the cathode follower. Connect the output of the cathode follower to the meter. It will be necessary to adjust the voltage divider so that the proper amount of signal is fed to the tube, resulting in a correct VU reading, namely a "0" VU indication at maximum permissible recording level. Record a 400 cps signal, from an audio oscillator or test record, so that it barely causes the neon lamp to light; this is maximum permissible recording level. Then reduce the 400 cps signal 6 db, using a VTVM or other suitable device to measure it, and adjust the voltage divider so that the VU meter reads "0" VU. All this assumes that the neon lamp lights up at the 3 per cent harmonic distortion level. If you know that it lights up at some other distortion level, then reduce the 400 cps signal an additional 3 db for each 1 per cent distortion above the 3 per cent point. To illustrate, if the lamp ignites at 5 per cent harmonic distortion, which is quite often the case, then reduce the 400 cps signal 12 db instead of 6 db."

**QUESTION:** "I have recently acquired the 23 tape recorder, incorporating separate record and playback heads. It appears to do an excellent job. However, when taping my records, one characteristic does not particularly satisfy me. With the tape recorder connected to my preamplifier, I can use the tape-monitor switch to compare tape playback with the disc that I am recording. Level controls are adjusted to obtain the same volume from the tape and the disc. I find that the sound is different when switching back and forth. When playing the tape, there is some degree of treble boost and bass attenuation. The tape output jack on my preamplifier is ahead of all tone controls, so that the signal going to the tape recorder is flat. I would appreciate your explanation of what causes the deviation from flat response."

**ANSWER:** "The difficulty may be due to: (1) incorrect record equalization.

(Continued on page 73)



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# The Indispensable Engineer

NORMAN H. CROWHURST\*

Producing a superb recording nowadays requires an unusual blending of the engineer and the musician. Often we are told of the strong and valid case for the "indispensable" engineer—herein we present the case for the equally "indispensable" musician.

**N**ICE, ISN'T IT, to feel that you're indispensable to some one, or for something? Kind of good for the old ego! Small wonder then, if a recording engineer, who provides an indispensable link between a wonderful performance and those who rely on records to hear it, might have an inflated ego. But maybe it's not that. . . .

Look at it this way. You've listened to records. By and large, LP's achieve a very good standard of "quality"—at least to suit the great majority who buy them. If the recording companies keep, say 95 per cent, of their customers happy, that's a pretty good record; the engineer is entitled to consider himself a success at his job. But I guess that most of the *odd 5 per cent* read this magazine; the ones with a more highly developed musical critique, who find that few records achieve really 100 per cent, all-round satisfaction. The record companies may regard this 5 per cent as the "screw-ball" hi-fi addict. But they know enough to realize they are really a sort of advance guard. Defects their more critical faculties detect today will annoy the majority tomorrow. So something should be done.

What is lacking? Sometimes, as those "in the know" will tell you, there is a big difference—too big—between the original master tape and the ultimate pressings the public get: too much is lost in the process, or some distortion creeps in. This often gets blamed on "poor recording technique" although strictly it is a production problem—the original recording may have been good.

Often though, a record is crystal clear as far as its "audio quality" is concerned. The trained ear of the engineer—or you and I—cannot detect any of the usual forms of distortion, and the frequencies are all there, at least when you use the best playback equipment. The engineer who recorded it is probably proud of the faithful job he has done in transcribing the performance—good or bad ("it's what people like" he may say to himself)—onto the disc. But it does not satisfy the musically critical listener.

Some reviewers would give such a record a top mark for recording quality.

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

and say the performance is lacking the impact or satisfaction that other performances of the same score may give. It's not that the musicians, or some of them, lack correct tempo, synchronism, or accurate pitch. The intonation may be technically perfect. But some of the instrumental parts may sound weak, or unconvincing; or the whole performance may seem to lack the "spirit" appropriate to the piece.

We could outline the changes a bit more perhaps, but from here it looks as if the man at the recording knobs has pretty good reason to be happy: 95 per cent of the people who buy the ultimate products are quite satisfied; and of the complaints he does get, those blamed on recording technique are really faulty production procedure, and the rest are due to the fact that even the best musicians are not always on top form—or maybe he didn't have the best musicians!

But just a minute Mr. Recordist, don't go away. Are you sure your efforts can really be exonerated from blame, or maybe "contributory negligence," every time? I believe there are a number of ways in which you can be partially responsible. A little incident may help show how.

Two bass players, friends of mine, were comparing the amplifiers they use to reinforce their instruments. They had one instrument there, with its internal pickup or "mike," and the two amplifiers. One of the players was fingering the instrument, a technician was plugging the jack alternately into the amplifiers, and indicating which, and the other player was listening. The player at the instrument said "This one is definitely the better amplifier, the other one just does not have it." The other player declared he could hear no difference.

So the man at the instrument said "Well you come and *feel* the difference for yourself." So they switched places. And, to the amazement of both of them, in fact of the anyone present, switching places switched impressions. To the inactive listener, even the professional player, both amplifiers seemed to do an equal job; but with his fingers on the instrument, he did not feel he was get-

ting the same "response" from his instrument.

One amplifier made the instrument feel responsive, like a "good bass." With the other one the player had to work harder—which any good player would do subconsciously—and even then, the "feel" no longer gave him the satisfaction of a "good instrument."

What was different between the amplifiers? We could, presumably, turn this question over to a test lab, and find out, in db's, percents, and what-have-you. But I doubt very much whether any of us would be much the wiser. And what has this to do with recording? Artists don't hear the sound from the amplifiers used to record their efforts while they're playing. That's true. But this incident provides two angles from which to proceed.

From what I have seen of laboratory tests on amplifiers, I am morally certain that the differences our musician friends observed would not be accounted for by the test results. In this experience, the player subconsciously "made up" for the poor amplifier's deficiency. But if he doesn't hear it (as when playing at a recording session), one amplifier is the same as another to him. He is not to know that one amplifier will record him giving a sensitive performance, while the other one will make him have "wooden fingers." But both amplifiers would satisfy the usual performance checks for their job. This is one way that musicians can be blamed for deficiencies that are really electronic.

That's one angle. The other we might preface with the remark: "Musicians are *people*." I believe, when a musical program is being recorded, the musicians are the VIP's. But this sometimes gets overshadowed by the indispensable part the engineer and his equipment plays in trapping the sound and getting it on the record.

In those almost-forgotten days of acoustic recording, when the performers clustered round the mouth of the recording "trumpet," subordinating the musician's customary comfort at his instrument to the necessity for concentrating the sound was justifiable. But as recording techniques and equipment have



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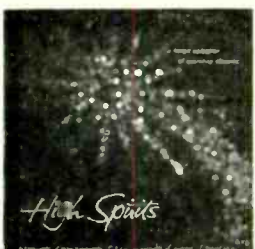


# 3 MUSICAL BONANZAS

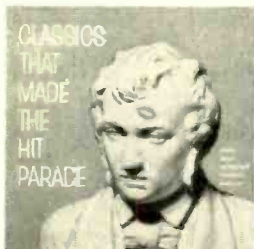
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improved, there becomes more and more reason why the opposite trend should prevail. But doesn't it, already? Yes, I guess so, but I also feel it often could be taken further, with more consistently "high performance" results.

A musician's performance can be influenced, for good or bad, by a number of things, besides an amplifier: the state of his liver; domestic problems (although it has been known for mental stress at home to induce better performance at work, too); the quality of his instrument; the atmosphere (decoration, styling, lighting) of his surroundings; the studio acoustics (often in more detail than just the number known as "reverberation time"); and his position relative to his fellow players (comfortable, strange, etc.).

Most top-rate musicians will, it is true, give apparently impeccable performance under a wide range of the permutations among these variables; some of them, I believe, when their liver is virtually afloat in alcohol. But the above-mentioned conditions, particularly the ones outside the musician's immediate control make a difference to *him*. His intense musical training and experience enable him to give a *faultless* performance in spite of what is probably only a subconscious discomfort after the first few minutes of warming up, long before the red light goes on. But his subconscious discomfort may well make the difference between a flawless performance and a *superb* one.

Let's be more specific. Since electrical recording began, and techniques changed for the better, one of the main problems for the recordist has been that of obtaining aural balance—not only between individual instruments or groups, but between the composite program coming from the orchestra and the "background" contributed by the studio or auditorium where the recording is made. This last point is important both to the players and the recordist.

Playing in a concert, just for the benefit of the audience, the members of the orchestra take their places dictated by tradition, with minor variations according to the whim of the individual conductor or leader. Each one hears the complete work from an aural perspective unique to himself—one from which, by long familiarity, he can contribute his part with confident facility, born of long training and practice. The conductor even, who has the best perspective (as regards balance) of anyone in the whole group, hears a very different version from that received in a average audience seat. But his training too has enabled him to judge what he hears so it will sound superb to the audience.

But it is a typical audience impression that the record has to capture. Many,

who have never had it to do, imagine that all you need to capture this impression is a high-quality microphone placed in a "typical" audience seated position. Anyone who thinks that should try it sometime. He'll have the shock of his life! What happens and how can we explain it? Like this.

Although our ears faithfully transmit every little sound that is audible along the auditory nerve to our brains, the complex of nerve cells at the receiving end do quite a job of work on it before it comes into the conscious area of the brain to be recognized as "sound." As proof of this, pay particular notice next time you have a meal with a friend in a crowded restaurant, or when you are at a cocktail party with a room full of guests.

When you talk to your companion, all the other conversations seem to be just an unrecognizable babble in the background. You notice it. It lends atmosphere. But it does not intrude into your conversation. But maybe, if two or three of you are conversing, in a group, the others will wander into a subject that does not hold your interest. Your concentration on this particular conversation weakens, and you become much more aware of the babble which before was only a background. What a noise it suddenly seems!

Then maybe one of the group speaks directly to you by name, or the subject arrests your attention once more. If you observe carefully, your hearing faculty seems to turn down the volume on the babble again, so it's only a background once more.

A similar thing happens, but you will have much more difficulty observing it, when you go to a concert—in fact all the time, in everyday life. People who live by a commuter track never notice the trains passing (unless they get interested in hi-fi). The summer crickets' incessance fades toward the end of their season; but when an extra-cold fall night suddenly silences them, we become aware of the silence.

In the concert auditorium, in fact everywhere, we make the same kind of discrimination between the direct sounds we want to hear and the reverberation, or echo effect, of the same sound traveling 'round the room. You can realize this is true if you ever completely change the furnishing of a room. Maybe you decide to carpet the floor, use upholstered furniture and heavy drapes, where previously there were none of these sound-absorbent surfaces. You will become abruptly aware of the difference.

So your hearing concentrates on the program directly from the orchestra and relegates the reverberation to the background. If it wasn't there you would

(Continued on page 65)



# How High is Fi?

Puzzled by the poor sound of an amplifier with excellent statistics?  
This explanation answers the puzzle and points out the way to Fi.

GEORGE FLETCHER COOPER\*

**A** YEAR OR SO AGO I expressed in another monthly my growing doubts about a lot of this hi-fi business. Angry readers sprang to their typewriters (though fortunately not in Old Chicago) and pointed out that bats could hear this frequency and Venusians, in their space suits, could hear that. Now all I want is that the bats in my belfry should keep out of my hair, and I just will not try to keep up with the Jones' from Venus: I don't even know how to drive a space-ship.

The sudden expansion of hi fi in the last ten years or so has been a very remarkable phenomenon. Twenty years ago it was very difficult to find a broadcast receiver which would pass the highest frequencies handled by an up-to-date carrier telephone system. I do not mean a program channel, but just the ordinary speech channel. To sell carrier equipment then you needed to offer 2 db down at 3400 cps: it was a good receiver which had a 6 db bandwidth of 6000 cps at i.f., which means 6 db down at 3000 cps. At the low-frequency end the broadcast receivers were better and anyway you could always tap out after the detector. It was, indeed, the low-frequency end which got most of our attention. The domestic loudspeaker in a domestic box might have a limit of 200 cps but the original signal went down to 30 cps or 50 cps and the hi-fi fans of those days were after the low notes. They were after high notes too, but recording techniques were not much good above 8000 cps and although the broadcasters talked glibly about 6000 cps no one in politics ever had the sense to stand up and say that one clear channel is worth three with monkey chatter. This statement is true about politicians throughout the civilized world, of all colors and parties. The result was that even with tweeters we settled for about 10,000 cps.

All this is before the days of feedback, at least feedback as we use it now, and it is surprising to look back and notice that the professional amplifiers of those days were designed to give only 1 per cent distortion. I don't think this sort of figure was obtained in the domestic amplifiers and the limitation of quality

in the home was almost entirely due to intermodulation in the amplifiers. Just over ten years ago there came a great change: amplifiers with some 20 db or more of negative feedback appeared on the market. The first ones were good and they sold, and then there appeared some feedback amplifiers which were not so good. The only difficulty came in finding out why they were not so good. Once you have bought the amplifier and if you have the full range of professional test equipment it is not too hard to work through the system and find out what is wrong, provided you know what you are looking for and you realize you will never get your money back. Most of the hi-fi addicts who got caught with the not so good amplifiers had no real test equipment. They knew their amplifiers covered 20 to 20,000 cps, that the 400 cps distortion was  $\frac{1}{2}$  per cent or whatever, and yet it didn't sound so good. When the fellow next door (name of Jones) showed off his amplifier, flat from 5 to 50,000 cps, it sounded better. Here was the answer, bigger and better bandwidths. Away we went happily doing the right thing for the wrong reason.

I have no real objection to doing the right thing but it seems to me best to do it for the right reason, because otherwise there may be side effects which undo much of the good. Let us go back to the basic amplifier and see if we can see why the bad amplifiers were bad. They had a good frequency response, flat from 20 to 20,000 cps. They had 26 db of feedback, perhaps. I am not describing any particular amplifier, by the way, but these numbers are chosen just for something to reason about. The designer was perhaps a bit lazy because he used large coupling capacitors and he saved his money on the output transformer. Knowing he had 26 db in hand for feedback he designed the output transformer to be 3 db down at 400 cps, thus saving a lot of iron and copper. At 20 cps it would be 26 db down and therefore, roughly speaking, the feedback would just hold up the response. I do not propose to calculate all this out in detail because all I want to do is illustrate the scale of things. At 400 cps there is more than 20 db of feedback so that up to a reasonable load level the distortion is

knocked down by a factor of 10 and the quoted distortion figures are obtained.

Now consider that deep organ note at 40 cps. Here the gain is 20-db down so that we have only 6 db of feedback. Actually, things are better than they seem, because the second harmonic at 80 cps finds 12 db of feedback and the higher harmonics even more. However, at 40 cps the transformer reactance, which already equalled the load at 400 cps, has fallen to one-tenth of the proper load. The unhappy output stage is now working not into its proper resistive load but into a much smaller inductive load. Any attempt to get the sort of voltage swing needed is doomed to failure. What makes this situation particularly unpleasant is that it is not easy to hear these low frequencies. Consequently, the musical instruments used to produce them are powerful engines delivering quite high levels to the air; our loudspeakers must therefore deliver high levels if we are to have faithful reproduction. The lower the frequency the more power we need and the harder it is to get it because of the falling off of the transformer impedance.

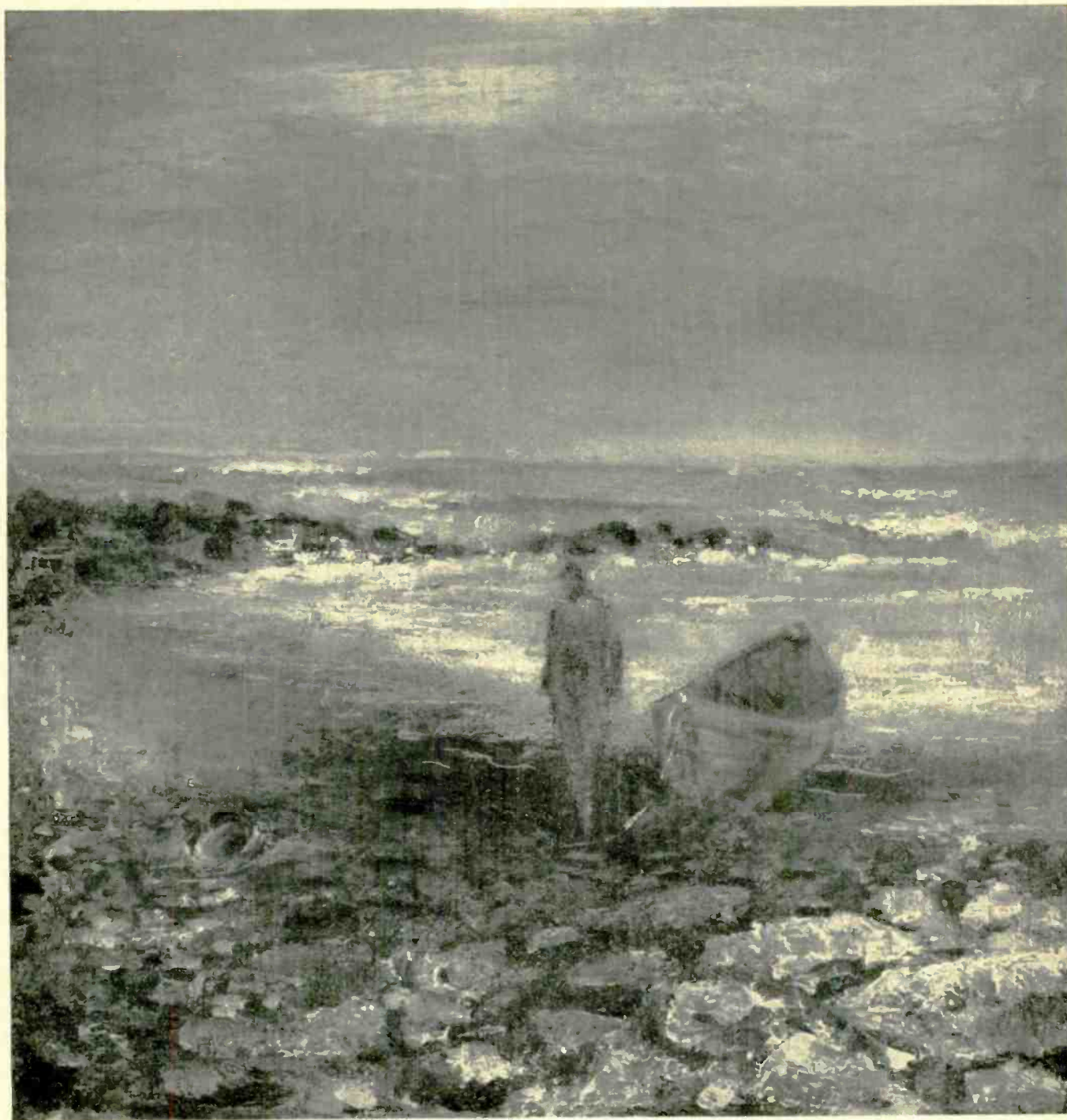
As the output stage is driven to the limiting points by these very low frequencies, its gain necessarily drops to zero. You will see this quite easily by noticing that for a small increase in instantaneous input near the peaks of the 40 cps signal, there is no change in the flat-topped output. The remainder of the orchestra is thus cut off completely during this period and the 40 cps signal acts as a modulating signal to the remainder. It is this intermodulation which is fatal to quality.

When we apply the same rough calculation method to an amplifier which has a response flat down to 2 cps and has 26 db of feedback, we can see at once that the output transformer is probably only 3-db down at 40 cps and will not run us into nearly as much trouble at this sort of frequency. Even so, the effective load for the output tubes is only 70 per cent of what it should be and the load line has become an ellipse so that the 2 cps amplifier will not give full undistorted power at 40 cps.

Before we explore this topic further, let us see what happens at the other

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end of the frequency scale. Matters are much more complicated here, and I suspect that there are some rather queer things happening even with the good feedback amplifiers. The designer of the output transformer is faced with a choice between two methods of construction. He can make a very simple structure, with relatively high leakage inductance, which will have a clean smooth cutoff beginning at perhaps 8000 cps, or he can use a multi-section structure to get a much lower leakage inductance, and a cutoff at, perhaps, 16,000 cps, with a whole bunch of resonances in the region between 20,000 and 100,000 cps. In either event he is faced with the fact that the output transformer will have a top cutoff which soon averages 12 db per octave and therefore gives a phase shift of 180 degrees. To keep the amplifier stable, he adds those neat little C-R step circuits in the plate loads of the early stages. Usually, therefore, the gain of the amplifier without feedback starts to fall at around 8-10,000 cps.

Just as at the low frequency end, the use of feedback enables a nice imposing response figure to be quoted, with the sort of numbers I have been using, the response might be flat up to 50,000 cps, and a little bit of faking would take it even higher. Faking may seem a hard word but up in this region the phase shift through the amplifier has come round nearly 180 degrees, so that the feedback will be positive and can be used to lift up the response. Even without this extra frill the feedback situation up in the 20-50,000 cps region is not so good. I do not think we need discuss the load line of the output tubes up here because the signal level will be pretty low; as you would expect the load line moves to make matters worse.

Does it matter? After all I have said that only bats can hear these high frequencies so why should I trouble my head about them? The answer lies in the compromise nature of musical scales. In a pure scale we divide the octave into a number of intervals, five in the pentatonic bagpipe scale so that:

$$\begin{aligned} f_2 &= \sqrt[5]{2} f_1 \\ f_3 &= \sqrt[5]{2} f_2 \\ f_4 &= \sqrt[5]{2} f_3 \\ f_5 &= \sqrt[5]{2} f_4 \\ f_6 &= \sqrt[5]{2} f_5 = 2f_1 \end{aligned}$$

This is all right, but when the scale becomes a complex of whole tones and half tones some difficulties appear. So long as instruments can produce any frequency the situation is still unchanged provided that the player has a good enough ear but with the introduction of the piano, with its fixed tuning, matters really came to a head. As soon

Fig. 1. Response shaping network to be substituted for the simple feedback resistor.

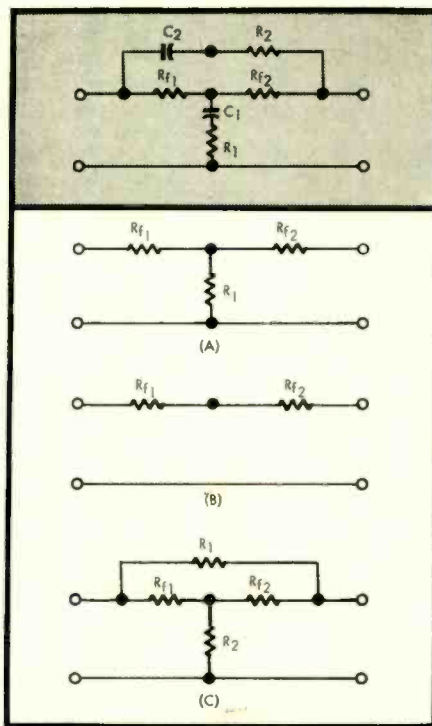


Fig. 2. (A) In the middle of the band. (B) At low frequencies. (C) At high frequencies.

as there is a change of key some notes should change frequency but unless you have one of the ingenious machines built in the early days of the piano which could actually do this you are stuck. The answer, of course, is to arrange the tuning so that it sounds nearly right all the time. By now, indeed, we are so used to it that we do not notice anything at all, so used to it, in fact, that even without a piano around most players of other instruments adjust to the piano.

The difficulty arises as soon as the music becomes complex enough to call for more than one note at a time, which is of course almost all music. If we have two notes,  $f_1$  and  $f_2$ , they sound discordant if  $f_1/f_2 = m/n$ , where after dividing out common terms  $m$  and  $n$  are both fairly large, and concordant if  $m$  and  $n$  are small. But now we have modified  $f_1$  and  $f_2$ , so that instead of  $f_1/f_2$  being, say,  $4/3$ , it is now  $4/3(1 + \delta)$  where  $\delta$  is a small quantity. Let us take some numbers, not particularly musical ones but arithmetically convenient, with  $f_1 = 808$  cps and  $f_2 = 600$  cps and  $\delta = 0.01$ . The ear would accept this as a concordant interval with amplitude flutter and there would be no unpleasant subjective reaction. All musical instruments worth considering produce harmonics and let us consider just the convenient pair

$$12f_1 = 9696 \text{ cps}$$

and

$$16f_2 = 9600 \text{ cps}$$

I postulated earlier that in an imperfect amplifier there might not be really enough feedback at 96 cps. But this frequency is produced by intermodulation of these two harmonics and, because of lack of feedback, appears at the loudspeaker. The chance that this "compromise difference tone", multiplied will not be thoroughly unpleasant is slight. But worse is to come. It is known that certain harmonics completely ruin the sound of a compromise chord and makers of musical instruments try to eliminate them by arranging for the hammer of a piano or the bow of a violin to apply the excitation at a node of the unwanted harmonic. Our amplifier may not be so fussy, however, and can generate these particular harmonics up in the region above 10,000 cps where our feedback no longer operates properly. Round they go, mixing and intermixing, with the nonlinearities of the loudspeaker and of the ear doing all they can to make matters worse.

One more effect deserves mention. We have seen that it is inherent in our music that the harmonics of instruments playing in harmony should be slightly different in frequency. The difference frequency will appear on the supply line to the output stages, which is almost invariably push pull and biased well down. Unless a regulated supply unit with nearly zero impedance is used, this difference frequency will feed back to provide some plate modulation or screen modulation in earlier stages.

I do not know of any other survey of these imperfections of the feedback amplifier, possibly because it took quite a long time and quite a lot of propaganda to persuade people that they could be designed to be really stable and that the advantages are worth the extra trouble. Now, however, we can take feedback for granted and start looking at the effects more critically.

Before going on to the amplifier problem I should like just to mention my own distrust of the low-frequency loudspeaker. I am eagerly awaiting the production of a loudspeaker with a very low-mass electrostatic microphone stretched right across in front of it. Suppose that the spacing between the microphone diaphragm and the speaker diaphragm is 6 inches. Then at 1100 cps the phase shift will be 180 degrees, at 550 cps the phase shift will be 90 degrees. I would guess that up to 400-500 cps it should be possible to apply feedback which would include the actual loudspeaker itself in the loop.

