AUDIO

SEPTEMBER, 1960
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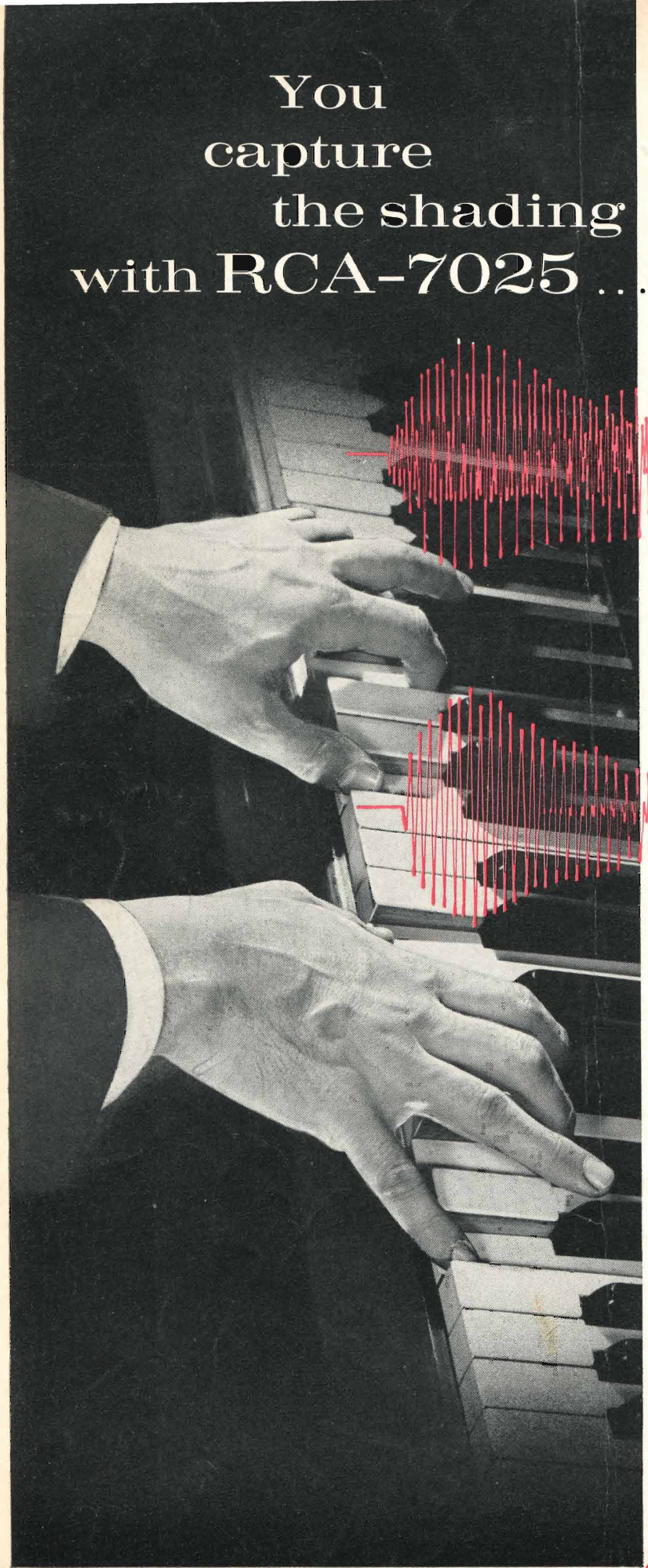
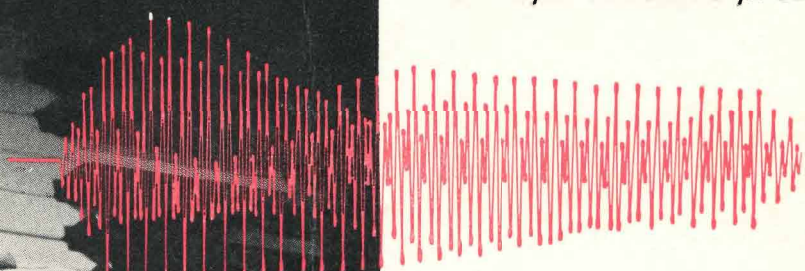
One of a series

You capture the shading with RCA-7025 . . . .

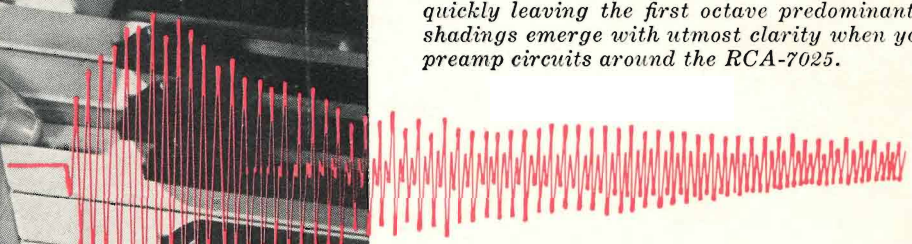
. . . the low-noise high-mu twin triode for supersensitive preamplification





C below C, 130.81

Shifting overtones give the piano its vibrant ring. Lower register tones, as the first oscillogram indicates, may generate 10 or more perceptible overtones that continually change in relative intensity. In higher registers, as the second oscillogram shows, the struck tone dominates at first, but fades quickly leaving the first octave predominant. The subtlest shadings emerge with utmost clarity when you design your preamp circuits around the RCA-7025.



C above C, 523.25

Developed especially for high-gain resistance-coupled preamplifier stages in top-quality audio systems, this 9-pin miniature twin triode performs with almost imperceptible hum and noise. Hum is minimized by use of a double helical hairpin-type heater in each triode unit. Minimum noise and microphonics are assured by use of an exceptionally sturdy cage structure with short, stiff leads, oversized side rods and newly designed micas.

Result: *average noise and hum voltage for each unit is only 1.8 microvolts rms.* And—this versatile performer operates from either a 6.3- or 12.6-volt heater supply for extra design flexibility.

Characteristics, Class A_1 Amplifier (Each Unit):

Plate Voltage	100	250	volts
Grid Voltage	−1	−2	volts
Amplification Factor	100	100	
Plate Resistance (approx.)	80000	62500	ohms
Transconductance	1250	1600	μmhos
Plate Current	0.5	1.2	ma

Discover a new world of preamp performance with the RCA-7025. For full information on RCA's comprehensive line of audio tubes, check with your RCA Field Representative, or write to *RCA Electron Tube Division*, Commercial Engineering, Section I-91-DE, Harrison, N. J.

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RADIO CORPORATION OF AMERICA

SEPTEMBER, 1960 VOL. 44, No. 9

Successor to RADIO, Est. 1917.

AUDIO

ENGINEERING MUSIC SOUND REPRODUCTION

CONTENTS

COVER PHOTO—The "Second Hearth of the Home" is the description of the stereophonic high fidelity music system in this model room which was featured in the August issue of *Living for Young Homemakers*. To the right of the fireplace are a Fisher stereo receiver and a Rek-O-Kut turntable and tone arm, and Audax loudspeakers are located on the lower shelves of the two bookcases.

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PROJECT COMPLETED
Now the Garrard Laboratories Proudly Announc
Garrard

an Entirely New Kind of Record Playing Unit

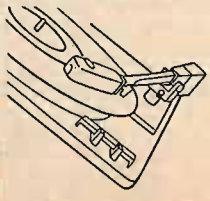
AN AUTOMATIC TURNTABLE

GARRARD'S LABORATORY SERIES TYPE A

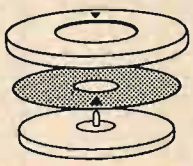
Now, at last, you can enjoy all the advantages of a true, dynamically-balanced tone-arm (with a built-in calibrated pressure gauge), a full-size, heavy-weight, professional turntable, a laboratory balanced precision motor... plus the much-wanted convenience of the world's finest automatic record-player... all in one superb instrument! △ No one but the Garrard Laboratories, with their unmatched facilities, could have accomplished it. With 40 years of manufacturing experience, and the highest engineering and precision standards in the Industry, Garrard set out to develop an all-in-one unit that would satisfy every critical requirement, even surpassing the professional turntable standards established by the NARTB.

THE ONLY DYNAMICALLY-BALANCED TONE ARM ON AN AUTOMATIC UNIT Now, for the first time, a tone arm which meets the very latest engineering standards established by the Industry—has been incorporated into an integrated record-playing unit. This highly advanced tone arm is put in perfect dynamic balance by moving an adjustable counterweight. At this point, it is in "gyroscopic" balance, with zero pressure. To set the tracking pressure designated for any cartridge, a pointer is moved along a calibrated scale at the side of the arm, which is graduated in grams. This built-in stylus pressure gauge now shows the precise tracking force. The accuracy of this setting is even greater than that which could be measured by any separate stylus pressure gauge. The arm will now track correctly even if the player is intentionally tilted, or if the record is warped or not perfectly concentric.

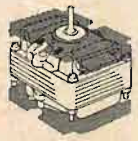
And incidentally, regardless of the number of records on the turntable, the angle at which the stylus meets the record is negligible, due to the unique geometry of this arm. △ Since all of these engineering refinements guarantee that there is no unequal pressure on the sides of the stereo record grooves... distortion, channel imbalance, record and stylus wear are eliminated, resulting in perfect stereo reproduction. But "perfect performance" also requires minimum friction, and this is assured by the two precision needle pivots on which the arm is set. This arm is precision-mounted for you, thus affording all the advantages of the separate arm, yet none of its inherent disadvantages. The danger of the tracking error which often occurs in the mounting of separate tone arms, is eliminated completely because there is no possibility of even the slightest mislocation of the arm.



FULL-SIZED, HEAVILY WEIGHTED, BALANCED, POLISHED, CAST TURNTABLE The weight of six pounds has been determined as the optimum for perfect balance, torque and flywheel action in this unit. This combination insures silent, on-speed running. The Garrard engineers have conceived of this new turntable as a "sandwich". It is actually two turntables balanced together... a drive table inside, and a heavy, cast turntable outside. The two turntables are separated by a resilient foam barrier, which effectively damps out any possibility of noise or vibration. Furthermore, being of non-ferrous metal, the cast tables offer no attraction to sensitive magnetic pickups.



NEW "LABORATORY SERIES" MOTOR The Type A is built around a newly-developed Garrard four-pole shaded motor, which was designed especially for it. This laboratory motor is the perfect match for the new turntable system, and provides quiet accuracy, regardless of load or voltage changes. Constancy of speed is such that this motor will bear the closest scrutiny by sensitive measuring instruments. The armature is micro-balanced on exclusive Garrard equipment, and free of vibration. The total result is true musical pitch and clear sustained musical passages, without the irritation of wow or flutter. The "Laboratory Series" motor is completely shielded, top and bottom, with specially-designed and accurately oriented plates, insuring the absence of hum, even with the most sensitive magnetic pickups. To minimize even the slightest vibrations, the entire motor assembly is isolated from the unit by shock mounts of a special formula and design.



THE GREAT PLUS FEATURE OF AUTOMATIC PLAY—WITHOUT COMPROMISE! The convenience and desirability of being able to play records automatically, and to have the unit shut itself off, have long been recognized and accepted. Certainly, even the most critical user would want these features, but only if they could be incorporated without compromising the quality, performance or inducing record wear. This has now been accomplished in the Type A, by adding Garrard's exclusive pusher platform changing mechanism, with its smooth, one-piece center spindle, to the arm, turntable and motor described above. This unique combination of features means that for the first time ever, there is a record playing unit which answers every requirement of both performance and convenience. It accomplishes this to such a degree that it is certain to appeal to every person, regardless of whether he already owns equipment, or is planning to buy a new system. The fact is that the Type A obsoletes all previous equipment. It protects records better. It has performance and features superior to separate turntables and arms. It also incorporates professional characteristics not found in any record changers.

The concept of this great new Garrard record-playing unit was extravagant, but the price... is surprisingly modest—made possible **$69.50** only because of Garrard's extensive facilities, highly developed production methods and critical quality control procedures. △ If there ever was a single record-playing device which answered every requirement of every music system—we believe this is it. △ And with the Type A, once and for all let us lay the ghost that simply because a record player makes available certain automatic conveniences (which you may or may not use at your option)—that this in any way implies that the unit cannot be actually superior to a separate turntable and arm. △ For in this bold new unit you will find the realization of everything you have wanted in a record player. Examine it thoroughly, and you'll want to install the Garrard Laboratory Series Type A in your own music system—now. △ Your dealer has—or soon will receive—the LABORATORY SERIES TYPE A GARRARD. Let your own eyes and your own searching examination, prove beyond doubt that this is indeed the record player for you. Or, if you prefer, write today for illustrated, descriptive booklet.

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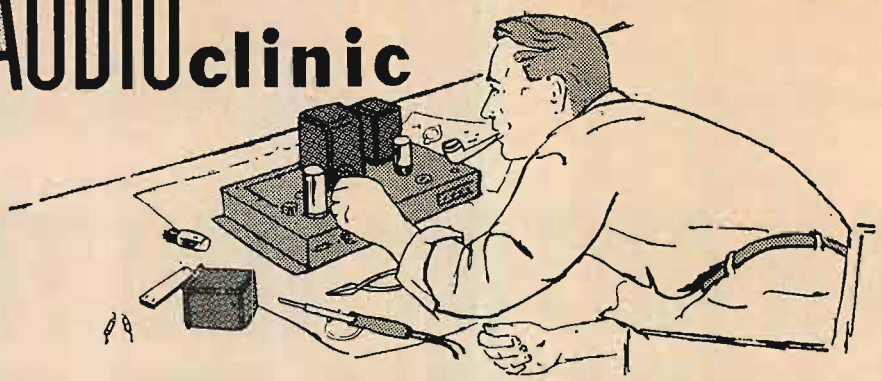


JOSEPH GIOVANELLI*

The Electronic Crossover

Q. Please discuss the benefits of channeling a single-system source (monophonic) through separate bass and treble amplifiers to separate treble and bass speaker systems.

A. The benefits of funneling a single-channel monophonic sound source through separate bass and treble amplifiers are matters of subjective opinion. Some authorities advocate this practice in order to make monophonic sources appear to be stereo sources, with all the low sounds coming from the bass speaker and all of the high sounds coming from the treble speaker. Of course, the sound thus achieved is very different from the sound derived through the use of two-channel sources.

Enthusiastic advocates of this two-channel, electronic crossover system (as it is called) believe this method can eliminate intermodulation distortion to a very considerable extent. After all, this intermodulation distortion results when high tones are modulated by low ones. Since the highs and lows are completely separated, distortion is at once minimized over that produced by conventional single-channel methods. It is possible to eliminate the more conventional crossover networks found in the two-way speaker system, thereby eliminating distortion from this source. This distortion results because of the resonant circuits used in the more complex low- and high-pass filters.

Proponents of the electronic crossover system also believe that this system can be balanced to suit the acoustical environment of the listening room better than can be done with ordinary systems.

Opponents claim that the results are not really that good, especially when you take into account the increase cost of such an arrangement. The CCIF method for measuring IM distortion shows that distortion is still present at both low and high frequencies, so nothing is gained when these blocks of sound are separated. Their contention is that the separation does not lead to as true a blending of sound as occurs when a single amplifier is used. They state, also, that the fewer the tubes and other circuit elements in a system, the less will be the over-all alteration of the sound.

You take your choice.

The following three questions came from the same source:

A Shorted Power Transformer

Q. What effect would a one- or two-turn short circuit in the high-voltage secondary have on a power transformer and could this condition be detected?

A. A one or two-turn short in the high-voltage secondary winding of a power transformer would not alter its characteristics very much, but the short would place a load on the transformer which would create a hot spot at the shorted turns. The degree to which the effect will be noticed depends upon the efficiency of the transformer and upon the location of the short with respect to the primary. It can be expected that the transformer would gradually destroy itself because of overheating. More and more turns will short. Finally there would be an additional short which would be sufficiently serious to cause the transformer to smoke and become inoperative. Before this point is reached, however, one of the turns might open, immediately ending the life of the unit.

The only way that such a condition could be detected is if it were noticed that the transformer was running abnormally warm or hot. Of course, this overheated condition is also symptomatic of leaky filter capacitors, trouble in the filament circuit and/or anything else which places an abnormally high load on the power transformer. I would suspect this type of trouble sooner than I would suspect the possibility of the shorted turns which was under discussion here.

Plate Resistance and Transformer Impedance

Q. How can it be determined that the primary impedance of the output transformer is matched to the plate resistance of the output tubes working push-pull?

A. It is not really possible to determine when an output transformer is matched to the plate of the output stage to which it is connected. This is true because we do not match impedances in output stages. Pentodes have too high a plate resistance to wind a transformer with enough turns to match impedances properly. Further, we do not wish to match impedances correctly despite the fact that such a match would give us maximum power transfer. But unfortunately, this condition also gives us maximum *distortion* transfer. Under certain conditions distortion transfer decreases faster than power transfer. Tube manufacturers determine empirically and mathematically just what the proper relationship is between the tubes' plate impedances and the actually impedance of the transformer with which the tubes are associated. The whole picture is further complicated when negative feedback is applied. This has the effect of lowering the impedance of the output stage as a whole.

Perhaps what you would really need to know is the impedance of a particular transformer, and whether this transformer can be used with a particular set of output

(*Continued on page 60*)

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

AUDIOMAN NO. 12

Richard J. Henry, 26, single, draftsman and Chicago resident, latest to join ranks of Audiomen of the Month.

FULFILLING the tradition of Audiomen, Richard J. Henry is constantly being called upon to help his friends and neighbors in planning their own hi-fi systems. And he is well equipped to help others because of the experience he has had in designing and building his own system over the past seven years, during which time he has been both music lover and audio hobbyist. He has a record collection of more than 250 LP's and some 50 stereo discs, and more than 50 stereo tapes. He has facilities for playback of both tape and disc in stereo, and so far records only monophonically, but looks forward to the time when there will be something on the air to record on stereo so he can increase his stereo tape collection.

For equipment—at the last writing, and anything can change in an Audioman's equipment line-up in a week, even—Mr. Henry was using two Dynakits for his power amplifiers, and two Dynakit preamplifier-control units, a Metzner Starlight turntable with a Rek-O-Kut arm, a Knightkit FM tuner, and a Viking stereo tape deck. Additional heads for the Rek-O-Kut arm permit him to interchange cartridges between stereo and monophonic reproduction—a Fairchild 225 serving for the mono application and a Shure M3D for stereo. His loudspeakers are a University Master in the left channel and a Stephens FR-80 in the right, the latter being enclosed in cabinet of the Argos type.

The "special" inputs to the Dynakit preamps have been wired to tape equalization for stereo reproduction, but a Viking record/playback amplifier is used for both operations on mono. The tape deck and the recording preamp are mounted on a hinged panel in the bookcase at one side of the fireplace. The preamps and FM tuner are mounted over this panel on shelves. Mr. Henry's ingenuity came to his rescue in the design of the shelves, for they do not extend all the way to the rear of the bookcase —thus providing considerable ventilation to the units. The hinged door which mounts the tape recorder is covered with grille cloth which obscures the two openings in the wooden panel that provide for circulation of air.

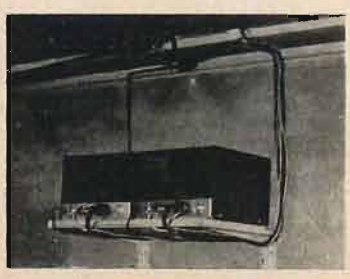
The phono turntable is spring mounted in a base resting on top of the mantle. The major heat source—the two Dynakit power amplifiers—are mounted on a shelf in the basement, as shown below. This is always

desirable if the home will permit it, but rarely possible when one lives in a multi-storied apartment building.

To make his speaker system cabinets, Mr. Henry obtained plans from University for the "Master" System, and the second unit is built along the lines of the Argos "Californian" enclosure. Time for these constructional projects was borrowed from his hobby activities of skin and SCUBA diving, but he still finds time to hear a live concert of the Chicago Symphony Orchestra several times a year.

* * *

And so go the Audiomen—dedicated hobbyists who give of their time and energy to help others to find the same enjoyment from music reproduction that they have enjoyed for many years. Contrary to general belief, high fidelity is not a new hobby—it has been active for at least thirty years. In the early days one had to compromise between a "flat" high end and needle scratch—now it is likely to be a compromise between adequate bass and too much rumble. But so it goes—and the Audioman, recognized or not, is the mainstay of the art, the backbone of the industry, and the originator of many of the art's innovations. Æ



Left, the entire system mounted adjacent to the fireplace, except for the power amplifiers (above) mounted on a shelf in the basement.

LETTERS

Air Suspension—Another Excursion

SIR:

Mr. Avedon's introduction to his article[1] in the June AUDIO creates the impression that it is a rebuttal to my article[2] in the January issue. In fact it is not; where Mr. Avedon does touch on the main issue (i.e., whether the enclosed air in an acoustic suspension system creates significant speaker distortion) he has come over to the other side, and I make him welcome.

I would like to make four points about his article:

1. The major issue in the two original articles[3] has almost disappeared from view, and an inconsequential side issue has taken its place. Mr. Avedon no longer claims that the air-spring in an acoustic suspension enclosure exhibits significant non-linearity; his new (and correct) thesis is that the now admittedly tiny amount of non-linearity is only partly due to the adiabatic process, and that isothermal operation would not erase but merely reduce a non-linearity that has no significance to begin with.

2. The lack of consequence of this side issue is pointed up, ironically enough, by the fact that Messrs. Avedon, Kooy, and Burchfield in their original 1959 article, and I in my January article, both made the same error with respect to it (blaming air non-linearity entirely on the adiabatic process), without this error affecting our ability to disagree. They wrote:

> "It is extremely difficult to make this process anything other than adiabatic . . . [the] pressure variations must cause greater distortion for a given excursion of the cone *due to the inherent non-linearity of the adiabatic process* (italics mine). This is an unavoidable consequence of the laws of physics. So when it is said air suspensions are inherently more linear than mechanical suspensions a misstatement has been made. . . ."

I, too, considered only that part of air non-linearity associated with adiabatic conditions in my discussion of the gas equation, although in addition I employed a complete, and accurate graphical demonstration. My error was caught by Mr. Novak (LETTERS, March) and acknowledged by me (LETTERS, May). Now Mr. Avedon taxes me with this error, actually made by both of us, as though it were central to the issues between us, devoting a major part of his article to the subject.