After that short digression let us turn back to the amplifier. How can we get the best results, assuming of course, that we want to keep the cost within reason? The first step must be to get

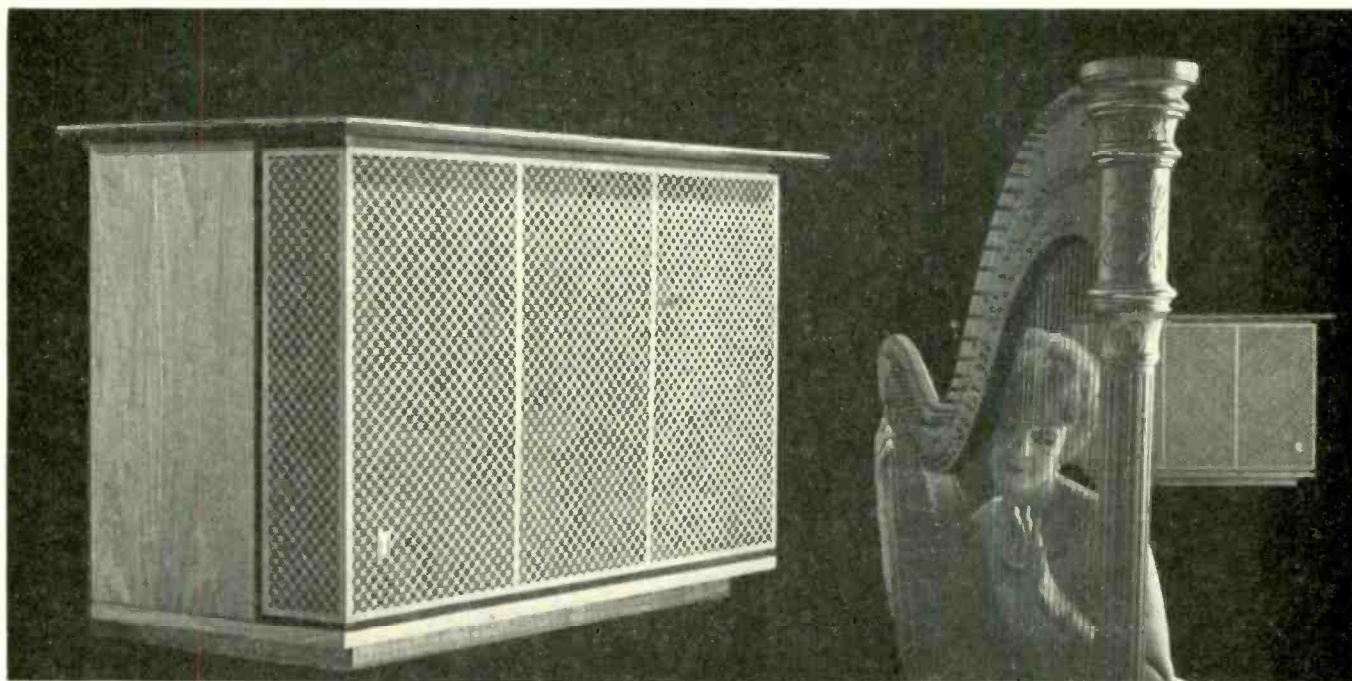
(Continued on page 65)



  
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*The "Truly Phenomenal"*

## FISHER FM-200

In the entire history of FM tuner design, there has never been an instrument to match the Fisher FM-200! Here are a few of its *unequaled* features: ■ 0.5 Microvolt Sensitivity! ■ SIX I.F. Stages! ■ FIVE limiters! ■ Golden Cascode Front-End! ■ Sensational MicroTune Invention!

**D. W. PASSELL, Chief Engineer, WNCN, New York,**  
tunes Fisher FM-200 to WHCN, Hartford affiliate of the Concert Network, for direct off-the-air link. He says: "The FM-200 is very good in rejecting strong local signals which overload other tuners, or cause noise."

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## Read What Fisher FM-200 Users Write Us:

### T. Mitchell Hastings, Jr., President, The Concert Network:

"After extensive field tests of the finest FM tuners available today, including such tuners as the .....\* and the .....\* which costs over \$2000.00, we have found the Fisher FM-200 to be superior in selectivity, sensitivity and fidelity. We are therefore equipping every station on our network with the Fisher FM-200 for direct, off-the-air relay operation. The performance of the FM-200 is particularly remarkable at our Hartford station, where there are four maximum-powered FM broadcast stations operating within 100 yards of this tuner... Truly Phenomenal."

\*Names omitted for ethical reasons

### John M. Conly, Atlantic Monthly:

"Has all its predecessor's virtues and some astonishing powers of its own. One hundred and twenty crow-flight miles (out of a bad location) mean nothing at all to the Fisher FM-200. And it separates stations which I earlier had thought should be expected to overlap. This tuner is an especial boon to those who live at critical distances from good music stations."

### Francis G. Cleveland, Tamworth, N. H.:

"By far the best we have ever heard or seen. The weather has been gales and snow, conditions which ordinarily lead to a lot of noise, yet the FM-200 has been quiet and packs tremendous

power. WHXR Boston, 120 air miles, with a mountain range between us, registers between 3½ and 4 on the meter, making the FM-200 fantastically good. And it has the *solid sound* which HIGH FIDELITY magazine spoke of in its review of the FM-100."

### Dr. Paul F. Hausmann, Milwaukee, Wisconsin:

"I have logged stations in Chicago I had never heard before, as well as Kalamazoo, Michigan and Cleveland, Ohio. Yes, Cleveland, Ohio! Furthermore, I was able to reach through and separate WFME in Chicago (100 miles away) from WRJN-FM in Racine, 25 miles away and *directly in the path of the Chicago station*. I have never accomplished this before!" (\*338 miles)

### FISHER 202-R FM-AM Tuner

■ Stereophonic Tuner with FM section identical to the FM-200, plus an AM tuner with an FM-calibre tonal range.



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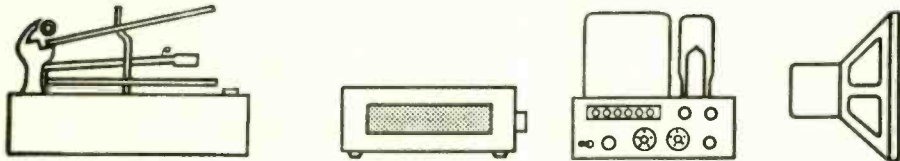
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# EQUIPMENT



# PROFILE

## FISHER FM-200 FM TUNER

In the past year the high fidelity industry has strongly reaffirmed its pursuit of excellence—a renewal of its original declaration that quality is the *raison d'être* of component high fidelity. Perhaps its the weather, or, more important, a rediscovery of the fact that there are a sufficient number of consumers willing to pay for the best. Anyhow, the Fisher FM-200 is a clear expression of this; an FM tuner for those who appreciate the best and are willing to pay for it. As an aside, we would like to record our delight with this trend—it is bound to have beneficial effects on all price levels. Certainly the design and development know-how accrued in producing the FM-200 is, and will be, reflected in the entire Fisher line.

### Features

In models previous to the FM-200, Fisher found it unnecessary to include a.f.c.; they really did not drift. As we all know, a.f.c. has certain disadvantages as well as advantages; it prevents pulling in weak stations which are close to stronger ones and, in some instances, tends to increase distortion. The method devised by Fisher to overcome these handicaps (they call it "MicroTune") is to automatically cut out the a.f.c. during tuning, and automatically cut it back in afterwards. By this one stroke both objections are substantially overcome;

weak stations are easily tuned in and, because tuning is accomplished with the aid of a sensitive meter, the center of the pass-band is more accurately located. Of course one may well ask: "Why is a.f.c. necessary if the tuner is drift-free?" Primarily, in the FM-200, it is because of the wide-band design which makes it extremely difficult, if not impossible, for tuning assisted only by a meter to find the exact "center" for minimum distortion. On the other hand, a.f.c. will finish the job started by the tuning meter; it will pull the signal into the center of the channel after being brought close by the meter.

The method whereby "MicroTune" is accomplished is quite interesting. When the operator's hand is placed on the tuning knob, the 60-cycle hum normally transported by the human body is amplified to operate a relay which cuts out the a.f.c. Conversely, when the hand is removed, the relay is de-energized and the a.f.c. reinstated. This method is obviously more elaborate than the a.f.c.-defeat switch, but it does have the virtue of simplicity of operation; the lady of the house will never "forget."

Another feature of the FM-200 is the incorporation of i.f. muting; between-station "hash" is reduced to a bearable level by cutting off the last i.f. stage when "that" level is reached. This feature is obviously meant for those sensitive souls who cannot be bothered to turn down the volume control while tuning.

### Circuit Description

The antenna input circuit of the FM-200 makes provision for a 72-ohm coaxial input as well as the usual 300-ohm line. The 72-ohm input is of great value for those who reside in industrial or metropolitan areas where a great deal of interference is common. In addition, both the 300-ohm and 72-ohm inputs employ balun transformers for a balanced line. A local-distance switch permits reducing the signal level by 20 db before it reaches the r.f. amplifier stage, thus preventing overload.

The single-tuned input goes to the cascade r.f. amplifier (Fisher calls it a "Golden Cascade" because of the use of frame grid tubes with gold-plated grids—which is supposed to reduce, significantly, secondary emission by the grids) and from there, through a double-tuned circuit to the oscillator-mixer. Both the r.f. amplifier and the oscillator-mixer are double triodes. Following this are six i.f. stages with 12 tuned i.f. circuits. The last four i.f. stages also act as limiters, as does the wide-band ratio detector, so that there are effectively five limiters. Audio output is by means of a cathode follower. The oscillator, ratio detector, and a.f.c. circuits are temperature compensated so that drift is really no problem, even without a.f.c.

### Performance

Now we are at the "moment of truth," as the bullfight *aficionados* call it—"How well does it perform?" Simply stated, the FM-200 is a superb FM tuner. Its usable sensitivity, by IHFM standards, is 1.6 uv, which places it in the top rank in this category. We were able to tune in stations more than 75 miles away with the folded dipole supplied. The signal received was exceptionally free from noise, interference, and distortion. Also, in answer to those who might wonder if such great sensitivity might be a problem with strong signals, we received all local stations undistorted without using the "local" switch.

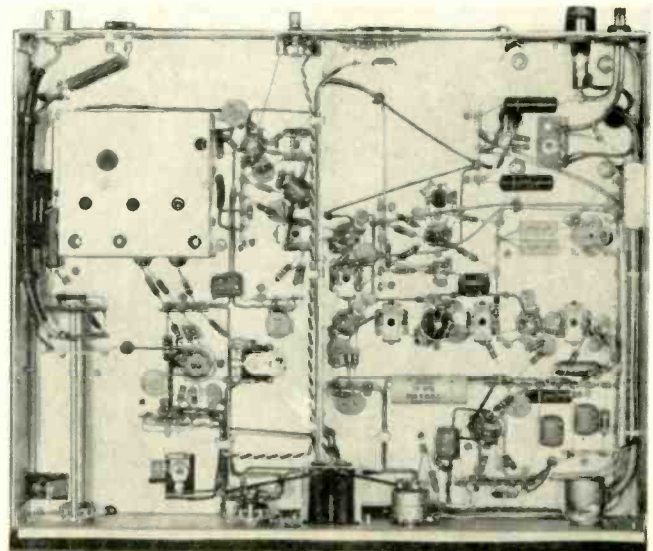
This tuner carries current engineering practice to its logical extremes. The use of six i.f. stages is certainly an example of this—we can think of no other current nonprofessional tuner with as many i.f. stages. Equally important, careful examination of the circuit and construction clearly indicates that the FM-200 will perform at optimum level for many years.

There are many other "statistics" which we gathered in the process of evaluating this tuner—but suffice it to say that the music lover will be delighted with the FM-200. It is a real step forward. E-26



Fig. 1. The Fisher FM-200 FM tuner (above).

Fig. 2. Bottom view of the FM-200 showing the excellent construction (right).







## WHAT IS THE SECRET OF MAKING A SATISFACTORY MULTI-WAY SYSTEM ?

The prerequisite, of course, is that the individual loudspeakers used are of high-performance type. The woofer, squawker and the tweeter must be capable of faithfully reproducing the sound range for which they are respectively responsible. Another important factor is that the loudspeakers used are well-balanced in the matter of tone quality and efficiency. Otherwise, full effect of a multi-way system can never be achieved.

PIONEER woofers, squawkers and tweeters are acclaimed highly for their efficiency and high tone quality. Moreover, their performances are well-balanced in every respect. When you are making a multi-way system, do not forget to collect a complete set of PIONEER hi-fi loudspeakers. You will be sure to obtain sound reproduction from the dynamic bass to refreshing treble that will charm you to your heart's content.

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Voice Coil Impedance: 8 or 16 ohms  
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Frequency Range : 30-4,000 cps  
Power Input : 20 watts  
Sensitivity : 105 db/watt  
Total Flux : 220,000 maxwell  
Flux Density : 10,000 gauss

### 6 1/2-inch Mid-Range Speaker PM-16B

Voice Coil Impedance: 8 or 16 ohms  
Resonant Frequency : 360-420 cps  
Frequency Range : 400-6,000 cps  
Power Input : 25 watts  
Sensitivity : 104 db/watt  
Crossover Frequency : Low; 500-800 cps  
High; 2,000-5,000 cps  
Total Flux : 65,000 maxwell  
Flux Density : 10,400 gauss

### Horn Tweeter PT-4

Voice Coil Impedance: 8 or 16 ohms  
Cutoff Frequency : 1,500 cps  
Frequency Range : 1,500-16,000 cps  
Power Input : 20 watts  
Sensitivity : 105 db/watt  
Crossover Frequency : over 3,000 cps  
Total Flux : 22,500 maxwell  
Flux Density : 14,400 gauss

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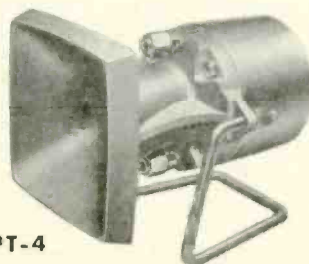
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PW-30C



PT-4



PM-16B

## GARRARD TYPE A AUTOMATIC TURNTABLE

The Garrard Type A turntable is a transcription-type turntable and dynamically balanced tone arm with the well-known Garrard record-changing mechanism superimposed on it. At first thought, it would appear as if two contradictory elements are being united: on the one hand we have a desire for the utmost fidelity as evidenced by the transcription-type turntable and arm; on the other hand we have a desire for convenience as embodied in the record changing mechanism. On second thought, however, we began to realize that a certain proportion of our record playing time would be well served by a record changer—for instance the background music we enjoy while concentrating on other activities. The question then becomes: "Can these two functions be successfully combined without compromising either?"

### Operation

Before answering this question at length, it might be well to take a quick look at how this unit works. First off, it should be noted that the Type A offers 4-speed operation: 78, 45, 33 $\frac{1}{3}$ , and 16 $\frac{2}{3}$  rpm. This 4-speed operation is accomplished by means of a 4-stepped pulley on the motor shaft which drives a rubber idler, which in turn engages the inside rim of the turntable. Speed change is effected by shifting the height of the idler, thus engaging the correct pulley step. The idler is disengaged from both turntable and pulley in the off position.

For manual operation, the record-pusher mechanism is pushed out of the way (note the lever beside the mechanism in Fig. 3—pushing this lever to the rear also moves the pusher mechanism to the rear) and the MANUAL switch is set in the ON position. Although the automatic record changer is not in operation, the end-of-record cut-off switch and arm return still function. Oddly enough, in appearance anyhow, the record-size feeling arm rotates out to "feel" for a record after the arm is returned to the rest. This, of course, highlights the small difference between the automatic and manual modes. Manual operation is really automatic operation minus two steps: the initial determination of record size so that the stylus will "fall" in the lead-in groove; and pushing the following record into "ready" position. In reality, if one were to leave the pusher mechanism in position and place a stack of records on the spindle, operation would be completely automatic, even in the MANUAL mode, after the first record is played. The point here is that the unit is really an automatic record changer with two functions disabled one records worth for manual operation.

Functioning of the mechanism is quite precise and effortless, as we might expect from Garrard. This mechanism, in essence, has been available for a good many years—and it has received many well-deserved tributes during these years. The changer is certainly one of the strong points of the Type A.

### The Arm

This arm is obviously the culmination of many previous Garrard arms; its outward resemblance to the TPA/12 and to the arm used on the Garrard Model 411P leaves no room for question about its antecedents. Other points of similarity are the

unusual canted vertical pivots and the horizontal bearings. Points of departure are the adjustable counterweight for dynamic balance and the stylus force spring with calibrated scale. With these, after the cartridge is installed, the arm can be dynamically balanced and then the stylus force set. In general, this is the procedure followed for most of the high-quality arms extant today. The result of being dynamically balanced is that the stylus will exert its force perpendicular to the record plane, no matter what angle the record plane is to the floor (or ceiling if you're inclined that way). We have all seen this demonstrated, and indeed, being curious, we tilted this turntable to some ridiculous angle. It works. (It is definitely *not* recommended for turntables however; they are not designed to operate for long at "ridiculous" angles.) This means that this

possibility of hum from the motor being induced in magnetic pickups. (Along this line, it should be noted that the cast turntable is made of a nonferrous metal.) The motor is isolated from the turntable by special shock mounts to avoid transferring vibrations from this source to the record.

### All Together Now

Now that we have examined the parts, we can return to the question of whether this unit can satisfy transcription turntable requirements with the convenience of a record changer. As we have noted, the individual parts are really quite excellent, and together they come as close as is possible to performing both functions. We must keep in mind, however, that a record changer must have its arm set at a height appropri-



Fig. 3. Garrard Type A automatic turntable.

arm will track even warped records. This arm is certainly out of the standard changer-arm class.

### The Turntable

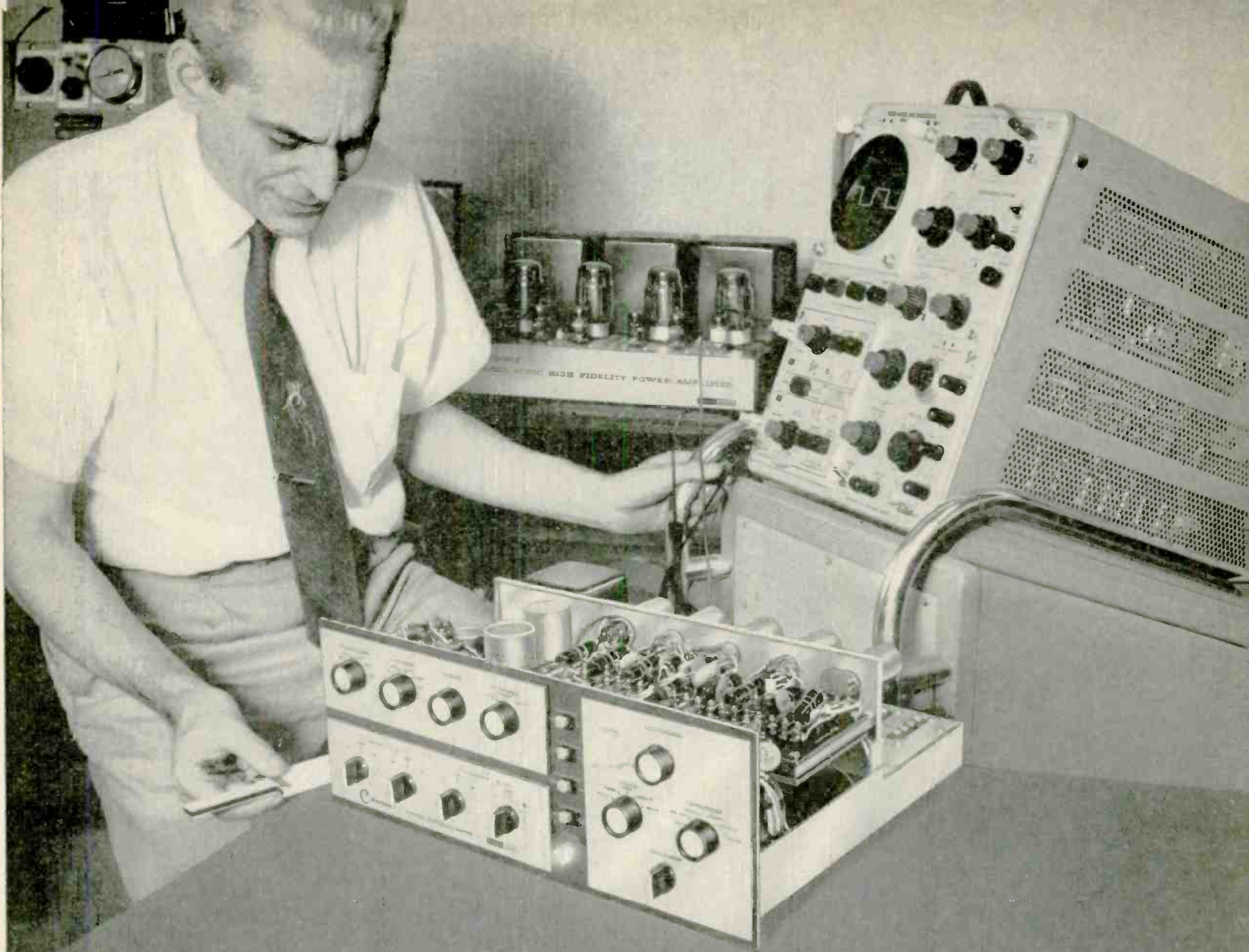
The turntable is really one of the most unusual elements of the entire mechanism—it is really two turntables in one. On top there is a heavy, cast turntable which weighs some six pounds; underneath there is a drive table, which in appearance is the same as an ordinary changer table. Between the two turntables is a foam-plastic mat. The effect is as if a changer such as the RC88 "Mark II" had a cast turntable superimposed over the existing one. In any event, the system works exceedingly well; wow and flutter measure below 0.2 per cent.

The motor driving this turntable is a four-pole shaded unit with a dynamically balanced armature. The motor is shielded top and bottom to eliminate the slightest

ate for a stack of records. Thus, there will be some tracking error on all records but the one which is at the correct height. In addition, stylus force for a record changer must, for various reasons, be greater than a transcription unit. The minimum value we could achieve was 2 grams. Although this is a very low figure, it does not permit taking full advantage of the excellent pickups available nowadays which can operate well at a stylus force of 1 gram or less. A side note here is that we had to use a stylus-force gauge to determine the 2-gram figure we arrived at because the graduated scale on the arm is not calibrated below 3 grams.

In summation, the Garrard Type A automatic turntable is a fine record changer-transcription unit combination. For music lovers desiring the convenience of a record changing mechanism, the Garrard Type A is an excellent choice. E-27





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The basic quality of the "Citation Sound" was summed up by the Hirsch-Houck Labs in HIGH FIDELITY: *"The more one listens... the more pleasing its sound becomes."* Another glowing tribute to Citation and its talented engineering group, headed by Stew Hegeman (shown above), came from Herbert Reid who said in HI-FI STEREO REVIEW: *"Over and above the details of design and performance, we felt that the Citation group bore eloquent witness to the one vital aspect of audio that for so many of us has elevated high fidelity from a casual hobby to a lifelong interest: the earnest attempt to reach an ideal — not for the sake of technical showmanship — but for the sake of music and our demanding love of it."*

Perhaps the ultimate tribute came from ELECTRONICS ILLUSTRATED when it classified Citation as: *"The Rolls-Royce of the kit field."*

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## EICO ST-40 STEREO AMPLIFIER KIT

The Eico ST-40 is 40-watt (20 watts per channel continuous sine wave power) stereo integrated amplifier kit, one of Eico's new "Medalist" line of kits. This line features handsome styling with a clearly evident family relationship between the various units in the line. Although "window dressing" is a must in today's market, it is the performance of this amplifier which is of major concern to us. This is not meant to deny the importance of appearance, it is really a question of priorities. (As you might guess from this, we are of the "form follows function" school.) In any case the Eico ST-40 exhibits all of the well-known Eico electronic design know-how. There's an old expression to the effect that experience will show through—and Eico is one of the oldest names in the kit business. The ST-40 is a lot of amplifier for the money.

### Circuit Description

The ST-40 is an audio control center as well as a power amplifier and thus contains provisions for accepting a wide variety of signal sources, with appropriate switching to handle them. There are six low-level and seven high-level inputs. Two of the low-level inputs in each channel are phono inputs, one with a 47,000-ohm load and the other with a 100,000-ohm load. Both feed the preamplifier tube (12AX7) and are equalized (RIAA). The remaining low-level input in each channel is for tape head, which follows essentially the same path as the phono inputs—naturally, the equalization in this case is NARTB. At this point the high-level inputs enter the circuit. The signal now goes to the Baxandall-type tone-control circuit which uses a 12DW7/7247 double triode as an amplifier. Another 12DW7 is used as the driver/phase-splitter which drives the 7591 output tubes. The power supply utilizes a GZ34 rectifier tube with capacitor input. All heaters are supplied from special windings on the power transformer; a separate winding for each channel. Hum-bucking potentiometers are across the filament winding for each channel.

In addition to the tone controls, there are high- and low-frequency filters for rumble and scratch, each filter consisting of two separate sections for maximum effectiveness. In addition there is a loudness switch to insert a bass-boosting network for those who must listen at low-volume levels. There is also a balance check switch. Feedback, for distortion reduction in the power output stage is taken from the 16-ohm tap of the output transformer and fed back, through a network, to the cathode of the driver tube.

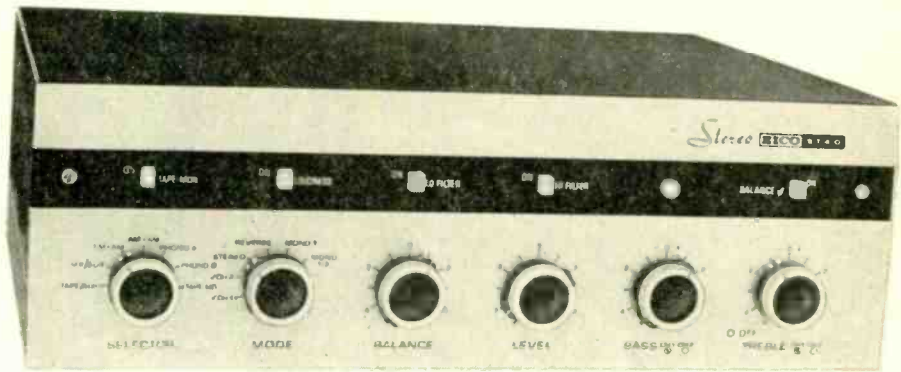


Fig. 4. Eico ST-40 stereo amplifier kit.