3. The real point at issue, the one that leads to meaningful conclusions, was described in my original answer as follows:

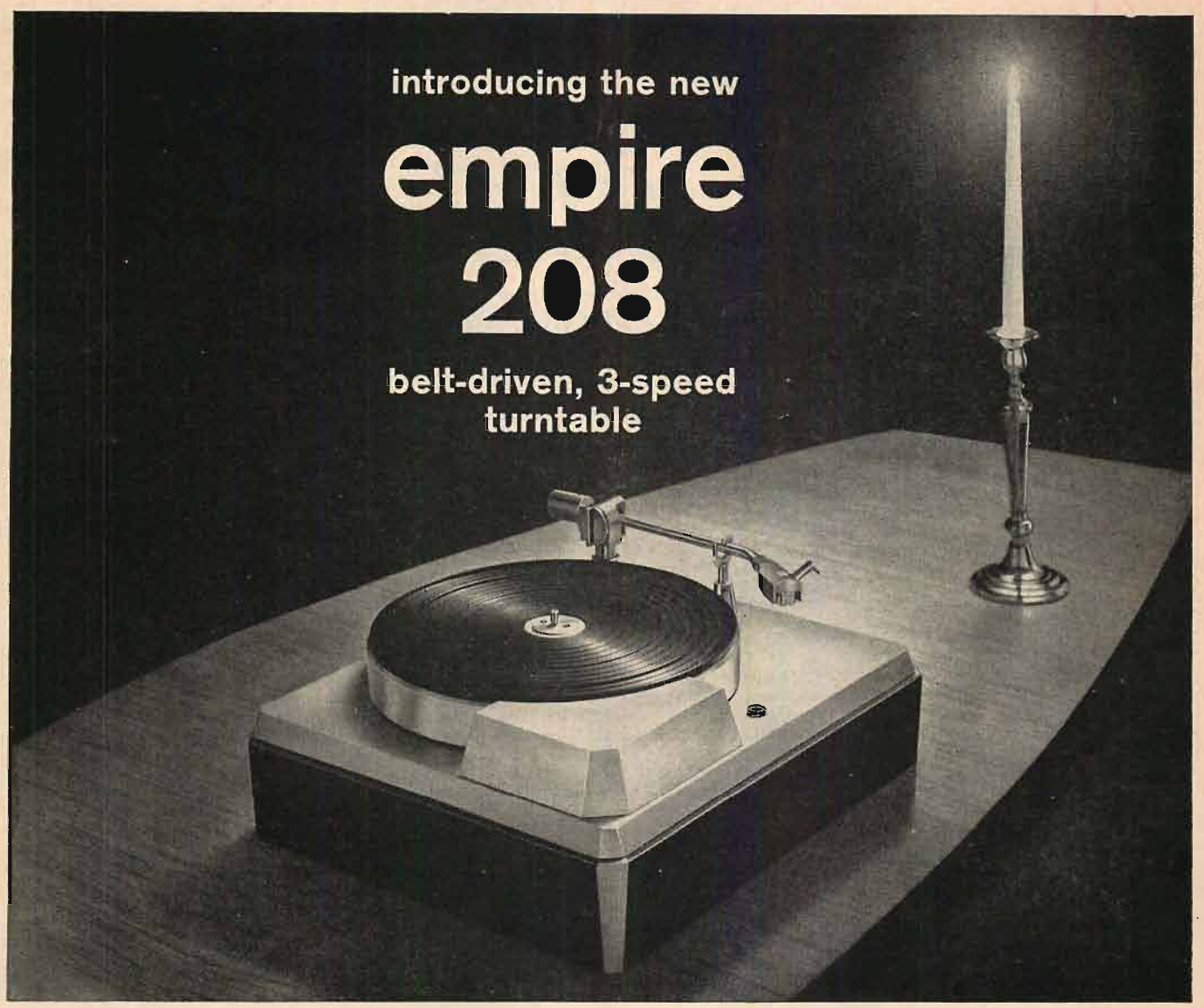
> "One statement in particular is made in the above-mentioned article which, if true, destroys as invalid the entire basis of the acoustic suspension system. This is the statement that the air in the cabinet of an acoustic suspension system is significantly non-linear. . . . Here is the first published theoretical objection to the acoustic suspension system, that the

(*Continued on page 64*)

[1] Robert C. Avedon, "More on the air spring and the ultra-compact loudspeaker", AUDIO, June, 1960, pg. 22

[2] E. M. Villchur, "Another look at acoustic suspension", AUDIO, Jan., 1960, pg. 24

[3] Ibid. and R. C. Avedon, W. Kooy, and J. E. Burchfield, "Design of the wide-range Regal speaker system", AUDIO, March, 1959, pg. 22



so quiet—no known amplifier can provide nearly enough bass boost to bring the rumble content to the audible level of the recorded music

Turntable noise or rumble is the inevitable by-product of mechanical motion. For, mechanical motion implies moving parts, and moving parts must contend with friction and tolerance, the two primary causes of rumble.

It is as impossible to eliminate rumble as it is impossible to eliminate the need for moving parts. However, by reducing the number of required moving parts; by refining the working tolerances; and by introducing effective friction-reducing techniques, rumble can be brought to a level that is so insignificant as to be virtually non-existent.

This is how the Empire 208 achieves a rumble content so incredibly low that no amount of available bass boost can bring it to the audible level of the recorded music.

There are only two moving parts in the Empire 208 — the motor and the turntable platter. **There are no intermediate idlers.** A continuous seamless belt couples the motor directly to the turntable.

The motor is a heavy-duty hysteresis-synchronous unit with a dynamically balanced rotor. There is no measurable lateral tolerance or 'wobble' in the shaft. And, the 3-step pulley, press-fitted to the shaft, is ground to perfect concentricity with its rotary motion.

The turntable platter itself, a homogeneous aluminum alloy casting, is ground to precise concentricity, and then, carefully balanced. Its weight is six pounds. And the distribution of its mass has been carefully calculated to produce maximum flywheel effectiveness.

A case-hardened, lapped-surface, steel shaft serves as the main bearing. This shaft fits precisely into a lubricated shaft-well and rotates on a single polished steel ball. The inner wall of the shaft well is honed to a micro finish.

The idea of a single, ball-thrust bearing is not new. But, in the Empire 208, the ball is made an integral part of the shaft. It rests and rotates on a Nylon 'seat' at the bottom of the well. The use of Nylon is significant because of its extremely low friction coefficient and its high resiliency, the cushioning effect of which contributes to the absence of vertical rumble.

Empire 208 .....$87.50
Wood base in walnut, mahogany or fruitwood $12.50

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AUDIO ETC.

Edward Tatnall Canby

1. IF-IH

Periodically, these days, I seem to get involved with the Japanese—not in Japan (how I wish I could find a good excuse to get over there), but by indirection.

Japanese hi-fi has been discussed here before, more precisely, just a short time before the invasion of our shores by the present varied wave of Japanese equipment. Then later it was a recording of Japanese Noh drama (reviewed, duly). And, shortly thereafter, the stuff itself, the imported Kabuki troupe which gave a week of genuine Japanese stage stuff, with music, in New York City. My old friend in Tokyo, head of AP and enthusiastic hi-fi installer for the Tokyo international press and diplomatic corps, turned up in New York recently with a new Japanese wife. She speaks American, learned in Tokyo while in school; he speaks no Japanese though he's been there ten years. "What would you do," he said, "if you were trying to learn a language that is written in algebra?"

(Aside: Mr. AP, better known as John Randolph, hasn't got around to stereo yet in Tokyo. How can you put stereo in a Japanese "living room"? If the American housewife doesn't like two boxes where she thinks one will suffice, the Japanese lady has a whole world of delicate traditions as to living space that must not be disturbed by crass invasions of multiple blocks of furniture. And what of the Japanese room itself, with its sliding walls and variable spaces? Besides, Mr. Randolph won a vital domestic battle, long ago, when he managed to install a huge corner speaker in his Tokyo living room. What—TWO corner speakers? What?—Junk my precious folded horn?)

A Canadian correspondent, French name, English-writing, has been exchanging notes on Japan with me from an unlikely spot—Quebec. Seems he lived in Japan for a long while. He is my latest source of gossip on the hi-fi situation in Japan, supplementing my AP friend.

My Quebec friend has sent me a batch of Japanese hi-fi catalogues—not the ones for American consumption but those for the local fans. I pass on to you without personal comment—how would I know—his observation, that contrary to general impressions here, Japanese goods are neither cheap, nor built with "cheap labor" at this stage.

The stuff he sent me, in flyers and catalogues, is not exported because it is no longer competitive with our equivalent hi-fi, tends to cost more even in Japan. But the variety is astonishing; a catalogue from Sansui Electric (460 Izumicho, Suginami-ku, Tokyo) features, for instance, two pages of assorted radio tuners, in all the varied forms we might find in one of our own catalogues, plus stereo preamps and a large line of amplifiers ranging up to a 100-watt monster with carrying handles ($200); this is followed by pages of bewildering transformer arrays, dozens and dozens of them, with all the technical data, the whole printed via thousands of elegant Japanese characters and Western numerals, plus photos. Most impressive.

"The days of cheap labour in Japan are numbered in high-quality manufactured goods," writes my correspondent, Mr. André Thivierge. "If some of them are still slightly cheaper, look for other factors: low manufacturer's profit (around 1 per cent. . . .yes, 1 per cent; they depend on volume; here is a good lesson for the American producers). Automated plants have also reduced the cost of production.

"You will see that the prices in Tokyo, although interesting, are appreciably higher than most people think: skilled labour is well paid, salaries keep going up, and the cost of living is sinking to a new low everyday."

At that point in his epistle, Mr. Thivierge went off into the interesting question of Japanese music and the Noh plays, ending up with a fine list of recommended books in English on Japan itself—quite a versatile Canadian, this. But I'll stick to my subject.

Xz BF ZZ XS

The astonishing thing about the Japanese hi-fi catalogues and flyers I have in front of me, as this is being written, is that they look so much like ours, are so clearly derived from our technology, use our Western technical terminology not only in the numbers but even in whole groups of letters—and yet, being Japanese, these catalogues and the goods they represent stand on their own feet.

This seems to be the Japanese *forte*, an unremitting strength of enlightened imitation. I remember opining on this subject in earlier writing, some years back; the impression is enormously heightened by these more recent developments. I wish you could see a few pages of this literature, printed in Japan for Japanese consumers. It is, shall we say, 100 per cent grown-up, mature. Nothing amateurish, naive, amusing—far from it. The mere look of the pages will bowl you over.

And the strangest thing of all is the curious mixture of Japanese and English that they display—for Japanese readers.

Across the bottom of a double page, for instance, it says SANSUI'S TRANSFORMERS HIGH FIDELITY AMPLIFIERS—just like that. And, under a typical hi-fi photo of Mr. Family Man listening to his rig—only this gent is very Japanese and he's curled up with his knees crossed on top of a Western arm chair—there are four model photos, each with specs next to it, each with a Western designation: the FM-5, AF-350, PM-880, and so on. Most of the rest is printed in fine-line Japanese characters, but the terminology of importance stands out in "English." If I may substitute meaningless letters for the Japanese characters, here are some typical lines of amplifier specs.

Xz BF ZZ XS 6AQ8, (12AU7) x 2, (6CA7) x 4, (5AR4) x 2. That, as you can catch, is the tube complement. Power output is thus: **SBF TZ 70W (35W x 2 SX GBF SZ SLX).** Easy—a dual 35-watt stereo job. So it goes, right down the line, and even without the meaningless characters you can figure practically everything you need to know about each of these amplifiers, tuners and transformers.

Of course the correct characters are much prettier than my substitute jargon-letters and, indeed, the whole page layout of these catalogues is delicate and quite beautifully set up, the characters themselves done in sharp, very fine type and printed with spidery accuracy.

As you can see, the Western and Japanese terminology is thoroughly mixed, the recognizable letters and numbers appear right along with the unrecognizable characters, all in the same line. The same goes for numerous fine-lined diagrams, explaining stereo speaker hookups, varying inputs and outputs and the like—you can read all the pertinent info, interspersed with cryptic hieroglyphics.

Four-Way

—Which brings me to a final point that may have been blossoming obscurely in the back of your mind as you read the above. You had thought, as did I, that Japanese characters were printed *up-and-down, in columns.* And if not that, then (you thought vaguely), don't they go "backwards," from right to left? How in blazes can you read a hi fi catalogue (or anything else of the sort) in which standard Western stuff is intermixed with the oriental?

I have one flyer here, for instance, that presents arms and turntables, from a company that must perforce remain anonymous because its name on the flyer is in Japanese characters. So are the large, boldface names for the various models, and quite decorative, too. But in the middle of

■ 規　格

使用真空管	(12AX7)×4，(12AT7)×2，6X4
信号対雑音比	HIGH LEVEL……60db LOW LEVEL……55db
利　得	MIC端子　入力　2mVにて出力1V TAPE端子　〃　2mVにて　〃　1V MAG端子　〃　2mVにて　〃　1V X-TAL端子　〃　25mVにて　〃　1V TUNER端子　〃　250mVにて　〃　1V AUX端子　〃　200mVにて　〃　1V
トーンコントロール	20 c/s……±17db(BASS) 20K c/s…±18db (TREBLE)
ランブルフィルター	20 c/s……フラット 50 c/s……1K c/sにて－3 db 100 c/s……1K c/sにて－3 db
ラウドネス	OFF……フラット 1 ……ボリュームを¼に絞った位置で1K c/sに対し＋4 db (20 c/s) 2 ……ボリュームを¼に絞った位置で1K c/sに対し＋8 db (20 c/s)
クロスオーバー	500 c/s
消費電力	100V　50～60 c/s……65VA
寸法・重量	横巾 386㎜　奥行 222㎜ 高サ 124㎜　重量 7.8kg
電　路	スプ

現金正価　29,700円……完成品

Reproduction of part of a page from the Japanese catalog described by Mr. **Canby.**

each long and cryptic model name I see—like so many Japanese characters themselves—the letters Hi-Fi, imbedded in the meaningless array! Sort of like this:

RzSplftXYzHi-FiXwrfTszPlf

My first thought was that you probably should read this from the right-hand end, then when you get to the middle you reverse, to take in "Hi-Fi", and then continue backwards out to the left. So I started in asking casual acquaintances about this li'l matter of directionality, and you'd be surprised how long it took to get a positive answer. It came, again, from Quebec and Mr. Thivierge.

He says that, yes, Japanese characters do—or did—go down, not across. But we must remember that these characters do not represent letters in our sense, nor do they present whole words, either. (They once did, I gather, but have been stretched from the original meanings of each section of the complex characters into new uses.) Instead, they represent syllables, or equivalent. (They would seem, if I'm right myself, to be a rough equivalent of shorthand, except that shorthand removes all the vowels that it can.)

In any case, what with the modern world being as complicated as it is, the Japanese have philosophically adapted themselves to everybody in sight; they read their characters any old way, up, down, sidewise, in circles or what have you.

If I understand Mr. Thivierge rightly (and a lot of readers will have had some direct experience of this), Japanese characters run left to right when convenient, and especially in technical literature where Western symbols and words are used in their own shapes. Thus, the quantities of detailed information in my hi-fi catalogues is clearly printed in horizontal format, not vertical, and it doubtless reads from left to right throughout, in order to accommodate the Western terminology—including that fine term, hi-fi.

But there's a further twist to all this calligraphy. Seems that, with their syllable writing, the Japanese also transliterate large numbers of our words into rough Japanese syllable equivalents, and write them out in their own characters. Mainly the new-style terms imported from the West, like telephone, and so on.

Now when these get into the four-way stretch, as to reading direction, there can be oddities to baffle the Western mind. He quotes a three-syllable, three-character word which is pronounced, more or less, To-ba-ko, and means what it says. But in Japanese practice these three sounds, as represented by the equivalent trio of characters, may run in any old direction, depending mainly on aesthetics—which, always, are of ultraspecial importance in Japanese thinking.

If the page looks better, or the sign outside a shop pleases the eye more delightfully, the syllables are just as likely as not to appear "reversed"—i.e., Ko-ba-to. Just read it the other way.

Now I'm wondering, as I think of the import of all this, how many terms of audio importance have made the transition in these catalogues I have from Japan, and appear there not in recognizable Western letters and numbers but in Japanese syllable-equivalents?

Until I study Japanese, I won't know. But I do suspect that every loyal audio man in that country is already quite familiar with if-ih.

2. Earphone Stereo

As if we hadn't bollixed up stereo enough—I'm increasingly disturbed (in a

POV-467A-3 4"x6"

ML-8411A-3 3½"

AH-6656A-3 2½"

HIGH IMPEDANCE SPEAKERS FOR TRANSISTOR RADIOS

PIONEER miniature-size speakers for transistor radios have been highly rated because of unexcelled tone quality and uniform characteristics; and entirely new high-impedance speakers, in addition to those popular standard models, are now being mass-produced.

The notable feature of a high-impedance speaker is that it requires no output transformer; therefore truly natural tone quality is obtained by eliminating distortions due to output transformer. Furthermore not only a sizable expenditure for output transformer is saved but also the important issue of portable transistor radio —reduction of its weight—can be solved. However besides its merits just described above, a high-impedance speaker unfortunately has its demerits—difficulties present in mass-producing voice coil of excellent quality.

The uniform and superior voice coils for PIONEER high-impedance speakers are now being sucessfully mass-produced by the application of unique winding devised by PIONEER research staff and by the adoption of new mass production system. On account of the rational combination of three essential components—voice coil of good quality, powerful magnetic circuit and exclusive cone paper—, a PIONEER high-impedance speaker reproduces sound amazingly beautifully.

There are now, ready for the market, 18 kinds of high-impedance speakers for transistor radios, and we are fully prepared to meet large orders—however large they happen to be.

SPECIFICATIONS

Model No.	Voice coil impedance	Resonance frequency	Frequency range	Power input	Sensitivity
AH-6656A-3	70 ohms	310-410 cps	310-4,000 cps	0.1 watt	94 db/watt
AH-6656B-3	100 ohms	〃	〃	〃	〃
ML-8411A-3	70 ohms	200-280 cps	200-4,000 cps	0.3 watt	96 db/watt
ML-8411B-3	100 ohms	〃	〃	〃	〃
POV-467A-3	70 ohms	110-160 cps	110-8,000 cps	1.5 watt	98 db/watt
POV-467B-3	100 ohms	〃	〃	〃	〃

Yumi Shirakawa (Taho)

5 Otowacho 6-chome, Bunkyoku, Tokyo, Japan

FUKUIN ELECTRIC, LIMITED

pioneer

mild way) by the numerous and revived sales pitches for what we once called, quite logically, binaural earphones—two-channel phones, one channel to each ear. In days of yore, these phones were used for their proper purpose, the re-creation of a startling sense of presence and of natural liveness via two-channel earphone recording. Not stereo recording at all, but "binaural," the two mikes set close together in an approximation (that's all you need) of the actual placement of the ears. Sometimes, the painstaking specialists buid up actual dummy heads, complete with ear canals, or with specially designed mikes-plus-baffles to give the actual pickup of the ear. But generally speaking, any two mikes will do, provided they aren't more than, say, two feet or so apart. That's a big enough "head" for anybody, thank you.

Now, opportunely, these same phones are back again in force,—for stereo. "For stereo reproduction unattainable with speakers" shouts one fine ad, out of our own journal. And this company (Clevite Walco) is decidely not the only one which claims stereo sound out of headphones. Some Very Big Names are doing the same, more or less.

Binaural Again

Now looky (as we used to say when I was a kid). Lookit. You don't get stereo sound out of *any* earphones, because phones bring you each of two channels *exclusively to a single ear*. You hear, relatively speaking, as you do in nature, the two microphones—if there were two—acting as your ears, in extension.

Stereo is produced via loudspeakers, and it depends on a more complex set of factors, defying exact description by the likes of me, but undeniably and definitely dependent on the *hearing of each channel by both ears*. You hear the left speaker with both ears and you hear the right speaker with the same—and if there's a center speaker, you hear that with both ears too. Utterly different from the earphone situation, yes?

Now stereo has its tricks and techniques. The ability to recreate a sound-curtain that spreads across from side to side and extends back in apparent 3-D, all from two loudspeakers, is the essence of good stereo, and it is something that at first, ten years ago, I really didn't believe could be done. Yes, I know, I came upon "loudspeaker binaural" sort of late, considering that it was active back in the early Thirties, with Stokowsky and Blumlein and who-all. But, then, the demonstrations I got weren't very convincing, in the pre-commercial stereo years, and (to admit a very important point) my ears weren't trained to hear stereo. (Millions of people suffer from that lamentable lack of training today, too, and I wish we'd do something about it. . . .)

No, I didn't think much of early stereo. But as graybeards will recollect, I was nuts about earphone binaural. I still am. It's an astonishing phenomenon, if still largely uncommercial. You just have to do it for yourself, with your handy stereo tape recorder. But what uncanny effects! Especially in the case of such ordinary jumbles of sound as confused conversation, the pauses between music at rehearsals (when people talk, here and there, in casual, half-whispered conversation). I've always found, like the fabled Siamese, that in earphone listening of this sort, the tuning up is the best part of a concert, if the intermission isu't even better.

And there are the bird songs, recorded

(*Continued on page 77*)

C24

STEREO CONDENSER MICROPHONE

The pre-eminent microphone for stereo recording and transmissions by MS and/or XY pickup techniques • The relative angle of the two sensitive mikes in the slender head can be varied through 180° with visual indication of their positions • Nine different directional-sensitivity patterns, from Hypercardioid (−15 db or better) through Figure-8, are available independently for each channel, instantly and silently by electrical remote control • Output impedances of 50 and 200 Ohms selected by a simple change of connections • Each C24 supplied complete with all needed cables, transistor-stabilized power supply, twin remote-control selector unit, and individual frequency-response curves for each mike. Write today to the USA import and service representatives for full data and names of dealers.

Frequency Range	30 to 20,000 cps
Cardioid Discrimination, 0° to 180°	−15 db or better
Crosstalk between Channels	−40 db or better
Output Level per Channel	33 db re 1mW for sound field of 10 dynes/sq cm.
Residual Noise Level	20 phon or less
Output Impedance, per Channel	50 and 200 Ohms
Sensitivity per Channel (for 200 Ohms)	1 mV/microbar
Preamplifier Tube	6072 (12AY7)
Power-Line Voltages	110, 125, 145, 220, 245 VAC; 50-60 cps

Microphone Length, 10¼"; Diameter 1-5/8"; Weight, 1 lb 3 oz.

AKG

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CHESTER SANTON*

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

STEREO

On Tour With The New Glenn Miller Orchestra — RCA Victor ✪ FTP 1001

At the time this tape was reviewed, United Stereo Tapes was not handling shipments to reviewers of RCA's first four-track open reels. For that matter, neither was RCA Victor. In order to provide tape fans with at least an interim report, I selected at random on the open market a reel with the New Miller orchestra under the direction of drummer Ray McKinley.