### Construction

The kit designer has several factors to consider which are considerably different from what other designers must face: his designs may be constructed by people with *absolutely* no knowledge of electronic techniques and with only the most rudimentary measuring instruments available, even if they know how to use them. Therefore if the potential of the circuit design is to be achieved, considerable thought must be spent in anticipating potential trouble spots. In reality he must design for the least common denominator. Let us consider an example of what this means.

Most of the time, in fact in 99 44/100 per cent of the cases, we build the kits which are reviewed just as any kit builder would. Then, of course, we make measurements with our more than normal amount of measuring equipment. In this case, however, we found it necessary to have the kit constructed by someone else. In a way this is valuable. The knowledge and dexterity we have achieved after several tons of kits and other projects makes it difficult for us to spot certain types of construction problems. Anyhow, the person who built this kit was certainly representative of the "average" audiofan buying such equipment today—he loves music and knows very little about electronics. After he had completed the kit we lugged it to our "lab" and started the usual testing procedures. The measurements were so erratic that it was obvious that a more searching look at the "innards" would be necessary. First, we took voltage measurements at the tubes. The heater voltage was very low. Next, we spent some five to six hours trying to determine the reason for that low heater voltage with no success. Finally, we carried the unit back to the Eico factory. Naturally it took one of their engineers (actually the engineer who designed this amplifier) just a few moments

to determine where that heater voltage was disappearing to. Now we have arrived at the point of this lengthy explanation. The reason for the disappearing heater voltage was due to that type of human error which not even the most perceptive kit designer would anticipate: a screw and nut had been oriented in the wrong direction.

In the circuit description we noted that potentiometers were used across the filament windings of the power transformer in order to balance out hum. With this arrangement the metal case of the potentiometer is "hot" and therefore must be isolated from the chassis. For this reason, the potentiometer mounting hardware must be oriented with the head underneath the chassis and the nut above—or else the nut will touch the case and ground it to the chassis. Naturally this is exactly what did happen. Once this hardware was reversed the amplifier began to behave the way an amplifier should.

Oh yes, of course the instruction manual carefully described the correct orientation of these screws but our "average" constructor "corrected" the manual because "these were the only screws with their heads underneath the chassis."

Other strong points of this manual are the large, clear pictorial diagrams and the large type size used in the instructions. Too often we find ourselves "seeing double" after a kit-building session because of small, closely spaced type.

On the debit side of the ledger—there was a capacitor missing from the kit. This isn't a calamity but it can be a highly annoying occurrence for the audiofan without a "junk box."

### Performance

The performance of an amplifier, or indeed any electronic instrument, may be considered in two aspects. First, does it meet its published specifications? Second, are these specifications "good"?

First, we can state that the Eico ST-40 meets its published specifications (with only two very minor variations—probably a result of instrument error). Fig. 5 shows that the frequency response from 30–20,000 cps is within plus or minus .55 db at 20 watts output (published rating is 40–20,000 cps within plus or minus .5 db). Intermodulation distortion at 20 watts is 1.05 per cent (published rating is 1 per cent). Harmonic distortion at 20 watts output and at 40 cps is 1.9 per cent. At 1 db down from 20 watts it is only 1 per cent at 40 cps. Residual hum in either channel is minus 76 db or better. Channel separation at 1,000 cps is over 31 db.

In summation, therefore, the Eico ST-40 is an easy building integrated stereo amplifier kit of handsome appearance with excellent specifications in its category—an excellent buy for those with a modest budget.

E-28

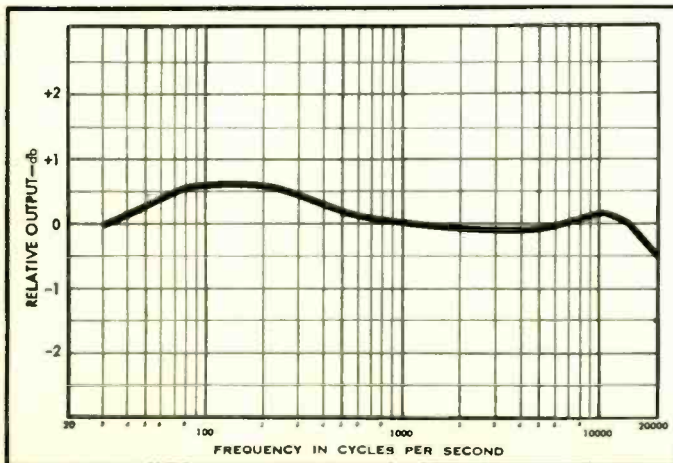
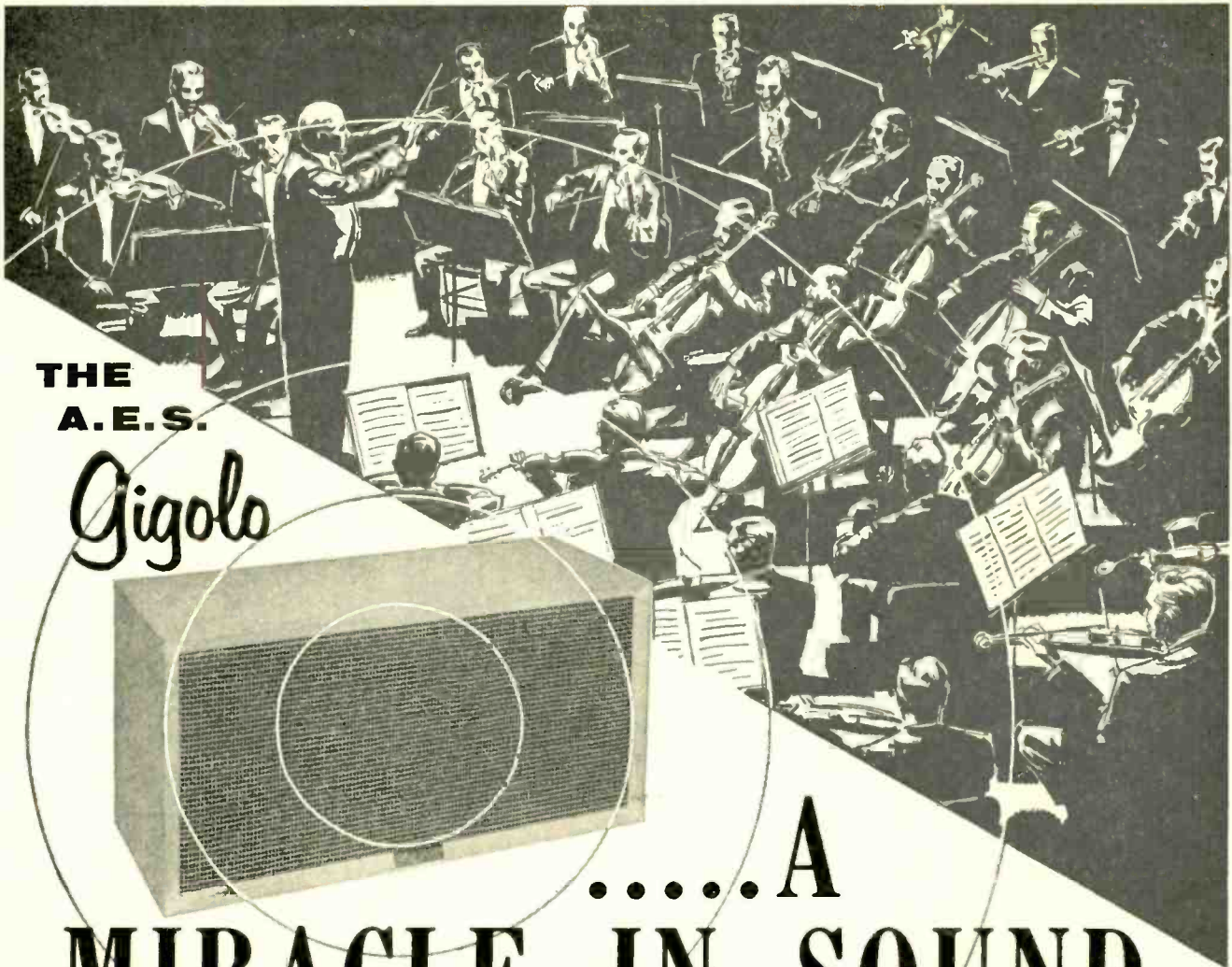


Fig. 5. Frequency response of the ST-40.





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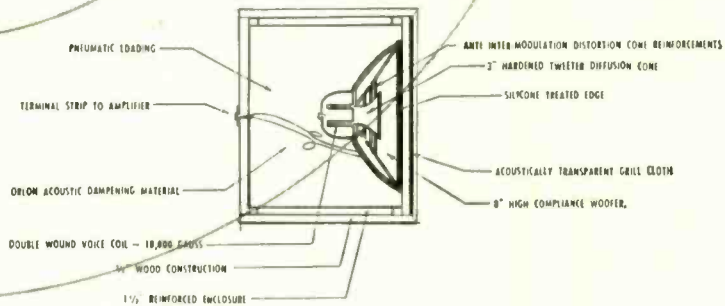
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## GOODMANS "ALPHA" SPEAKER SYSTEM

Goodmans, a British firm, is an old and respected name in the loudspeaker industry. Up to now they have concentrated on speakers rather than systems. The "Alpha" is their first entry into the systems field.

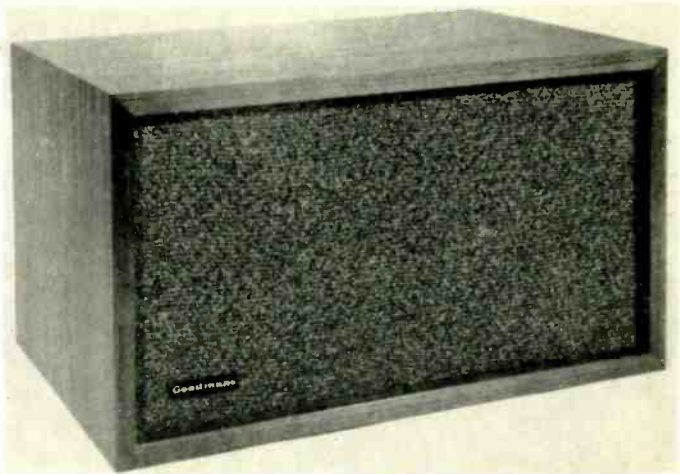
Not only is this a first for Goodmans as a system but it also marks a turning point in their marketing philosophy. Prior to the introduction of this new system, a Goodmans speaker was generally intended for the advanced audiophile. Now for the first time, Goodmans is inviting the neophyte to "get his feet wet." They are offering him a Goodmans system at a very inviting price. For those music lovers who up to now have had their music "strained" through the inadequate speakers of the high-volume "package" manufacturers, here is an excellent opportunity to markedly improve their system economically.

### The System

Inside the hand-rubbed walnut- or mahogany-finish cabinet are two Goodmans speakers: an eight-inch full-range unit and a rigid-cone 3½-inch tweeter. The woofer has a 7¼-ounce magnet and a foam plastic surround. The tweeter has a fully enclosed metal back. The enclosure is acoustically lined and a crossover network is built in.

In addition to being economical in price the Goodmans "Alpha" is also economical of space. The dimensions are a mere 21¼" x 11¼" x 11¼".

Fig. 6. Goodmans "Alpha" speaker system.



### Performance

The stated frequency range for the Goodmans "Alpha" is 40-17,000 cps. Obviously they are not claiming the full rich bass of units such as the Goodmans "Audiom" 955—nor indeed would we expect it. On the other hand, within its range, the "Alpha" provides a clean well-balanced sound of great smoothness. It is definitely a non-fatiguing type of sound. Many small systems are rather fatiguing to listen to over a period of time. Although we couldn't be explicit as to the reason for this, we are inclined to think that balance and how well high-frequencies are handled would be of

extreme importance here. Perhaps the best way to communicate what we mean by fatiguing sound is to compare it to the sound of heavy brass passages coming through a very cheap table radio. In our experience listening to that type of sound over a period of time is extremely nerve racking and actually exhausting.

Refocusing on the Goodmans "Alpha," in our estimation it offers clean, well-balanced sound at an exceptionally low price. For those music lovers who cannot afford the more elaborate Goodmans speakers here is a financially painless way toward better sound. **E-29**

## AUDIO DYNAMICS ADC-1 STEREO CARTRIDGE

Some eight months ago a fledgling company announced its intention to introduce a new, high quality stereo cartridge. From their description, this new cartridge would reveal hitherto unsuspected sounds in our records. As usual, when we hear such claims, we took a very positive position: we would be very happy to have these virtues demonstrated. After having tested, and "lived with," the ADC-1 for a period of time we must report we are happy; it does indeed reveal shadings and nuances we had not known were in the recording.

### Features

Before reporting on the vital statistics of the ADC-1, we would like to indicate some of its features. One convenient feature of this cartridge is the ease with which the stylus may be replaced. The view shown in Fig. 7 indicates the simple, single-finger procedure for removing the stylus assembly. A flick of the thumb is all that is required. Reinserting the stylus assembly is equally simple.

Another, and probably the most important, feature of this cartridge is the extremely high compliance which is a prime reason for its ability to track at a stylus force of one gram or less. Certainly this can substantially reduce record wear, which makes it a very fine feature. More important, high compliance reduces distortion.

One feature of this cartridge only became apparent after a considerable amount of records had been "tracked"; it does not seem to accumulate dust. This is a valuable virtue in a pickup which tracks with such a small vertical force—an accumulation of dust can produce an unusual amount of "distortion."

Although it has nothing whatever to do with performance, the ADC-1 cartridge is encased in a gold-plated mumetal shield

which gives the appearance of high quality. Of course, the mumetal shield does have a practical function—it prevents stray magnetic fields from inducing unwanted signals. This is very close to having your cake and eating it.

### Performance

Previously we noted that the ADC-1 is an excellent cartridge. By this we mean that it easily meets all of its published specifications, and that these specifications are excellent. Indeed, in several cases it exceeded its specifications. For instance frequency response is stated to be 10-20,000 cps within 2 db. Our measurements showed them to be within 1.7 db. It is easily possible, of course, that instrument (and human) error could account for this difference, but at least it is on the credit side of the ledger. At a recorded velocity of 5.5 cm per

second, output was 6.9 millivolts per channel at 1000 cps. Channel separation at 1000 cps was 31 db; at 20,000 cps channel separation was 18 db. Recommended stylus force for the ADC-1 is .75-1.5 grams. We were able to track well at .9 grams. Although we were unable to measure lateral and vertical compliance, it is stated to be  $10 \times 10^{-6}$  cm/dyne. From the way this cartridge performed, coupled to the accuracy of the specifications we did check, we could well believe it.

In listening tests, A-B'd against two extremely fine cartridges, the ADC-1 proved itself a first-class performer. It introduced the smallest amount of coloration of any of the cartridges we compared it with. An exceedingly fine first product, well able to hold its own against "old" names. **E-30**

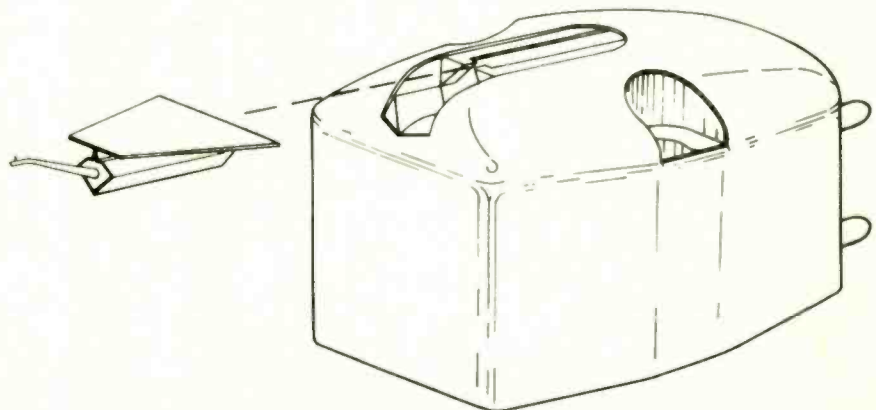


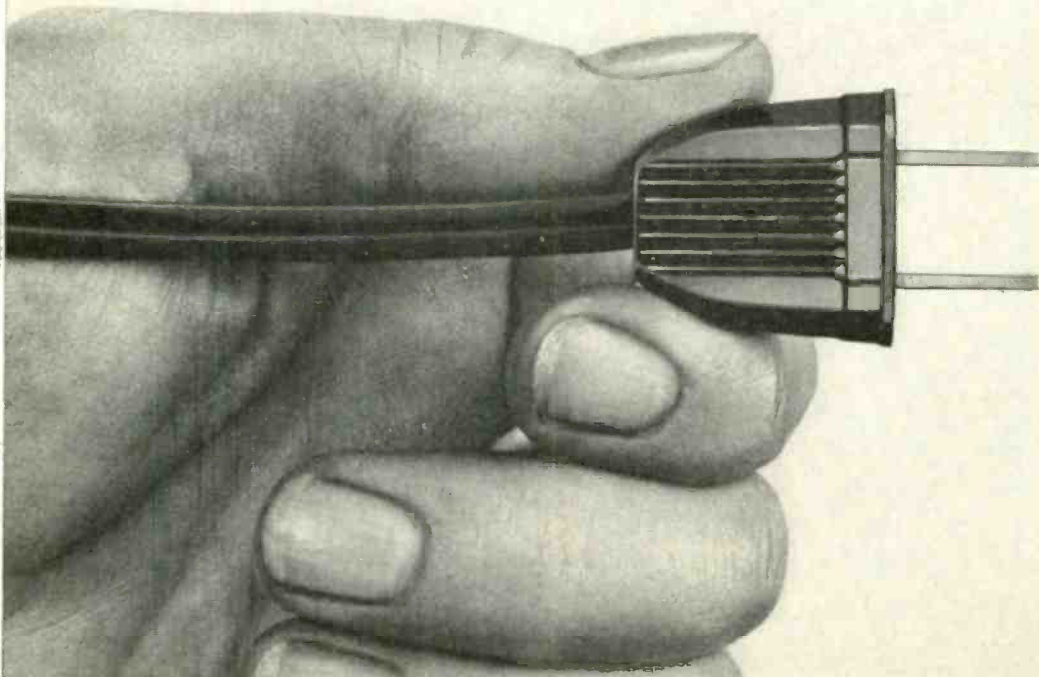
Fig. 7. Audio Dynamics ADC-1 stereo cartridge.



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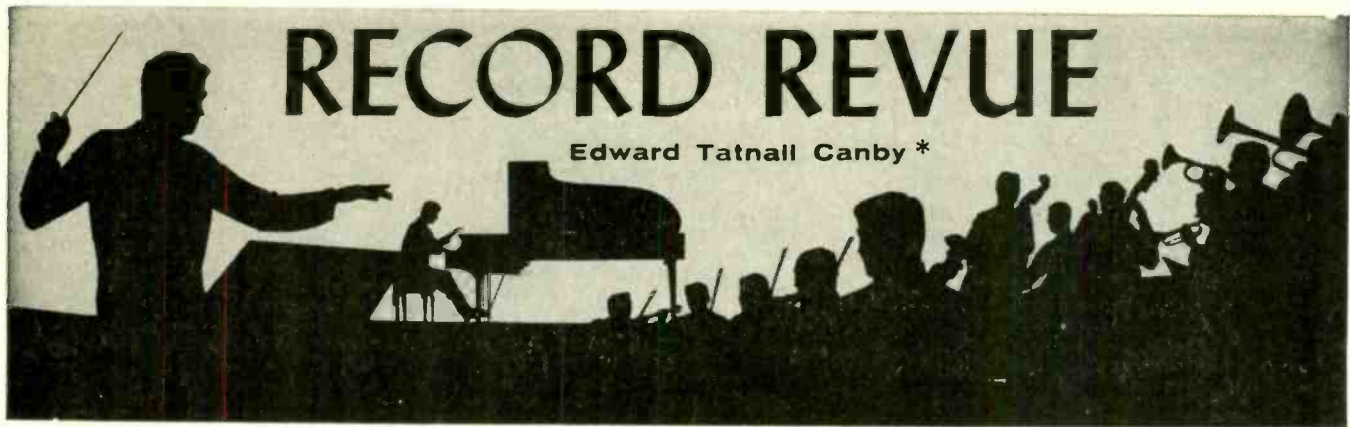
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# RECORD REVUE

Edward Tatnall Canby \*

## TESTING

**The Orchestra—The Instruments.** Vienna State Opera Orch., Bauer-Theussl.

Shure Bros., Inc.  
(Special recording)

This is a well produced and interesting purely musical "test record," minus spoken comment and minus test tones, all but one example consisting of fairly complete short excerpts from a variety of classical works illustrating instrumental and recording problems, principally in concert ranging from trombone (Rimsky-Korsakoff) to double bass (Dittersdorf), trumpet, clarinet, oboe, harp, and numerous more. The recording was done by Westminster, with the orchestra set up in a standard concert array on the stage and—an interesting point—each solo concerto played with the soloist in his normal orchestral position, without special miking.

Excellent and concise boxed notes in columns give paragraphs of comment on the music and its background and ("What to listen for") on the stereo recording. There is a welcome minimum of fancy language and practically no exaggeration, which is something to marvel at.

The first band takes apart and puts together a complex climactic passage from Tchaikovsky's "Fifth Symphony," the printed score reproduced complete in miniature with a quite elaborate discussion. For musical old hands this won't prove very much but for many others it should be very interesting. Lovely recorded sound and excellent playing of the excerpts by a first-class orchestra.

To my mind the most significant aspect of this record for the record specialist is the exceptionally good results provided by the solo recording—at a distance, in normal stage balance with the orchestra, entirely minus accent or other special miking. With not a single exception, these concerto recordings are wholly musical and surprisingly realistic.

Perhaps the best way to record, after all, is the simplest. Recording directors please take note, and give ear.

*N.B.* The musical examples were not from previously made recordings nor are they available in complete form. All were especially made for this disc. Makes a difference.

**TestingTestingTesting.** A Comprehensive Tool for Testing Equipment. Produced by Dr. Kurt List.

Westminster SRX stereo

At deadline time I had only fully absorbed part of this complex and useful test record but I'll get it in here, along with the above. The leaflet in this one goes to unusual lengths to explain many factors in equipment performance, along with the tests devised for their checking, and the amateur will have to work hard to absorb all it offers; but the results should be worth it. The language and approach are specifically for the home listener (not the engineer or hi fi expert), but this does not entail oversimplification, except inasmuch as any such explanation—short of a professional engineering course—is bound to be compressed and simplified.

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

## Dixie Special

**Whistling Thru Dixie.** (Steam locomotive sounds).

Mobile Fidelity MF 6  
(P. O. Box 1156, Burbank, Calif.)

This RR disc concentrates on the sound of the old-fashioned train whistle, and the collection of eloquent sighs, whoops, and groans that echo through these assorted Dixie hills and valleys (including New Mexico and Arkansas) are something to hear. Naturally, there is much choo-chooing as well since whistles aren't any good without a locomotive to whistle from.

I had thought the steam railroad was dead back with the last O. Winston Link disc. But here we go again as of the summer of 1960! I gather, however, that what remains in steam is largely small-time freight, coal, and assorted mining and the like, minus passenger runs and on local lines like the Warren & Saline River here, an outfit slightly smaller than, say the B & O or the C & O.

Whistles seem even more picturesque on the little lines than on the big ones. The engineers are more cooperative—in fact, some of these seem to oblige more than might be expected if a large tape recorder were not set up next to the right of way. Probably against regulations, but genial and friendly-like. One recording in which a whistle gets stuck half-way open is just too good to be true. Imagine your Buick auto horn stuck fast where everybody within ten miles could hear you! Takes quite awhile to get this whistle stopped.

I miss here the imaginative long sequences of time, the eloquent little side-effects, the crickets, kids playing, church bells, the living country silence, that so enliven the O. Winston Link RR discs. These are mostly shorter excerpts though nicely edited and to the point. But Link has no whistles to match these incredible instruments, each one with a personality and nary a one that doesn't wail like a hound baying to the moon.

Steam whistle blowing was, of course, a true folk art and a kind of musical expression. Every man had his own "signature"; the whistles gave each artist an astonishing range of expressive sound with which to work. As the concert hall liveness completes the symphony, so too does the mournful liveness of the mountain valleys complete the sound of the steam whistle. The two are unforgettable. That's what's on this disc and I admit I was aesthetically moved by the sheer humanity of it all.

Interesting how the mechanics of business technology are always turning into artistic expression. Take the steel drum, now . . .

The first side presents numerous right and left test tones, some of which test via the ear, others requiring a meter to read levels. Good. If you're going to test, then test. (I didn't.) Most of the testable attributes of a stereo rig come up for treatment here, from phasing to wow and flutter, separation, frequency response, etc.

Side 2 goes in for musical tricks—I played

this side awhile back but want to hear it again before commenting in detail. In any case, some of the printed accompanying remarks will give you the idea—"Motion from left to right for proper balance and separation. The harp wanders across the room . . ." "Motion from rear sides to front center for separation and depth perspective. An oboe (back right) is answered by a horn (back left). Both gradually move forward until they meet in the center, with pizzicato strings providing the accompaniment." And so it goes, including broken glass being hurled from right to left.

My impression is that these stunts sound more effective in print than they do in stereo itself, but they can still be useful in correcting equipment unbalance and in delineating the practical limits of stereo directionality and motion as far as *your* equipment is concerned.

P. S. No spoken commentary, no voice, including test-tone bands.

**"Wall to Wall Stereo"—Laboratory Test Record.** Assorted pops excerpts.

United Artists UAL 96 stereo

In contrast, this "test record" is no more than an obvious promotion for the company's recorded products, introduced by commercial-style plugs from an announcer, pointing out the hi fi "marvels" of each of the numbers. There's a test pattern in the first band, to give some semblance of "laboratoriness" to the disc; the rest is catalogue material. Both sides are the same—in case you ever wear out one side by too much playing. Not much chance I will.

**Vanguard Stereolab Test Record.**

Vanguard VSD 100 stereo

This is a more concise and businesslike test record than Westminster's. It is shorter, covering similar ground in respect to right channel, left channel, balancing, phasing, etc., but in this case with accompanying spoken explanation by an announcer. He's an announcer, but not as objectionable so as some of the unctuous individuals who narrate many test and scientific discs (see the Bell Labs "Science of Sound" album, for instance, on Folkways).

Things move rapidly here and a lot is covered in a short time. The concise printed discussion is on the album rear. Side 2 is identical with side 1, in this case an obviously useful feature.