Could be I happened to pick a lemon among the dozen or so items in the first release. If the other reels have the distortion this one has, Victor would be well advised to start all over again in four-track open reel. The entire tape is overloaded in signal level. The worst distortion occurs in the quiet ballads. The muted trumpet passages in the second selection, *Rainbow Rhapsody* break up completely even with sharp cutoff at 5000 cycles. It is hard to resist the impression that some one inadvertently used, at 7.5 ips, the recording level and equalization that had been worked out for the now defunct RCA 3.75-ips tape cartridge.

The latest batch of stereo records received for review contained a new disc by the Miller-McKinley orchestra (*Dance Anyone?* RCA LSP 2193). The same studio had been used for both recordings, Studio A in New York City. The disc, while not the cleanest stereo recording coming out of Victor's plants these days, had considerably less distortion than the tape. The dance program based on re-recordings of many of the original arrangements in the old Miller library (*Adios, Sunrise Serenade,* etc.) was playable with adequate adjustment of the treble controls but the tape presented an insurmountable problem. As luck would have it, the tape has the more interesting program of the two because it contains the music played by the band in its recent tour of Europe (both sides of the Iron Curtain) and North Africa.

Gus Farney: Colossus — Warner Bros. ✪ WST-1359

It is surprising how small a percentage of the current tape catalog is devoted to organ recordings. Leon Berry, Dick Liebert, and George Wright have been well represented on discs. Wright alone has a sizeable quantity of tapes on the market. A fourth organist now joins the tape roster to intrigue those who feel that the stereo disc can not do justice to the pedal notes of a Wurlitzer organ. Gus Farney, before settling down in Salt Lake City, the scene of this recording, was a featured organist for twenty years with the Paramount Publix Chain of movie theatres in the Central and Intermountain States. Those were the days when moviegoers demanded glamorous sound and the organist shared billing with the stars.

The Wurlitzer heard in this reel first saw the light of a theatre in 1930 as a three-manual, nineteen-rank job at Staten Island's Paramount Theatre. It was moved to Salt Lake City in the early fifties. Following a year of reconditioning, it is now heard in this recording as a five-manual, twenty-four-rank instrument with over 230 stops. Housed in a hall seating only 200 people, the two tone chambers face each other at a distance of forty feet. A nice set up for stereo.

If this compilation of data has whetted your sonic appetite, I'm sure you won't be disillusioned when you hear this tape on a system that doesn't have to apologize for its handling of bass fundamentals. Equally attractive is the transparent nature of the sound of the organ throughout its range. Gus Farney has versatility to spare in a program that covers *Londonderry Air, Granada, Singin' in the Rain,* and the Orpheus in Hades *Overture.*

David Rose: Waltzes in Stereo — Kapp ✪ KT 41027

In recent years, relatively few light-music tapes have been issued that can stand up to this one in over-all appeal. It steers a middle course. Play it at background level and you have music in three-quarter time that avoids any suggestion of corn. Open it up a bit and the strings of the David Rose orchestra blossom with the sweetness you get after replacing a year-old set of amplifier output tubes. David Rose is in a position to take much of the credit for the success of this release. His arranging these days has a poise that puts in the shade some of the sunniest hits of his early career. Although he covers a variety of waltzes in the course of this reel, Rose sets himself a stern task at the beginning with Johann Strauss' *Tales From The Vienna Woods.* A polished reading of this waltz has eluded far more exalted conductors. He has a very effective wrinkle in the course of this arrangement—a contrast in dynamics seldom tried on pop tapes. Midway through the piece, the strings are suddenly hushed to about one third of normal volume for a subtle interplay within the orchestra that only stereo could capture. So daring is the deliberate drop in signal, many tape fans will instinctively perk up their ears at this point for entrance of tape hiss. I was pleased to discover that, unlike some of the first four-track tapes, this release has ample leeway in signal-to-noise ratio. On my set up, the reel came through with flying colors in a low level passage that might have embarrassed some of the early two-track stereo tapes as well as the present four. Of course, it is still possible to encounter a recent four-track with noticeable background noise but, by and large, the items processed for release this summer have licked this particular problem.

The seating plan of the orchestra is on the unorthodox side, having been worked out to give maximum advantage to the strings. The sound source in the studio is a lazily curving semi-circle with the string-less choirs relegated to the background. A neat feature of the album is the ease with which the scene shifts from Vienna to Hollywood and then to Tin Pan Alley. The treatment of Victor Young's *Around the World* is the best I've heard with the exception of the original sound track (Decca tape 9046) but that older reel cannot match this recording in cleanliness of sound. *Diane* and *Intermezzo* represent other movie classics. Irving Berlin's *Remember* shares honors with *Beautiful Ohio* and *Missouri Waltz* in the nostalgia department. Operetta favorites such as *Deep in my Heart* and *Die Fledermaus Waltz* complete the collection. In the taste of its musical concept and instrumental performance, this release is equal to albums turned out by the leading aggregations specializing in light music. The flat response is a welcome bonus.

The Button-Down Mind of Bob Newhart — Warner Bros. ✪ WST 1379

The appearance of comedian's monologues on tape recordings would indicate that there are homes in this country with electricity and tape machines but no running phonographs. Discs will probably continue to be the more economical medium for night club humor with anyone who absorbs a comedian's act in one playthrough and then forgets about it. Those who subject comedy to the rigors of repeated playback under party conditions may find the idea of humor on tape not too far fetched. Shelley Berman and Jonathan Winters are already available on tape (Berman in mono) and now UST has added the reel version of Bob Newhart's initial recording which catapulted him to fame last spring. Without resorting to the razor sharpness of a Sahl or a Berman, Newhart activates the imagination of his audience with a minimum of verbiage. The hazards of a driving instructor are conveyed with refreshing subtlety and indirection. The political advice to Abe Lincoln in present-day public relations jargon has established Newhart as a wit to be reckoned with in future releases.

Famous Continental Marches — London ✪ LPM 70023

Goldman Band: Sousa Marches in Hi-Fi — Decca ✪ ST7-8807

The London tapes are still coming through with a whale of a lot of variation in top-end response. This collection of marches from the Continent played by the Band of the Grenadier Guards requires somewhat more treble rolloff than any other London tape I've heard so far. The curve on the tape may be similar to that used for Mantovani's strings but the piercing blare of music for brass band adds its own share of complications. After some fiddling, I finally got the reel under control by setting my cutoff filter at 7000 cps and rolling back variable treble from the zero position normally used for tape. The puzzling top end occasionally encountered in their tapes tempts me to go along with the theory that some London tapes arriving in this country for processing by UST still have the British CCIR recording characteristic. Once oriented, the band of the Grenadier Guards campaigns with distinction through four European countries in famous marches from France, Spain, Germany, and Italy.

The Goldman Band, in contrast, sounds comfortably civilian in the marches of John Philip Sousa. Richard Franko Goldman, the son of the band's founder, has included a few surprises in his program. Some of the marches, written for Sousa operettas such as "The Bride Elect" and "The Free Lance," were originally meant to be sung. Listening to them now, it is obvious that singers and audiences of that day were made of sterner stuff.

Les Brown: Swing Song Book — Coral ✪ ST7 57300

Tape is providing a better grade of fuel for the Les Brown powerhouse. This outfit is one of the few survivors of the famous era of large swing bands—the decade that began in the mid-thirties. The appearance of a few more tapes such as this one could lead to a revival of interest in the big bands that once ruled the roost. This reel gives every sign that Les Brown has preserved a brand of morale in his

(*Continued on page 71*)

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

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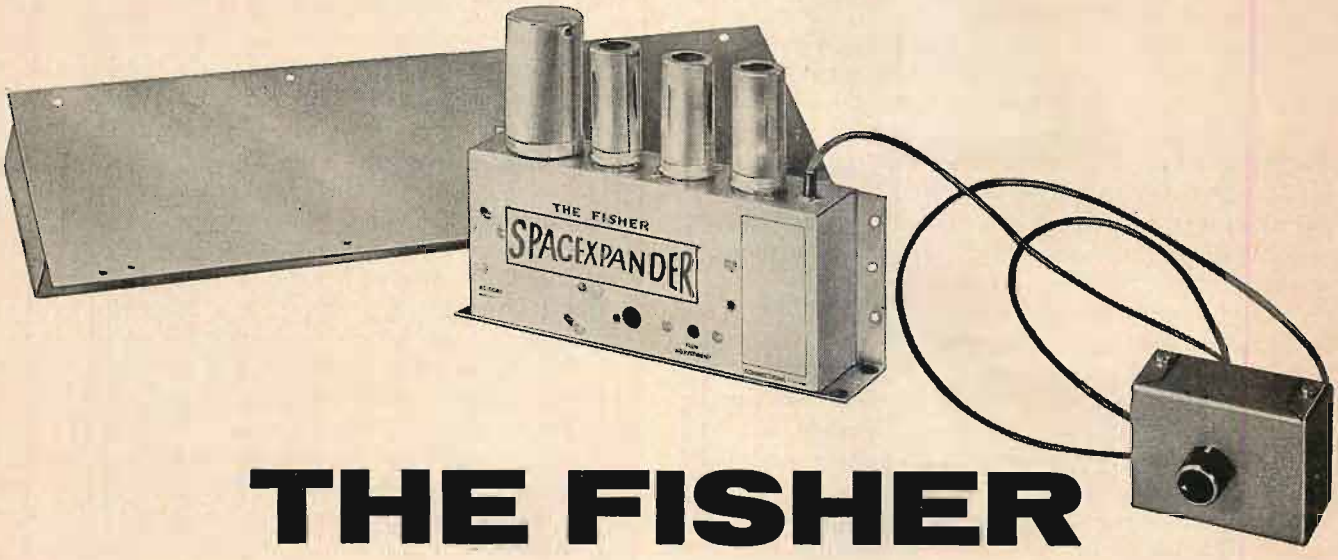

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■ It is well established that one's perception of the size of the room or hall in which music is being played is based on the amount of reverberation in the signal reaching one's ears. With the revolutionary new FISHER Dynamic Spacexpander, Model K-10, you can now literally create living concert hall acoustics *in your own home,* and on *any* type of signal—whether from records, radio or tape—at the turn of *one simple control!* The results are astonishing.

The patented design of the FISHER K-10 permits the blending of any desired degree of reverberation with the input signal to create a result that is truly the living music itself. Listen to any of your favorite programs or records with the FISHER K-10 in operation and you will find that, without it, the program actually sounds 'dead'—the most dramatic proof of what the FISHER Spacexpander does!

Best of all, there are *no* moving parts to get out of adjustment—*no* motors, *no* continuous tape belts, *no* complicated drive mechanisms. The FISHER K-10 is a marvel of simplicity and superb electronics, designed to give years of trouble-free, thrilling service.

Complete assembly, **$59.50**

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beration in the signal reaching one's ears. With [illegible] will find that, without it, the program actually

EDITOR'S REVIEW

THE SHOW SEASON

Each year when September rolls around we begin to get into the spirit of the show season. There is a distinct possibility that there is something about our own interests that sets us apart from the average individual in that we enjoy hi-fi shows. But since we recognize the fact that there is a lot of fun to be had at a show and so many new things to see and hear, there is still some hope for us—or so we would like to believe.

By and large, hi-fi shows are too loud, too crowded, and too full of "showmanship." In the first place, there are too few rooms in which one is likely to hear good sound reproduced at levels which would be acceptable in the average living room.

But it has long been the custom of exhibitors when they feel that the audience of the moment has been there long enough, to reduce the sound level for a few minutes. Immediately the crowd leaves the room and when the sound level is raised to the show normal—which we would estimate to be around 95 to 100 db—the room fills up again. Now there is nothing wrong with that technique—if the same people stayed in an exhibitor's room for an entire day he would be able to show his wares to not more than twenty-five people, and that wouldn't pay him for the time of his staff and for the rent of the room. Consequently he must take the necessary steps to "ventilate" the room properly—to ensure a continuous circulation of people.

It is also considered standard practice to use a reproduction curve which has been called—in these columns as well as elsewhere—the standard hi-fi show curve. This curve consists of a boost of around 10 db at 100 and 10,000 cps. But there is a very good psychological reason for this reproducing characteristic. When people come into an exhibit room for the first time, they expect something out of the ordinary. Given two rooms with equivalent equipment and the same records, the room with the boosted highs and lows is the one in which the people will congregate.

Actually, there is a very good reason for this. When one listens to properly reproduced music in a crowd, it is not likely to make an impression. Consequently, the person in charge of the exhibit soon learns to boost the bass and the treble to give a "showy" effect. The average customer reaction is "listen to that bass" or "those highs," as the case may be. The average hi-fi customer, upon installing a system in his own home, will play it with the highs and lows accentuated for the first week or so. Then he will begin to realize that it doesn't sound right, and he will gradually lower both ends so that in about a month he is playing it either with the controls in a flat position—giving him *electrically flat* response—or in whatever position will give an acoustic response which is approximately flat.

We are in full accord with this custom. We know from experience that the average visitor to a show will walk right past a room in which the reproduction is what would be termed "flat." Actually, frequency response is one of the least of our problems—distortion is far more important—and distortionless reproduction *can* be demonstrated easily by any component manufacturer. The important thing is to offer some musical reproduction which is clean and sufficiently "doctored up" that it is impressive to the ear.

Showtime is the opportunity the industry has to let people know just how good component high fidelity can sound—let us make the best of it. But it is most important that we make use of some showmanship, regardless of what form it may take. We must first get the people interested enough to notice hi-fi—once it penetrates their consciousness, its own quality will clinch the interest and win more converts to the growing number of audiofans.

WHERE ARE THE SHOWS?

In the first place, that is a good question. So far, we *know* of only four shows scheduled for the next three months—even though there are rumors of a few others. To begin the season, there is the New York High Fidelity Music Show which opens on September 7 for a five-day run at the New York Trade Show building. The next one we know about is the 9th Annual Chicago High Fidelity Home Entertainment Show operated by the International Sight and Sound Exposition at the Palmer House in Chicago on September 23, 24, and 25. Then comes the 1960 Stereo Hi Fi Show sponsored by the Sacramento (California) Valley Electric League. This show is held at the fabulous Sacramento Inn, where the first show in that area was held in the spring of 1959. The dates for this show are October 28, 29, and 30.

Following that comes the Northwest High Fidelity Music and Stereophonic Show at the Hotel Leamington, Minneapolis, on November 25, 26, and 27.

Then, for the benefit of travelers—or those who can use the shows as a *reason* for traveling—there is the Audio Fair in Yorkshire, England, and the Feria de Alta Fidelidad in Mexico. There will probably be others—but unfortunately we often do not learn about them until after they have taken place.

Anyhow, we like 'em, and we'll attend as many as possible.

STANTON Calibration Standard: Model 381 – An ultra-linear professional pickup for recording channel calibration, radio stations and record evaluation by engineers and critics...from **$48.00**

Collectors Series: Model 380—A precision pickup for the discriminating record collector...from **$29.85**

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15 THOUSANDTHS OF A SECOND IS A VERY LONG TIME

It's much faster than you can wink an eye, yet time enough for Bell Laboratories' new high-speed switching terminal to transfer your voice to another channel while you are talking by telephone.

The new terminal—recently introduced on the transatlantic cable—uses the idle time in the conversations of talkers on a group of channels to provide paths for other talkers. This time-sharing technique, called Time Assignment Speech Interpolation, permits the sending of 72 simultaneous phone conversations over this deep-sea system where only 36 could be sent before.

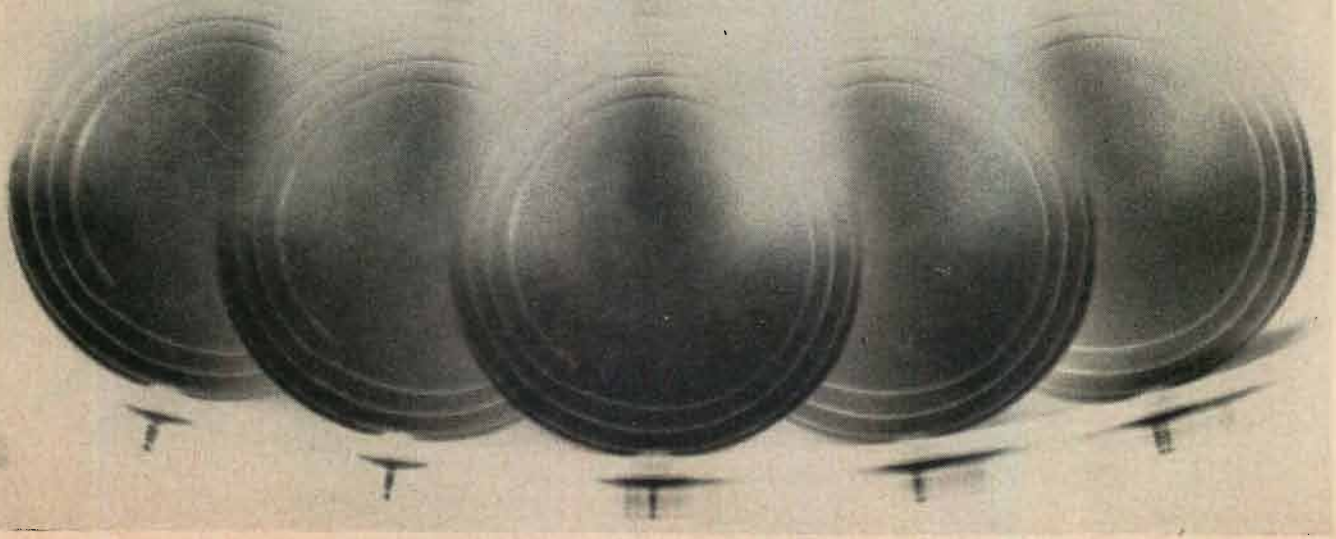
TASI takes advantage of the fact that in a normal telephone conversation you actually talk less than half the time. You do not talk when you are listening, and even when you do talk there are pauses between sentences, words, and syllables. When there are more talkers than channels, TASI puts this idle time to use.

Scanning each circuit thousands of times a second, TASI instantly notices when you aren't talking, then quickly switches in someone who *is*. TASI also notices when you resume talking, immediately finds a channel not in use that moment and switches you to it. Your voice may be switched many times during a single conversation in a time too fast—about 15 milliseconds—for your ear to perceive.

The TASI switching terminal was rendered feasible by the transistor—an invention of Bell Telephone Laboratories. More than 16,000 transistors are employed to achieve the compact, dependable, high-speed circuitry required. TASI is another example of how Bell Laboratories works to keep your telephone service the world's finest.

BELL TELEPHONE LABORATORIES

WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT



Electronic Crossover Design

NORMAN H. CROWHURST*

While some sort of complementary responses can be obtained by guesswork, the methods presented here will ensure accuracy of matching between low- and high-pass sections.

ELECTRONIC CROSSOVER is the term often applied to circuits in which the only electronic parts are tubes serving purely as normal amplifiers; the crossover function is performed solely by R-C elements. As an earlier article showed, it is impossible for a simple R-C network of more than one stage to achieve the desired crossover response.[1] The regular L-C type crossovers, to be inserted in the loudspeaker circuit, have been covered elsewhere.[2,3,4,5]

However, the modern trend is towards separate amplifiers, using an 'electronic' crossover ahead of the power amplifiers, which is where these units, generally of poor design, are used. Correct design procedure is no more difficult, once understood, and takes few, if any, more components. This article will give step by step details of designs using different slopes, as well as the basic derivation for the methods (in the appendix).

Most people want the simplest circuit that will do the trick, but what constitutes the trick may vary with circumstances. If you only want an ultimate rolloff of 6 db/octave, then a single R-C combination is all you need. But many favor a greater slope to get more definitive separation, so they need an electronic type, using more than one R-C section, *with feedback to give the requisite shaping.*

That last phrase is italicized because, in spite of several statements the writer has made in various places to this effect, the fact does not seem to be generally accepted. It is a mathematical fact.

As with many things of this nature, there is more than one way of tackling the design, according to your fancy. You can do the whole thing by theory; you can adopt a completely practical method: or you can use a combination of both.

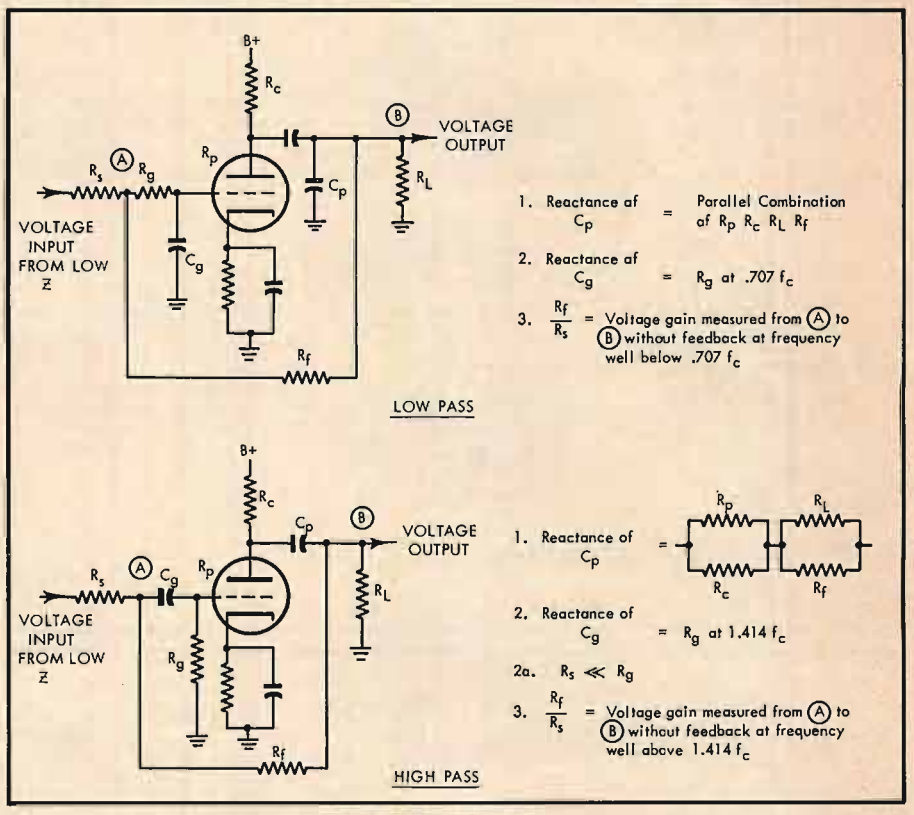


Fig. 2. Method of design based on calculations, using tube circuits. Triodes are shown for simplicity, but pentodes can be used equally well.

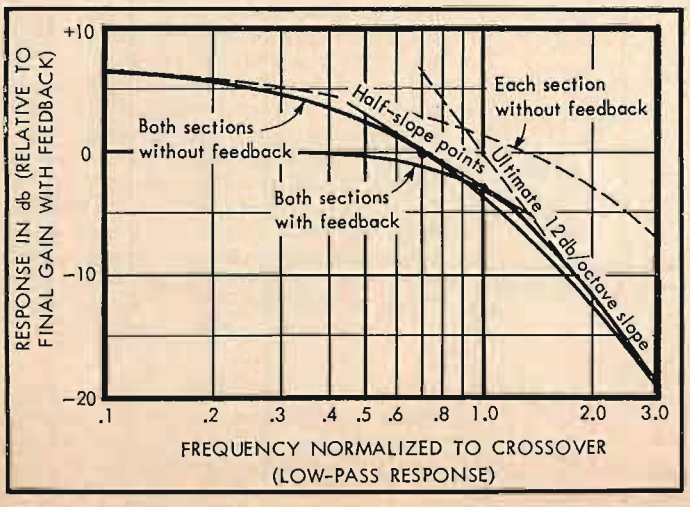


Fig. 1. The basic response relationships in a two-section filter, with feedback, using identical non-interacting sections, to produce a 12 db/octave type.

12 db/octave Type

The theory of the 12 db/octave type is illustrated graphically at *Fig.* 1. The sharpest possible turnover without feedback uses two identical rolloffs, without interaction between them, to give 3 db, 45 deg. each, or 6 db, 90 deg. total at the design frequency. This point will also give unit, or half-ultimate, slope. Applying feedback cuts down the gain in the pass range, but runs into the same ultimate 12 db/octave slope, as feedback becomes ineffective.

By using 6 db of feedback, the location of the unit slope reference point is pushed "out" (up in a low-pass or down in a high-pass) by a ratio of $\sqrt{2}$. The

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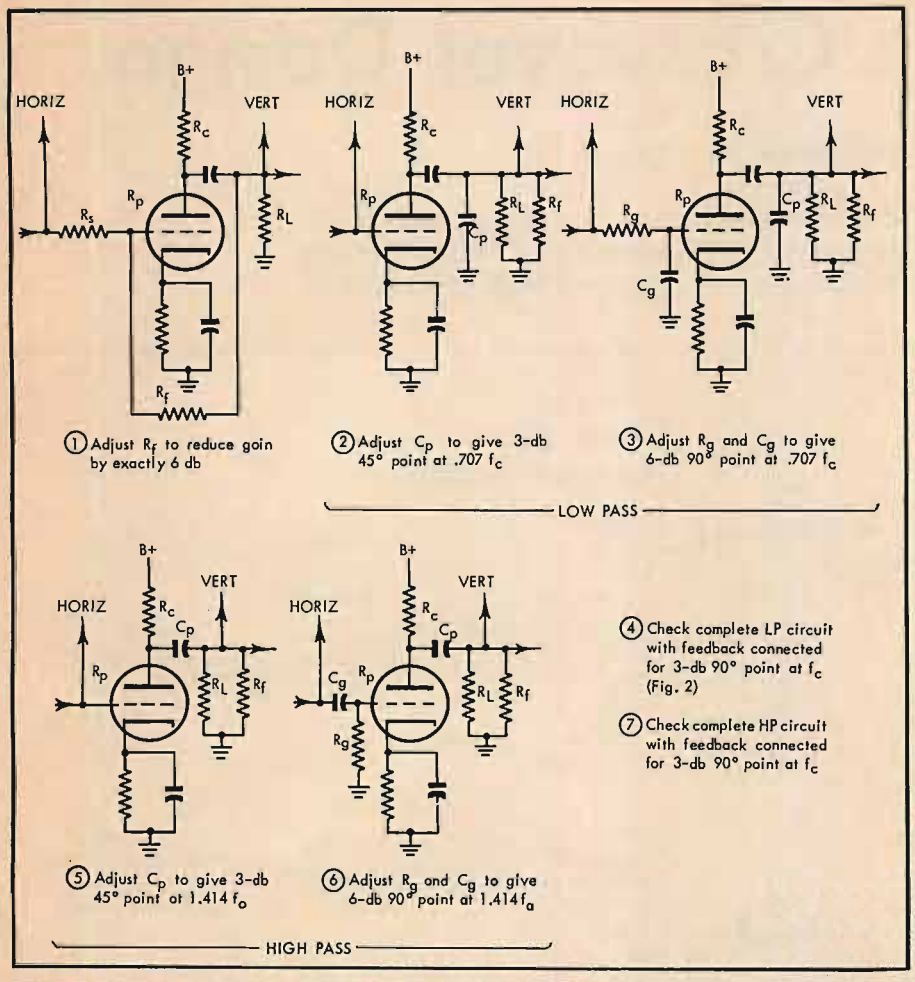


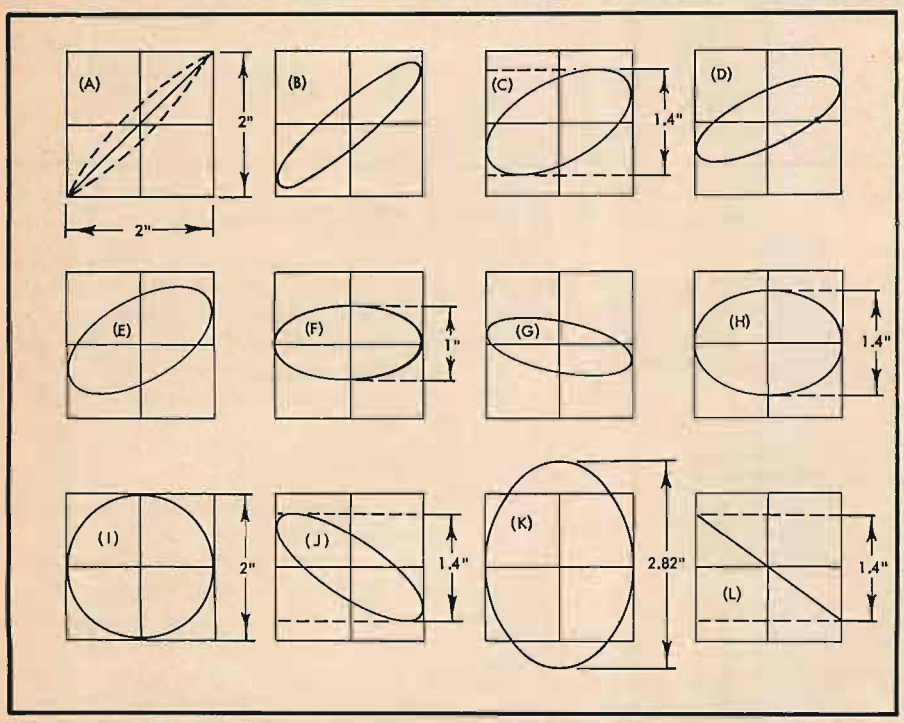
←Fig. 3. Sequence of adjustments for setting up correct response experimentally.

attenuation from pass band level is brought to 3 db, and the phase shift is the correct 90 deg.

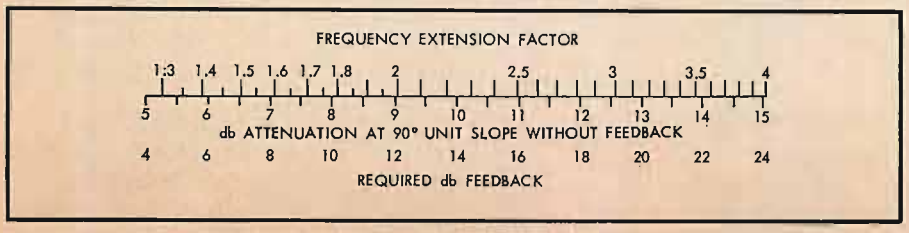
So the procedure is to calculate the response of both the grid- and plate-circuit rolloffs to give their 3-db, 45-deg. points at a frequency ratio of $\sqrt{2}$ before crossover, and then apply feedback so the loop includes both these rolloffs in the forward transmission path, to just 6 db. This is easy to calculate, because the attenuation of the feedback has to just equal the forward gain.

In calculating the rolloffs, be sure to include all effective resistance elements. For the low-pass type, where shunt capacitance bypasses the circuit conductance, the parallel value of all resistances must be used. In the grid circuit of a tube, this will be a series feed resistor, coming from a low-impedance point to which the feedback is connected. In the plate circuit the plate resistance of the tube must be taken in parallel with plate-coupling resistor, the output-load resistor, and the feedback resistor.

For the high-pass type, series coupling capacitance must be referred to the total resistance with which it is connected in series. In the grid circuit this will usually be the grid resistor, because the input side will be kept lower in value to avoid interference with the feedback. In the plate circuit, the plate resistance of the tube, in parallel with the plate-coupling resistor, must be added to the output-load resistor in parallel with the feedback resistor.



←Fig. 4. Scope patterns associated with practical alignment method, for filters of different sharpness. (A). Set horizontal and vertical trace at low or high frequency (within pass band) to standard measurement. (2). Dashed curve is permissible elliptical deviation from straight line. (B), (C), (D). Succession of ellipses passing through 3-db 45-deg. point of single section. (C) is precise point. (E), (F), (G). Succession of ellipses passing through 6-db 90-deg. point of two identical non-interacting sections without feedback. (F) is precise point. (H). Trace at crossover frequency of 12 db/octave type when correctly adjusted. (I). Trace of two-stage loop of 18 db/octave type, correctly adjusted, before extra stage is added. (J). Trace of complete 18 db/octave type, correctly adjusted at crossover. (K). Trace of two-stage loop of 24 db/octave type, correctly adjusted, before extra two stages are added. (L). Trace of complete 24 db/octave type, correctly adjusted at crossover.



←Fig. 5. Scale to assist in determining frequency shift and amount of feedback to use in conjunction with two sections that give other than 6 db attenuation at 90-deg. unit-slope point.

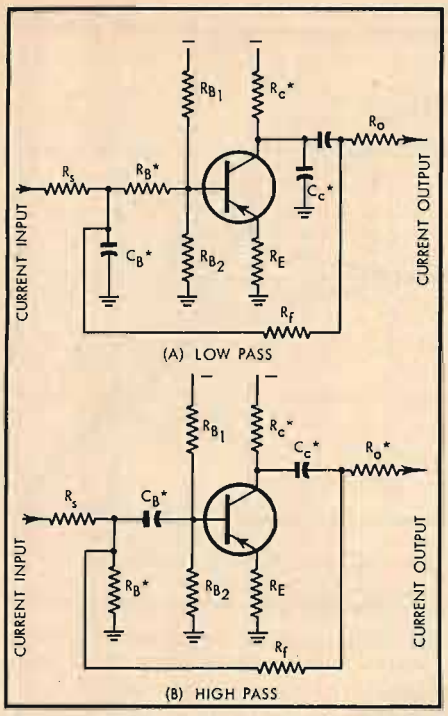


Fig. 6. Transistorized circuits for 12 db/octave filters. Components marked with (*) contribute to the frequency response determination.

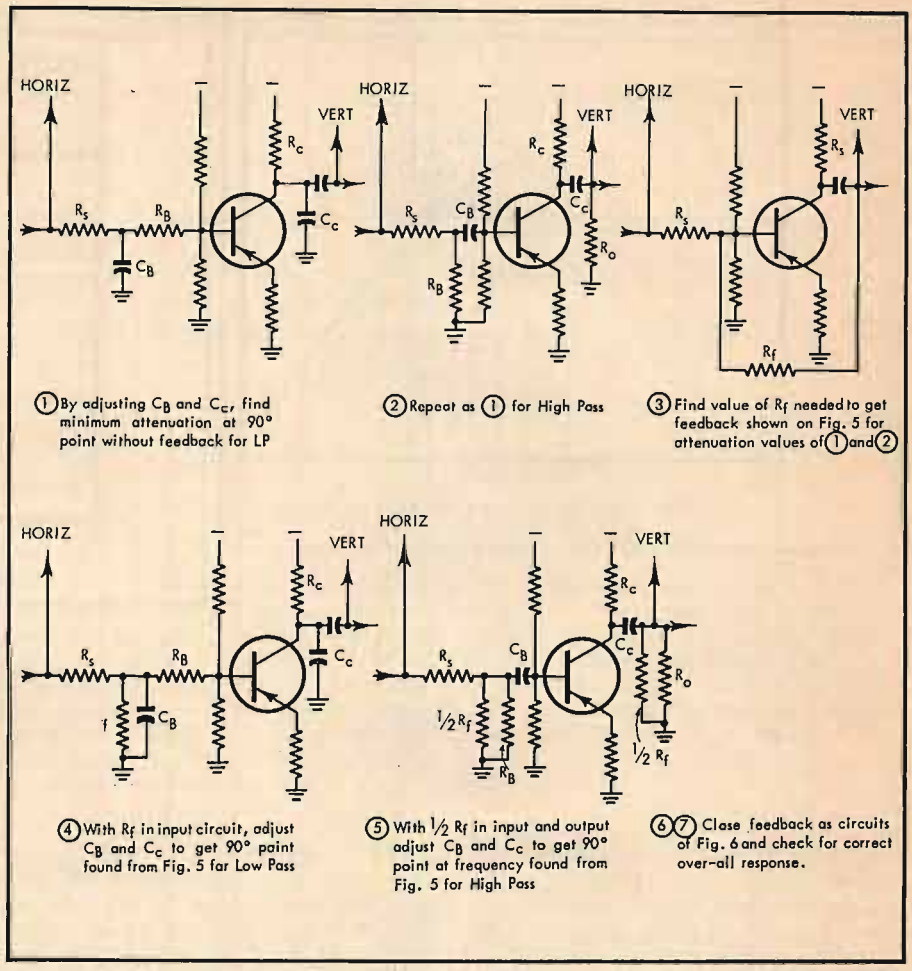


Fig. 9. Sequence of adjustments and measurements to set up a transistorized filter with correct response.

Figure 2 shows the low- and high-pass versions with relevant quantities for a tube circuit design.

To be sure you have the right response shape, the practical method is better. In fact for transistor circuits it is the only workable method, because there is inevitable interaction between input and output circuits that does not occur with tube circuits. But knowing the design basis makes the practical method very easy to use.

If you try to juggle all the circuit values, you have just too many parameters to see where you are going. So it is best to start without the feedback and adjust the rolloffs so addition of the feedback will push the response into the right place. With a tube circuit the plate circuit rolloff can be set first, using a low-resistance input to make the grid rolloff ineffective (*Fig.* 3). Then the input point can be moved back to adjust the grid-circuit values.

These adjustments can be made by looking at the transfer characteristic on the 'scope. Set the gain of the vertical and horizontal 'scope amplifiers so the trace at mid-band frequency (the middle of the band crossover is intended to *pass*) is a 45 deg. line, or narrow ellipse, measuring 2 in. wide by 2 in. high on the 'scope graticule. Now move frequency to the point $\sqrt{2}$ before crossover: if the crossover is 1000 cps, this will be 707 cps for the low-pass and 1414 cps for the high-pass.

When only one rolloff is being checked, the 3 db, 45-deg. ellipse is characterized by its height dropping from 2 to 1.4 in., while the width remains at 2 in. When you are checking two identical ones together, the 90-deg. ellipse is the one where it lies horizontal in its transition from sloping one way to the other (*Fig.* 4). You want to set the ellipse so the height of this horizontal one is exactly half its width. Without feedback, it will never be more than half the width, but it may be less.

You also need to get this 90 deg., 6-db point (which is what being half the height means) precisely at the $\sqrt{2}$-to-crossover frequency. Finally you add 6 db of feedback and the response moves into its correct form, characterized by the height of the horizontal ellipse being 1.4 in. high when it is 2 in. wide. Be sure to check the mid-band transfer pattern for 2 in. each way before you make each measurement.

You may fancy using a lot more than 6 db feedback in a tube stage, and in a transistor circuit, you will probably have no choice, because the interaction will prevent you from getting the 6-db, 90-deg. combination that is only possible with identical *non-interacting* sections.

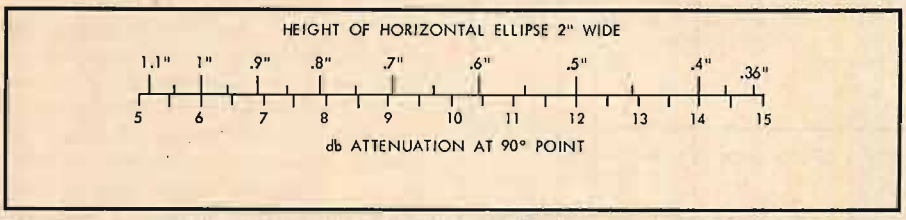


Fig. 7. Scale to help determine attenuation at 90-deg. point from the 'scope trace.

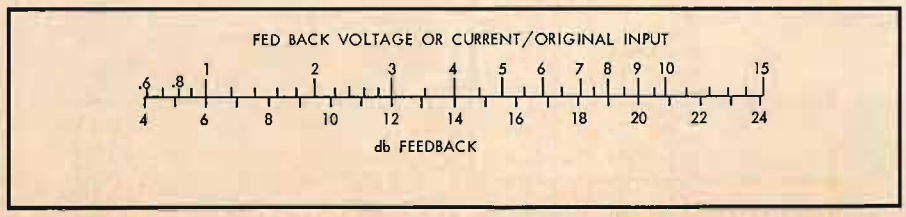


Fig. 8. Scale to aid in calculation of feedback resistor, by giving relation between internal input and fed back component.

low-resistance input to make the grid the point √2 before crossover: if the half its width. Without feedback, it will

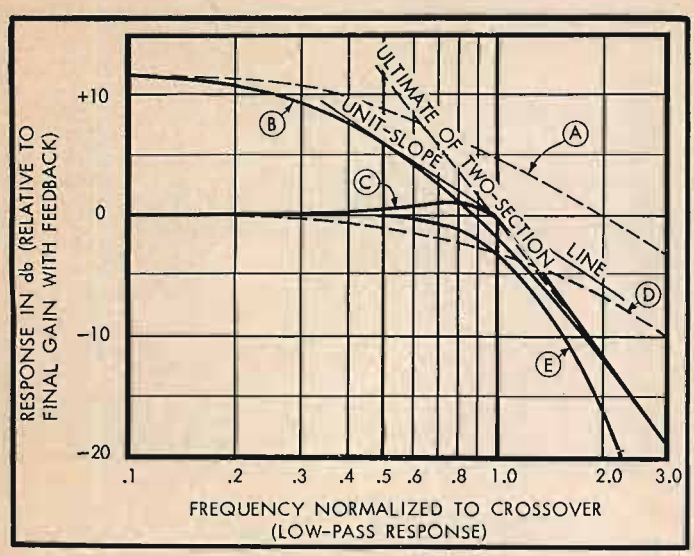


Fig. 11. Basic response relationships in the alternative method of constructing an 18 db/octave filter, using identical non-interacting sections in feedback loop. (A). Response of each section inside feedback loop. (B). Combined response of both sections without feedback. (C). Response of two-section part with feedback added. (D). Response of external section. (1). Over-all response, 18 db/octave.

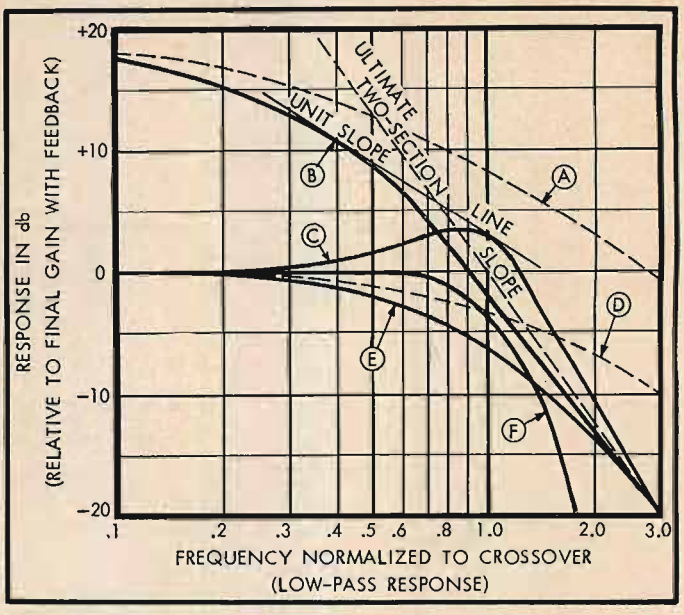


Fig. 14. Basic response relationships in the alternative construction of a 24 db/octave filter, using identical non-interacting sections inside feedback loop. (A). Response of each section inside feedback loop. (B). Response of both sections without feedback. (C). Response of two-sections with feedback added. (D). Response of each external section. (E). Combined response of both external sections. (F). Over-all response, 24 db/octave.

The ready-reference scale of *Fig.* 5 will help in this operation.

Either decide how much feedback you want to use, or find out (with the transistor circuit of *Fig.* 6) the minimum attenuation you can get at the 90-deg. point without feedback. From this, using the appropriate scale on *Fig.* 5, find the frequency shift the feedback will give you. This enables you to calculate the frequency to which the 90-deg. point must be adjusted without feedback. The db attenuation at the 90-deg. point can easily be figured from the height of the horizontal ellipse on the 'scope. Using a 2-in. reference size, the scale of *Fig.* 7 will give a quick reference for this.

Having adjusted the 90-deg. point to one of the frequency/attenuation combinations dictated by *Fig.* 5, all you have to do is to add the corresponding amount of feedback and your response should be right. To aid in calculating feedback values, Fig. 8 shows the relative feedback voltage or current, against the no-feedback input, for different amounts of feedback.

But in getting the feedback right, watch that the value of feedback resistor needed does not load the output circuit so as to change the equivalent response without feedback. This is most likely to prove a problem where the forward gain is not very high and an appreciable fraction of the output has to be fed back.

If, as may happen in transistor circuits, it is not economically possible to use feedback resistors high enough to avoid modifying the circuit resistance values, a modified approach may help. First find out, from the possible response without feedback, how much feedback you are going to need. Suppose this proves to be 8 db, next find the resistance value that will give you this much feedback in the pass band. Then get the response without feedback in the right place, by returning the feedback resistor you are going to use to ground instead of the input or output circuit and adjusting the rolloff values. Finally connect the feedback and you should have the right response. *Figure* 9 shows this sequence.