Musical examples are confined to two, on the last band (deliberately, to emphasize possible tracking and similar inner-groove errors in playback), a brief large-organ piece and the ultra-familiar *Sabre Dance* from the "Gayne" Suite of Khatchaturian. I must say I was relieved to find that both excerpts played on my system without noticeable distortion. I was expecting the worst.

The record sells at Vanguard's demo price, and a cryptic label says that the stereo version is \$2.98, mono \$1.98. Now just how does one test stereo speaker balance and right-channel response on the mono version? Especially at \$1.98! (Answer: There isn't any mono version—it was just a stock label.)



**SPECIALTIES**

**The Art of Julian Bream. (Guitar).  
RCA Victor LSC 2448 stereo**

Guitarists come in three general types: folk, Spanish, and Classical. Julian Bream is England's contribution to the last of these and his British modification of the school of Segovia—all of today's classical guitarists go back to Segovia—is highly musical, tasteful, knowledgeable, expert in technique and unassuming. You won't be jounced off your feet by these gentle sounds (unless you use all 200 watts of your super-system) but if you'll keep quiet and pay modest attention, you'll sure be pleased. He's good.

The classical guitar repertory revolves on a couple of bases: music for lute and older guitar-like instruments, from the 16th century on, is the primary foundation, followed closely by the school of Romantic-minded recent composers who flocked to dedicate works to Segovia over the many years—perhaps that is why so many of them have a rather Spanish air to them. A third basis is the arrangement, or transcription, (from music for other instruments, notably piano) and this ranges all over the lot. Finally there

are new "modern" pieces, mostly of a very mild modernity, sporting a few little dissonances and plenty of guitar trickery but seldom of any great or atonal profundity. The guitar ain't that kind of instrument.

Bream follows a respectable course here through these areas. There are a few mildly modern works, notably a sonata by Lennox Berkely (scarcely modern at all, though quite virtuoso); some Scarlatti and Cimarosa, as of the 18th century harpsichord: an inevitable Spanish Albeniz (from the piano); a Ravel arrangement—and a piece by the Frenchman Roussel entitled significantly, *Segovia*. That puts things in the proper frame of reference.

Bream is an easy, fluent player, not wooden nor clumsy as are some classical guitarists; he isn't a very vigorous performer (as in Flamenco guitar) but this is quite OK for his music. If you like any sort of guitar, this should be an enlightening disc.

**Maurizio Pollini: Chopin. (Piano Concerto No. 1.) Philharmonia Orch., Kleitski.  
Capitol SG 7241 stereo**

Records. I suggest, have a sober way of giving a long second-look at prodigious per-

formances, far from the excitement and the furor. The judges who picked this winner were people like Artur Rubinstein, Nadia Boulanger, Malcuzyński—they ought to know. And therefore it is, figuratively, in even smaller type than usual that I say I found Signor Pollini's Chopin fingering brilliant but in musical respects just what one ought to expect—a 'teen-age virtuoso job, shallow, superficial, studied, not really feeling the musical expression as a more adult mind could do, not even hearing the harmonies rightly, as evidenced by what seemed to me poor pedalling, unmusical blurring of chords together at the wrong places. Out of the dozens of recordings of this overplayed work, this is the last one I'd ever pick for my own pleasure. Not even the orchestra—the world's best—is very convincing.

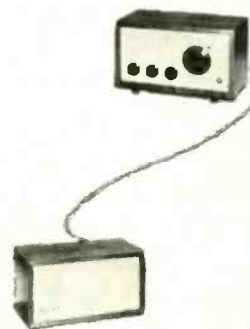
Well, darn it, whaddya expect? With all the hoopla publicity attendant upon these huge international musical contests, with all the flowery winning claims, like the Mobilgas Economy Runs (ever notice how every car seems to win something or other?), there's bound to be a built-in let down in a recording of this sort, barring extraordinary circumstances . . . unless you are the kind of guy the record companies hope for, who sits down to this record and eats up the accompanying



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publicity until he is glazed with the marvel of it all, hypnotized into sheer trance-like wonder.

Well, go get yourself into a trance, then, and listen to this prizewinner. There'll be another one waiting for you tomorrow. And of course I could be all wrong. (That's what keeps critics awake nights.)

**Ivan Davis Playing Piano Works of Liszt.**  
**Columbia MS 6222 stereo**  
 (Mono: ML 5622)

Well, here's another prizewinner, right here; but this one is an elderly 28 (he looks 17 and cross-eyed on the cover), publicity is milder, and the music very satisfactory indeed. He's OK, this man.

The old and original tradition of Liszt playing, blood-and-thunder, is possible only for a very few gifted and/or older pianists nowadays. Inevitably most of our younger pianists must try to find a more modern approach to this ultra-Romantic music and very few of them do. They bang and whang, or they play glittery and tinny. They seldom get over the grand style, the big, impressive manner, the long line, that so bewitched our grandpas and their grandpas. And above all, too many younger pianists miss the real musical modernism, the strong, first-class musical mind at work, underneath the Liszt glitter and the Liszt big noise.

Davis doesn't put on a beard for an old-fashioned effect. He sounds modern and new. But, first, he does indeed hear Liszt's musical strength, and he can project its musical sense, which is three quarters of the battle. Second, he phrases well and does not pound; his glittering decorations are faultlessly shaped and always within the harmony (as they should be). And he plays with soberness and no apology, putting forth the outdated pianistic pyrotechnics for what they really are, decorative embellishment of a solid musical foundation. (Nothing is more dreadful than Liszt played apologetically as so much friftery show stuff!)

The long, grand line is not fully realized here as the old masters of thunder used to do it. But maybe nobody really can do that any more, within the modern school of "pianism." Anyhow, Davis is a real musician and you'll enjoy listening to him.

Included are *Liebesträume* and *La Campanella*, the *Concert Etudes No. 2 and No. 3*, the *Mephisto Waltz*, *Funérailles*, *Hungarian Rhapsody No. 6*

**Shakespeare: The Tempest. The Phoenix and the Turtle. Marlowe Society recording.**

London OSA 1318 (3) stereo

Ever heard of Shakespeare's "The Phoenix and the Turtle"? Not in my school days, I didn't.

For many months, I've been watching helplessly while two great piles of complete Shakespeare on stereo LP grow on my living room floor (a third pile waits from last year). I'll not be likely to catch up in a lifetime, nor until I give up music altogether in favor of Shakespeare alone.

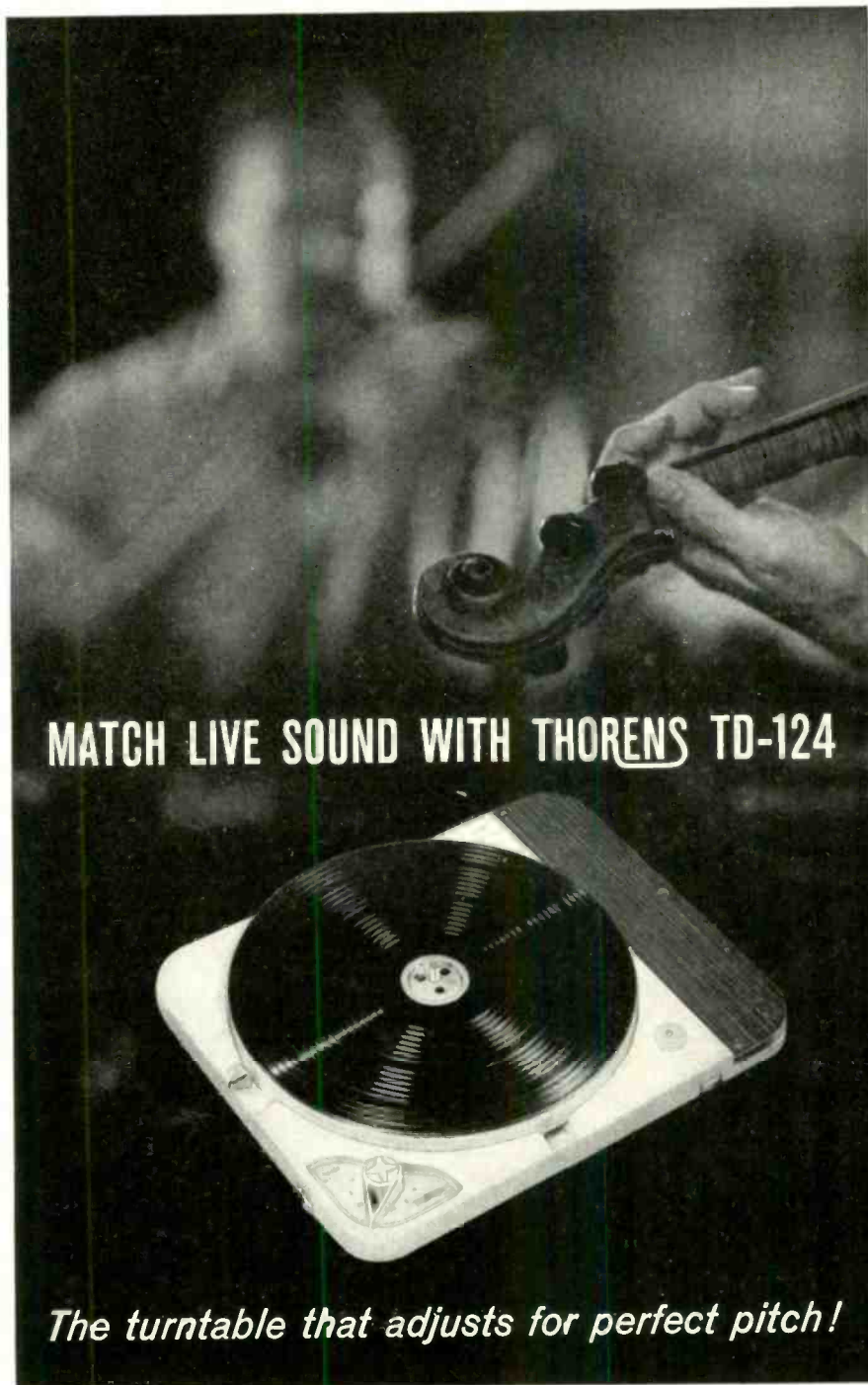
The London Records pile, to which this is the current addition, is already impressive. I've sampled only a bit, part of one play, but I liked it—the production is high-level, under the British Council, in association with the Cambridge University Press, etc., etc. Its oddest feature is anonymity—not an acting name listed anywhere. But even so, I gather that Britain's top acting talent is involved.

I urge all who are interested, then, to try this series, and also the competing complete Shakespeare product from Caedmon (with names). Sometime, I hope to get to a direct comparison of two of these many huge albums. Meanwhile . . .

**Russian Easter. A Russian Christmas. St. John's Russian Orthodox Choir, Lavriliak.**  
 Cook 1096, 1095 mono.

Somebody referred these to me—I hadn't set ears on a Cook record for a good many seasons.

St. John's is, if I am right, somewhere in



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New Jersey, U.S.A. and the excellent Russian singers are recruited from the local ranks, presumably second or third generation. No matter—they have the traditional Russian style very much in hand, or in voice. And they sing in tune, in the old church language of Church Slavonic which sounds like "Rooslan" to you and me and (it says) is related to Bulgarian and Greek.

The Russian Orthodox music is interesting because it reflects past Western influence upon Russian musical practice, dating perhaps back to Peter the Great, who Westernized Russia. The music is always unaccompanied (as is correct Western Gregorian chant, the traditional music of the Catholic church); but the Russian product is harmonized, and in a peculiar style that ever so clearly comes straight out of the West in the middle to late Eighteenth century. On the other hand, the actual harmonized body of this music developed only in the late Nineteenth century, and so it preserves a quite passionately Romantic style, full of swoops and slides and

mystery. Moreover, the harmonies, so much of the period of Mozart and Haydn, do not move from key to key but stay put, with much chant-like repetition, an aspect that is wholly unlike any corresponding Western music, which "modulates" from key to key.

The music here is evidently all "composed" by one man, A. L. Vedel, but the style and content is very much that of the Russian church composers from Bortniansky to Kastalsky and Rachmaninoff.

I have had time to listen only to the Easter record. Better try both.

**More of Hal Holbrook in "Mark Twain Tonight!"**

**Columbia OS 2030 stereo  
(mono: OL 5610)**

Here's a laugh—dozens of them. I think the cream of the Mark Twain Impersonation by Hal Holbrook went into Volume 1 of this series, which was absolutely lovely in every

microgroove line; but there's plenty left for this record as a sequel. I'd suggest, though, that Volume 1 is a necessity before you so much as try this. Both can be had in amusing stereo—more stage-like than the mono version.

Don't let me spoil the fun by anticipating any of the stories and comment. Just listen.

**The Kingston Trio—Tijuana Jail, etc.  
Capitol Double Compact 33 MA1-1577**

**Maria Callas Sings "O mio babbino caro,"  
"In quelle trine morbide" (Puccini). Phil-  
harmonia Orch. Serafin.  
Capitol Compact 33 F-4529**

**Soviet Army Chorus and Band: Volga  
Boat Song; Tipperary.  
Capitol Compact 33 F-4530**

I can guess that some of the people over at RCA Victor aren't very happy these days as the big, hard, brassy pops industry quietly gets ready to ditch the 45 disc, RCA's last stand in its 1949 "revolution" that lost to the LP in the classic field. The above three records represent a couple of million others, available and in the works, if publicity is indicative. Evidently the 7-inch 33-rpm record had to await a reintroduction until a proper name came along for it to hang on. "Compact" was just the thing, natch. That did it.

(Columbia introduced a 7-inch 33 back near the beginning of Microgroove, but it didn't pan out. There weren't any compacts then.)

No reason why quality shouldn't be reasonably OK on the under-three-minute compact 33's, and passably good on the double-length double compacts (around 5-6 minutes per side, two standard numbers). But maybe the juke box and beach portable determine quality in these items. I didn't find this sampling so wonderful, though it really doesn't matter much—these aren't exactly carriage-trade hi fi numbers, nor so intended.

I'll admit I am shocked to hear the degree of hard-boiled banality that has grafted itself onto the once-isolated art of folk singing. Those Kingston kids can play and sing perfectly well, and in good style, but the pops approach, for the millions (bucks, not people), so sloshes them in gloppy reverb and slick miking that the mixture is just so much gluey juke. The Rea Army's *Tipperary* will make your hair stand up, a real bear hug, in "Rooslan" and "Anglitch." Maria Callas, excerpted (I suppose) from her fancy full-length classical, comes out just about the right speed for her brand of musicianship. (Nope, she's no favorite of mine.)

Anyhow, all hail the new king; and a fond goodby to a million 45's plus a couple million fat center spindles, gone with the compact breeze.

## SOME CLASSICS

**Tchaikowsky: Serenade for Strings, Op. 48. Suk: Serenade for Strings, Op. 6. Strings of the Kapp Sinfonietta, Vardi.  
Kapp KC 9054-S stereo**

This is one of the finest recordings of music for strings I've heard in many years—thanks to a happy combination of worthwhile string music, wonderfully alive string playing, and top-quality string recording.

Of the two works, the Suk was to me by far the most interesting, perhaps merely because the Tchaikowsky piece is familiar in many other recordings. Suk is one of those names one sees, but doesn't hear. A few specialist fiddle pieces, yes, and he was well known as leader of the Bohemian String Quartet many years ago. But this is my first hearing of the youthful Suk suite, composed when he was all of 18, in admiration for and imitation of his excellent master, Dvorak. And though there are some mildly corny spots—nothing like Montavani or Melachrino—the general expression of the piece is of an astonishingly warm and knowledgeable Romanticism superbly tailored for string playing.

Both the Suk and the less innocent Tchaikowsky are played here as they seldom have been I am sure, with fire, wonderful ensemble, airy lightness and extraordinary control. Teamwork! is the phrase that kept coming

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to my mind. The players are apparently New Yorkers; the music, in any case, is perfectly suited to the brilliant, shiny somewhat high-tensioned discipline that is common in New York performances.

**Vivaldi: The Four Seasons.** Strings of the Kapp Sinfonietta, Vardi.  
Kapp KC 9056-S stereo

The same brilliance and good ensemble, the same fine recording heard on their Tchaikovsky-Suk record is found in this performance too, but the music is of a very different sort and the playing is not as intimately suited to this earlier style of music.

"The Four Seasons" has had umpteen recordings since the first that I can remember, the Concert Hall Society LP that was one of the earliest LP records (other than Columbias) to be released, back in the fall of 1948. This new one is, of course, an outstanding job of hi-fi-stereo expertise, the latest and best. But on musical grounds it would require a fantastically special performance to make another recording especially worthwhile. The trouble with this one is simply a rather characteristic unawareness of certain elements of "Baroque" styling, as currently practiced in the rest of the Western world. It is mainly in the excellent soloist, David Nadlen, who continually offends my slightly sensitive ear with his wrongly played cadence trills, done in good Nineteenth century manner from the bottom up—they should trill from the top down. In the louder, faster sections there is also a certain jounciness of rhythm, where a smoother phrasing would have helped. Not overly important, and the many plus factors easily outweigh my minor complaints.

The best competition that I know of comes from "I Musici" and from the "Solisti di Zagreb." These three recordings tell us together about all there is to know about Vivaldi's now popular survey of the year's weather, unless you want to know how *not* to play the music, in which case I refer you to the Philadelphia Orchestra. Ugh.

**Beethoven: Piano Concerto No. 1, Op. 15: Piano Sonata No. 31, Op. 110.** Andor Foldes; Bamberg Symphony, Leitner.  
Deutsche Grammophon 138636 stereo

The "First Concerto" is actually not Beethoven's first (it merely picked up a low opus number in the publishing) and it already flaunts one of the Beethovenian innovations—plenty of length and breadth. The gruff composer is already in his own here, in spite of a relatively minor "Mozartean" inheritance, but it isn't one of his most original works nor is there much depth of soul.

The Foldes interpretation is good. Skillfully deadpan is one way of describing it; or economically classical. The whole performance (with Leitner and the Bamberg orchestra) stresses the utmost in accuracy, every phrase shaped to perfection—nobody ever did Beethoven harm by this! The more passionate, more humanistic playing so common back twenty or thirty years could not do much for this work anyhow, except perhaps in the joyous final rondo, where I seem to hear old Schnabel's almost polka-like forcefulness in comparison to the relatively mellifluous Foldes accuracy.

A worthwhile performance, and nicely recorded with the piano at a proper concerto distance, in perspective with the orchestra. (Thank goodness, the ultra-close-up technique of microphoning for concerto sound is going out.)

The solo piano sonata, last half of side 2, gives a better nearby look at Foldes in his present playing. This man has always had a fantastically abundant reserve of technique in sheer finger work: his problems, and solutions, have from the beginning of a long career been strictly matters of interpretation, how to make use of those ten high-power finger-hammers. He used to play hard, cold, steely music, brilliant but not often affectionate, the sound frequently ugly through sheer finger-power. Now, if the mikes aren't misleading me, he is going through a classic phase, using more pedal, a carefully tailored and graded tone with hardly ever any harsh-

(Continued on page 82)

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**STEREO**

**Franz Jackson and the Original Jazz All-Stars: A Night At The Red Arrow  
Replica PLP104S**

The large recording companies are rarely successful in requiting the demand for traditional jazz, either through indifference or plain lack of common sense in the studio. Some of the more fervid fans attempt to correct the situation once in a while, recording favorite bands and hoping against hope that a professional job will result. Ewing Nunn, Bill Russell and a few others consistently beat the odds, but too often something along the line goes awry. Franz Jackson is the first old-time leader to try his luck at the game, directing his own septet on the stand at the Red Arrow just outside Chicago, engineering the date himself, and taking on all the other production problems. Good fortune attended this example of rugged individualism, and the recording is causing fans and critics alike to applaud right along with the club patrons.

The youngster of the band at forty-eight, Jackson started his professional career with Carroll Dickerson at the Grand Terrace in 1932, and then worked with such Chicago leaders as Jimmy Noone, Roy Eldridge, and Earl Hines. While playing under Frankie Newton and Red Allen in New York, he studied broadcast engineering at RCA Institutes in 1945. Steady employment as a performer kept him from putting this knowledge to work, until the decision was made to assume both roles in an effort to record his band the way he thinks is best.

Like many other jazz musicians, Jackson never feels too comfortable in a studio, and his position as leader only compounds the difficulties of pleasing a producer. "The musician must adjust to acoustics which are strange to his usual playing circumstances," he explains, "and the arranging and placing of instruments to certain microphones all tend to put the performer ill at ease. I wanted the band to sound as it does in the club where we have played together for the past five years. The microphones were placed in the same positions as that of the public address system. Only one setting of the controls was used so that the true dynamic quality of the band as it is actually heard is there. No special coaching or lectures were given to the musicians about playing louder or softer during the recording. The entire idea was to get the feeling of the musicians under usual working circumstances.

"In most cases, the feeling dies after the first playing. Repeating becomes all forced after that—the feeling is: 'I must do this and not make a mistake!' This does not make good jazz! One plays best when he is relaxed and each jazz chorus is an adventure during which time anything might happen, and often does. The interest is always high when the public can see and hear. The best jazz chorus has musical and technical errors. That is to say, often a musician hears something coming out of his horn that he did not intend. It is then that one must invent something to give

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

continuity. This happens to me often—and from listening, I believe it happens to others just as frequently."

From the first round, pure tones of Jackson's clarinet on *Red Arrow Blues*, traditionalists will realize a treat is in store. Any lingering doubts are erased when Bob Shoffner joins in on trumpet and recalls the days when he replaced Louis Armstrong in King Oliver's band. A veteran of the Streckfus river boats, he still plays in the regal Oliver style and solos throughout with a vigor that belies his sixty years. Also the same age and the other senior member is drummer Richard Curry, who went to London with James P. Johnson in 1923. Rozelle Claxton started out as a pianist with Jimmie Lunceford's original Chickasaw Syncopators, and trombonist John Thomas played under Erskine Tate at the Vendome.

The sparkplug of the band is a light-fingered banjoist named Lawrence Dixon, and few dancers will resist his compelling beat. Besides doing a specialty on *Mr. Banjo Man*, he has something new to say about *Mack The Knife*. This scoundrel never deserved all the punishment administered by the pop singers who followed Louis Armstrong. The band treats him better than any of the high-priced arrangers, proving that its venerable members do keep up with the times. Schoffner and Jackson engage in entertaining vocal chit-chat here and on such tunes as *St. James Infirmary*, and *Ice Cream*, with a channel for each voice in stereo. Their humorous byplay is less effective when compressed into a single channel.

Jackson readily admits that a studio recording would smooth off rough edges and give better technical results, including a fatter sound for Bill Oldham's tuba. The banjo is favored instead, and justly deserves the prominence it receives. A Concertone 505E tape recorder and Electro Voice 655C and 667 microphones were used, with two microphones in front of the band and an extra one to pick up the piano. This equipment, well within the price range of many home recordists today, permits Jackson to turn out a far better job than professionals could when he went to school. A musical ear enables him to select a more natural balance than is found on quite a few stereo spectacles. Few dealers and no discount stores stock this release, but Jackson can be reached at 5358 South Wells Street, Chicago 9, Ill. The band's only other recording is no longer available, although Mercury may now issue an LP made a year or so ago.

**Duke Ellington: Peer Gynt Suites and Suite Thursday**

**Columbia CS8397**

Following on the heels of a successful jazz collaboration on Tchaikovsky's *Nutcracker Suite*, Duke Ellington and Billy Strayhorn turn their attention to another familiar classic and to a John Steinbeck novel. Their special delights are those portions of Edvard Grieg's music which permit them to draw on the richest colors of the orchestral palette on *Storming*, or blend delicate voicings on *Asa's Death*. The featured soloists are happiest

when allowed to stomp about like Peer Gynt himself on *Hall Of The Mountain King*, or bounce away in taperschorean flights on *Antra's Dance*. Ray Nance, Booty Wood, Jimmy Hamilton, and Paul Gonzalves all perform like Norwegian folk heroes.

The Monterey Jazz Festival commissioned *Suite Thursday*, and it was recorded immediately after the concert premiere last September. The most important effort of the collaborators to date, it will repay continued study and is essential to any jazz library. Monterey officials are missing out on some excellent promotion by not reprinting Ellington's description of the four parts from the program notes and sending copies to Columbia for inclusion in each album. Paul Horn substitutes for Johnny Hodges on alto sax, and Lawrence Brown's trombone brings Cannery Row to life, aided by a fine stereo recording job.

**Helen Humes: Songs I Like To Sing!**

**Contemporary S7582**

A recent return to the recording wars on this label started Helen Humes on the second stage of her career with a bang that awoke the public and critics alike to what a jazz singer should be. The term is misapplied more often than not, and this sequel is another exact definition of all the essential requirements for the part. Besides providing arrangements to show her special qualities, Marty Paich heads a fourteen-piece band set up like the old Count Basie band with which the singer first made a name for herself as featured vocalist in 1938. Eared among the dozen numbers are two she recorded then, *If I Could Be With You*, and *Don't Worry 'Bout Me*. Her natural and effortless swing indicates what a prize asset she would be to the present Basie band. Especially noteworthy is *Million Dollar Secret*, one of her own blues which she made into a hit single before retiring ten years ago.

Paich also gratifies her desire to record with strings. Unlike many jazz singers, Miss Humes possesses the emotional maturity and depth to take this attempt in her stride, nobly assisted by Ben Webster's tenor sax on *My Old Flame*, and *Imagination*. Engineer Howard Holzer gives the band the full benefit of stereo.

**Al Hirt: The Greatest Horn In The World**

**RCA Victor LSP2366**

After blowing stellar horn on two Audio Fidelity LP's made in New Orleans, Al Hirt bursts the bonds of Dixieland and begins an ambitious career on the club and hotel circuit. Part of the build-up involves a label change, along with some uncertainty about what sort of backing best suits his big, brash trumpet tone. One thing positive is that both studio groups heard here are large enough to match his massive frame and 299 pounds of avoirdupois. The first is a big band of twenty pieces, and the other a thirty-man outfit which includes twelve string players. Henri René conducts, and each rhythm section boasts a harp, along with two drummers and two guitarists to fill out the stereo extremities.

Aided by strings, Hirt envelops melodies with the loving care of a Billy Butterfield, and he exerts the rhythmic drive and acrobatic style of Harry James to swing the band. Either combination is irresistible, but Hirt sounds best when emulating Charlie Shavers on *Undecided*. Hirt belongs in front of a big band of his own, and his searing trumpet seems to predict the future on an old spiritual, *I'm On My Way*.