(*Continued on page 65*)

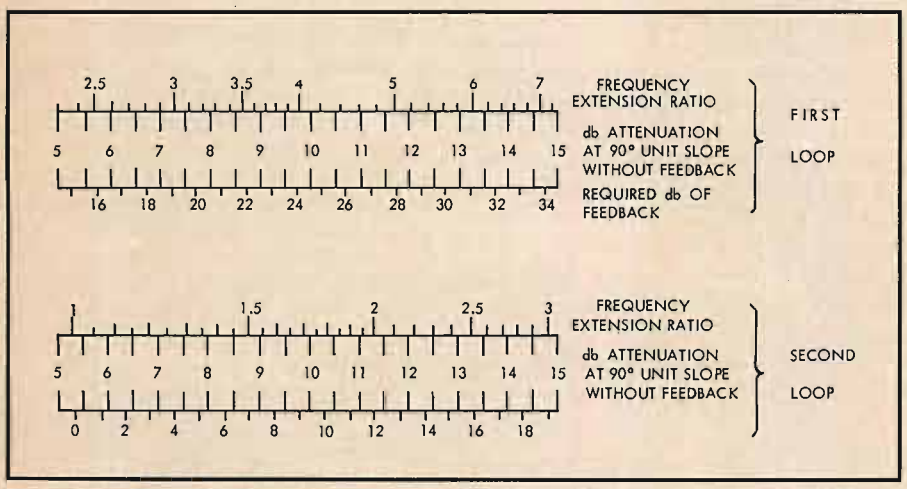


Fig. 12. Scales to aid in the design work of filters of the type represented in Fig. 16.

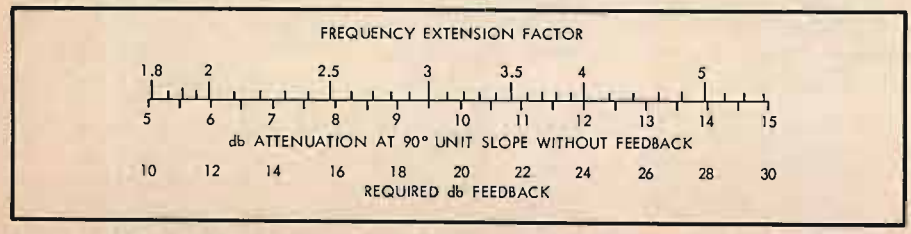


Fig. 13. Scale to assist in determining frequency shift and amount of feedback to use in conjunction with two sections that give other than 6 db attenuation at 90-deg. unit-slope point, for the feedback part of the 18 db/octave filter.

The Musical Scale as an Engineering Tool

D. E. JOHNSON*

While the musical scale is particularly familiar to musicians, it may not be so generally recognized that it is based on the logarithmic system in the same manner as are decibels.

THE USE OF LOGARITHMIC ratio units to express amplitude is common practice, but such units are seldom used for frequency. Perhaps the chief reason is the awkward size of the better known log frequency units. A chance relationship between the decibel and the musical scale makes consideration of the scale as an engineering tool well worthwhile.

Development of Logarithmic Frequency Units

As the art of telephony progress, the need for logarithmic amplitude measurement became evident. Several units were devised to meet the need. These units, such as the standard cable mile, the neper, and the decibel, were each carefully defined mathematically.

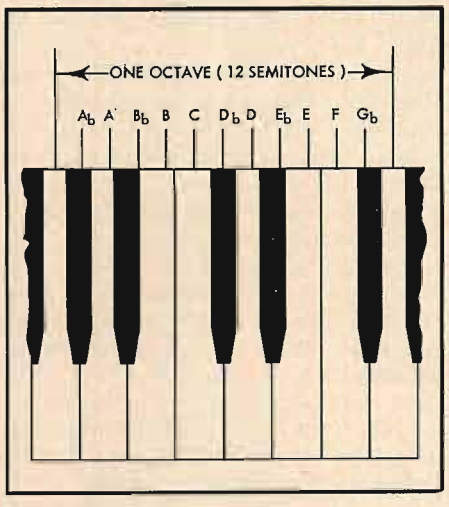


Fig. 1. One octave, as it appears on a keyboard instrument, consists of twelve semitones.

Exactly the opposite had taken place in the field of music centuries before. Logarithmic units of pitch were developed and used long before they could be defined. In fact, they were in use even before the relationship between pitch and frequency was discovered. The result was ambiguity and, quite often, error in the naming of the units.

Probably the oldest logarithmic frequency unit is the octave, which represents a ratio of 2 to 1. Ancient music was essentially melodic rather than harmonic. It consisted of tones sounded in succession rather than together. The ancients, however, did discover that any melody could be sung by two people at two different pitches, without discord. The required pitch relationship, which we now call an octave, became so well established that practically all of the many musical scales devised were subjected to an attempt to make them fit it. The octave was divided into five equal steps by the Javanese, into seven equal steps by the Siamese, into five unequal steps by the Japanese, into several scales of five unequal steps each by the Greeks, and into many other scales[1] by many other peoples.

Our modern scale stems from the Greek scales by way of medieval monasteries[2]. Certain of the Greek scales were modified and used by the early Christian Church. The tones were given the letters of the alphabet Γ (gamma), A, B, C,

(*Continued on page 58*)

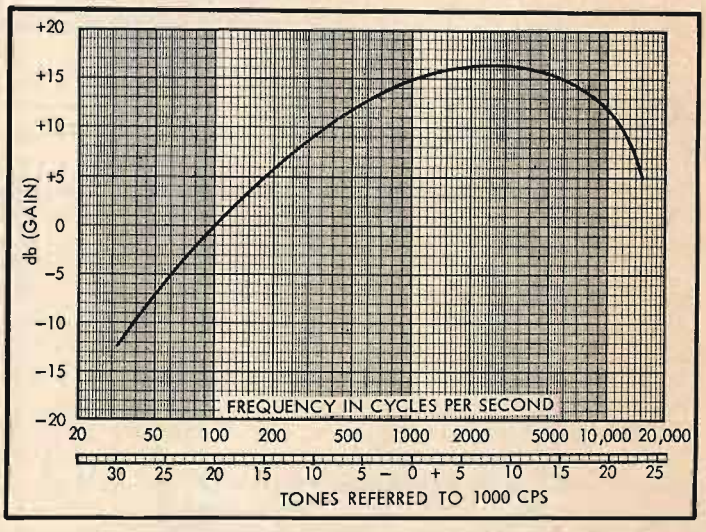


Fig. 2. Typical curve plotted on frequency scale, and related to a linear tone scale.

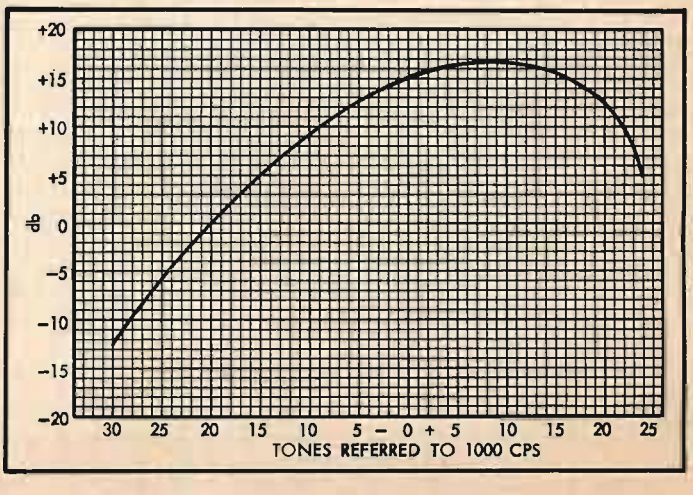


Fig. 3. Same curve as Fig. 2 plotted on linear tone and db scale.

[1] *International Cyclopedia of Music and Musicians*, New York: Dodd Mead and Company, 1952.

[2] Hannah Smith, *Music: How It Came To Be What It Is*. New York: Scribner, 1907.

* *Member of the Technical Staff, Western Electric Company, Winston-Salem, N.C.*

Graphical Solution to the Tracking Problem

This method of determining optimum offset angle, optimum overhang, or the minimum distortion point will appeal to those who do not have the patience or equipment to make the more conventional measurements normally employed.

W. B. BERNARD*

WITHIN THE LAST FEW YEARS there have been published a mathematical analysis[1] and a graphical analysis[2] of the stylus tracking problem. The mathematical analysis of the problem is excellent but if you do not have the equations available when you wish to set up the new turntable and arm you still have the problem. The graphical solution referred to will show the errors but will not indicate the optimum overhang or offset angle for a given situation.

By making a change in the graphical solution it is possible to find easily the optimum overhang of the stylus and the optimum offset angle. If we consider the record to be moving under the pickup arm the graphical analysis becomes much simpler and will yield the desired information needed for optimum adjustment of the arm. Let us start with a non-offset arm to simplify the analysis in the beginning. Referring to *Fig.* 1, the point *P* is the point about which the arm pivots, or in this case, the point about which the rest of the record playing assembly pivots underneath the arm. Point *S* represents the stylus which moves laterally in the direction of the line *SYZ* when subjected to the action of the undulations of the record groove. A circle of radius *SX*, of which the arc C_1 *X* is a part, represents all possible positions of the center of the turntable when the stylus is at the minimum playing radius and a circle of radius *SZ*, of which the arc *Z* C_2 is a part, represents all possible positions of the center of the turntable when the stylus is at the maximum playing radius on the record.

For a non-offset arm the optimum tracking is obtained when the stylus "underhangs" the center of the turntable. In the case illustrated in *Fig.* 1 the underhang is represented by the distance *CS*. The arc *C*, C_1, C_2 represents the path of the center of the turntable as it moves under the pickup arm with the underhang *CS*. This arc crosses the arc representing the minimum playing radius at C_1 and crosses the arc representing the maximum playing radius at C_2. The line C_1S represents a radial from the center of the turntable to the stylus and therefore is the direction in which the stylus should be moved by the record when the stylus is at that radius. Since the line *SZ* represents the direction in which the stylus is free to move, the angle C_1SX represents the tracking error at the minimum playing radius. Similarly the angle C_2SZ represents the tracking error when the stylus is at the maximum playing radius. For any other playing radius the error can be found by measuring the angle from the line *SZ* to a line connecting point *S* with the intersection of an arc at the radius under consideration and the arc *C*, C_1, C_2. Thus we see that at a playing radius equal to *SY* there is no tracking error.

By using an offset in the end of the pickup arm it is possible to have a zero tracking error at two radii and to greatly reduce the error at other radii in comparison to errors obtainable with a non-offset arm. *Figure* 2 is a graphical plot of the determination of errors for an arm with an offset angle of ϕ and an overhang of *SC*. In this case, line *SZ* represents the direction in which the stylus is free to move and the arc *C* C_1 C_2 C_3 represents the path of the center of the turntable under the overhang of *SC*. The arc *W* C_1 represents the smallest playing radius and the arc *Z* C_3 represents the maximum playing radius. The lines from *S* to the intersection of the arc *C* C_1 C_2 C_3 with the radius under consideration represents the proper line of motion for the stylus when it is at these points. As in *Fig.* 1 the tracking error at a given radius is the angle between line SZ and the line representing the correct direction of motion for the stylus. Thus the error at the minimum radius is the angle C_1SZ which we have labeled $\theta 1$, and the error at the maximum radius is C_3SZ which is labeled $\theta 3$. There is a maximum error of the other sign at a

(*Continued on page 76*)

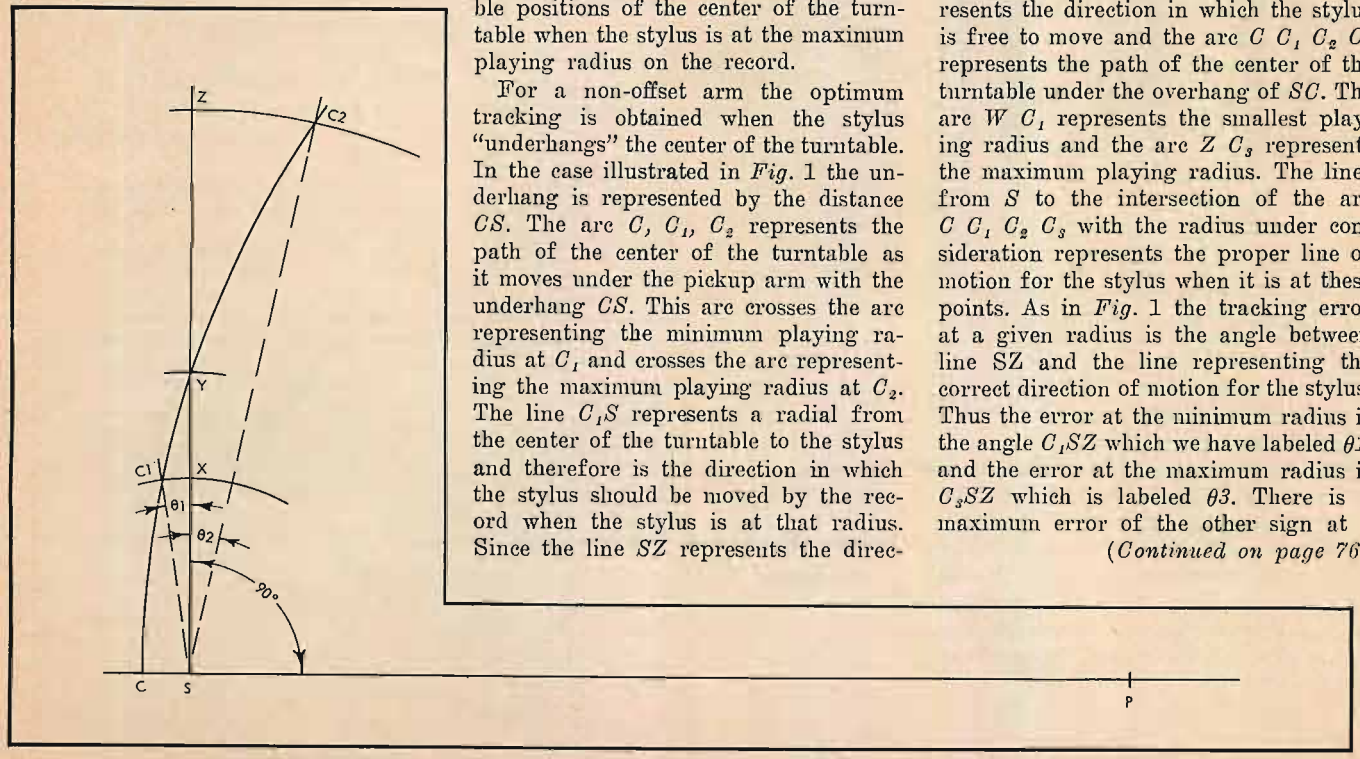


Fig. 1. Graphical diagram as described by the author as it appears for a straight arm.

3151 South Glebe Road, Arlington 2, Va.

[1] Dr. John D. Seagrave, "Minimizing pickup tracking error." *Audiocraft*, December, 1956.

[2] F. J. Hennessy, "Tracking errors in record production." *Wireless World*, November, 1958.

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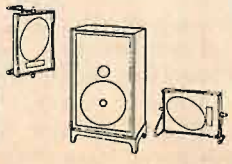

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Write for Free Illustrated Brochure "KU"

I Married a Hi-Fi Addict

by

ALICE BROOKS*

Relatively few wives are as good-natured about their husband's hobby as this one who authored this typical saga of the gradual creation of the family's first home system.

THE OTHER DAY, having run out of *Good Housekeepings* and *Ladies Home Journals,* I picked up my husband's copy of AUDIO and idly began to look at the pictures, for being a mere woman I generally find the text a bit difficult to understand.

This time it was different—I found a very amusing article by J. Gordon Holt entitled "What is High Fidelity?" which was right up my alley. The very preface of the article marked it as mine:

"All hitherto published explanations of high fidelity have been written for the specific purpose of confusing the novice hi-fi enthusiast and frightening away the would-be hi-fi enthusiast. Here at last is the hi-fi primer to end all hi-fi primers, written in the simplest of terms and sugar-coated for the person who likes to daydream while reading."

My only wish is that I could have read it several years ago.

To most women, and to a great many men too if they'll admit it, the term "hi-fi" is just another name for a radio-phonograph. They realize that they'd like to own one because it is better than the set they bought ten years ago, but they don't know why it is better. Those who have recently acquired a high-fidelity component rig enjoy the fuller, richer tone of the music, the greater range and the sense of being present in the same room as the orchestra or artist. But, again, most of these don't know why they enjoy it more and—let's face it—don't particularly care.

I didn't particularly care either until my husband was bitten by the hi-fi bug five years ago.

Winter in the Yukon

At the time we were living at Whitehorse in the Yukon Territory where there is no television and recreation is somewhat limited during the long winter months. Most of the inhabitants develop an interest or hobby of some sort which is apt to be more active than it would be "outside."

My husband and I have always been somewhat longhair in our choice of music and gravitated towards those of similar taste at Whitehorse. One of our new friends, as a hobby, had built his own hi-fi set from components and some of these were built from kits in a kind of prefabricated manner. My husband, although limited in radio or electrical experience, became intensely interested.

At the time, however, we weren't in a financial position to go right out and buy all the components for a music system and so we started accumulating the parts (pardon me, components) one at a time.

Mr. Holt in his article described components in this way:

"A high-fidelity system may be visualized as a chain with a phonograph pickup at one end and a listener at the other end, with sausage-like links, called components, in the middle."

Our first component was a large speaker, which I later discovered had cost quite a lot of money. If I had known then how much it cost, it would probably have been our last component.

However, there we were with a speaker —a thing of dubious beauty and not much joy all by itself.

About six months after we acquired the speaker, we were transferred from Whitehorse to Trenton in eastern Ontario and, on the way through the States, we stopped at a factory which makes radio and hi-fi kits and picked up two containing the parts for an amplifier and something called a preamplifier. The need for both has been explained to me many times, but I guess I just don't have the right kind of mind. I do realize, however, that they must both be necessary or they wouldn't be there—and there they are.

It was some time before we got settled into a permanent home in Trenton and the kits were finally assembled. This, by the way, was about a year after we got the speaker, or first component.

By this time, I was beginning to realize that this was all costing money, and probably quite a bit, but we now had such an investment in our three components that it seemed easier to go along with the whole thing than to bring it to an unpleasant head.

In my silly female way I asumed that we were nearing the end. Ha!

The next item for the set was another speaker. It seems that the big one, a combination middle-range speaker and woofer, captures the middle range and brings out the bass response just dandy, but a small speaker, called a tweeter (no less important because of its size and, I was assured, much lower cost), is necessary to capture those high, high notes. I think I could have done without the tweeter and the high, high notes, for as Mr. Holt says:

"Woofers are preferred by people who do not like treble tones, such as women."

How true.

Now, just in case you've not been following too closely and have gotten lost among the components, we now possessed two speakers, a preamplifier and an amplifier and it had only taken a year and I don't know how much money. (I've never inquired too closely into the cost of the set—I really prefer not to know.)

Looking back the sequence of events gets a bit hazy, but I think the next items we bought, on a trip to Syracuse, N.Y., were a turntable and an AM tuner. I know we got the tuner in Syracuse because it worked beautifully in a large city with several broadcasting stations, but didn't in Trenton, a small city with only one. The trouble was that it brought in too many distant stations and they all ran together—something to do with "sensitivity" or "selectivity"—well, anyway, it didn't work worth a darn. We live in Winnipeg now where there are six local stations and it operates quite efficiently.

The AM Tuner—What it Does

Oh, by the way, I discovered that an AM tuner is the same thing as a plain, ordinary radio, without an amplifier and speaker. You wire it into the music system when, as and if it is ever finished, and out comes music and people talking.

The turntable was nice, but it didn't have a pickup arm.

Back to Mr. Holt:

"The pickup picks up the bends in a

(*Continued on page 60*)

* *34 Bourkewood Place, Winnipeg 12, Manitoba.*

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"Circuit Sentry" Protects Tubes in P.A. Amplifier

Simple protector circuit added to conventional amplifier prevents damage to output tubes in case of shorts on the loudspeaker line.

J. LEVITSKY*

IN MOST COMMERCIAL and industrial public address systems utilizing fairly high power amplifiers, break-down of the amplifier output tubes often results from a short or a severe overload of the speaker line. In many such systems, the amplifier feeds power via the 70-volt line to numerous speakers distributed over wide areas, each speaker being provided with its own separate matching transformer. Under such conditions, due to the long runs of line and a large number of components connected across it, partial or complete shorts may occur rather frequently.

* *Chief Engineer, Fanon Electronic Industries, Inc., 439 Frelinghuysen Ave., Newark 12, N. J.*

The severity of the problem can be seen by a glance at the data in Table I.

TABLE I

Power Output watts	Input Signal volts	Normal Plate Dissipation, watts	Shorted-Output Dissipation, watts
5	.08	19.8	57.2
10	.13	21.8	73.7
20	.19	23.0	81.5
30	.24	25.0	81.8
40	.29	28.3	82.1
50	.31	30.2	84.8
60	.34	27.3	83.5
70	.38	24.5	82.2

This data was taken with the Fanon 70-watt amplifier (model 3370), employing two EL-34 power output tubes, operating in class AB_1. Columns 1 and 2 show the audio power output for different levels of input under normal trouble-free conditions. Column 3 shows the corresponding power dissipations per tube under the same conditions. Column 4 shows the tube dissipations for the same levels of input signals, with the 70-volt line shorted to ground. Since the average audio power output of a P.A. amplifier may be somewhere between 25 and 30 per cent of its peak output, when signal is being applied, the data in column 4 indicate that if a short occurs in the speaker line, each tube is dissipating roughly three times its maximum rated power. Even if a high-resistance short takes place, say about 25 per cent of the rated load, the dissipation in each tube is much higher than the maximum allowable, as shown in *Fig.* 4.

The reason for this very high dissipation in a class B or AB type amplifier under conditions of a speaker-line short are two-fold. One reason is that with the speaker line shorted, the plate-to-plate impedance of the output transformer primary is very low, and therefore the signal plate voltage variation is quite small. The plate dissipation is therefore much higher than normal, since under normal conditions the plate voltage varies over a wide range.

The second reason is that most amplifiers employ negative feedback in order to improve stability, minimize distortion, and so on. With the speaker line

(*Continued on page 74*)

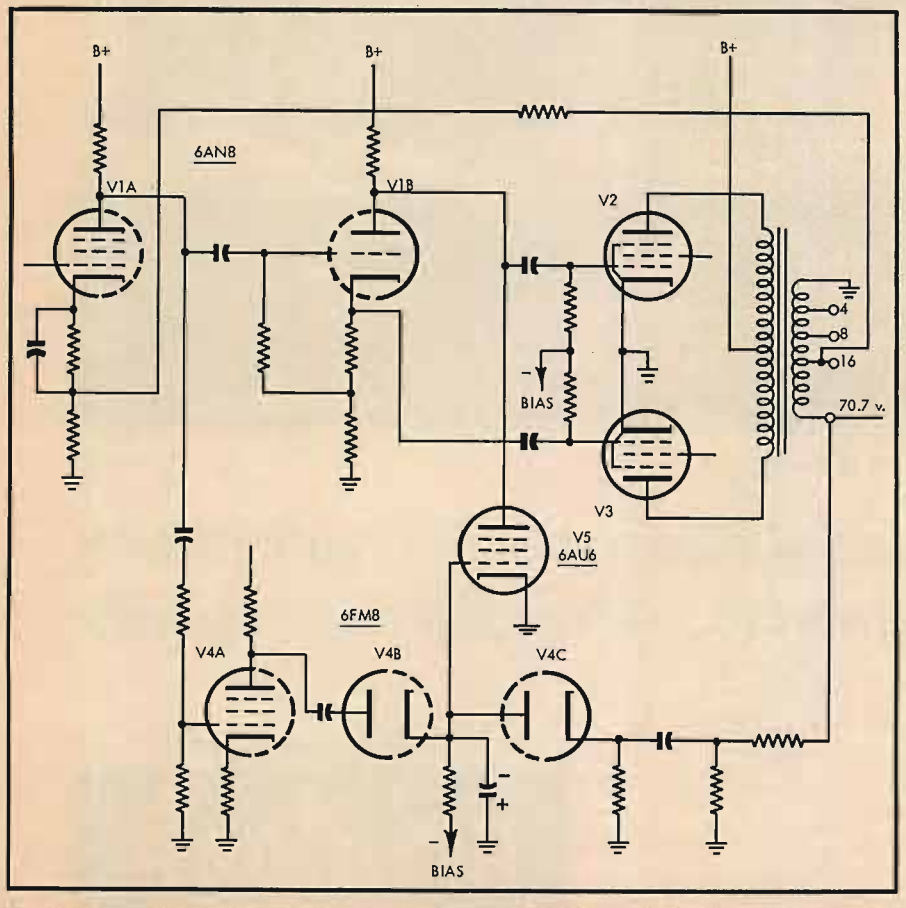
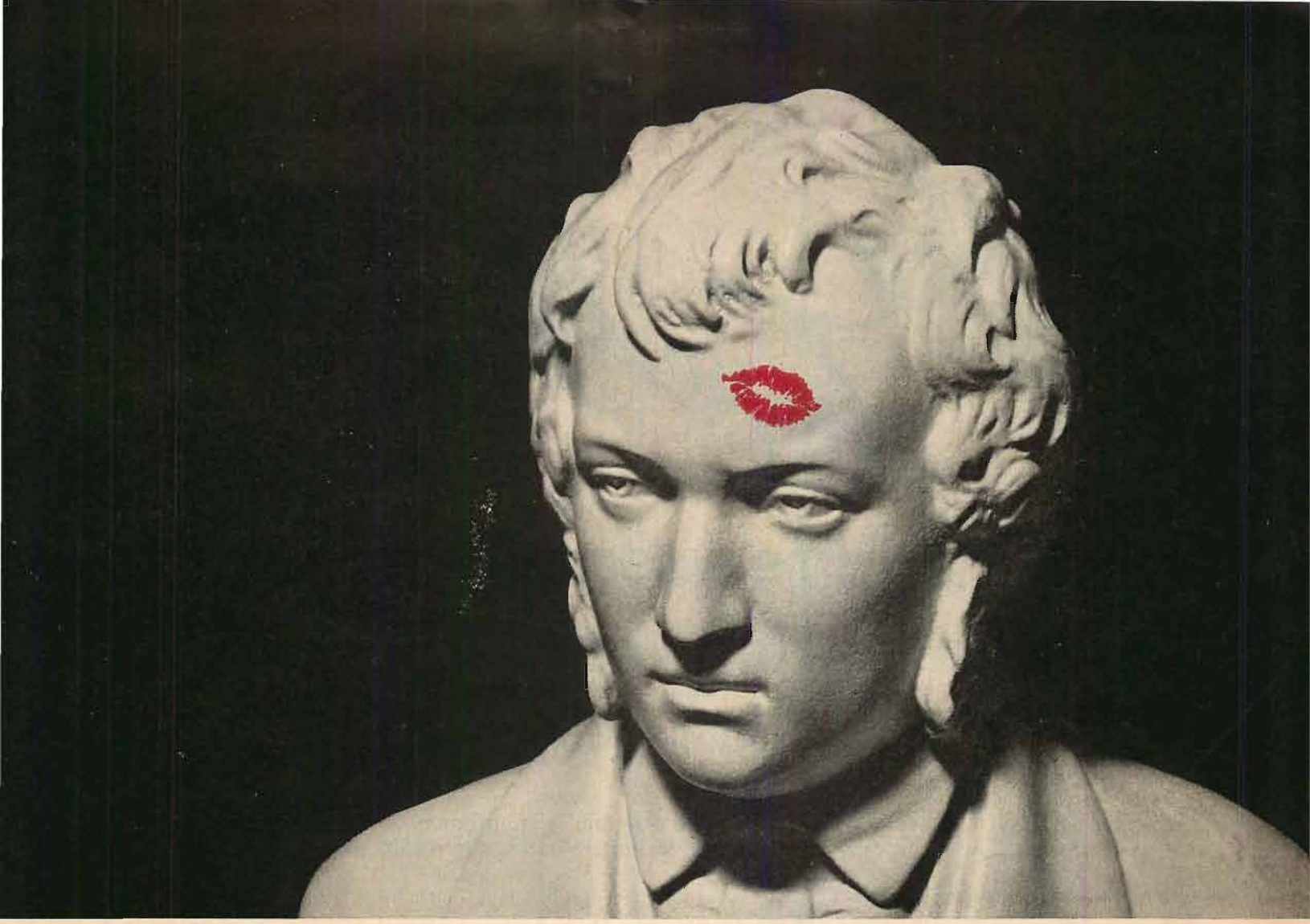


Fig. 1. Schematic of final stages of typical P.A. amplifier to which the "Circuit Sentry" has been added (enclosed in dotted lines) to remove signal in case speaker line becomes shorted.



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Waldteufel . . .	Espana Waltz (Hot Diggity)
Chopin	Polonaise No. 6, in Ab Major (Till the End of Time)
Tchaikovsky . . .	Symphony No. 6 in B (The Story of a Starry Night)
Rachmaninoff . .	Piano Concerto No. 2 in C Minor (Full Moon and Empty Arms)
Chopin	Fantasie Impromptu in C# Minor (I'm Always Chasing Rainbows)
Tchaikovsky . . .	Romeo and Juliet Overture (Our Love)

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Checking Frequency Response, Equalization, and Azimuth

HERMAN BURSTEIN*

Checking the performance of a tape machine to maintain it in optimum condition requires making a series of tests. The methods of making them and of evaluating the results are all described here.

WHEN SOUND REPRODUCTION is faulty, various checks of the tape machine's performance are obviously needed. More than this, the meticulous audiofan may wish to keep a step ahead of impaired performance by having his tape machine checked periodically, however well it may be working at the time. Accordingly, it is the purpose of this article and the following one to discuss basic tests of tape recorder performance. The present article deals with the inter-related factors of frequency response, equalization, and azimuth. The next article will deal with checks of other aspects of performance, including bias current, distortion, signal-to-noise ratio, record-level indication, wow and flutter, tape speed, erasure, and head height.

In these days when very good audio test equipment, such as vacuum tube voltmeters, oscillators, oscilloscopes, distortion analyzers, and the like, can be had in kit form at modest prices, it is not unusual to find the audiofan possessing some of these instruments or able to borrow them from friends. Therefore this article is aimed in part at the audiofan in a position to make instrument checks of his tape machine.

But this is not meant to suggest that the serious audiofan should go out and purchase or otherwise obtain access to test equipment if he has not already done so. In most instances the owner of a tape machine will rightfully turn to a qualified technician for a check of performance. Nevertheless, a comprehension of testing procedures may stand him in good stead, and therefore this article is aimed equally at the latter type of owner. If he knows what should be checked and how to check it, there is a better chance of his wants or needs being met by the technician, at least in part because the two speak the same language. The knowledgeable audiofan is in a position to ask the right questions and to profit by the answers.

The testing techniques to be discussed are basic procedures that apply to the majority of tape recorders in home use. It should be noted, however, that because of variations in the design of various brands and models of tape machines, the *specific* procedures may be somewhat different for certain tests. Hence the audiofan who plans to probe the operation of his machine is well advised to obtain a service manual from the manufacturer.

* *280 Twin Lane E., Wantagh, N.Y.*

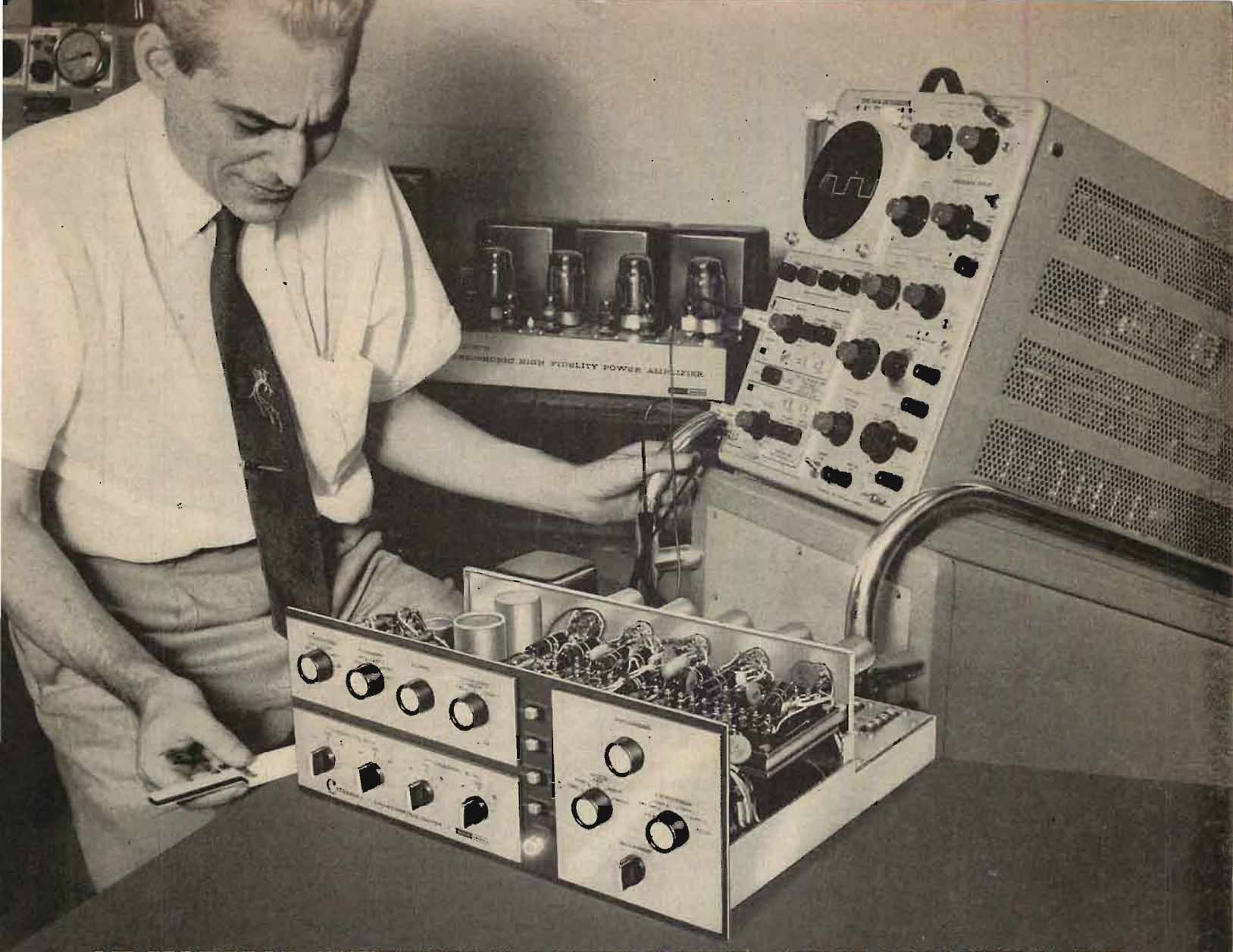
Frequency Response

The effects of azimuth alignment, bias current, dirty heads, tape-to-head contact, and other factors upon frequency response have been discussed in earlier articles. It is presumed that all these have been attended to before checking frequency response, or else that they will be attended to as the result of checking frequency response.

In checking frequency response we may be concerned with (1) over-all response, namely the result of recording and playing back audio signals; (2) playback response only; (3) with both over-all response and playback response. If a tape machine is used only for playback of recorded tapes, over-all response is obviously not a consideration. On the other hand, although a machine is used for recording as well as playback, one will still be interested in playback response in itself if he plans to play recorded tapes. It is quite possible for a tape machine to have relatively flat record-playback response, yet fall quite wide of the mark in playing recorded tapes.

The best course in checking playback response is to use a test tape. It is not sufficient to check playback equalization, namely the frequency response of the playback amplifier, to ascertain whether this equalization conforms to a standard curve. By playing a test tape one takes into account not only the playback equalization but also the characteristics of the playback head, which tend to produce treble losses, and other factors that may affect frequency response, such as the cable from the head to the playback amplifier.

Using a test tape, it is quite difficult and generally unsatisfactory to check



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In AUDIO MAGAZINE, editor C. G. McProud, wrote: *"When we heard the Citations, our immediate reaction was that one listened* through *the amplifier system clear back to the original performance, and that the finer nuances of tone shading stood out clearly and distinctly for the first time."*

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."*

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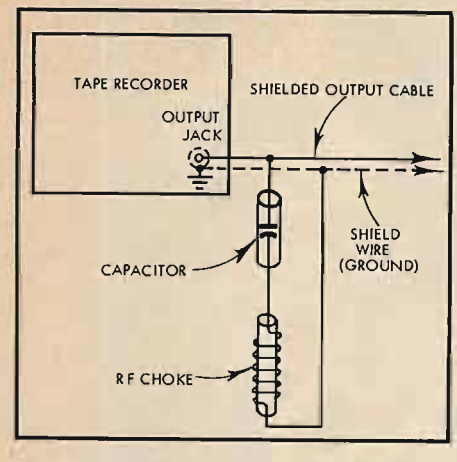

Fig. 5. Method of connecting a bias trap across output.

cause after various frequencies are recorded, the tape must be rewound and then played back. Accordingly, it may be desired to check a minimum number of frequencies spanning the audio range. However, these frequencies should be no more than about an octave apart. The following ten frequencies would provide a fairly satisfactory measure of response: 30, 50, 100, 200, 500, 1000, 2000, 5000, 10,000, and 15,000 cps.

A more thorough check of frequency response, one that is more likely to uncover significant peaks or dips, might use the following frequencies: 30, 50, 70, 100, 200, 300, 500, 700, 1000, 2000, 3000, 5000, 6000, 7000, 8000, 9000, 10,000, 12,000, and 15,000 cps. Note the emphasis on the 5000 to 10,000 cps region. In the attempt to achieve response out to 15,000 cps, some machines peak excessively in the region of 5000 to 10,000 cps. This is illustrated in *Fig.* 4. Curve A shows over-all response that is only 3 db down at 15,000 cps but at the cost of a 5 db peak at 8000 cps. Curve B is smoother, having a peak of only 2 db at 8000 cps, although response is therefore down 6 db at 15,000 cps. By and large, Curve B provides more accurate reproduction and better listening.

It is vital that the test frequencies be recorded at a level at least 20 db below the maximum permissible recording level as indicated by the record-level indicator. The procedure would be to feed in a tone, say 1000 cps, that causes the indicator to read maximum—the eye to close in the case of an electronic indicator, or the pointer to read 0 VU or slightly higher in the case of a VU meter. Then the signal of the audio oscillator would be reduced 20 db (or more) as measured by a VTVM connected directly to the oscillator. This signal reduction is imperative to avoid overloading the tape at high frequencies due to the large amount of treble boost incorporated in the record amplifier. (In the case of program material, the highs are usually much lower in level than the mid-frequencies, so that tape overload is thereby avoided.)

When checking frequency response of a tape machine with separate record and playback heads, there is no problem in keeping track of the frequency being tested. But there is a problem of frequency identification when checking a machine that uses a record-playback head, because all the frequencies must be recorded, the tape rewound, and then played back. One method of frequency identification is to intersperse voiced announcements with a microphone, and to monitor the tape playback with a speaker. However, this is laborious. Another technique is to "mark" several key frequencies, say 100, 1000, and 10,000 cps. This can be done by turning the oscillator on and off several times when each of the key frequencies are recorded, causing the VTVM pointer to fluctuate in playback as an indication that a key point has been reached in the schedule of recorded frequencies. Monitoring the tape with an oscilloscope can serve in identifying the test frequencies.

While testing frequency response is on the whole much easier in the case of a machine with separate record and playback heads, because one can record and play back simultaneously, there tends to be one drawback. This concerns pickup of bias current at the output jack of the tape machine. Hence the VTVM may be reading not only audio signal but also bias signal, preventing an accurate measurement of frequency response. Bias current, which typically lies between 50,000 and 100,000 cps, has radio frequency characteristics and therefore is apt to appear at various places, including the output jack. This tends to be especially true in compact home machines, where the record and playback amplifiers are very close together and it is difficult to shield adequately against radiation of the bias frequency. The fact that it is necessary to check frequency response at a level at least 20 db below maximum permissible recording level aggravates the problem.

To prevent bias current reaching the VTVM in significant quantity, one can connect a simple, inexpensive bias trap across the output jack, as illustrated in *Fig.* 5. This consists of an r.f. choke and a capacitor in series between the high side of the output jack and ground. If the resonant frequency of these two components corresponds to the bias frequency, the latter will be shorted out to ground. A garden variety 2.5 millihenry choke and a capacitor in the range of 1000 to 4000 μμf (micromicrofarads) will cover the range of 50,000 to 100,000 cps, wherein the bias frequency probably lies. Given the bias frequency (as stated by the manufacturer of the tape machine), one can calculate the required capacitor from the formula $C = 1/\pi^2 f^2 L$, with C representing the capacitor in farads, f the frequency in cps, and L the the inductance in henries of the choke. This formula can be stated in more convenient terms as approximately $C = 25{,}000/f^2 L$ with C in μμf, f in kilocycles (thousands of cycles), and L in millihenries.

If the calculated capacitance calls for a non-standard value of capacitor, one may try using several capacitors of the nearest standard value; due to their tolerance, one or the other may fall sufficiently wide of nominal value to achieve maximum attenuation of the bias current. In most tape machines it is possible to change the bias frequency by adjusting the slug in the oscillator transformer. One could adjust the oscillator frequency to coincide with the resonant frequency of the bias trap, but this is unwise. Changes in bias frequency can change the amount of bias current going through the record head and thereby alter the distortion and frequency response of the tape recorder. Also, changes in bias frequency (upward) tend to decrease the

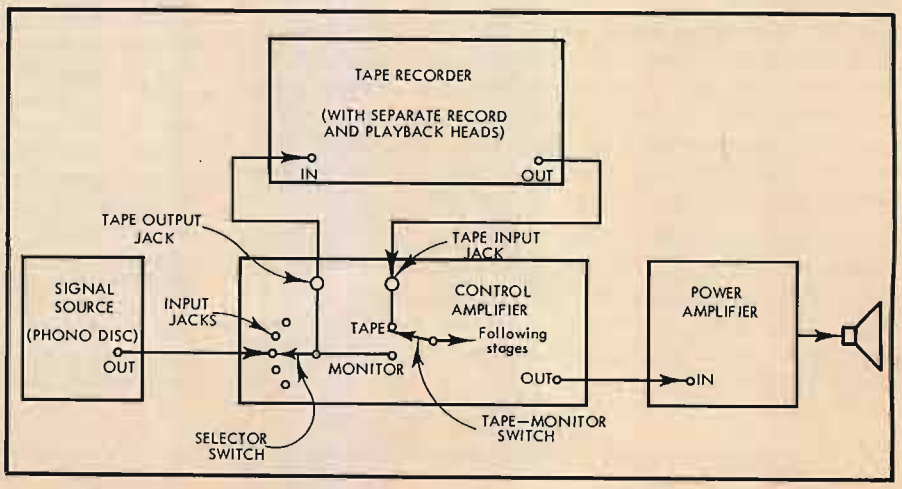

Fig. 6. Set-up for checking record-playback response by comparing playback signal with original source.