**Les McCann Ltd. In San Francisco**

**Pacific Jazz PJ16**

Almost as much a subject of controversy during the past year as Ornette Coleman in critical writings, Les McCann enjoys the advantage of seeing the public continue to buy his recorded output. The pianist's latest effort was recorded in San Francisco, near the end of a country-wide tour, during an engagement at the Jazz Workshop. Herbie Lewis, a promising youngster who replaced Leroy Vinnegar, is heard on bass, and the drummer is still Ron Jefferson. McCann introduces four more of his popular gospel-tinged blues, then proceeds to well-planned examinations of *Red*

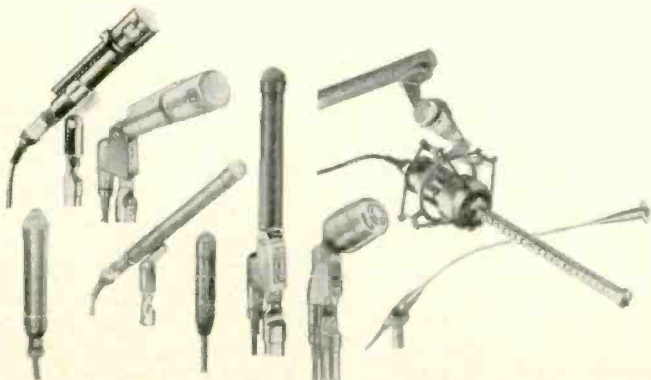


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*Sails In The Sunset, I am In Love, and Jeepers Creepers.* As on a previous in-person LP made in Los Angeles, the trio establishes a close and immediate rapport with the audience, and engineer Reece Hamel surveys the whole scene in fine stereo.

**George Russell: Stratosphunk**  
Riverside RLP9341

This is George Russell's first effort as leader of a regular working group, despite several LP's to his credit and a considerable reputation as composer and arranger. One of the major difficulties facing jazz writers is obtaining adequately rehearsed performances of a serious work. Another is frequently cited by Ellington and concerns the need to hear theories tested out in practice. Pleasant as the prospective solution of these problems may be, Russell first must develop a group capable of carrying out his ideas, and this initial progress report on his new sextet is highly encouraging.

The written parts of the title tune are less noticeable than in previous recordings by studio groups. Dave Young, tenor sax, and Al Kiger, trumpet, exercise with fire and intensity on *New Donna*, and *Things New*. Most significant is the fine spirit of all concerned on *Kentucky Oysters*, a potent gospel waltz contributed by trombonist Dave Baker. Ray Fowler engineered the date at Plaza Sound Studios.

**Charles Mingus Presents Charles Mingus**  
Candid 9005

After recording two remunerative Columbia albums to propitiate the "gods of mammon," Charles Mingus switches labels and leads his disciples along a more rigorous path. The imminent departure of Eric Dolphy and Ted Curson from the fold is one reason for choosing such an intransigent course, as both men are anxious to show all that was learned during the year they attended the Jazz Work-

shop. Little space is wasted on frivolity, although Mingus endeavors to create a club atmosphere in the studio by dimming the lights and introducing each number with short satirical comments. His humorous remarks on bass are more to the point, whenever the students become too serious, and sly phrases serve as constant reminders that the spirit of levity also is a part of jazz.

Another Mingus precept is to throw away the rules and allow complete freedom of expression, a pursuit he encourages with hearty rhythmic support on *Folk Forms, No. 1*. The source material employed here is similar to that probed by John Benson Brooks on his *Alabama Concerto*, which derives from Harold Courlander's recordings of field cries and hollers. Both composers seem to be speculating on what other forms or directions the pioneers of jazz might have picked to develop a new music. By going back beyond first formal origins, they give the players a clean slate for improvised solos that should intrigue traditionalists and modernists alike. Curson's trumpet statements sound spontaneous and fresh in this context, yet he can scarcely be called a great innovator. Dolphy, who works hard on alto sax for this distinction and may eventually attain it, also switches to bass clarinet for an enlightening conversation with Mingus on *What Love*.

The member of the quartet who has lasted longer with Mingus than anyone else is drummer Dannie Richmond, and together they form one of the great rhythm teams of all time. While the technique of both is advanced and Mingus handles the bass with the speed of a guitarist, they still remember to be as functionally exciting as Pops Foster and Baby Dodds. Mingus exerts poetic license in making another version of *Faustus Fables*, adding the spoken words which Columbia omitted out of deference to record club subscribers. The music is graphic enough to stand alone, and Mingus should consider the implications of his remaining title, *All The Things You Could Be By Now If Sigmund Freud's Wife Was Your Mother*. All of his problems might be solved by setting up a separate identity that would be less evasive of commercial success. There is never anything evasive about his bass playing, and engineer Boh d'Orleans gives the firm, plump tones the full benefit of stereo.

**Gil Evans: Out Of The Cool**

Impulse S4

New jazz labels are apt to spring up any time of the year, in any part of the country, and this year's crop promises to be more bounteous than usual. The current entry turns out to be a subsidiary of Am-Par Records, one of the saddest names picked for a label yet, and is an attempt to revitalize the parent company's jazz line. Some bright executive evidently thought a word like Impulse might sell as many records as Command, the profitable trademark of another subsidiary. The guiding genius is Creed Taylor, who left Bethlehem Records to produce the earlier jazz releases, of which only those bearing Oscar Pettiford's name are worth preserving. The project is more ambitious this time and includes albums featuring Ray Charles, J. J. Johnson, and Kai Winding.

Of primary interest is the recorded debut of the new Gil Evans orchestra, augmented to fourteen pieces on the date, and those listeners who can stand the thought of more snow are invited to mush along for a good fifteen minutes on *La Nevada*. Budd Johnson, tenor sax, and guitarist Ray Crawford are warming influences, but the leader seems bent on duplicating the commercial success of his albums with Miles Davis on Columbia. His LP's for Prestige and World Pacific are more bracing examples of Evans, but the Columbians are the ones that sell. The featured solos of Johnny Coles, a promising young trumpeter, now sound the same as those of any other Davis imitator. Trombonist Jimmy Knepper remains highly individual on John Benson Brooks' *Where Flamingos Fly*, and Evans is as colorful as in scoring Kurt Weill's *Bildao*, and George Russell's *Stratosphunk*.

Apparently having learned a lesson from Command's success with stereo spectaculars and public reaction to the dubious sound of previous jazz items, the company decided to invest in a good engineering job. Rudy Van



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Gelder handled the first four releases at his studios in Englewood Cliffs, N. J. The Evans orchestra is heard in natural balance and the only special effects are in the arrangements, so perhaps it was also decided that the market for gimmicked stereo might be waning.

**Bob Prescott:** Cartoons In Stereo with Cy Harrice

Audio Fidelity DFS7008

**Earle Doud:** Sounds/Funny

Epic BN598

Sound effects alone used to be good enough to show-off plain old-fashioned high fidelity equipment, but new stereo rigs demand demonstrations of larger and fancier dimensions. The coughs and snorts of each racing car are dramatized on these two productions in sketches of varying hilarity. Cy Harrice, who developed a large repertoire of voice as a TV-radio announcer, portrays assorted characters as they become entangled with sound effects drawn from the extensive library of Robert J. Prescott. All three major networks have engaged Prescott's services since he began creating appropriate noises in 1935. Today his son, Peter, assists him in recording rocket flights to outer space, submarine descents, games of Russian roulette, and other decible-producing events.

Epic awards top billing to Earle Doud, writer and performer of the comic incidents, and mentions engineers Ralph Curtis and Garry Gladstone only in passing. This team covers several additional happenings, including a visit to the old swimming hole, the serving of a fifty-gallon drink, a persistent kitten, and the inevitable ping-pong game. Both narrators enter into the action, ensuring plenty of stereo movement on either album.

Bob and Ray engaged in similar exploits for RCA Victor during the early days of stereo, but now another cycle seems on the way and other companies will probably be heard from. Entertaining as they are to some, the funny men never quite catch the true excitement of sound vibrations. If Audio Fidelity wants to keep ahead of the game, it should cover a bet missed this time. Eavesdropping microphones in the head office when Sidney Frey first hears a new and sensational sound could beat anything yet. His enthusiastic reaction would be both vocal and physical. When Prescott shows up with tapes again, the place had better be wired for stereo.

**Andy And The Bey Sisters**

RCA Victor LSP2315

Andy Bey and his sisters, Salome and Geraldine, were born in Newark, N. J., but first drew attention when such authorities and Richard Gehman and George Wein heard the trio in Europe and began sending back reports. When they returned home, George Avakian decided Chet Atkins was the man and Nashville the place to produce this debut album. That the Beys survive the journey from continental boites to the stronghold of country music in such fine shape should be proof enough of their adaptability. They sing just about any type of material, in any number of styles, with originality and their own special sound. There are jazz scat vocals on Arnett Cobb's *Smooth Sailing*, and a quiet mood on *Dreamy*. A sophisticated side appears on *A Felicidade*, and Leonard Bernstein's *It Must Be So*. Andy, who is pianist of the group, also takes vocal honors on Ellington's *Mood Indigo*. Atkins devises a buccolic setting for *Trees*, but that's only half the story. The rest is well worth hearing.

**Jonah Jones:** The Unsinkable Molly Brown

Capitol ST1532

**Chico Hamilton:** Irma La Douce—Bye Bye Birdie

Columbia CS8390

Both of these jazz treatments of Broadway show tunes are reasonably respectful of the original scores and the composer's intentions. The unsinkable Jonah Jones is the perfect choice for the buoyant Molly, and the melodies are never lost overboard in his spirited quartet versions. Most of Meredith Willson's themes are just right for the trumpeter's perky style, and he adapts readily to the

others. No second invitation is needed after Jones asks everyone to *Belly Up To The Bar, Boys*, and his shuffle rhythms are equally irresistible to dancers.

Chico Hamilton tackles two assignments in making his debut on Columbia, and the "Irma La Douce" score fits his quintet as snugly as a pair of French kid gloves. "Bye Bye Birdie," an unrestrained lampoon of rock-and-roll singers, is another matter, and turn about becomes fair play when the drummer solves the problem by gently satirizing Charles Strouse's boisterous music. The youngsters are now almost too perfect on *Kids*, and adults will have nothing to complain about. Three new members settle into Hamilton's style of chamber jazz with a minimum of disturbance. Guitarist Harry Pope is featured on *Our Language Of Love*, bassist Bobby Haynes on *Put On A Happy Face*, while Charles Lloyd doubles on flute and alto sax to work up a head of steam on *There Is Only One Paris For That*.

**Cecil Taylor:** The World Of Cecil Taylor

Candid 9006

According to Buell Neidlinger, bass player on all of Cecil Taylor's LP's to date, the pianist practices eight hours each day, at the least, and has done so over a period of almost twelve years. Brilliant technique and complex ideas distinguish Taylor's playing on his debut album, released about four years ago on the Transition label, so to say that his ideas seem clearer and the technique less noticeable today may be somewhat of a tribute in reverse. Once word gets around that Taylor is easy to understand, his position as a ranking member of the jazz avant-garde will be threatened. But if practice has made him more accessible, he still is far from being dull or merely competent. His atonal passages sound more personal and less like exercises borrowed from European composers. On hearing Taylor's three new originals, collectors lucky enough to have a copy of the deleted Circle LP in their libraries are likely to want to refresh memories of Henry Cowell playing his own piano compositions.

The present quartet was one of several groups to work at various times in Jack Gelber's play "The Connection," and Taylor composed a tension-filled ending for the first act titled *Mr. Archie Shepp*, his newly acquired tenor saxist, delivers an emotional solo on this agitated piece, then relaxes on *Lazy Afternoon*. Taylor also relaxes briefly on a lyric trio version of *This Was Nearly Mine*, and his fully developed left hand is a joy to hear in Bob d'Orleans excellent recording.

**Henry Mancini:** Mr. Lucky Goes Latin

RCA Victor LSP2360

Even private eyes take vacations, and Henry Mancini goes along on this one to introduce Mr. Lucky to colorful and exotic Latin rhythms, fashioning a dozen melodic themes about those selected. All are polished to appeal to dancers accustomed to hotel ballrooms rather than plantation compounds. Care is also taken to outfit each with effects, both gaudy and subdued, for stereo listeners. Bob Bain and Laurindo Almeida strum romantic guitars and mandolins, and Erno Neufeld heads the large string section. Jimmy Rowles plays tinpanola (Brazilian piano), and Bobby Hammack backs him up on Hammond organ. Another veteran of Mancini's television series making the trip is Shelly Manne, who invites fellow percussionists Frank Flynn, Larry Bunker, and Milt Holland. Engineer Al Schmitt gives everyone a cheerful send-off.

**MONO**

**Jazz Of The Forties, Vol. 1: Jazz At Town Hall**

Folkways FJ2841

As the great late masters Sidney Bechet, James P. Johnson, and Baby Dodds are among the principal performers, this Town Hall concert is a part of jazz history that can never be relieved except on records. One in

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a series organized by Bob Maltz, it was held September 21, 1946, and the billing also lists such stellar attractions as Muggsy Spanier, Miff Mole, Pee Wee Russell, Pops Foster, and Art Hodes. George Hoefler's notes were evidently written four or five years ago, indicating a hitch in plans to hand this well-preserved live recording down to posterity. The delayed arrival is opportune, however, as most studio recording involving similar personnel fifteen years ago are now off the market.

All the excuse Baby Dodds needed to put on an act was a concert, and audience attention often centered on the little drummer's antics. A favorite trick was to tick off time on woodblocks and snare-rim, then reduce the dynamics to the whisper of two drumsticks vibrating in one hand, and finally burst into the famous shimmy beat which brought the entire drum set and his whole being into play. The critics went pale with exasperation even then, but the customers were entranced—just as most purchasers of this album will be. Judging from the recording balance, the engineer was also a Dodds admirer intent on making the drums audible throughout. Or, knowing how horn players move about at such gatherings, he simply decided to play safe. Listeners can consider it an extra bonus when Spanier steps to the fore on *Relaxin' At the Touro*, or Bechet solos on *China Boy*, and *Dear Old Southland*. Johnson's piano is featured on *Maple Leaf Rag*, and his own *Snowy Morning Blues*.

**Jeannie Robertson: The World's Greatest Folksinger**

Prestige/International 13006

**The Best Of Peggy Seeger**

Prestige/International 15005

The burgeoning Prestige label has just put forth another line to supplement the four jazz offshoots already in its catalog, and the collector of folk music should have no trouble spotting one or two plums ready for picking. Several importations from the British Isles

are included, but not to the neglect of our home-grown American product, with Kentucky's Jean Ritchie heading the list. That this reviewer should turn his attention first to a singer bearing the same last name is only natural, especially since reports from abroad about her prowess had aroused his curiosity. Clan loyalty and forebears who came from the part of Scotland where Jeannie Robertson grew up undoubtedly color any opinions expressed here, but Irish partisans of Mary O'Hara are welcome to dispute the "world's greatest folksinger" claim. Before they do so, however, they will need to listen to songs racy enough to be banned in Ireland, even though some of the most improper are traditional ballads which Child collected. The singer is entirely unaccompanied on the first of her albums to be issued in this country, except when her daughter joins in on several Aberdeen street game songs. Informative notes by Hamish Henderson and a printed text are enclosed.

Peggy Seeger, who is married to Scottish folksinger Ewan MacColl, now lives in Britain where her concerts are well received, perhaps because she often returns English songs to their native heath in American versions. Both she and her husband are represented in the new series with LP's sent back from overseas. Distance seems to add a touch of nostalgia to fifteen songs she learned in this country, or it may be due to the inclusion of such childhood songs as *Pretty Little Baby*, *Raccoon And Possum*, and *The Old Woman And Her Little Pig*. Ken Goldstein produced both albums.

**Elmo Hope With Frank Butler And Jimmy Bond**

HifiJazz J616

A veteran of the Bud Powell era in New York, Elmo Hope settled in Los Angeles about five years ago and became a direct influence on several of the younger pianists around town. Club owners were not bowled over by his arrival, however, and the effect on the listening public was less noticeable. This album, his first in four years, should go a long

way toward remedying the oversight, mainly because of the presence in the trio of Frank Butler, a drummer fleet enough to punctuate Hope's swift lines at will. Together with bassist Jimmy Bond, they romp through several uptempo Hope originals in a manner guaranteed to leave jazz fans breathless. When Hope turns his attention to ballads, the commercial properties of the group become strikingly evident. A particular treat for the audio minded is Butler's finger drumming on the Latin-styled *Something For Kenny*. Butler is the leading candidate for the role left vacant when Kenny Clarke went to Europe, and proper presentation should make him a drawing card equal to Jo Jones or Dave Brubeck's Joe Morello.

**Fats Waller In London Capitol T10258**

During a memorable European tour in 1939, Fats Waller spent an August afternoon at the H.M.V. studios near London, and the six magnificent solos he recorded there on the great Compton organ are foremost among the prizes contained in this reissue package. Faithful Waller fans will remember that Victor once pressed the sides in this country and may still cherish copies of *Deep River*, *Lonesome Road*, *Go Down Moses*, and the rest. How altered overseas alliances permit Capitol to make the collection available on LP for the first time is easy to understand, but why the transfers from original masters were done in Paris by engineers of Pathe-Marconi is one of the mysteries of the recording trade. The refurbishing job is good, however, and all organ fanciers will quickly realize that a master of the console was at work.

Waller also alternates between organ and piano to wreak havoc on tunes of the day, and vocalizes with accustomed abandon on his own *An't Misbehavin'*, and *Flat Foot Floogie*. Edmundo Ros turns up on drums, along with trombonist George Chisholm, among the Britishers who man the stellar assisting group. A serious Waller, a joyous Waller, and Waller at his best make this an essential LP.

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## ENGINEER

(from page 39)

miss it, but you are not dominantly conscious of it, as you are of the performance itself.

This the microphone, sitting in your seat, cannot do. And once the sound has been picked up, recorded and played back, our ears cannot make the separation any more, either. Apparently, now all of it, program complete with reverberation, comes from the same loudspeaker, our ears have no means of "knowing" which is which.

So the recording people have to resort to some kind of "subterfuge" to make a record that sounds like our hearing faculty thinks it should. One way to do this is to use a "dead" studio for the players to perform in. Then the recordist can add "adjustable" reverberation from echo chambers or other units to get just the right amount and kind.

If the orchestra or musicians have had a background of recording music for movies in this kind of studio, or in fact any experience in it, they may be as at home this way as any other. Of course

it is something anyone can get used to. But many really get the "feel" for their performance partly by the reverberation "coming back" to them. The "dead" studio gives them a sensation rather like you get when you talk in such a room, an unnatural "sucking up" of your voice. Can you imagine how a church organist would feel, playing a console in a silent room, without being able to hear the music he is making? It's a bit like that.

Most musicians will do better work, more likely to fall in the superb category, by using a studio that is not too dead, and in which they feel comfortable with their instruments.

Another, and I think better, method is to spot as many microphones as may be necessary, "close in" to various sections of the orchestra, so the recordist can achieve balance between instruments without any unnaturalness. But in doing this it is still important, as far as possible, to allow the individual musicians to work in their normal manner, and get the recording right by proper attention to the microphones. An additional, distant microphone then picks up the natural reverberation separately, and the recordist can adjust the over-all

balance between program and reverberation.

As far as indispensability is concerned, the engineer in the recording business does occupy a rather unique position. The musicians with whom he works are usually quite unfamiliar with modern electronics. If they think they know something about microphones or amplifiers, it is often wrong—technically. So the "informed" engineer has his little castle all to himself. Some recordists, it is true, know very little more about the equipment they use than the musicians with whom they work. But they have "grown up" in the job. Now that books have been written on the subject, and classes can be found that teach it, the situation will undoubtedly change. But, until recently, a record company could not just go out and hire a "trained recordist"—except one who had learned by doing.

So we should progressively see better work from the "indispensable" engineers, resulting in a higher proportion of recordings that will please at least most of that odd 5 per cent. And a step towards this, in some areas, will be an increased recognition of the importance of the musician, the real VIP. **Æ**

## HOW HIGH

(from page 42)

the best possible output transformer. I would not be sure that the best way of doing this is not to use a transformerless output stage although this involves two additional problems; how good are the available high impedance loudspeakers and how much will the necessary supply regulation cost? On balance, perhaps, the extra complexity of the power supplies compared with the solid permanence of a good transformer will bring us back to the conventional solution.

The output transformer is, for all practical purposes, the output stage. I myself would always use pentodes rather than triodes but the tube manufacturers give me all the details of bias and screen supplies. In general, the tube maker is interested in getting the maximum quotable output and it is sometimes worth while moving away from the recommended conditions and trading output for linearity. But the basic frequency response of the amplifier is determined by the output transformer and this must have enough iron and enough copper to keep up the inductance at high levels and low frequencies, a balanced structure, low leakage and capacitance to keep the high frequency response good. It is here that your dollars really buy quality.

The earlier stages of the amplifier

will rarely raise any special difficulties. They must provide the wanted gain, the wanted phase splitting for the output stage. They must not produce too much distortion and it will not be too difficult to make sure that the phase characteristic will allow us to apply the wanted amount of feedback. I have written at length about this elsewhere and I do not propose to discuss it further here. After all, response control is a first generation feedback amplifier problem and the object of this study is to deal with the defects of first generation amplifiers.

We now have an amplifier without feedback. We can measure the over-all frequency response. Now we must remember the basic natural law that you cannot have your cake and eat it. We want to use our feedback to reduce non-linearity so we cannot use it to improve the frequency response. This is an absolutely fundamental concept which cannot be evaded. Where the response is improved the full benefit of feedback in the reduction of distortion is lost, and in the extreme cases the distortion may actually be increased. The feedback path must therefore contain extra elements which will shape the response to follow the response of the amplifier without feedback. Instead of a single feedback resistor, for example, we may split this resistor into two,  $R_{f1}$  and  $R_{f2}$ , and add, as I have shown in Fig. 1, a low-frequency correcting network  $C_1R_1$  and a high-frequency correcting network  $C_2R_2$ . In the middle of the frequency

range the network is effectively that shown in A of Fig. 2, but at low frequencies it turns into the form shown in B of Fig. 2. The high-frequency performance is shown in C of Fig. 2. Of course, the network suggested gives at most a slope of 6 db per octave while the top cutoff due to the output transformer will be at 12 db per octave but there is quite a considerable advantage to be gained, especially if the network 6 db per octave can begin at a lower frequency than the transformer cutoff. My feeling is that here it is every man for himself, that the best balance between high harmonic intermodulation and wide frequency response depends both on the material and the listener.

Quite deliberately this has not been in any sense an article on amplifier design. Within reason one can always design an amplifier to have a specified performance: the only requirement is that the performance should really be specified before you start. Most hi-fi amplifiers appear to be designed to a cost plus bandwidth specification. I believe that this is based on some false assumptions and that bandwidth is less important than intermodulation. I am not prepared to be as dogmatic about this as my critics will be: all I suggest is that for a given price there is a compromise solution which will give the greatest satisfaction. I do not even suggest that the compromise which suits me will suit you. **Æ**



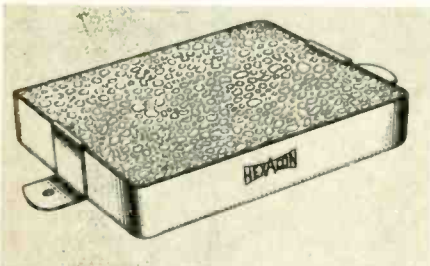
# NEW PRODUCTS

• **AM-FM Stereo Receiver.** A compact stereo receiver, Sherwood's Model S-7000 combines an AM-FM tuner with a 50 watt stereo amplifier. Featuring 19 front panel controls and switches and 9 inputs, the S-7000 is compact in size, measuring only 16½ x 14 x 4½ inches. All that is required to complete a stereo music system is the speaker system, a record changer or turntable, and a tape deck. The tuner section



includes separate tuning eyes for FM and AM, independent FM and AM tuner operation for stereo simulcast reception, a.f.c. in the FM section. Typical FM sensitivity, by IHFM standards, is 1.8 microvolts; AM sensitivity is 2 microvolts at 60 per cent modulation for 0.5 volt output, 6 db signal-to-noise. Continuous amplifier output is 24 watts per channel; hum and noise is 80 db below 24 watts; frequency response is ±1 db 20-40,000 cps. Intermodulation distortion is 1.5 per cent and harmonic distortion is 0.5 per cent at 24 watts continuous power output. The damping factor is 5. For stereo tape recording, two cathode follower outputs and front panel tape monitoring switch combine to make the system highly flexible. Model S-7000, less case, is priced at \$299.50. A brown leatherette case is available for \$7.50. Sherwood Electronic Laboratories, Inc., 4300 N. California, Chicago 18, Illinois. **E-1**

• **Soldering-Tip Cleaning Sponge.** Hexacon Electric Company announces a new soldering-tip cleaning sponge which saves time and extends soldering-iron tip life. It eliminates the excessive tip wear caused by use of abrasives. It also eliminates contamination caused by use of wiping rags. Cleaning takes place while the tip



is hot, without removing protective solder. The fine porosity of the sponge makes it ideal for cleaning small tips, while the size of the sponge is large enough for even the largest tips. Another advantage of the fine porosity is that the sponge will hold more water, which in addition to the adequately sized aluminum tray, keeps the sponge wringing wet. Hexacon Electric Company, 266 W. Clay Avenue, Roselle Park, N. J. **E-2**

• **16-in. Professional Integrated Tone Arm.** A new 16-in. tone arm and cartridge combination manufactured by Bang and Olufsen of Denmark is now being distributed by Dynaco, Inc. This arm, the TA-16,



features the "Isodyne" principle of inertial balance to attain dynamic equilibrium. This concept, on which patents are pending, maintains equal pressures on each side of the record groove regardless of the frictional forces which tend to make conventional arms slide inward. Application

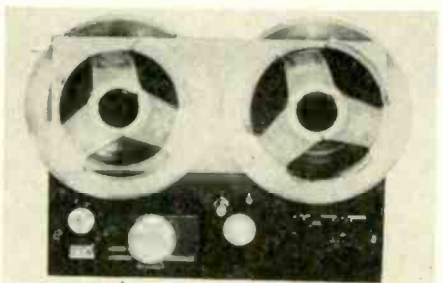
of this principle yields lower record wear, lower distortion, and other related benefits. The TA-16 can track at stylus forces as low as one gram with a tracking error of less than one degree. Tracking force is determined by a linear spring set by a simple, easily read slide which permits accurate settings to fractions of a gram. The TA-16 gives flat response within 2 db from 30 to 15,000 cps, with 30 db of channel separation up to 10,000 cps. Output is 7 millivolts. Dynaco, Inc., 3912 Powelton Ave., Philadelphia 4, Pa. **E-3**

• **French Provincial Cabinets for High-Fidelity Components.** Featuring authentic French Provincial design, the new Rockford Special Furniture Co. Model 1100-1101 ensemble combines an equipment cabinet and twin free-standing speaker



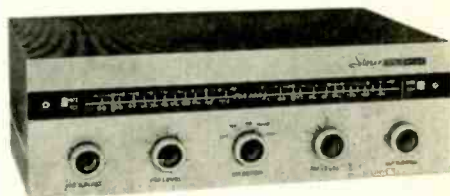
enclosures. In the equipment cabinet, Model 1100, the upper right compartment is designed for record changer, transcription turntable, or tape recorder; the lower right compartment has space for 150 records; the upper left compartment is designed to house amplifier and/or pre-amplifier, or tuner. Lower left compartment provides additional space for unclassified use. Over-all size of the equipment cabinet is 41 x 32 x 19½ inches. The Model 1101 speaker enclosure is designed to house up to 15-in. loudspeakers. An adapter board for 12-in. speakers is provided. Over-all size of the speaker enclosure is 21 x 32 x 19½ inches. For further information, write for Bulletin R-19 to Rockford Special Furniture Co., 1803 W. Belle Plaine, Chicago 13, Illinois. **E-4**

• **Custom Tape Deck.** A new custom deck, the Model 199D, and record-playback amplifier, Model A905, have been introduced by Roberts Electronics. The 199D is the same deck—mechanically modified to adapt it to custom installation—used in Roberts Model 990 stereo tape recorder, and features the patented Roberts multiple adjustment head that offers rapid



selection of recording and playback functions. The deck provides 4-track monophonic record-playback and 2-track stereo playback. The record-playback amplifier feature bias oscillator circuits, rear jacks, chassis enclosures, a.c. outlets, and record-playback levers. Two are required for a stereo installation. Price of the 199D is \$209.50 and of the A905 is \$124.50. Roberts Electronics, Inc., 829 North Highland Avenue, Los Angeles 38, California. **E-5**

• **AM-FM Stereo Tuner.** Prewired, pre-aligned r.f. and i.f. stages of both the FM and AM sections make the new Eico ST96 an easy kit to construct and reduces the problem of alignment. The new tuner features Eico's traveling tuning indicators



which contract into an exclamation point at the exact center of each broadcast channel. Two completely independent sets of controls allow the ST96 to be used for separate and simultaneous FM and AM reception, or for FM-AM stereo. It will also receive FM-Multiplex upon addition of an adaptor. The FM section has a.f.c., a.f.c. defeat, a.g.c., and a broadband ratio detector for improved capture ratio and easier tuning. FM frequency range is 20-15,000 cps. The AM section features switched "wide" (to 14,000 cps) and "narrow" (to 7000 cps) bandpass. AM frequency range is 20-9000 cps (wide), 20-4500 cps (narrow). Panel controls include: separate AM, FM tuning; separate AM, FM level controls; selector switch for choosing AM only, FM only, AM-FM stereo, or FM-Multiplex. The ST96 sells for \$89.95 in kit form; wired, the price is \$129.95. Both prices include a metal cover. Eico Electronic Instrument Co., Inc., 33-00 Northern Blvd., L. I. C. 1, N. Y. **E-6**

• **Compact Speaker System.** In keeping with the modern trend towards decreased size, the new Tannoy "Cadet" is a mere 11 x 13½ x 24¾ inches in size. Of course the scant size is not an indication of performance; within its 1½-cubic-foot volume is contained a 10-in. Tannoy dual-concentric loudspeaker which was designed specifically for an enclosure of this volume. In common with the other Tannoy dual concentrics, this speaker incorporates



two completely separate loudspeakers: a horn-loaded high-frequency unit and direct radiator low-frequency unit. The low-frequency unit has a curvilinear cone, plastic-terminated surround, and the whole unit is dustproofed by means of an acoustically transparent center dome and rear suspension. Although not claimed to have all the "brawn" of its 12- and 15-in. big brothers, this speaker will provide the extended range coupled with low harmonic distortion for which its elders are already well known. Power handling capability is 20 watts and impedance is 16 ohms. The Cadet is available in oiled walnut at \$145.00, or in a Deluxe version with polished walnut or mahogany finishes for \$157.00. Tannoy (America) Limited, P. O. Box 177, East Norwich, L. I., N. Y. **E-7**



# NEW SPEAKERS FROM H. H. SCOTT



Distinguished panel of musicians from Boston's famous symphony orchestra evaluate speaker performance in home of Hermon Hosmer Scott, Lincoln, Mass. Left to right, kneeling: Leonard Moss (Violin), James Stagliano (Horn), Berj Zamkoshian (Organ), Everett Firth (Tympani). Standing: Bernard Zighera (Piano), Hermon Scott, Roger Voisin (Trumpet).

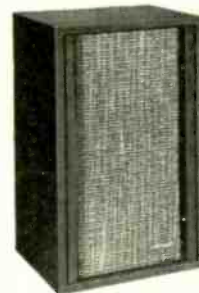
## Famous musicians first to hear remarkable new H. H. Scott speakers!

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*"The closest I have heard to the true sound of the violin. I was not even aware I was listening to a recording."* Leonard Moss, Violinist. *"The trumpet sound was uniform and consistent in every range, from the lowest to the highest note . . . a feat virtually unheard of in any other speaker."* Roger Voisin, First Trumpet; Recording Artist, Kapp Records. *"I have never heard any reproduction of organ which sounded so faithful to the original. I felt I was sitting in the center of Symphony Hall."* Berj Zamkoshian, Organist. *"Every other speaker I ever heard sounded nasal and artificial. This was the first one that did not."* Bernard Zighera, First Harpist and Pianist. *"I was in the control room when this recording was made. Played through these new speakers, the reproduction was closer to the original performance than I've ever heard before."* James Stagliano, First Horn; Recording Artist, Boston and Kapp Records. *"The percussion came through with amazing clarity. The cymbals, the snare drum, the tympani and the bass drum all were equally true to the way they sound when I play."* Everett Firth, First Tympanist.

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### H. H. SCOTT MODEL S-2 WIDE RANGE SPEAKER SYSTEM:

This four-driver, acoustic compliance system consists of a low resonance, high excursion woofer, two dual-cone mid-range units, and a special wide dispersion spherical tweeter. Dimensions: 23 3/4" H x 18 1/2" W x 12 1/2" D. Available in mahogany (\$199.95), oil finish walnut (\$199.95), fruitwood (\$199.95) and unfinished (\$179.95).\*



### H. H. SCOTT MODEL S-3 WIDE RANGE SPEAKER SYSTEM:

A three-way acoustic compliance system of true book shelf size. Consists of a specially designed low resonance woofer, a mid-range unit and a wide-dispersion super-tweeter. Dimensions: 23 3/4" H x 11 3/4" W x 9 3/4" D. Available in mahogany (\$129.95), oil finish walnut (\$129.95), fruitwood (\$129.95) and unfinished (\$114.95).\* (\*Slightly higher west of Rockies)



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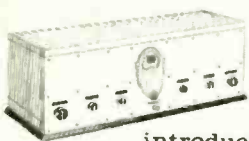
# 33 YEARS OF HIGH FIDELITY

It was 1927... Amos and Andy had not yet become a national pastime... and radio listeners were more familiar with a cat-whisker than with a vacuum tube. Yet it was in this year 1927 that the concept of high fidelity was born.

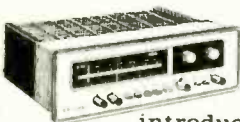
It was brought to life by a company of unusual vision, a group of skilled radio engineers who early foresaw the day when people would no longer be content with the mere reproduction of sound, but who would demand that it be reproduced with the highest possible degree of fidelity.

That degree of fidelity was amazingly high, even in 1927, for those listeners fortunate enough to own an SR-7, the first audio product made by the young Sargent-Rayment Company. There are still SR-7s in existence today, capable of functioning perfectly, after a third of a century.

The principles laid down in 1927 still hold good today. Testifying to their basic soundness, S-R components over the years have always out-performed and out-lived ordinary units. Backing this up is the strongest, longest guarantee in hi-fi history. Any S-R unit you buy today is guaranteed for 15 months, on a pro-rated, money-back basis (except for tubes, which carry a 1-year warranty, 4 times longer than normal).



SR-7, introduced in 1927



SR-1040, introduced in 1960

If you've not yet had an opportunity to learn about Sargent-Rayment's "seven steps to superior reproduction," check today with your dealer. And if you're planning a component system, ask him for a copy of the S-R High Fidelity Planning Folder.

# SR

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• 4926 E. 12th Street, Oakland 1, California  
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• **Stereo Dynamic Microphone.** A new stereo dynamic microphone utilizing two separate dynamic microphone elements within one single compact unit has been introduced by Lafayette Radio. Completely



flexible, the Model PA-263 eliminates the need for two separate microphones during stereo recording at home and is equipped with a switch for selecting stereo or monophonic operation. The individual dynamic microphone elements are equipped with separate transformers and provide a polar pattern, in effect achieving two omnidirectional patterns 90 degrees apart for an almost complete pickup within 360 degrees. Frequency range is 50-15000 cps and the response is essentially flat from 80 to 10,000 cps. Impedance is 50,000 ohms. Equipped with a heavily weighted metal base, the PA-263 is easily adaptable for use with all types of floor stands. The PA-263 is priced at \$17.95 Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y. **E-8**

• **Lightweight 4-Track Stereo Tape Recorder.** A lightweight version of the Norelco "Continental" tape recorder, the new "Continental" 200 (Model EL3541) operates at 7½ ips and incorporates a narrow-gap, 4-track record-playback head. The "Continental" 200 will play standard 4-track stereo tapes (head output) through an external system, and will record and play back monophonically on 4-tracks. The 200 is provided with input



jacks for recording from microphone, tuner, or phonograph, with facilities for mixing (two sources), and for "sound-on-sound" recording. The machine also includes an output jack for monitoring with headphones. The 200 may also be used as a self-contained public address amplifier and speaker system. A foot switch is available as optional equipment. North

American Philips Co., High Fidelity Products Division, 230 Duffy Ave., Hicksville, L. I., N. Y. **E-9**

• **New Mylar Recording Tapes.** Reeves Soundcraft has just added two new Mylar-based recording tapes to its "Hi-Fi" line. Hi-Fi 50M is on a 1 mil Mylar base and provides a 50 per cent increase in length



over standard tape reels. Hi-Fi 100M is on a tensitized ½ mil Mylar base and provides double the playing time of standard tape reels. Both tapes feature Soundcraft's "FA-4" oxide formulation. The tapes are available in attractive, multi-color, hinged-box packages. Reeves Soundcraft Corp., Danbury, Conn. **E-10**

• **Bulk Tape Eraser.** Designed to serve a dual function, the new "Magneraser" offered by the Amplifier Corp. of America completely erases tape on the reel, without rewinding, and also demagnetizes record-playback and erase heads. The erasing process is so efficient that even on severely overloaded tape the background noise level is lowered 2 to 6 db below the

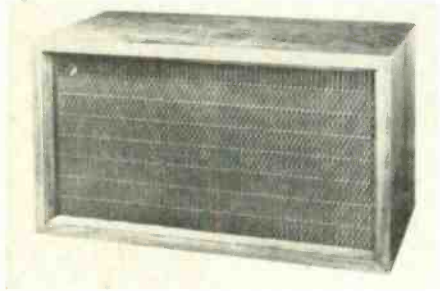


noise level of virgin tape. Wear and tear on the tape is reduced because erasure is effected on the reel. Also, because of its light weight, the "Magneraser" is easy to use in demagnetizing record-playback and erase heads, thus reducing background noise further. The unit operates on any alternating current (50 or 60 cps), and furnishes the necessary gradually diminishing magnetization field which the tape normally encounters during supersonic erasure. Features include a spring-loaded pushbutton type on-off switch which automatically cuts off the unit when released. The "Magneraser" is available in two models: Model 200C for 100-130 volt operation; Model 220C for 200-260 volt operation. Price of either model is \$18.00. Amplifier Corporation of America, 393 Broadway, New York 13, N. Y. **E-11**

• **Bookshelf Speaker System.** Billed as a "dangerous loudspeaker," the new EMI "Dutton" bookshelf-sized loudspeaker system features a handmade elliptical-cone woofer and two cone-type high-frequency units. Designed by Dr. Dutton (whence the name of the unit) and built in England, this unit is claimed to be an adaptation of their professional studio monitor system,



also designed by Dr. Dutton. The danger potential, as claimed by the manufacturer, is that this speaker system will make owners of bulkier and higher-priced systems dissatisfied when they chance to hear



this miniscule unit. Perhaps the manufacturer's claims are accurate but we ourselves would hesitate to predict as to what would disturb the audiofan. In any case, for all those daring souls willing to risk the danger, information may be obtained from Scope Electronics Corp., 10 Columbus Circle, New York 19, N. Y. E-12

## New Literature

• **Turntables.** An illustrated, 8-page brochure which details prices and specifications for the complete line of Rek-O-Kut stereo turntables is available free. The line includes seven models, all of which feature hysteresis synchronous motors. In addition these tables feature a new belt drive system. Also described is a new stereo turntable kit. The two-color brochure also includes such accessories as bases and acoustical mounts, and the S-320 stereo tone arm. Rek-O-Kut Company, Inc., 38-19 108th St., Corona 68, N. Y. E-13

• **Tape Recording Reference.** The Nortronics Company, Inc. announces the publication of comprehensive tape recording reference intended to dispel the "veil of mystery" regarding tape recording. Basic principles of tape recording and how to convert to 4-track stereo is explained in the simplest possible terms. Several features appearing in print for the first time are: clear photographs of "treated" recorded tapes; "phantom" views of erase and record/playback heads; the most complete reference tables to date on 4-track conversion and replacement. The reference guide is available directly from the company or at any of its dealers for \$25. The Nortronics Company, Inc., 1015 South 6th Street, Minneapolis 4, Minn.

• **Cartridges and Tone Arms.** A revised edition of a brochure describing its line of cartridges and tone arms has been issued by Shure Bros. The 8-page brochure gives complete performance specifications and prices of the company's Laboratory Standard, Professional, Custom, and Standard Stereo Dynetic phono cartridges. Also included are details on the Professional tone arm and the Studio Stereo Dynetic integrated tone arm and cartridge. Other equipment described is the new M60 stereo line preamplifier and the M66 broadcast stereo equalizer. The brochure is available free from Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill. E-14

• **Flutter: Its Nature, Cause, and Avoidance**—is the title of a booklet available free of charge from the Amplifier Corp. of America. Written by N. M. Haynes it provides a technical description of flutter and its associated disturbances, wow and drift. The 12-page brochure also details causes and methods of measuring flutter. Finally, specifications and price are given for a professional flutter meter manufactured by the company. Write to Amplifier Corp. of America, 396 Broadway, New York 13, N. Y. E-15

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ITALIAN PROVINCIAL *Center Equipment Cabinet* (Model 600) with lift top is designed to house amplifier and/or preamplifier or tuner, any record changer or most transcription tables or tape recorders. Space for 100 LP records, and books or decorative display. Free-Standing *Twin Speaker Enclosures* (Model 601) permit proper stereo separation for desired listening in any room. Each houses up to 12-inch loudspeaker. *Cabinet Ensemble* (Model 600-601) in Fruitwood or Oil Walnut finish. Also available on special order in Hand-Rubbed Mahogany, Blonde, or Ebony.

Open view at right shows compartments in either of the Italian or French Provincial Equipment Cabinets



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Model 1100-1101

FRENCH PROVINCIAL *Center Equipment Cabinet* (Model 1100) is designed for any record changer, transcription table, or tape recorder, amplifier and/or preamplifier or tuner. Has space for 150 LP record albums and other use. Free-Standing *Twin Speaker Enclosures* (Model 1101) permit proper stereo positioning for thrilling reproduction. Each houses up to 15-inch loudspeaker. Includes adapter board for 12-inch speaker. Also accommodates tweeters. *Cabinet Ensemble* (Model 1100-1101) of Cherry finished in Fruitwood.

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You can often also hear the result in the form of distortion, drift, and noise.

You'll never see a cherry spot in a Sargent-Rayment high fidelity tuner or amplifier. Years of experience have taught S-R that following tube manufacturers' recommendations not only makes good engineering sense, but also permits S-R to guarantee its products 15 months, and tube life a full year, four times normal.

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# ABOUT MUSIC

HAROLD LAWRENCE\*

## Electronics By Leaps And Bounds

**A** PRIVATE AUDIENCE gathered in the New York City Center on March 19 for the preview of the music for a new Balanchine ballet, "Electronics." None of the usual sights and sounds accompanied the event: the fire curtain bearing the legend, "Asbestos," was down; the music stands in the pit were bare; and no orchestral players were tuning up in the wings. The only signs of activity were to be found in a side box where Stewart Hegeman hovered over banks of gleaming amplifiers and preamplifiers, which were to drive some 31 loudspeakers deployed through the auditorium. Cued up on a tape machine was the recording of the ballet music itself, ready to be played at the push of a button. The lights dimmed, a relay clicked, and the hall suddenly filled with sound.

"Electronics" was composed by Remi Gassmann on an electronic instrument called the Studio Trautonium, which was invented before the war by Friedrich Trautwein, and developed by Oskar Sala. The work makes no use of basic sound materials, natural sounds, or sine-tone generators, in contrast to other electronic compositions. Yet it is essentially diatonic, and its textures often closely resemble those of existing instruments. Clear-cut melodies, not far beyond the reach of conventional notation, are heard in such recognizable timbres as trumpet, trombone, piccolo, bass clarinet, violin, snare drum, cymbal, gong, bells, and harpsichord. There are, to be sure, sounds of strictly electronic character: some recall the optical film engravings of the Canadian movie man, Norman McLaren; others, familiar to tape

editors and sound engineers, include the stutter of untaut tape bouncing off the playback head; pitch and rhythmic changes due to manipulation of tape transport speeds (e.g., bassoon turned oboe at twice the normal speed; full orchestra attack transformed into a chaotic roar at half speed); and the effects of filters, resonating panels, and echo chambers. As the work progressed, and the listener adjusted to the instrument's sonorities, it became increasingly clear that, stripped of its electronic garb, "Electronics" represented no radical departure from symphonic music.

At the press conference following the performance, Mr. Gassmann conceded that his work was symphonic in texture; his aim was not a total rejection of traditional sounds, but rather a "logical extension of orchestral means." How far was this extension, and what was gained in the process?

In decibels, frequency range, and 'sonic mobility,' the Studio Trautonium easily transcends the capabilities of the symphony orchestra. Thanks to Stewart Hegeman's audio installation, the composer had at his disposal 960 watts of power. Naturally, not all of this was brought to bear, although the peak output actually utilized approached the threshold of pain. (A little more, and Mr. Gassmann, whose dynamic palette seems to crave Cinerama-like levels, would have ended with no loudspeakers and no audiences.) In frequency range, too, "Electronics" surpasses "live" instruments, producing sound above and below the range of normal hearing: 10 to 40,000 cps. Finally, the Studio Trautonium enables the composer to perform transmutations of sounds, such as changing a twittering "piccolo" to a *ponticello* "viola."

\* 26 W. 9th St., New York 11, N. Y.



Fig. 1. Rehearsal of "Electronics" ballet at New York City Center.

(Photo by Martha Swope)

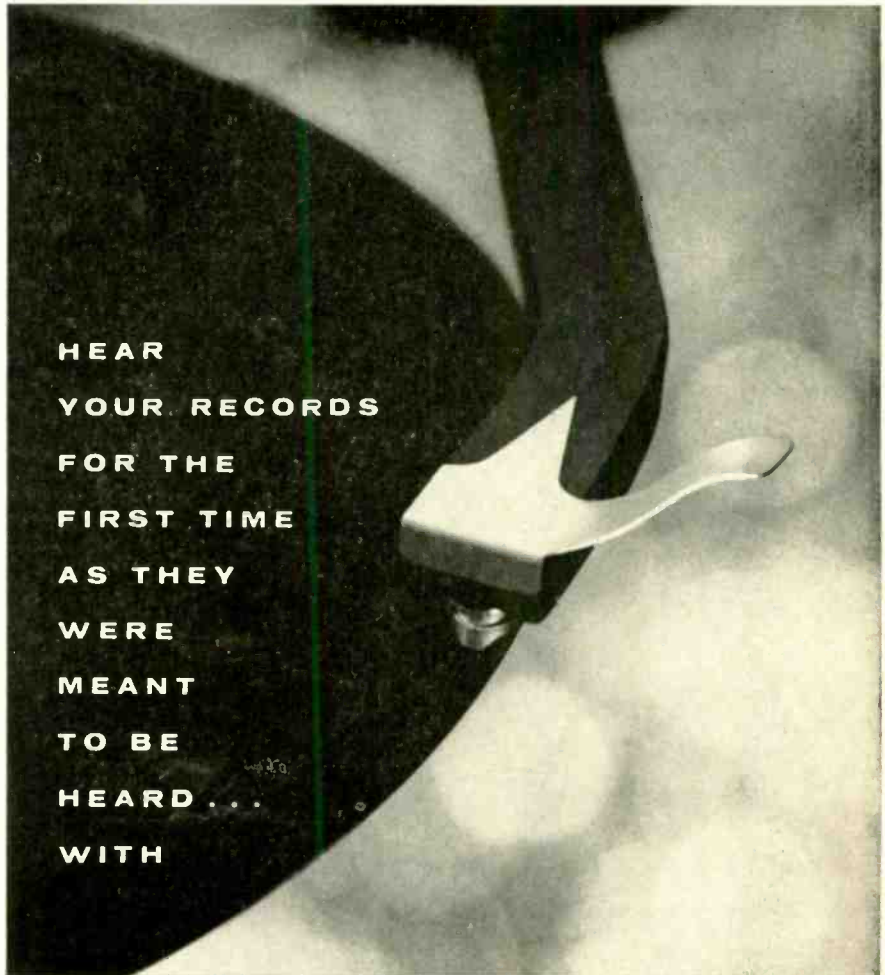


According to Mr. Gassmann, the Studio Trautonium is the *ultimate* instrument. Sonically self-sufficient, it requires no external source material, and can produce "just about any sound imaginable." To prove this, the Trautonium people have brought out a demonstration tape that includes, in synthesized form, the sounds of a mine explosion, a steam locomotive, a small town band "amusingly out of tune," a full military band, and the ambience of a chemical factory. "Until the turn of the century," Mr. Gassmann explained, "four simple methods were used to produce musical sounds: instruments were scraped, blown, plucked, and knocked. An American composer, Thaddeus Cahill, was the first to develop an electrical approach to sound production." Cahill's invention, the Telharmonium (1906), was the granddaddy of all electronic instruments. Ferruccio Busoni heard it demonstrated in New York and observed: "Only long and conscientious experimentation and an advanced education of the musical ear will make this unfamiliar material accessible to a new generation and useful to the art of music."

Electroponic instruments have now been with us for over half a century, and Busoni's reference to long and conscientious experimentation still applies. In the case of "Electronics," for example, it took Remi Gassmann no less than three years merely to "prepare to compose *with* the Studio Trautonium." The composer explained the use of the word, "with," instead of "for": "The creativeness of the instrument itself ushers the composer into the magic realm of the 'controlled accident' where, in the final analysis, he must make the right choice in his selection of tonal material." The conventional image of the composer seated at his work table, physically removed from the instruments or voices for which his music is written, is replaced here by the electronic composer who deals directly with his medium, thus bypassing the intermediate steps of notation and interpretation. The elimination of music's middle man, the performer, puts the composer on the same footing with the painter and the writer, whose works are presented to the public *exactly* as they were created.

What is the Studio Trautonium, and how does it operate? "It looks like a harmonium with a lot of dials," Mr. Gassmann reported. The composer manipulates two strings which do not produce music, but electrical impulses. The impulses are chased through complex circuits and emerge as tones from a loudspeaker. Each tone may undergo dozens of transmutations before achieving its final registration. Unlike the R.C.A. music synthesizer, the Studio Trautonium is capable of transmitting "those intangible elements that only a performer can bring to a performance; that is, the shades between the tones. The possibilities for the composer," continued Mr. Gassmann, "so extend beyond the traditional means of musical expression that one can easily foresee a time when our present instruments will become as obsolete as the sackbut and the lute."

It is really difficult to evaluate the Studio Trautonium on the basis of Gassmann's composition. In this mixture of purely electronic material with conventional timbres electronically produced, the



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Try the hand heat test on conventional equipment, then on Sargent-Rayment. We guarantee S-R will be cooler by far.

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old-fashioned sounds won out. One could not escape the feeling that, at heart, "Electronics" was a symphonic work that had been 'transcribed' for electronic instrument. This impression was engendered not only by pitch and timbre, but by the music's thematic treatment, plan of dynamics, and rhythmic character. Now that Mr. Gassmann and the Studio Trautonium have gotten thoroughly acquainted, perhaps they will travel down a more adventurous path in the future.

"Electronics" was performed on some of the finest audio equipment available today. The music seemed to come from all parts of the hall. (This "wall-to-wall" effect is the aim of several electronic composers, including Karlheinz Stockhausen, who wants "to be able to bring sounds from every surface area of the room.") Distortion was imperceptible, and the reproduction was truly wide-range. Yet something was missing. The Studio Trautonium, like all other electronic instruments, lacks the quality of "liveness" associated with traditional instruments. Of course, by its very nature, electronic music is non-objective. The electronic composer is totally unconcerned with realistic sound since, through his work, he is creating a new "realism." "Live" tone, a blending of numbers of partial tones according to the laws of acoustics, has no place in the world of the

electronic composer, who breaks up the components of sound, isolates pure tones, and constructs his own series of partials.

Theoretically, there should be no external coloration to the sound of electronic music beyond that which might be caused by the playback system itself. In practice, however, all pure electronic music is encased in a sonic envelope which somehow diminishes its claim to "limitless kaleidoscopic tonal possibilities." Even while "Electronics" was sounding forth from all corners of the hall, the music had a peculiar boxed-in quality. We found ourselves yearning for an honest-to-goodness, open-window sound, say, of a trombone glissando, a plucked string, or the snap of a twig—anything to relieve the instrument's built-in "color."