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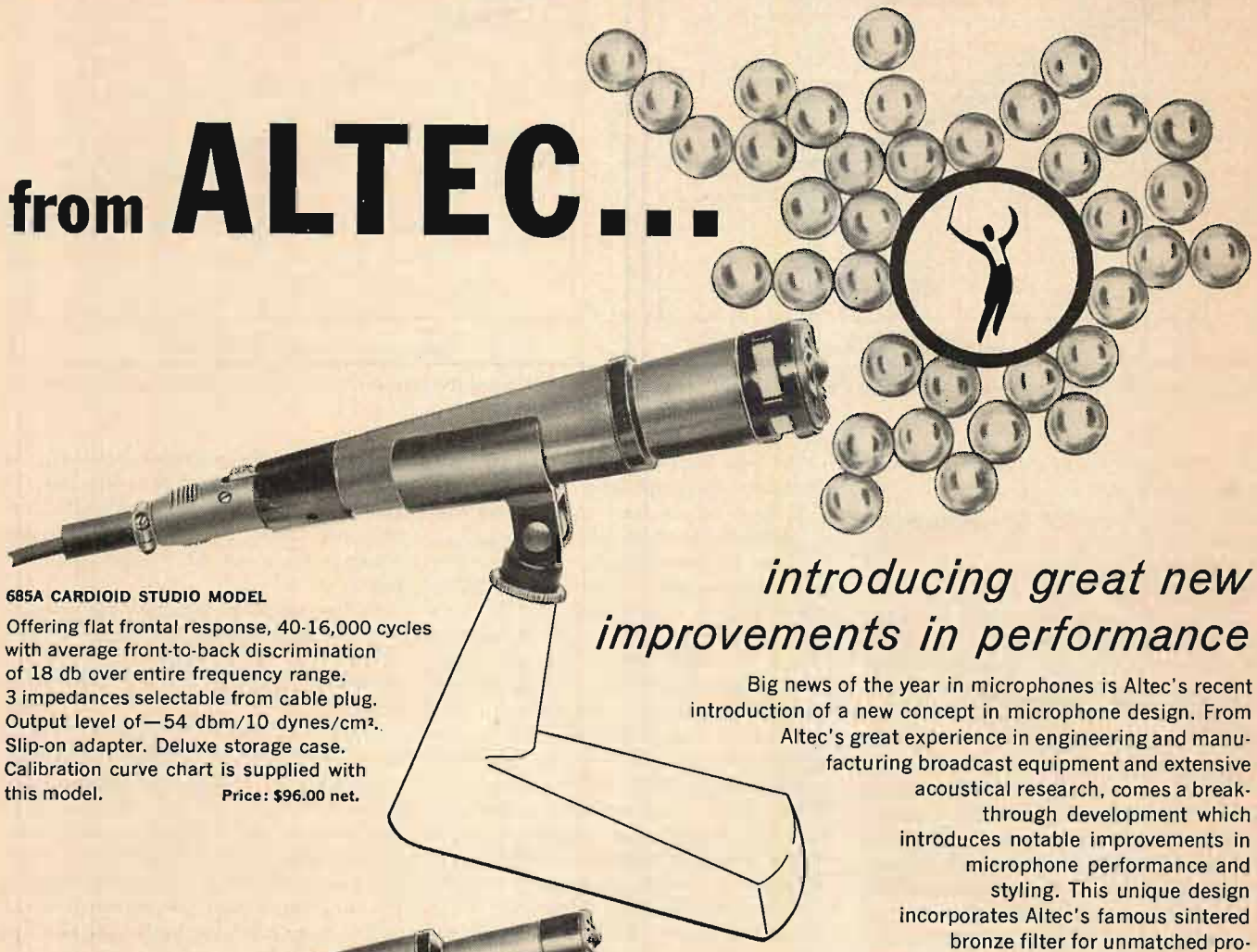

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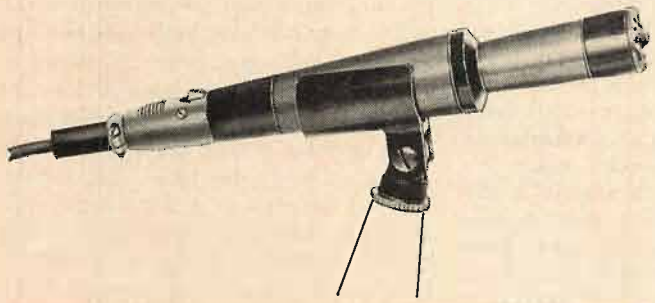

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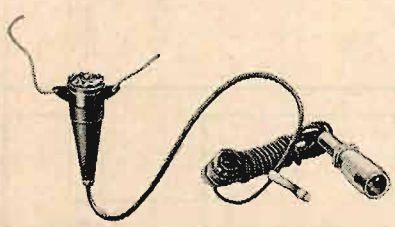

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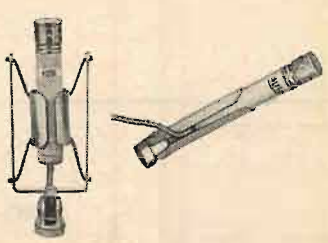

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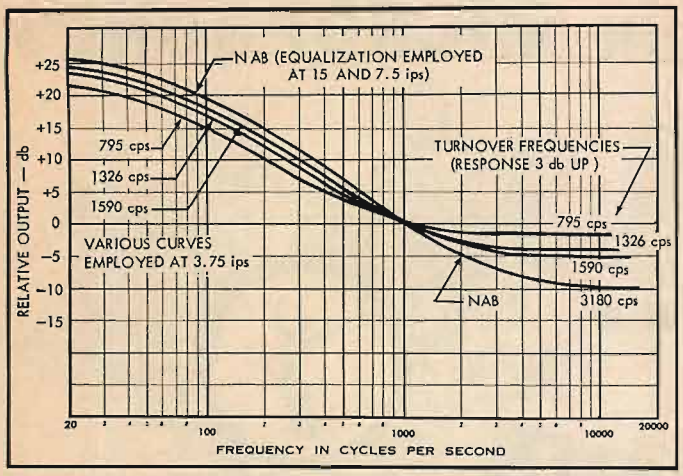


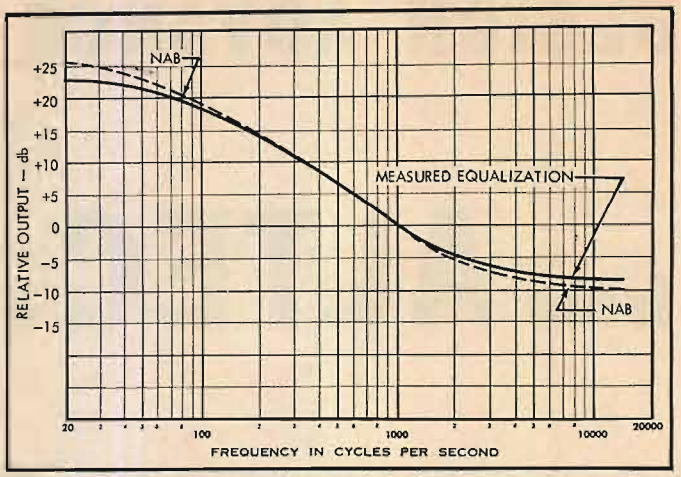


Fig. 7. (left) Playback equalization curves. Fig. 8. (right) Typical measured playback equalization into a tape machine claiming adherence to the NAB curve.

effectiveness of the erase head. One will probably find that even though the resonant frequency of the bias trap is not exactly the same as the bias frequency, nevertheless sufficient attenuation will take place to prove satisfactory.

In the absence of test equipment, one can nevertheless make a fairly good evaluation of a tape machine's over-all frequency response by recording the music from a phonograph disc of good quality and wide range, and then comparing the tape playback with the disc. If the tape machine has separate record and playback heads, one can immediately compare the incoming signal (from the record) with the playback signal, provided that the control amplifier of the audio system has a tape-monitor switch, as illustrated in *Fig.* 6. Otherwise, and in the case of a machine having a record-playback head, it is necessary to record the tape, rewind it, and compare the tape playback with a replay of the disc.

With a little experience, one can learn to synchronize the two. Play a few measures of the recorded tape and stop the machine at an easily recognized point in the music. Start the record, and when it reaches the same point in the music, start the tape machine again. Switch between the tape machine and the phono disc by means of the selector switch in the audio system. If the record and the tape are not fully synchronized, either slow down the record by pressing a finger against the edge or slow down the tape by briefly turning the transport motor off and then on.

Equalization

As brought out in earlier articles, the tape recorder employs large amounts of equalization to compensate for bass and treble losses that occur in the record-playback process. If a test of tape recorder performance reveals that frequency response is deficient in playback or over-all, then one of the things we wish to check in order to learn the cause is the equalization in the record and playback tape amplifiers.

A check of playback equalization can enable us to ascertain fairly well whether the tape machine meets a standard playback characteristic, such as the NAB curve. *Figure* 7 shows the NAB playback curve, commonly used at 15 and 7.5 ips, as well as three curves that have been or are being used at 3.75 ips. If the measured equalization shows insufficient cut (referred to 1000 cps) in the upper treble range, there may be a very good reason, namely that the remaining treble cut is produced by the playback head and possibly other circuit elements. If the measured equalization shows insufficient bass boost, again there may be good reason. For one thing, the NAB standard permits response to be 4 db down at 50 cps. For another, the playback head may behave in a manner that causes some bass boost; a small head tends to behave in the same manner as its gap at very low frequencies, where the head as a whole is small relative to the wavelength recorded on the tape. *Figure* 8 shows the measured equalization that one might typically find in a machine of good quality, operating at 7.5 ips. There is somewhat less bass boost than called for by the NAB curve, and there is somewhat less treble cut (referred to 1000 cps) to compensate for high frequency losses due to the playback head. On the other hand, note that between 100 and 10,000 cps the measured equalization corresponds to the NAB curve, which presumes the use of an "ideal" playback head.

If the measured playback equalization comes within ±2 db of the NAB curve or other given curve between 100 and 10,000 cps, this may be considered excellent; within ±3 db is good. At 50 cps, the measured bass boost should not be more than 4 db below that of the standard curve. At 15,000 cps, the measured treble cut should not be more than 4 db in excess of the standard curve; taking into account the likelihood of head losses, the measured treble cut should probably be no greater than the standard curve.

The technique commonly used to measure playback equalization is shown in *Fig.* 9. The signal is inserted into the playback amplifier through the playback head in order to take into account high-frequency losses due to winding capacitance of the head, as well as other circuit capacitances. The signal is taken from a voltage divider made up of R_1 and R_2 in order to present a very small signal (on the order of 1 millivolt or less) to the head and thereby prevent overloading the playback amplifier. The gain control of the audio oscillator should be ad-

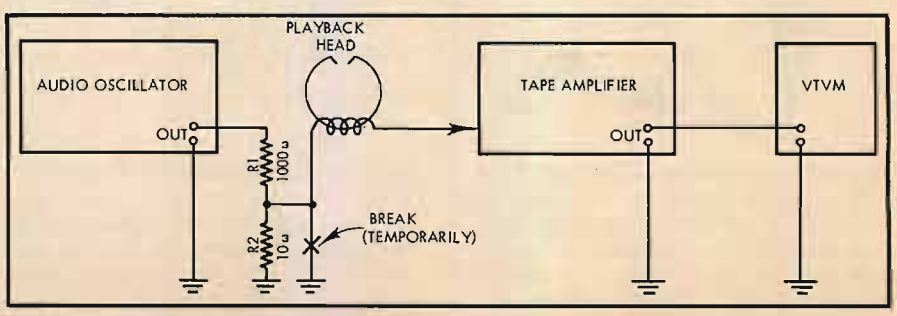


Fig. 9. Set-up for measuring playback equalization.

COLLARO INTRODUCES A NEW THREE MOTOR, THREE SPEED TAPE TRANSPORT MECHANISM

Professional quality now at a popular price! Here is a tape transport combining typically British top quality performance, ease of handling and truly unique economy. Utilizing the three motor design, usually confined to only the most expensive equipment, this newest Collaro unit offers the user perfect tape handling at speeds of 1⅞, 3¾, and 7½ ips. Now you can enjoy a versatile quarter track stereo/monaural recorder-reproducer, with separate heads for erase, record, and monitoring. Suitable amplifiers are commercially available for recording. Particularly with the growth of high fidelity quarter track pre-recorded tapes, this new Collaro tape deck, when equipped with a reproduce head only, offers an unusual opportunity for maximum musical enjoyment at a minimum investment.

It utilizes your existing high fidelity music system — connects to the magnetic cartridge input—thereby eliminating expensive additional electronics.

Three motor drive provides more versatile tape handling, while reducing the number of mechanical parts normally found in single motor mechanisms. The result—greater reliability and smoother operation • Reel size up to and including 7″ diameter, band type brakes, low wow and flutter • Three fully shielded motors to reduce magnetic and electrostatic fields • Head configurations are available to suit individual requirements • Unit equipped with six jacks for input and output circuits.

All this at prices starting as low as $99.50. For information on the Collaro Tape Transport Mechanism and Collaro record changers and turntables, write Dept. A-9, Rockbar Corp., Mamaroneck, N.Y.

ROCKBAR Corporation

RC-20

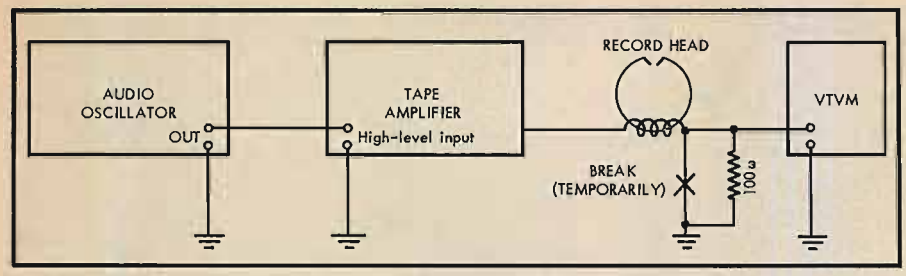


Fig. 10. Set-up for measuring recording equalization.

justed so that the playback amplifier delivers no more than about 1 volt output. Maximum output will occur at the bass end, with decreasing output as frequency rises. In the case of NAB equalization, there is 36 db of emphasis of the extreme bass relative to the extreme treble. In other words, if signal outpnt is 1 volt below 50 cps, then the outpnt will be only about 16 millivolts at 15,000 cps. Hence a sensitive VTVM is required. If a sufficiently sensitive VTVM is not available, one may increase the signal input into the head at a mid-range frequency, say 500 cps, and take into account the amount of signal increase in measuring output of frequencies from 500 cps upward. Bnt, as stated before, the signal input should not cause signal output to exceed 1 volt.

Figure 10 shows the procedure commonly used to measure record equalization, which may be compared with the record equalization curve—treble boost—specified by the manufacturer of the tape machine. (At a given speed, record equalization varies somewhat from one tape machine to another according to the manufacturer's decision as to the bias current that achieves the optimum combination of low distortion and extended treble response.) A low-value resistor, typically 100 ohms, is inserted between the ground lead of the record head and ground. As signals of varying frequency are fed into the record amplifier, voltage measurements are taken across the resistor to indicate the equalization characteristic.

If the VTVM does not have sufficient sensitivity, it may be feasible to use a 1000 ohm resistor instead. The important thing is that the resistance be small at all frequencies compared with the impedance of the head and other circuit elements (including plate resistance of the tube that drives the record head and the "constant current" resistor between the plate of this tube and the head). To be on the safe side, however, a 100-ohm resistor and a sensitive VTVM should be used. Before taking measurements of the equalization charactristic, it is necessary to remove the oscillator tube. Otherwise one will be measuring bias current, which is several times as great as the audio current that flows through the record head.

If record or playback equalization departs significantly from the prescribed curve, it may be possible to correct the situation readily by means of a control incorporated in the tape amplifier for this purpose. Such controls ordinarily are found only in machines of semi-professional and professional caliber. The less expensive machines generally incorporate fixed instead of variable equalization, and it becomes necessary to replace components, namely a resistor, capacitor, or inductance, in order to change equalization. This is usually a task for a service technician.

If playback response has been checked out as satisfactory (including equalization of the tape amplifier plus characteristics of the head and other circuit elements), and if bias current has also been checked out as correct (discussed in a following article), but it appears that record equalization requires adjustment, the proper procedure is to make the adjustment such that over-all response is as flat as possible. This may be somewhat more laborious than conforming the record equalization to the manufacturer's specified curve, particularly if the tape machine employs a record-playback head, so that it is necessary to rewind the tape before it can be played and checked for over-all response. However, adjusting on the basis of over-all response allows for slight deviations in bias current and for the characteristics of the particular head and tape one is using, whereas conforming to the manufacturer's record equalization may result in performance that, althongh good, is not as good as could be.

To avoid the possibility of overload in checking record equalization, the signal input to the record amplifier should be kept low enough to prevent the record-level indicator from exceeding a normal reading at any frequency.

Azimuth Alignment

To assure that the gap of the head is at right angles to the length of the tape, many tape machines provide for facile azimuth adjustment by simply turning one of the screws that fastens the head to the tape deck. Turning the screw up or down causes the head to tilt in one direction or the other. There are three ways in which the operator can check for azimuth alignment of the playback head or of a record-playback head:

1. The simplest and least expensive is to make the adjustment by ear when listening to a commercial prerecorded tape known to have wide frequency range. The head is tilted for maximum brilliance of sound.

2. The standard procedure is to employ an azimuth alignment tape, of which there are a number on the market. These tapes contain a high frequency tone, such as 7500 or 10,000 cps. A VTVM is connected to the output of the tape machine, and the head is adjusted for maximum output while playing the test tape. One should be on the watchout for "false peaks"—minor peaks on either side of the major peak indicated by the VTVM. One can also adjust on the basis of listening to the azimuth tone.

3. A laboratory technique, employed in making an azimuth test tape, consists of the following complex and time-consuming "absolute" procedure. Using an audio oscillator as the signal source, a high-frequency tone is recorded by means of the playback head one wishes to align. This tape is played back with the *base* instead of the coating against the head. A weak but measureable playback signal will be obtained. The playback head is adjusted for maximum output. Then the head is returned to a point half-way, as nearly as one can judge, between its first position and the second position; a half-way adjustment is called for because the azimuth error in playback is in the opposite direction of that in recording, as illustrated in *Fig.* 11. The procedure is repeated a number of times, until it is found that adjusting the head in playback results in no signal increase.

If the tape machine employs a separate record head, the playback head is aligned first. Then the record head is adjusted so that maximum output is obtained when recording and simultaneously playing back a high-frequency tone. Æ

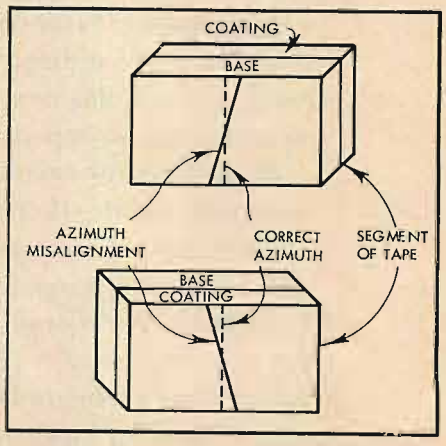


Fig. 11. Reversal of direction of azimuth misalignment when tape is played with base instead of coating against the head.

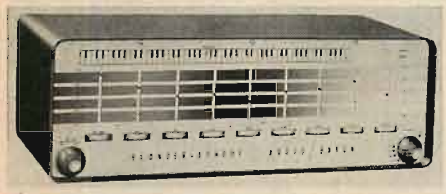
Buyers' Guide Additions

NOT ENTIRELY UNEXPECTED—as evidenced by our opening remarks to the August Buyers' Guide section—there were some manufacturers whose products were omitted. It is almost impossible to include everyobody—some did not send in photographs and information, and in some instances the products were on a limited availability basis, and so were omitted by ourselves.

We trust the information below will find the same reader acceptance that the entire Buyers' Guide section of the August issue did, and we commend all readers to this additional information.

BLONDER-TONGUE

• *Audio "Baton."* This is a unique high-fidelity instrument for providing complete control of the audio spectrum. It provides a 28-db control range for compensating for deficiencies in program source or in reproducing equipment. Nine compensator controls are octave-spaced at 40, 80, 160, 320, 1280, 2560, 5120, and



10,240 cps. Input is 1.5 volts rms, maximum, with impedance of 125,000 ohms at 1000 cps. Output is 1.5 volts rms, maximum, with impedance of 20,000 ohms at 1000 cps. Hum and noise are 60 db below rated output. Frequency range is 20 to 20,000 cps ± 2 db. Harmonic distortion is well under 1.0 per cent. A panel-mounted switch permits bypassing the Audio Baton when desired. This is an excellent instrument for the perfectionist in reproduced sound. Blonder-Tongue Laboratories, Inc., 9 Alling St., Newark 2, N.J. User net price, $119.95.

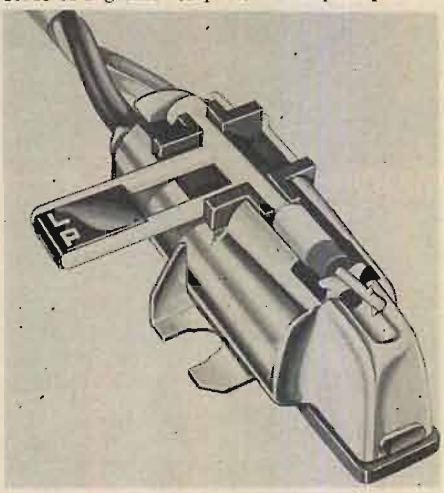
TRANSIS-TRONICS

• *All Transistor Stereo Amplifier.* Providing all the required facilities for a home music system amplifier with a power consumption of 70 watts maximum with both channels putting out the rated 25 watts, the Transis-Tronics TEC-25 amplifier is a remarkable de-

velopment of the semi-conductor art. Performance specifications show a music power output of 34 watts, a frequency response of 20 to 20,000 cps ± 2 db, and harmonic and intermodulation distortions below 1 per cent at 25 watts, the TEC-25 is well suited for any home or profesisonal application. Direct connection to a battery supply of anywhere between 12 and 18 volts permits use in an automobile or on camping trips—or even during line power failures in the home. 16 inputs, and 4-, 8-, and 16-ohm speaker outputs, plus a mixed A + B output for a center speaker. Transis-Tronics, Inc., 1650 21st St., Santa Monica, Calif. User net price, $249.50.

SONOTONE

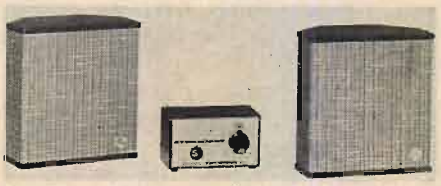
• *Ceramic Stereo Cartridge.* A turnover stereo cartridge for all record speeds, the new Sonotone model 9T plays monophonic records as do many currently available monophonic cartridges. Frequency response of the 9T is flat, plus or minus 1 db, from 20 to 17,000 cps. A compliance of 3.5×10^{-6} cm/dyne permits stylus force of 2 grams for professional pickup arms



and 3 grams for changers. Output is 0.4 volts. One feature of the cartridge is the gold-plated metal cover which shields the cartridge both mechanically and electrically. Stylus replacement is simplified because of the virtually unbreakable nylon needle assembly and prewired terminal plug. Protection for the styli is provided by turning the stylus positioning lever halfway between either position, thus eliminating the need for a needle guard. Sonotone Corporation, Elmsford. New York. Available with sapphire styli at $16.50, or diamond-sapphire styli at $19.50.

STEPHENS

• *"Steredot" SD101 Speaker System.* This system comprises two speakers in small sealed enclosures which are placed on each side of a full-range speaker to achieve three-channel stereo reproduction. The placement is not critical, and may be as little as four feet from the center speaker, or as much as the entire length of the wall. In operation, a filter network is connected to both stereo amplifiers,



the Stereodot units, and the center speaker. This network feeds all frequencies below 250 cps to the center speaker, at the same time feeding each Stereodot unit with one of the side channels at frequencies upward from 250 cps. The network also combines the two side channels to form a "matrixed" third channel signal which is fed to the center speaker through a level control. It is this third channel which makes possible the surprisingly realistic performance of the Stereodot system. The two Stereodot speakers, not having to reproduce bass, are extremely compact and easy to place in any installation. Stephens Trusonic, Inc., 8538 Warner Drive, Culver City, Calif. User net price, including level control, $139.50.