But let us be fair to the electronic composer. We have no right to expect his music to sound "live" in the usual sense. One cannot propel the raw material of sound into new musical space without upsetting old listening habits. And, judging from the reaction of the City Center audience, there was less to adjust to in Remi Gassmann's "Electronics" than in most other electronic scores.

How did George Balanchine feel about electronic ballet music? "It has one advantage over normal ballet scores—no orchestra, no musicians to pay." Æ

## HIGH FIDELITY WIDOW

(from page 27)

natured derision and jollity, explain to the group that you have some friends that you would like them to meet. Then dramatically reveal the hidden room, and its cosmopolitan atmosphere of musicians, firemen, locomotive engineers, and Zulus.

9. In the moment of stunned silence that follows, the enormity of the deception will penetrate to even the most obtuse. The addicts, accustomed to the relative perfection of records which are produced by creating a composite of the best segments of many performances, and every step of manufacture of which is marked by the utilization of all known technical developments, are unaccustomed to and unprepared for the total inadequacy of an actual performance. However, it must be admitted to the addicts' credit that even though in a state of bewilderment, they will rationally consider the implications of the just concluded demonstration and act upon their conclusions. They will correctly reason that since they are dedicated to the quest of imperfection, high fidelity is not their vehicle. They will, in fact, enter a state of true happiness for they will realize that they have discovered a fundamental truth of prodigious import.

They will realize that REALITY IS THE ULTIMATE IMPERFECTION!

9. Once the addict makes this dis-

covery, he immediately resolves to have nothing further to do with high fidelity and you have triumphantly completed his cure.

The criticism has often been raised that even though the preceding method does cure those stricken with the high-fidelity pestilence, it does give rise to another problem—a problem that evidences itself as a compulsive desire to attend actual musical performances. The cured addict, still driven by his relentless pursuit of imperfection, now realizing that his quarry lies in the realm of "live" rather than recorded performance, seemingly obtains total gratification from what he regards as the complete wretchedness emanating from today's concert stage.

In short, the former addict becomes a critic.

While the supervision and care of a critic is beyond the scope of this article, it is emphasized that critics are model husbands. This is a consequence of their realization that their scathing diatribes are worth money and should not be wasted on household matters. The critic therefore assumes a gentleness of speech and manner that simultaneously conserves his vitriolic inspiration, insures domestic tranquility, and publicly demonstrates your wisdom in administering the cure. Æ



## TAPE GUIDE

(from page 34)

(2) incorrect playback equalization, (3) or insufficient bias current, resulting in too much treble. If the discrepancy in frequency response between the source and the tape is substantial, I suggest that you return your tape recorder to your dealer or to an authorized service agency. But if the difference is in truth a slight one, I suggest that you be tolerant about it. The particular brand of tape you use, changes in line voltage, and similar factors can be responsible for minor deviations from flat response."

QUESTION: "I have read your article on tape recording in which you briefly discuss intermodulation distortion, about which I would like much more information. However, highly mathematical treatment would be of little value to me."

ANSWER: "Following are some articles on intermodulation distortion in tape recording and in general, which you may be able to find in your local library: Herman Burstein and Henry C. Pollak, "Distortion in Tape Recording," *AUDIO*, October 1956; Mannie Horowitz, "Understanding Intermodulation Distortion," *AUDIO*, August 1957; W. Philbrook, "Methods of Measuring and Specifying Audio Distortion," *Radio & TV News* (now *Electronics World*), August 1956; R. D. Keller, "Distortion," *Audiocraft*, March 1956.

QUESTION: "If I replace all the resistors in my tape recorder with deposited carbon resistors, will I improve the performance of my instrument?"

ANSWER: "So far as noise reduction is concerned, my experience with deposited carbon resistors, at least those made in this country, is not particularly good. Deposited metal film ones, however, are generally very good, although a bad egg can sometimes sneak in. I have had good luck with the Davohm Series 850. You need use low-noise re-

sistors only in the first stage or two of the tape preamplifier, namely as the plate load and cathode resistors. The only advantage of using them elsewhere is that, being also precision resistors, they may provide slightly more accurate equalization."

QUESTION: "I am 17 years old and have designed a tape amplifier. I believe I have something in which one of the audio magazines would be interested, and would appreciate your advice on how to go about writing an article and presenting it to one of these magazines."

ANSWER: "There are perhaps two schools of thought on trying to sell an article. One is to submit an outline. The other is to submit the article itself. My preference is to submit the article itself, although this might seem to call for a good deal of work with the possibility of no compensation. However, to construct a really good outline, good enough to interest an editor, you have to expend almost as much effort as in writing an article. With a good outline, the article almost writes itself. Moreover, even if your article does not sell, you will at least have the benefit of this experience toward your next article; often you will receive comments and suggestions from the editor, provided you have included return postage with the manuscript. Finally, a finished article has the flesh and personality to do a selling job that a cold, bare outline may fail to accomplish. You can go about preparing the article as follows: (1) Write down in any order whatsoever all the points you wish to discuss. (2) Eliminate those points which are of low order of importance and interest. (3) Determine three to five main topic headings that will cover what you have to say. (4) Group the points in step (1) under the appropriate headings and in proper order." Æ

## AUDIOCLINIC

(from page 4)

d.c. voltage is fed into the amplifier via a switch. This switch is used to make or break the circuit supplying the d.c. The observer views the 'scope each time the d.c. is applied or removed from the input of the amplifier. If the amplifier were perfect, you would see a sudden transient on each application or removal of the signal. However, with some amplifiers the observer sees a few oscillations, each one possessing a slightly lower amplitude than the one before it.

You can see that if an amplifier fails this test, a low frequency supplied to it is likely to remain even after the source of such signal has stopped producing it. This is another way of saying that the amplifier has poor transient response. This test will tell the observer something about low-

frequency transient response of the amplifier whereas the squarewave test will tell him something about the high frequency transient performance of the same amplifier.

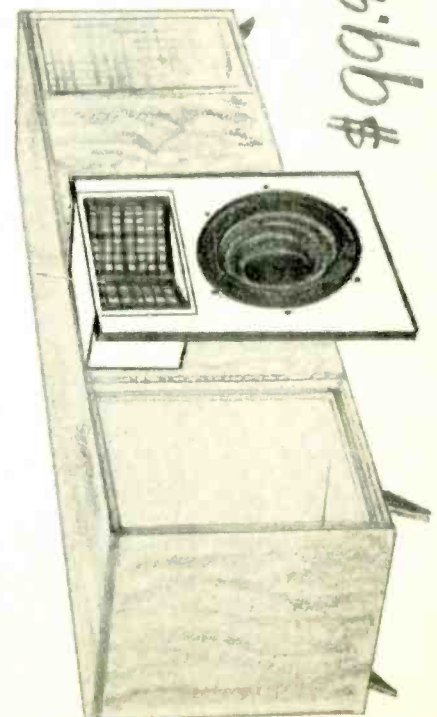
Have you ever tuned across an FM signal and found it hard to adjust the tuner for exact centering? Did you find that you had to turn the bass control nearly all the way out in order to be able to tune the system quickly? This is the result of the amplifier's inability to recover quickly from very low-frequency signals, and this fact would be noticed when making the d.c. transient test.

In an article which I believe will be ready soon, you will read about an amplifier I designed which was tested in this way. Æ

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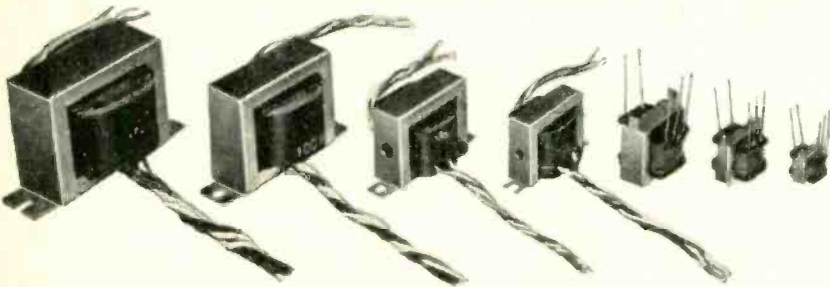
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Circle 74B

## FEEDBACK

(from page 23)

( $R_f$  is, of course, the 500-ohm cathode resistor), the mid-frequency gain will be about 50 db. Even at low frequencies where the actual gain is nearer 70 db, there will still be 14 db of feedback reserve, and at mid-frequencies, 24 db or more of feedback is available to reduce distortion.

NARTB equalization for tape playback heads has a single bass turnover at 3180 cps for the 15-ips speed, with a shelf appearing below 50 cps, and the same curve is used at 7.5 ips by general adoption. A feedback network such as is shown in Fig. 9 will provide the equalization for the preamp of Fig. 7, with a high-frequency gain of 44 db ( $\beta = 500/75,000$ ). Although the extreme bass boost demands an extra 35 db of gain at 50 cps, this amplifier still has 5 db of reserve gain at this point, with much more feedback at higher frequencies. If additional distortion-reducing feedback is desired at the low frequencies, some gain must be sacrificed for this privilege.

Other equalizers may be similarly designed, choosing the feedback network arrangement to give the proper shape to the response curve. The amplifier must have a gain without feedback equal to, or greater than, the desired gain at the highest point on the gain curve, plus the minimum amount of distortion-reducing feedback desired at this point. There will be a greater amount of feedback at all other frequencies as a result. While in most cases, the same response curve may be obtained with lossy-type equalizers followed by an amplifier to bring the gain up to the desired level, the advantage of the feedback equalizer is that the gain which is "thrown away" in the lossy pad is used to reduce the amplifier distortion in the feedback circuit. It takes no more tube stages to do this unless a great deal of feedback reserve is desired at the point of maximum equalized gain.

### Mixers

Often the occasion arises to add several signals together, as in a microphone mixer. The use of a triode for each signal, as in the common-plate or common-cathode networks shown in Fig. 10, is wasteful of tubes and space, when the same job can be accomplished by one tube section connected as a feedback amplifier. Since the necessary phase inversion is supplied by the single amplifying stage, we must insert the feedback signal at the grid, instead of the cathode. A simple way to do this is shown in (A) of Fig. 11 where the resistors  $R_f$  and  $R_i$  are used as a summing network. If the



output impedance of the tube is much lower than  $R_f$ , and the impedance of the input generator is smaller than  $R_i$ , the feedback ratio is just  $R_i/(R_i + R_f)$  so that the gain from grid to output  $= 1/\beta = (R_i + R_f)/R_i$ . But the input signal is reduced at the time it reaches the grid by a factor  $R_f/(R_i + R_f)$  by the dividing network acting backwards as it were, so that the total gain from input to output is

$$\frac{R_f}{R_i + R_f} \cdot \frac{R_i + R_f}{R_i} = \frac{R_f}{R_i}$$

Another way of looking at it is that since the stage gain is quite high, for any reasonable output, the voltage at the grid will be very small, essentially zero. Then the current flowing into this virtually grounded summing junction ( $v_i/R_i$ ) must be equal to the current flowing out ( $-v_o/R_f$ ) by Kirchoff's Law, so that the gain  $= -v_o/v_i = R_f/R_i$  again.

Increasing the number of inputs will not affect this result. In spite of the fact that the additional input resistors shunt some of the input signal to ground, the feedback ratio is also reduced, and by the same amount, so that the total gain from, say, input point no. 2 in (B) of Fig. 11 to the output is still  $R_f/R_i$ . A limit on adding inputs comes as usual when the feedback factor is so small that  $A\beta \approx 1$ . But until that point is reached, the summing junction acts like a virtual ground, there is no interaction among the signal sources, the gain in each channel may be adjusted individ-

ually, and the load impedance presented to the generator feeding channel  $N$  is just  $R_N$ .

Figure 12 shows two amplifiers utilizing this method of mixing circuits. The transistor amplifier in (A) of Fig. 12 mixes three inputs of equal current level, amplifies each by a factor of about 2, provides a fourth input of adjustable current gain from 1 to 2 and still has over 15 db of distortion-reducing feedback. The vacuum tube feedback mixer in (B) of Fig. 12 shows a volume control added to each channel, with channel 1 amplified by a factor of 2 and the other two by a factor of 4. The grid and base resistors used as bias returns do not alter the design significantly. Note that the feedback resistor is used as part of the base bias network in (A) of Fig. 12 to reduce the number of circuit elements at the expense of some additional current drain, but that a blocking capacitor must be used to prevent the vacuum tube plate voltage from affecting the grid bias.

It is entirely possible to use frequency-sensitive networks for the input and feedback impedances and combine the job of mixing and equalization in one stage. The same method of feedback may be used with a three-stage amplifier providing mixing, equalization, higher gain and the possibility of increased distortion reduction in one package. Many times, though, if R-C coupling is used between all the stages in a high-gain three-stage amplifier, instability and

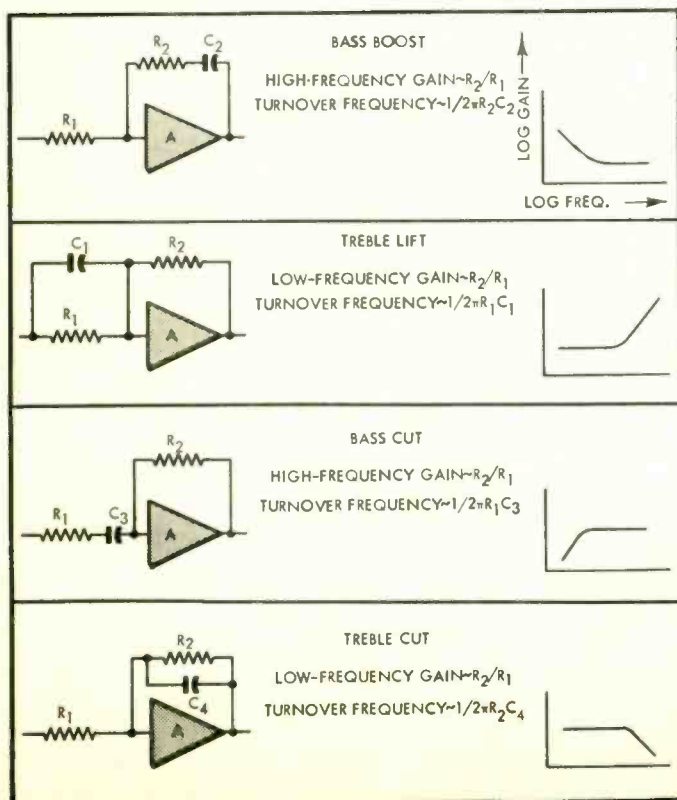


Fig. 13. Feedback networks suitable for tone controls when used with high-gain inverting amplifier.



Circle 75A

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even oscillation may result the first time the feedback loop is connected. If some of the stages may be d.c.-coupled without causing bias instabilities, there will be less possibility of inadvertently designing a feedback oscillator. Seldom are more than three low-level stages needed in a preamp, and if they are, it is better to provide a combination of several one-, two-, or three-stage feedback amplifiers than to attempt over-all feedback from the output to the input, unless, of course, you are either an expert or lucky.

### Tone Controls

The configuration just discussed,<sup>1</sup> the odd number of amplifying stages, voltage feedback, and the combination of the feedback and input signals at a virtually-grounded summing junction, is characteristic of the "operational" amplifiers having ubiquitous application in electronic analog computers. A more prosaic use in audio amplifiers is as a tone-control stage in preamps. Figure 13 shows four R-C networks which will produce high and low cut and boost characteristics. One possible adaptation of this circuit would be to fix the input and feedback resistors for the desired mid-frequency gain and to select the capacitors by a multipoint switch to give the proper response and turnover frequency. This produces the constant-slope, variable-turnover characteristic many experts think desirable for music tone-controls; a different arrangement is necessary for the older fixed-turnover, variable-slope controls.<sup>2</sup> Some ingenious feedback arrangements, notably the Baxendall-type illustrated in Fig. 14, provide an adjustable lift-cut characteristic by adjusting one separate potentiometer for the treble and bass frequencies, at the cost of some interaction between the functions, which is usually not noticeable in practice. This configuration can also be applied to a two-stage amplifier.<sup>3</sup>

### Potpourri

Before concluding this article, I would like to point out several applications of the feedback techniques which may be a little beyond the well-travelled path of most audio experimenters.

In Fig. 15, the symmetrical conduction characteristic of back-to-back Zener diodes is used to provide an amplifier which limits sharply at an output level

<sup>1</sup> Sometimes called an anode follower. See Charles P. Boegli, "The Anode Follower," *AUDIO*, Dec. 1960, p. 19.

<sup>2</sup> Barhydt, "A Feedback Tone Control Circuit," *AUDIO*, Aug. 1956, p. 18.

<sup>3</sup> Dynaco Preamp—Described in *Audio-craft*, March 1958, p. 16—See "Errata," *Audio-craft* July 1958, p. 33.

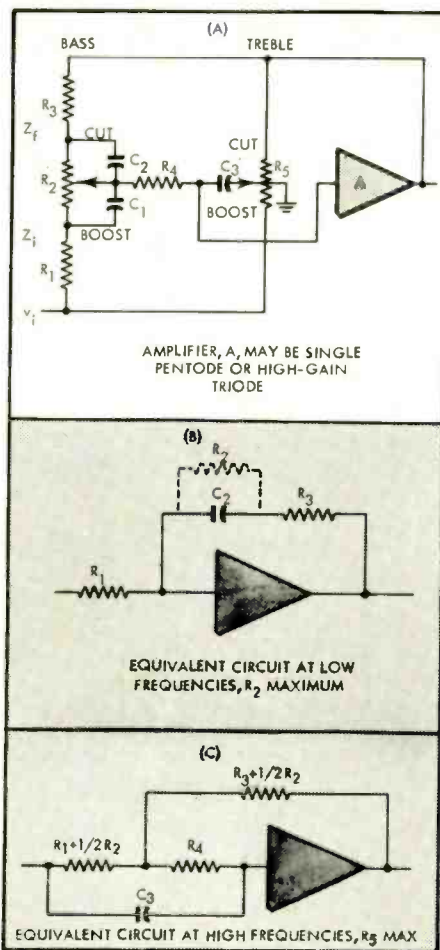


Fig. 14. Baxendall-type feedback tone control.

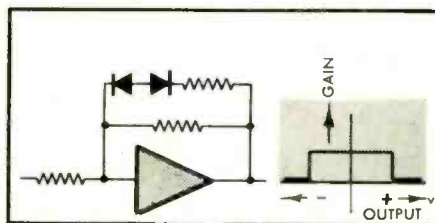


Fig. 15. Limiting feedback amplifier.

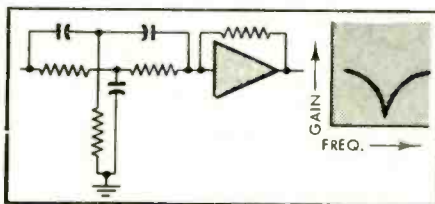


Fig. 16. "Notched" amplifier.

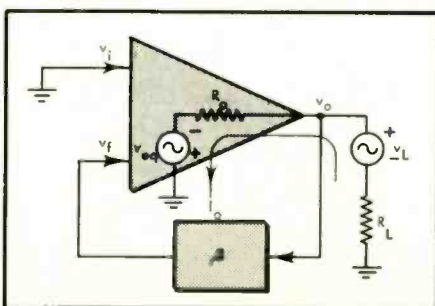


Fig. 17. Equivalent circuit.

equal to the Zener breakdown voltage of the silicon diodes. These can now be obtained with Zener voltages ranging from about 4 to 200 volts. Feedback limiting requires no special 4-grid tubes or large output power capabilities and the gain below the clipping level is practically unaffected.

An operational amplifier with a twin-T network as an input "impedance" is shown in Fig. 16. The sharp notch may be useful as a rumble filter or harmonic distortion analyzer in some cases. The notch may be sharpened by including the twin-T network inside the amplifier feedback path, or if the network is used as a feedback "resistor," the notch becomes a peak and we have a frequency-selective amplifier.

Thermistors, strain gages or other resistive transducers may be inserted into the feedback path of a high-gain amplifier instead of the input, to provide an output which is the inverse of their normal response, which may be an advantage in some cases, and to eliminate their elaborate bridge-bias networks.

At audio frequencies, the application of negative feedback techniques can be generalized to a few simple practices. Its benefits—reduction of distortion to almost unmeasurable amounts, extension of frequency response, hand-tailoring of response curves, multiple use of stages—so far offset the additional gain it requires, that there is no reason why it should not be an integral part of the design of every low-level amplifier. A careful follow-through of the small amount of arithmetic used in this article, particularly in the examples, will provide most of the mathematical sophistication (not much!) needed for a reasonable grasp of the feedback principle.  $\mathcal{A}$

### Appendix I

#### Output Impedance of a Feedback Amplifier

The output of an amplifier may be thought of as coming from a zero-impedance voltage amplifier in series with the resistance  $R_o$ , the output resistance, if no feedback is used. Since the load resistor  $R_L$  will drop the output voltage by a factor of  $R_L/(R_L + R_o)$  from the output supplied by the equivalent generator  $v_{eq}$ , the generator output must be  $v_o(R_L + R_o)/R_L$ , and as defined previously,  $v_o = A(v_i + v_f)$ . Suppose we temporarily short the input to the amplifier to eliminate extra distractions and pretend that the load tries to impose a little signal  $v_L$  onto the output circuit. Perhaps this might represent noise pickup or a signal induced by feedthrough from the following stage. The circuit of our amplifier, including a voltage feedback loop, now looks like Fig. 17.



The current which flows because of the action of  $v_L$  is just the output current  $i_o$ , since we have eliminated other signal sources. It passes through the combination of  $R_L + R_o$  and the internal generator, which inserts a voltage  $v_{eq} = (v_i + v_f)A(R_L + R_o)/R_L$  into series "aiding" with  $v_L$ . Even though  $v_i$  is zero, a voltage  $v_f = \beta v_o$  is fed back to the amplifier input in proper phase to produce the polarities shown. The current must then be bigger than that which would normally flow, for now by Ohm's Law:

$$i_o = \frac{v_o - v_o A \beta (R_L + R_o) / R_L}{R_o}$$

and the effective output impedance is

$$\frac{v_o}{i_o} = \frac{R_o}{1 - A \beta (R_L + R_o) / R_L} \approx \frac{1}{(-A \beta)} \frac{R_L R_o}{(R_L + R_o)}$$

if  $|A \beta|$  is much larger than 1, or a factor of  $1/(-A \beta)$  smaller than the parallel combination of  $R_o$  and  $R_L$ , which is what we would expect to find perhaps, without feedback. (Remember that  $A \beta$  must be negative.) Thus in a voltage amplifier the output impedance is reduced by the same factor as the gain.

We may use the same method to analyze a current amplifier to avoid the use of a more unfamiliar equivalent circuit if we change the value of the equivalent generator slightly and take a feedback current  $\beta i_o$  back to the input. Since

$$i_o = v_{eq} / (R_o + R_L) = A (i_j + i_i),$$

$$v_{eq} = (i_j + i_i) A (R_o + R_L) = \beta A (R_o + R_L) i_o$$

if the input is shorted. Then by Ohm's Law,

$$v_o = i_o R_o - \beta A (R_o + R_L) i_o$$

and the effective output impedance is:

$$\frac{v_o}{i_o} = R_o - \beta A (R_o + R_L) = R_o \cdot [1 + (-A \beta) (R_o + R_L) / R_o]$$

and the amplifier now looks as though it had a *greater* output impedance than it does if there is no feedback present, and again the increase is by about the same factor that the gain is reduced.

## Appendix II

### Distortion Reduction in a Feedback Amplifier

No real amplifier produces an output which is an exact multiple of its input; let us suppose that for a certain pure sine-wave input signal,  $S$ , producing an output voltage (or current)  $S \cdot A / (1 - A \beta)$ , there also appears on the output a small distorting signal,  $D$ . In most cases the amount of distortion is primarily dependent on the level of the

signal at some point inside the amplifier, being caused by curvature in tube characteristics, etc., so that the larger the signal, the greater the distortion.

Perhaps the gain of the amplifier actually changes at different signal levels, providing a limiting (or expanding) effect. This would correspond to a distortion signal of the same frequency as the sine wave but with varying phase. It is also possible that the pure sine-wave appearance of the output signal will be altered, which would be caused by distortion components of the second, third, or higher-order harmonic frequencies. The latter case is reported and discussed most often, but the gain-changing effect of a fundamental frequency-distorting signal is present in every amplifier to some extent (and can be dramatically seen when the amplifier overloads!).

In either circumstance, when a fraction,  $\beta v_o$ , of the output voltage is fed back to the input, it contains a part of the output distortion signal,  $\beta D$ . This is amplified and appears at the output as  $A \beta D$ , so that the distortion signal  $D$  actually appearing at the output is the combination of the distortion produced inside the amplifier,  $D'$ , and the fed-back voltage, so:

$$D = D' + A \beta D$$

and hence

$$D = D' / (1 - A \beta).$$

Thus the distortion signal measured at the output is reduced by the same factor as the gain through the application of feedback.

The main part of the distortion produced by the amplifier is cancelled by feeding a portion of the distortion signal back to the input and amplifying it out-of-phase with the originally distorted wave, but a small amount remains. Unfortunately, since the fed-back signal looks just like an input signal to the amplifier, it will be distorted too as it is amplified. Thus there will be an additional bit of residual distortion because the distorted correcting signal cannot eliminate all the original departure from a sine-wave output. If the distortion is small in the first place, these additional terms will be much smaller, but they have an effect disproportionate to their size.

No longer will the output look like the signal as the amplifier originally distorts it, but it will not be quite identical to a sine-wave either, indicating that its harmonic structure has changed. Suppose the amplifier produces mainly second-harmonic distortion. Then the fed-back signal contains the essentials of the difference between the output and the input, that is, the second-harmonic term. When re-amplifying this, the second harmonic of the second harmonic, or the fourth harmonic, appears in the output. This in turn will be reduced when it is

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Let's be modest about *Distortion*... we rate the Stereo 120 at below 1% IM at full power, but the fact is that most listening is done, not at 60 watts, but at between 1 and 5 watts. Distortion at these levels is rarely mentioned on specification sheets, because in most amplifiers the IM never goes below 0.5% at *any* power level. In each channel of the Stereo 120, IM is less than 0.1% at any level below 20 watts, which is why its sound is so startlingly lifelike and transparent.

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returned out-of-phase to the input through the feedback network, but it will not be entirely eliminated, and a further very small eighth-harmonic signal is generated.

Human ears are much more sensitive to equal amounts of fourth harmonic distortion than to second, so it is fortunate that its level is much lower. If, say, the amount of second-harmonic distortion present is 1 per cent of the output, the amount of fourth harmonic distortion created by adding the feedback path will only be .01 per cent of the output—usually insignificant compared to the fourth-harmonic distortion produced directly by the amplifier. This is not true when the primary distortion is large, and the sudden increase in high-order distortion products near the overload point causes a feedback amplifier to actually sound worse than an amplifier without feedback operating in this region.

AE

## AUDIO ETC

(from page 14)

1. "Electronics" is technically by far the most advanced tape music I've heard to date, whether electronically produced or recorded from "concrete" sounds. (The distinction is interesting but artistically not vital—one can be conservative or radical via either source.) Considering that every bit of this complex score represents in the ultimate sound a corresponding element of audio equipment, it is clear that electronic music is now advancing technically at breathtaking speed, in every aspect from the production of the "sounds" themselves right through to the mixing and rerecording.

Part of this high-speed expansion is in the human technique—how to use the equipment. You have to learn to "drive" it like a car. And you have to learn to "say something" with it. But a major part, too, is in the equipment itself.

It seems to me that the audio industry has here a special baby of its own, more intimately audio than any conventional recording and reproduction. There, audio is merely the means, the transducer. Here, audio is everything. Audio makes the musical raw material, audio puts it together, and audio reproduces it.

When you have a chance, just try "Electronics" for a purely technical listening session. As the ads say, you'll be amazed.

2. The use of more than a single track can free electronic sound from one of its biggest limitations, the one-dimensional sound-product. Now it has two and even three dimensions and at last can place itself on a technical equality with "live" sound. The special quality in "Electronics" as I heard it was the genuinely "stereo" effect—i.e., not a group of discrete "tracks" but a continuous curtain of sound.

3. "Electronics" also seems to have freed tape music from a tonal limitation that should theoretically never have been there in the first place—the feeling of limited



frequency range that somehow has muffled and pillowed-up so much tape music. Added to this has been distortion (via too much rerecording), also surprisingly absent in this new score. Finally, and most important, the over-simplified electronic sounds of the earlier taped music made for a lifeless, impact, lacking in presence, in too much of what we heard. Not enough overtone coloration, not enough sound-life. The "Studio Trautonium"—and no doubt the RCA Mark II—now produces all-electronic sounds with real bite and life, which seem "out in the open" instead of buried in the loudspeaker. Taped sound is coming of age. It sounds real.

4. One of the finest technological feats in "Electronics" went probably unnoticed by most listeners, the absence of background hiss and pop, even at extremely high volume levels—I mean pot levels. At no point was I aware of any tape sound at all, nor of course any a.c. hum, though the maximum sound in the auditorium was perfectly enormous. (Perhaps there was a certain amount of volume expansion, manual or otherwise; no matter. Even so, the level of background noise was outstandingly good.)

This has been a major problem in electronic music and, indeed, forced the entire remaking of Varèse's big score "Deserts," about which I wrote at length here some years ago. Tape equipment at that time evidently was not good enough to stand the rerecording necessary for assembly of the music. (And without a doubt, more advanced sound-source techniques now require less rerecording than formerly.)

5. Next—volume. It was probably so intended, but I'm sorry to admit that I had to put my fingers in both ears for many minutes at a time during the loudest portions of "Electronics." The maximum volume was just plain excruciating. Maybe you can take it; I couldn't.

Granted that it is a temptation to make use of overwhelming volume when you have it at your easy disposal (thanks to Stu Hegeman). Granted that it may be aesthetically desirable to curl the ears. Even so, I deplore the tendency to play everything loud, on the same grounds that I deplore overly-loud hi fi in the home. Similar grounds, anyhow. In ordinary home music, there is the original "live" music to be considered; here there is no such limiting factor. But volume is still volume.

How loud? Well, we had a full ballet symphony orchestra right on hand for comparative purposes. It made a pipsqueak noise at its most powerful, compared with Mr. Hegeman's nuclear sound-bombs. Let's skip the db—in lay terms, I'd say that

"Electronics" was five times as loud as the loudest orchestral sound in the same evening's entertainment. That's loud. In terms of db, bels, phons, mels and what have you, the measurements should be positively terrifying! The next day, I couldn't hear a 10,000 cps signal at all. It's a wonder I heard anything.

6. One of the biggest problems in the large scale reproduction of electronic music in auditoriums or concert halls, is that of loudspeaker directionality. When the Varèse "Deserts" was produced in Bennington, Vermont and later in Town Hall in New York, I was hauled in as unofficial consultant and counseled, as the best and wisest procedure, that the huge speakers be turned back side to the audience, aimed into the corners. Otherwise the front rows would have been simply mowed down wholesale, while the balconies would have lacked volume. You can't beam big speakers right at big audiences—unless you have dozens of them, discreetly held down to moderate individual sound levels.

Stu Hegeman's upward-directed speakers have posed some minor problems before this in home use—you may remember the "beer can" description I let fall in my account of his little Eico job: what happens if you spill beer on the top and into that conveniently upward-pointing paper cone? But in the new Harman-Kardon Citation X system (which directs sound both upward and outward) the perfect speaker for large-audience use has been found. The four speakers I could see from my balcony seat were exactly right for the job. There was directionality in many elements of the sound, but in no case did I feel that the power was beamed at me directly from the speakers themselves. They were unobtrusive. The sound was everywhere.

Some of this pleasant effect was due to clever positioning of the outboard speakers, mounted outside the proscenium on each side so that their upward component projected up the in-curved proscenium "surround" and reflected out from the arched curve at the top. A naturally excellent sound-distribution device, though probably not so envisioned by the architect.

Most other speaker systems, even so, would have had to be laid clumsily down on their rears, or tipped giddily upwards and sidewise, in order to avoid destructive beaming. Not so the Citation X with its upward-travelling component.

So much for first-night commentary. I still don't know such elementary things about "Electronics" as how many channels were used, whether there really is built-in reverberation and how it was produced, how the "Studio Trautonium" works and how Messrs. Gassmann and Sala worked. Let's hope that this important music will appear soon on stereo disc or home tape, for further study. It's worth it.

\* \* \* \*

P.S. Flash. As I was in the act of putting this piece into its mailing envelope I got a call from the people who handled the public relations for the audio portion of "Electronics." Had time just to ask some two or three questions. How many tracks? Astonishing—they said ONE TRACK. The stereo effect that I heard (as you may have discovered already) was via ingenious treatment of the sound through the stereo system—and 31 speakers. I could see only four of them. Reverb? They weren't sure, but thought maybe. 'Nuff said. My reaction that this was a highly successful example of pseudo stereo was thus technically correct. It was exactly that! Perhaps it was just as well I didn't know a thing ahead of time. Æ



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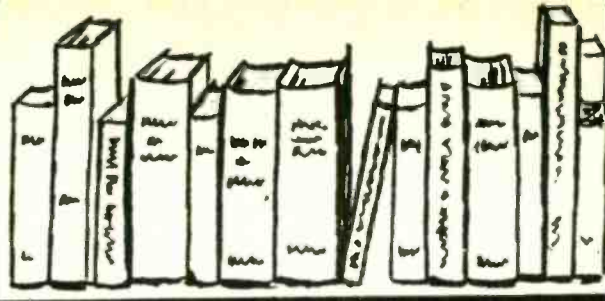
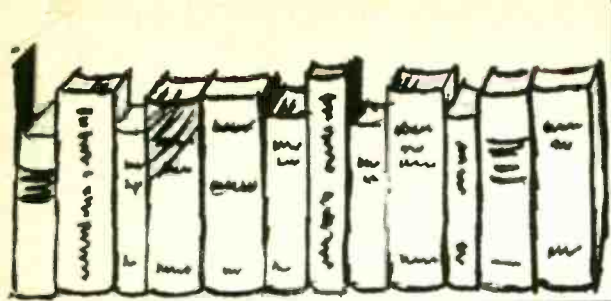
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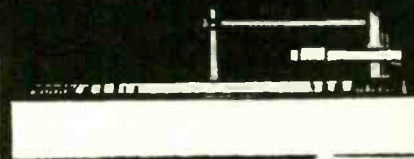
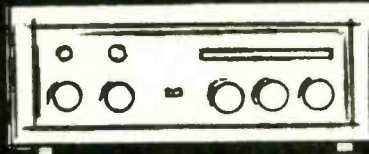
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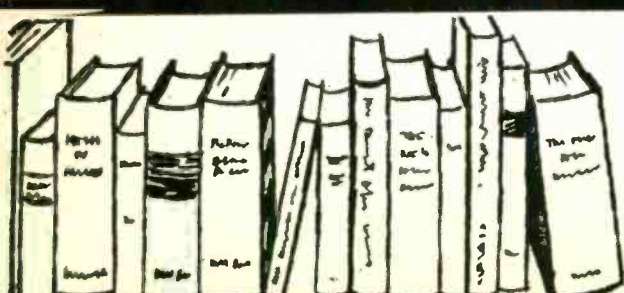
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## LIGHT LISTENING

(from page 8)

use of woodwinds and strings combines resourcefulness and a rich melting quality that's ideal for international favorites such as *Fascination*, *Just A Gigolo*, *The Sea*, and *Under the Roofs of Paris*. It would be pointless to attempt to give this album a comparative rating because it stands alone in its class.

**Percy Faith: Carefree**

**Columbia CS 8360**

The original compositions of conductor-arranger Percy Faith have now reached a number sufficient to fill an entire LP. The twelve selections recorded here fall into two natural divisions. Side one of the album is given over to bright and bustling novelties. Inspired for the most part by the rhythms of Latin America, these tunes are bound together by an insouciance that runs through most of Percy Faith's fast-tempo output. His *Brazilian Sleighbells* is a good example of an improbable concept carried off with saucy good humor. The harpsichord and plucked violin strings in *Pizzicato Polka* suggest a visit by a present-day hep American to the Vienna of Strauss' day. The reverberation favored by Columbia for the Faith sessions is less noticeable on side two of the album where the strings have a chance to unleash their tenderest eloquence in a fine group of ballads.

**The Sound of Hollywood**

**Medallion Ⓢ MST 47013**

Several factors raise this release above the run-of-the-mill movie album. In the first place, the Medallion Strings are under the direction of a seasoned New York conductor—Emanuel Vardi. Vardi came to this country at the age of four, attended the Juilliard School of Music and then proceeded to establish himself as one of America's leading violinists. His classical releases on the Kapp label already testify to his skill in balancing a string orchestra. His viola and cellos certainly stand an equal chance with the more assertive violins. Because he has not devoted too much time to the generally thankless job of conducting movie background music, Vardi musters adequate enthusiasm for this assignment. In assembling a representative collection of current movie themes, Medallion is stretching a point in labelling this the "Sound of Hollywood." The scores sampled include such colorful foreign entries as *Never On Sunday* and *Black Orpheus*.

**Don Costa: Echoing Voices and Trombones**

**United Artists Ⓢ UATC 2218**

What else can you do with voices and trom-

bones these days? Last year's search for novelty in demonstration-of-maximum-directionality recordings was already beginning to run dry of ideas when UA decided to join the parade. Tape, of course, is providing a supplemental audience for the channel switchers but surely only a hermit, hearing his first stereo recording, would find his attention riveted by the sudden appearance of voices in alternate speakers. The voices (male and female) offer no words in this reel of popular songs and the trombones merely keep the opposite channel busy. Hardly an inspired release.

**This is Norman Luboff**

**RCA Victor LSP 2342**

After amassing a total of fifteen currently-available choral albums on the Columbia label, Norman Luboff has switched his allegiance to RCA Victor. Whatever the reason for the move on Luboff's part, this new alignment of forces gives RCA the services of a mixed chorus that can handle a most generous variety of assignments in the popular field. Certainly this point is underscored in the program selected for the choir's first effort in Victor's spacious Hollywood studios. In what amounts to a sampler of the group's gamut of styles, the selections range from drinking songs and folk ditties all the way to Blues and the more sophisticated show tunes. Luboff fans will find the sound of the chorus a bit different in its new setting. Gone is the enhancement once provided by Columbia's judicious use of reverberation. It's loss, however, will not be judged a problem on any sound system capable of realistic response.

**Marty Paich Piano Quartet**

**RCA Victor LSP 2259**

An easy way to discover what you've been missing in single-channel recordings of music for four pianos is to sample any band of this stereo disc by Marty Paich's piano quartet. Much of the pleasure of this disc can be traced to the avoidance of stunts on the part of the arrangers. In these days of frenzied control-room activity, this recording crew was content to supervise a simple setup of four concert grands placed in a straight row calculated to span one wall of a listening room. A rhythm section that finds its busiest moments in the Latin and jump tunes is part of the accompaniment which includes some strings for the romantic ballads. Marty Paich, at right end, sets the pace for pianists John Williams, Pete Jolly, and Jimmie Rowles. The arrangements avoid the excesses of earlier four piano recordings in stereo where the melody was forced to scramble from keyboard-to-keyboard just to prove the existence of multiple channels. The mike pickup is close enough to satisfy any pent up craving for the combined bass of four pianos in full cry. The Paich touch is most evident in the jazz-derived treatment of *Honky Tonk Train*, a popularized *Honeyuckle Rose* and a multi-voiced *One O'Clock Jump*. The quartet hits its easiest stride while toying with the sonorities of *Misirlou* and *Stella By Starlight*.

## This Month's Cover

The installation shown on the cover this month is in the home of Hector Allen, who represents himself as a writer and world traveller. In any case, Mr. Allen is clearly a man with a great deal of interest in both reading and music—as indicated by this partial view of his home. One of the outstanding thoughts conveyed by this installation is that a high-quality component system can be placed on shelves. Note the absence of enclosures excepting, of course, the speaker systems. Here's a list of the components used:

1. McIntosh MR66 AM-FM stereo tuner.
2. McIntosh C20 preamplifier.
3. (2) McIntosh MC60 60-watt power amplifiers (hidden in closet).
4. Pickering Model 199 "Unipoise" arm with Stanton stereo "Fluxvalve."
5. Pickering Model 800 "Gyrapoise" turntable.
6. Garrard Model "A" automatic turntable with Stanton stereo "Fluxvalve."
7. (2) KLH Model Six speaker systems.
8. Viking Compact Model 85 4-track stereo tape recorder.

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 Sensitivity: -77 DB at 600  $\Omega$   
 Size: Height 75 x Width 48 x 27mm (Thickness)  
 Weight: 178 gr.  
 Switch capacity: Volt: 24v DC  
 Currency: 1A DC

### STEREO CARTRIDGE

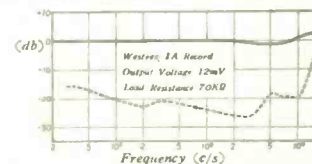
**C-75**

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Response: 20-17,000 cps.  
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## RECORD REVUE

(from page 59)

ness, a tremendous emphasis on perfect phrasing and shaping, note by note. Interesting—if he can go on (he's under 50) to combine style A with the new style B plus a still larger dash of human warmth. Foides will end 'way up on top and a great elder statesman.

**Mozart: Piano Concerto No. 21 in C, K. 467.** Rosina Lhevinne; Juilliard Orch., Morel.

**Columbia MS 6182 stereo**

The best part of this recording of a world-famous 80-year-old piano teacher is that anybody with half an ear—and no knowledge of either the Lhevinne name or of piano pedagogy—can enjoy the quality of the music-making. It's that good.

The old lady was the wife of Josef Lhevinne and for decades the two, out of Russia, were top-drawer piano teachers at the Juilliard School; when he died in 1944, she took over most of his teaching along with her own and, almost for the first time, she allowed her own piano performances once in awhile to emerge on the concert stage. She is still primarily a teacher. But when she's willin', what an exquisite performer!

You'll find her Mozart, as might be expected, of an extraordinary preciseness and accuracy. Every note is weighed and placed just so, and one can almost hear the teaching comment, as to shape of wrist, drop weight, phrasing, posture . . . but unlike most teacher-style playing, this is music too. That's what is so surprising.

After all, ideally every teacher should practice what she preaches. This one actually does. Amazing.

**FOR SALE:** Viking FF-75 tape playback deck with new quarter track stereo head—plays quarter or half track stereo and half track monophonic tapes. Sherwood 36 watt monophonic amplifier. Electro-Voice Regency speaker system (dark mahogany cabinet). Magnavox AM/FM radio with phono input and recording output. Any of the above for \$95.00 or make me an offer. Norman Reed, Graterford, Pa.

**FOR SALE:** Ampex 2-channel stereophonic tape recorder, 350 mechanism (like new) with 403 amplifiers and head assembly and carrying case. \$900.00. Also 400 console and mechanism with new 350 amplifiers and 1/2 track head assembly. \$400.00. Mechanism needs capstan motor replaced or repaired. Write: Audio-Video Company, 609 Hill Avenue, Pittsburgh 21, Pa.

**DON'T BUY HI-FI** components, kits, tape, tape recorders until you get our low, low return mail quotes. "We guarantee not to be undersold." Wholesale catalogue free. Hi-Fidelity Center, 220UC East 23rd St., New York 10, N. Y.

**NEW and unopened, warranties intact:** Sherwood S-5500 dual 24-24 watt stereo amplifier with or without cover \$134.00. Shure M7D pickup with N21D stylus \$56.00. G. Cain. 15 Manet Circle, Chestnut Hills, Mass.

**AMPEX 3761 MIXER.** Sigma manufactured. Four balanced microphone inputs, balanced output. Discontinued model, brand new, full warranty. Were \$315.00, now \$165.00. Stereo version also available. Sigma Electric Co., Inc., 11 E. 16th St., New York 3, N. Y.

**SELL:** In excellent condition: Marantz Audio Consollette, blonde cabinet, \$100.00; Model Two amplifier, \$140.00. Rek-O-Kut B12H turntable, \$90.00. John Haner, 683 Locust, Galesburg, Ill.

**SELL:** Acrosound stereo preamplifier S-1001 & 20-20 amplifier, perfect condition. \$95.00 for both. Two Stromberg AP-437 40 watt amplifiers, new, \$70.00 each. All equipment shipped in factory boxes. Schultz, 373 Carling Road, Rochester 10, N. Y.

## CLASSIFIED

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

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**PROMPT DELIVERY,** we will not be undersold. Amplifiers, tape recorders, tuners, etc. No catalogues. Air Mail quotes. Compare. L. M. Brown Sales Corp., Dept. A, 239 E. 26 St., New York 10, N. Y.

**COMPONENTS**—best quotations—sale items. Bayla Co., Box 131-O, Wantagh, N. Y.

**INDUCTORS** for crossover networks. 118 types in stock. Send for brochure. C & M Colls, 3016 Holmes Ave., N.W., Huntsville, Ala.

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

**AS GRAPHIC SERVICE.** Printers for the Electronic Industry. Catalogues, brochures, direct mail, complete art and copy service. New York City—TULIP 2-8050.

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**JAMES B. LANSING PARAGON,** oil walnut, perfect condition. \$1200.00. Will trade for pair James B. Lansing D5087's. Roy Thompson, 3710 Cloudland Drive N.W., Atlanta 5, Ga.

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**SELL:** 200 2400 ft. 1/4 inch tapes on cores, used once. Make offer. Technisonic Studios, Inc., 1201 Brentwood Blvd., St. Louis 17, Mo.

**AMPEX 300 3CSS.** Ampex 351C, Neumann AM31A, Preston 8N, 3 Gotham Grampion feedback cutterhead systems, 3 Altec preamplifiers, 2 Cinema Dialogue equalizers, 2 Gates transcription turntables with pickup arms and preamplifiers, Ampex 300 console cabinet. Above equipment less than year old. Make offer. John P. White, Jr., 363 South Acadian, Baton Rouge, La.

**WANTED:** schematics for multiplex receivers Browning R-1500 & Harkins FM mus-cast. Write: N. Carter, 20524 Alameda, Cleveland 28, Ohio.

**SELL:** James B. Lansing 375 driver, horns. Marantz Electronic crossover. Excellent condition. Best offer. Donald C. Jackson, 1905 N. Lamar, Austin 5, Texas.

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## Industry Notes ...

• **Everest Studio Bought by Fine Recording.** Belock Instrument Corp. has sold the lease of its Everest Sound Recording Studio at Bayside, N. Y., including all equipment, to Fine Recording of N. Y. Harry D. Belock, President of Belock Instrument, said that the Everest Division would continue to employ the studio for its stereo and mono recording. The studio is the only one in the East designed and constructed primarily for rerecording.

• **Burgess Battery Enters Audio Tape Market.** Burgess Battery Company, Division of Servel, Inc., has entered the magnetic tape field as the result of a 6-year long research and development program. For the past 5 years the company has operated a pilot production line turning out tape of optimum quality. A separate Magnetic Tape Division has been established to handle the production and marketing of the new line.

• **Pickering Promotion.** Offering a free stylus to play 78-rpm records with the purchase of a replacement LP stylus in the new "V-Guard Playmates" pack. Owners of the Models 380 or 381 Stereo Fluxvalves, whether in automatic changers or in transcription tone arms, can benefit from this offer. Models are available which will fit either category.

• **Minnesota Mining Builds.** Construction of a new branch sales office of Minnesota Mining and Manufacturing Co. began recently in Needham in suburban Boston, Mass. The new building will contain 54,000 square feet, more than twice the space available at 3M's present office in Newtown Center, Mass.

• **Rek-O-Kut and York County Chair Create Line.** A line of interchangeable stereo cabinet-components combinations have been created jointly by the York County Chair Co. and Rek-O-Kut. The line is designed to cater to a full range of consumer budgets and tastes.

• **Amplex Appoints.** Dr. Walter H. Cobbs, Jr., formerly research manager on films for E. I. duPont de Nemours Co., has been named manager of research and development at Orr Industries Co., a division of the Amplex Corporation.

• **New Concertone Western Sales Manager.** Barton O. Williams has been appointed Western Division Sales Manager for American Concertone, a Division of Astro-Science Corp. of Los Angeles, Calif. According to the company, Mr. Williams was appointed because of an over-all expansion of company activities.

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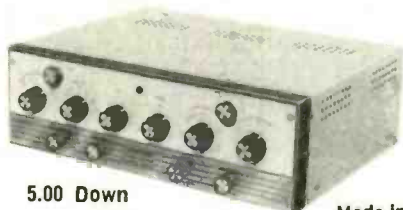
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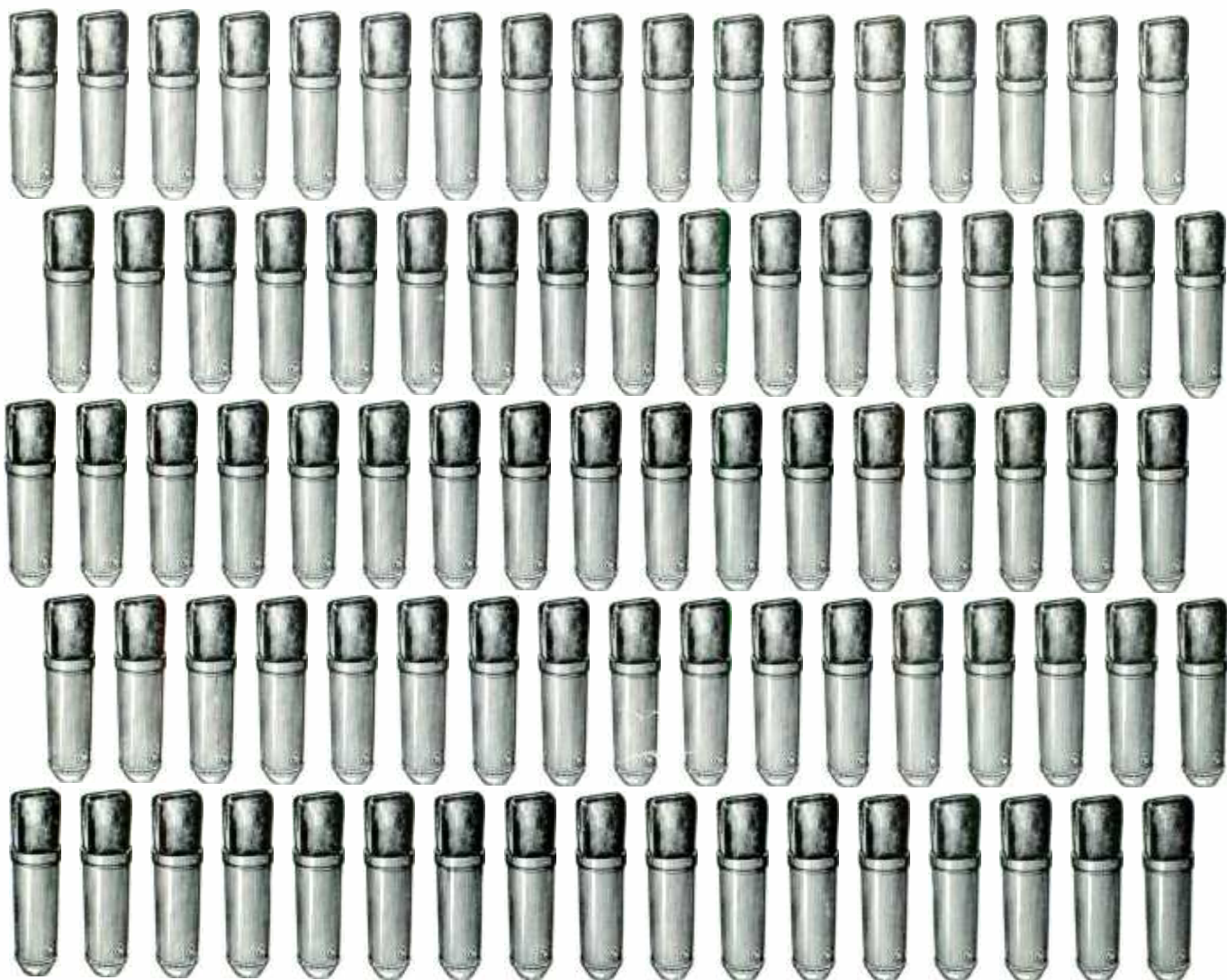
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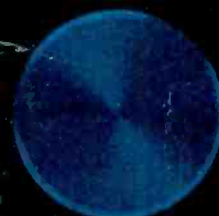
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