E2/12T 2-way spkr sys, C. Eames design	$275.00
Stereodot SD102 spkr sys	249.50
80FR 8" full-range spkr	$31.50
120FR 12" full-range spkr	60.00
150FR 15" full-range spkr	87.00
120CX 12" coaxial	97.50
150W 15" woofer	87.00

ALTEC

• *Polyester Film Microphone.* One of a new line of modestly priced professional-quality microphones, the Altec model 683A features a polyester film diaphragm and a sintered bronze filter. The use of polyester film as the diaphragm material, instead of aluminum, greatly

increases the ruggedness of the diaphragm thus taking it out of the delicate, easily damaged category. The sintered bronze filter placed in front of the diaphragm protects it from foreign particles such as ferrous filings, dust, and water.

CHARACTERISTICS

Type: Cardioid dynamic.
Frequency range: 45 to 15,000 cps.
Output impedance: 30/50, 150/250, and 20,000 ohms (selection by connections in microphone cable plug).
Output level: − 54 dbm/10 dynes/cm².
Hum: − 120 db (ref. 10^{-2} gauss).
Weight: 11 ounces (not including cable and plug).
Finish: Two-tone baked enamel, black and dark green, dark brown and platinum pink, or brushed chrome plating.
Altec Lansing Corp., Anaheim, Calif. User net price, $66.00.

MUSICRAFT

• *Electronic organ Kit.* Offering an attractive organ kit for home construction, National Sonics Corporation, 680 E. Taylor Ave., Sunnyvale, California, is now reaching the market. Shown at the San Francisco High Fidelity Show in January of this year, the Musicraft

organ is small enough for the average living room without giving it that overbalanced feeling that a full-sized organ console would. Yet it provides a complete variety of stops, and, optionally, external orchestra bells and the percussion circuitry required to obtain such tones as piano, guitar, harpsichord, and so on. Construction time for the entire organ is in the vicinity of thirty hours because of the ready-built and finished console and the unique key-switch assembly that is thoroughly enclosed for protection from dust and for simplification of the building process. User net price, approximately $750.00.

UP TO FOUR TIMES THE WORKING DISTANCE OF CARDIOID TYPES* with the Electro-Voice model 644 sound spot

Of all the audio problems confronting sound engineers, one of the most difficult to overcome is the use of microphones in spacious areas. Churches, auditoriums and amphitheaters present formidable problems in room acoustics and reverberation which degrade audio quality. Consequently, microphones cannot be placed at conventional distances from the source of sound. Under such conditions, loss of level and "presence" further add to the enigma of proper pick-up. The Model 644 Sound Spot is the answer. Here is a microphone providing acceptance within an included angle of 90° at high frequencies, high axial sensitivity, wide frequency response extending from 40 to 12,000 cps and excellent wind noise cancelling characteristics. Its highly directional feature permits unusual microphone working distances as well as startling flexibility in loudspeaker placement. Effective cancellation of sound at the rear and sides for unparalleled rejection of random noise, reverberation and feedback without frequency response loss. See Polar Pattern. Stop at your Electro-Voice distributor today and let him demonstrate the Model 644.

*Depending on Acoustical conditions.

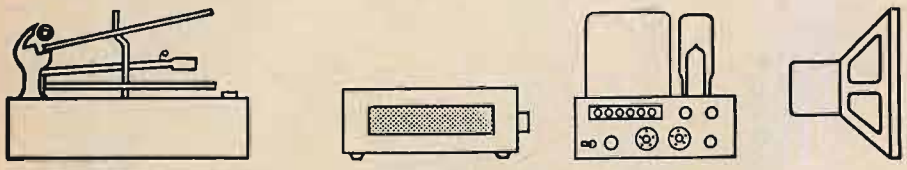
Other features: Output level—53 db. 150 ohm and high impedance. Impedance changed by moving one connection to connector. Low impedance only: line balanced to ground and phased. Acoustalloy diaphragm, shielded from dust and magnetic particles. Non-welded circuit with Alnico V and Armco magnetic iron. Pressure cast case. 5/8"-27 thread. Satin chrome finish. 18 ft. cable with MC4M connector. ON-OFF switch. Size: 2 1/16" diam. 16" length. Net Wt.: 2 lb. 9 oz. less cable. List Price $110.00. Desk stand available (extra).

Polar Pattern

Electro-Voice®

Commercial Products Division
ELECTRO-VOICE, INC.
Dept. 90A Buchanan, Michigan

EQUIPMENT PROFILE



EICO MODEL HF-89 100-WATT STEREO POWER AMPLIFIER

With the increased popularity of low-efficiency loudspeakers, there exists a growing demand for amplifiers of higher and higher power, so that 50-watt—dual 25-watt—stereo power amplifiers are almost ordinary and dual 35's and dual 50's and even higher-power units are becoming more and more important. While it must be admitted that there is relatively little need for a total of 100 watts for a home system over some 98 per cent of the time, it is the remaining two per cent where it *is* necessary to accommodate a transient peak without the certainty of a break-up in the sound. And the additonal power availability makes it possible to get out of the habit of cringing every time a loud passage comes along.

Then, too, many audiofans like the idea of being able to feed speakers in other rooms of the home along with those in the main listening area without the necessity for additional amplifiers.

One of the newer of the EICO kits is the Model HF-89, which comprises two 50-watt sections powered by a single silicon-rectifier supply, thus reducing the over-all cost below that of two separate amplifiers in addition to simplifying the construction. Each section consists of one half of a 12AX7 as a voltage amplifying stage direct coupled to a 6SN7 connected as a cathode-coupled phase splitter which, in turn, drives a pair of EL34's in an Ultra-Linear output stage. The power supply employs two silicon diodes in a voltage-doubler circuit which furnishes 475 volts to the output stage. A slide switch on the top deck of the chassis permits paralleling the two amplifier sections, resulting in a single 100-watt amplifier. Another diode is used for the fixed-bias supply. To ensure long life for the silicon diode rectifiers, as well as for the filter capacitors and the output tubes, a surgistor is connected in the primary circuit of the power transformer to limit the starting surge currents. Physically, the HF-89, shown in *Fig.* 1. measures 11 by 15 inches, and is 6 inches high, and it weighs 37½ pounds.

Construction

Building the HF-89 is comparatively simple, and should be completed in about eight hours as a maximum. None of the wiring is difficult, and the instructions are clear enough that even the novice should encounter no trouble in any step of the construction. Tie points are used profusely so that all parts are "tied down" at both ends (we have seen some units in which a resistor or a capacitor was fastened to a fixed point at only one end, with a wire being connected to the unanchored lead of the part—we do not consider this to be good design). Lengths of leads are specified for all connections, and the drawings are clear and easily readable. One feature of the instruction booklet that we are pleased to see is a voltage and resistance chart which shows d.c. voltages on all tube elements at no signal and at an output of 100 watts, and a.c. signal voltages (1000 cps) for a 0.5-volt input, as well as the usual resistance measurements to ground. Another feature of the EICO instruction books that we like is the over-all arrangement—the construction section is located in the center pages, while description, operation, and servicing data are located in the front and back pages. After the construction is completed and each step marked off, the center pages can be removed, leaving a much thinner book for permanent reference use. Actually, in most instances there is no need to keep the sheets covering the construction steps once the unit is completed—the few exceptions are with amplifiers which must be partially disassembled to change a component part.

Fig. 1. EICO Model HF-89 dual 50-watt stereo power amplifier.

Performance

Specifications for the HF-89 indicate a power output of 100 watts at an IM distortion of 0.5 per cent, and a harmonic distortion of less than 0.25 per cent from 30 to 15,000 cps and less than 1 per cent from 20 to 20,000 cps within 1 db of 100 watts. This specification of power seems to be a very small difference from the rated value, but it must be remembered that 1 db below 100 watts is 79 watts, which means that the harmonic distortion figures relate, effectively, to two 40-watt amplifiers. However, our measured results are even better than the specifications anyway. Our own measurements showed an IM distortion of 0.46 per cent at 50 watts on one channel and 0.48 per cent on the other. Separate bias and balance controls on the two sections permit adjustment to optimum performance separately. Harmonic distortion at 1000 cps measured 0.42 and 0.55 per cent respectively on the two channels at 50-watt outputs, and music power output measured 55 and 59 watts respectively at 1 per cent. An input signal of 0.53 volts drives the amplifier to full output, and with a 50-watt output on one channel and a shorted input to the other, the separation measured 57 db. Hum and noise measured 75 and 77 db below 1 watt output, which is slightly better than the specification of 90 db below rated output, since 1 watt is 17 db below 50 watts. We believe that all amplifiers should be rated for hum and noise as so many db below a fixed reference, since the normal listening level is likely to be about the same regardless of maximum output power, and it would be a more revealing way of specifying hum and noise.

Thus combining ease of construction and full conformance with the specifications, the HF-89 turns out to be an excellent amplifier. Listening quality is clean and smooth, with a good solid feel in the bass register which is the mark of a good amplifier. The output is adequate for even the most inefficient loudspeakers, and after one becomes accustomed to high-power amplifiers, he is not likely to be satisfied with any others.

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MUSIC SOUNDS BEST ON TAPE . . . he listens . . . he's enthusiastic . . . he agrees! From the full richness of opera to the tingling brilliance of jazz, you hear it all on 4-track stereo tape. Economical, too . . .because with 4-track stereo tape you get twice as much music on a reel. Listen to it today at stores displaying the 4-track symbol and you'll agree, too . . . music sounds best on tape. Write for complete catalog: 1024 Kifer Road, Sunnyvale, California. UNITED STEREO TAPES UST

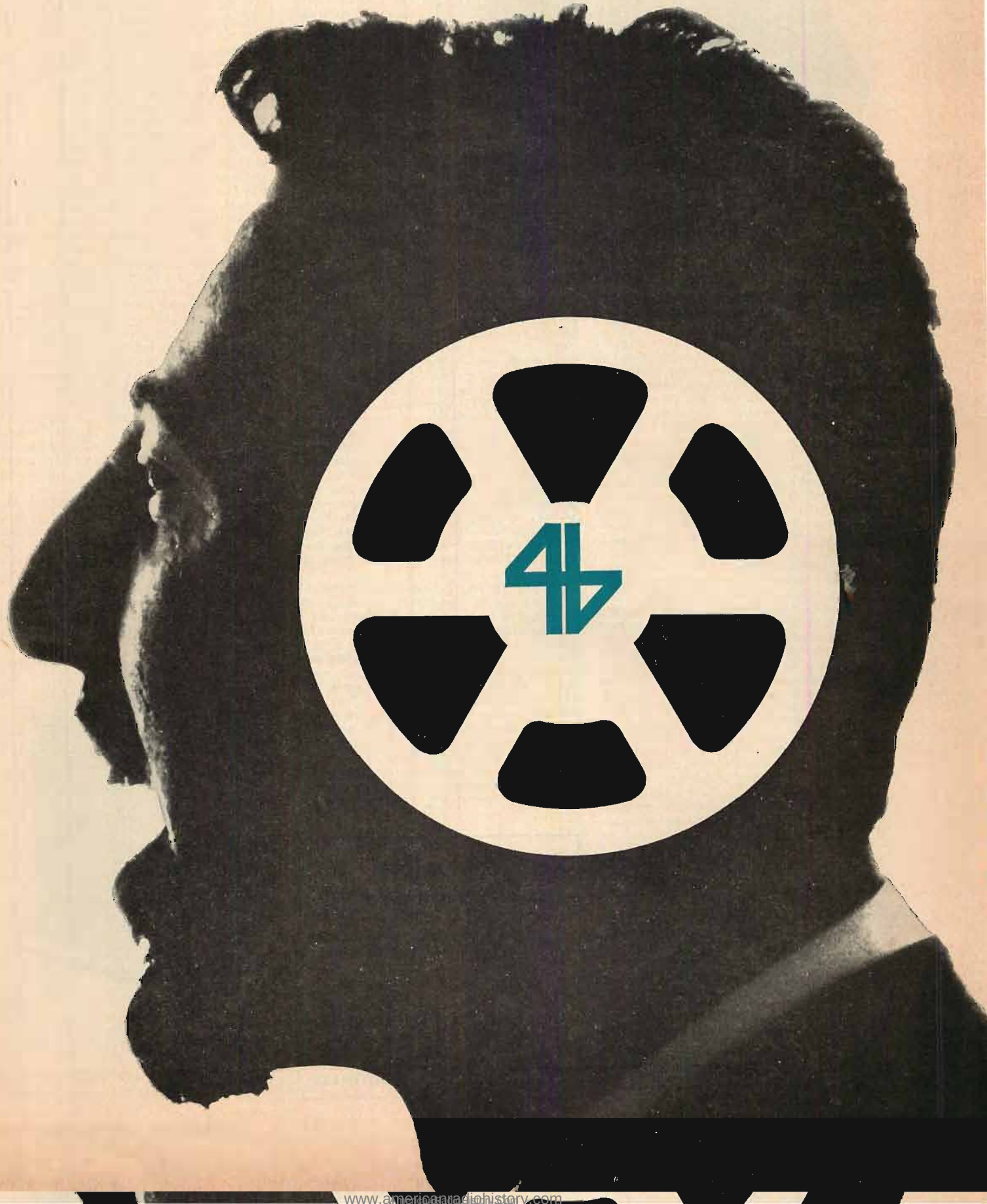

Fig. 2. Connoisseur F2S turntable and integrated arm and pickup on Formica-surfaced base.

CONNOISSEUR FIXED 2-SPEED TRANSCRIPTION TURNTABLE

Somewhat simplified from the original three-speed Connoisseur turntable and the current Model B, the newest model in this British-made line is obviously designed for the only two speeds that are of much interest to the present-day audiofan. For all ordinary uses, the 78-rpm record is in the same category as the dodo bird—it is only those who have a collection of old records which are important principally for nostalgic reasons that have much interest in the highest of the three speeds. Thus the economy of the two-speed construction permits anyone to own a high-quality turntable at a cost about half that of the three-speed models.

First introduced in the Model B, nylon graphite bearings are about the last word for turntable applications. As used in the Connoisseur, these bearings appear to consist of a block of nylon in which a square hole has been cut, and a saw cut is made through one corner of the square. The hole itself has a nominal width slightly larger than the diameter of the spindle, and an adjusting screw pinches the square together to fit the spindle. Thus the actual bearing surface consists of four lines of contact, all parallel to the axis, and this type of construction permits extremely close adjustment for a minimum of play in the bearing, in addition to making it possible to compensate for wear. The bottom bearings for both motor and turntable shafts are self-locating single pin points resting on nylon graphite. Drive between the synchronous motor and the turntable is effected by a double-stepped motor shaft and an idler assembly, with both motor and idler being carried on exceptionally resilient mountings. Speed selection is by a single knob which retracts the idler when the unit is not being used to avoid making flat spots, and the motor is started and stopped by a push button on-off switch. A neon indicator lamp shows when the power is on. Mounting requires a single cutout and three screw holes to provide a solid attachment of the platform to the motor board, and the pickup arm is then fitted to the board so as to preclude the possibility of *any* relative movement between the turntable shaft and the pickup—an absolute necessity for good reproduction.

Performance

The important consideration in any stereo turntable is that of rumble—wow and flutter are practically unmeasurable in any good unit on the market today. The model tested measured 52 db below a stylus velocity of 1.4 cm/sec at 100 cps—17 db better than NAB standards. Neither wow nor flutter is detectable to the ear—using piano records for the former and violins for the latter. The unit comes up to full speed in about one revolution of the turntable at 33⅓ r.p.m. Using the Formica-covered base available for the unit, and with the Connoisseur integrated pickup and arm—both shown with the turntable in *Fig.* 2—we could not find any trace of acoustic feedback when playing in a typical living room with the loudspeakers six feet from the turntable.

This is the third Connoisseur turntable we have had an opportunity of using—the first is still in use after six years, and is just as quiet as when new; the second has been in fairly heavy use for over a year. The F2S—Fixed 2 Speed—follows the same general type of construction, and would appear to be capable of providing a long and satisfactory life. It is attractively finished throughout, with shafts ground and polished to mirror-like surfaces, and with all internal parts finished as thought done by a watchmaker. This model is a fine performer, and its appearance indicates that it would be—in fact, the appearance probably contributes to the performance.

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HOMEWOOD INDUSTRIES' SPEAKER CABINET KIT

Of the great variety of speaker cabinets on the market, the bass reflex still appears to be the logical model for use with a variety of loudspeakers—most other designs require quite a bit of "tailoring" to match a specific loudspeaker mechanism, and while performance may be better when cabinet and speaker are designed to work together, the reflex can give excellent performance with almost any speaker unit, providing a few simple precautions are followed.

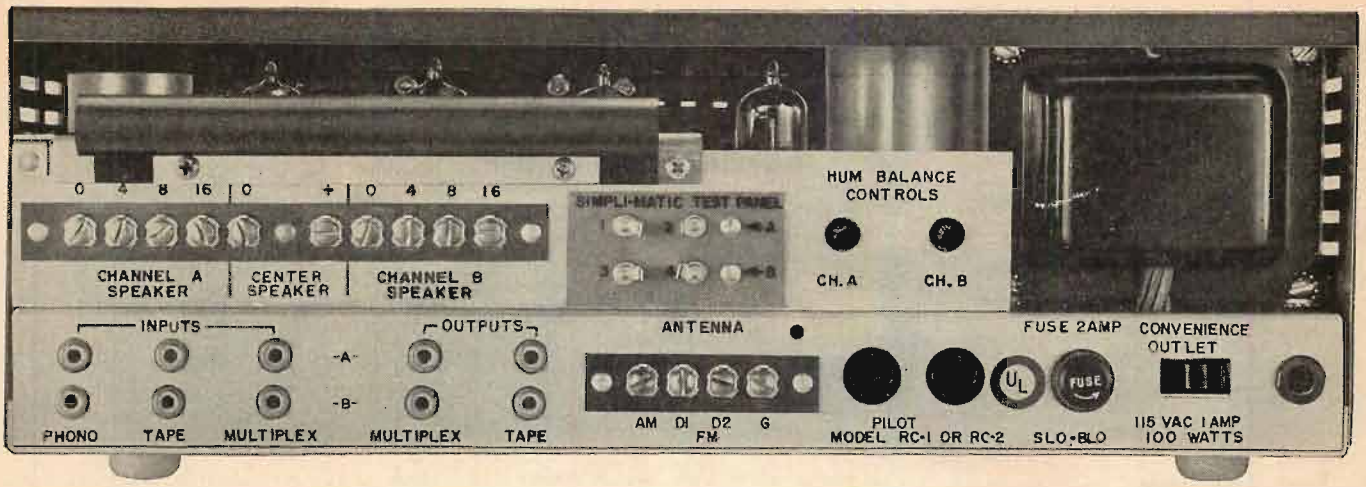
Measuring some 19 inches wide by 12 inches deep and standing 29 inches high on its 5-inch legs, the cabinet offered by Homewood Industries in kit form has an internal volume of about 2.6 cu. ft. The speaker panel has a cutout for a 12-in. unit and a reflex port with an area of 48 sq. in. The parts are all saw-cut to make neat joints which gives a factory-built appearance when completed. The frame for the front fits perfectly and complete construction of the cabinet will take only about 45 minutes. Sanding and finishing takes quite a bit longer, of course, depending on the type of finish desired. We used a Cabinart finishing kit which included stain, filler, and fine cabinetmakers varnish. A coat of stain takes about 15 minutes to apply, then one must wait until the next day. Filling and drying takes perhaps a half hour for the former and a day for the latter—except in humid weather. Two coats of varnish and the necessary drying take another two days, at least, again depending on the weather. No mention was made of the time for sanding, but the outside surfaces are well finished to start with, and an hour is adequate for the first sanding, and two more for final rubbing down of the varnish coats. When complete, however, the unit looks just like a factory-built cabinet.

We mounted a General Electric 12-in. woofer and a 4-in. tweeter for test listening, and found results more than satisfactory. Since the speaker panel is removable from the inside of the cabinet, this model is ideal for experimental mounting of various types and sizes of speakers.

In all, this cabinet will give a few hours of interesting work and result in a neat and attractive speaker for most any application.

J-30

Fig. 3. Homewood Industries' loudspeaker cabinet built from a kit.



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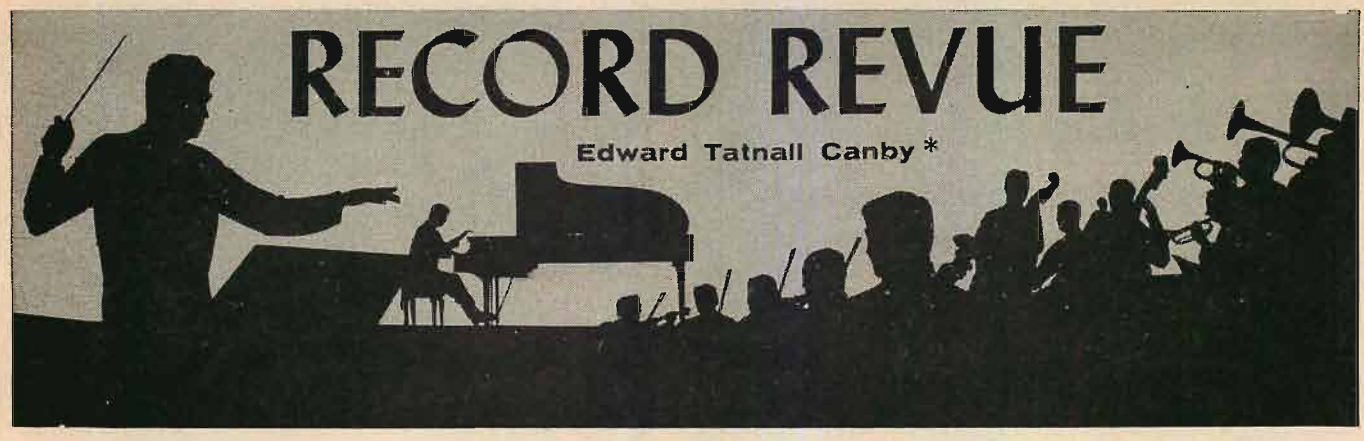

RECORD REVUE

Edward Tatnall Canby *

1. Ever Victorious . . .

Strauss' Don Quixote. Chicago Symphony, Reiner; Antonio Janigro, cello.
RCA Victor LSS 2384 stereo

This is a splendid example of the Soria-style record spectacular—it includes a big color booklet of extensive comment plus Skira prints, all about Cervantes and Don Quixote, the whole enclosed in a fancy book-type album.

"Don Quixote" is, of course, an excellent bet for the Soria technique. Everybody important has written about Don Q. and his author, Cervantes; but even better, every artist worth his paint and pencils has done a picture of Don Q., Sancho Panza and/or that noble and gawky steed, Rosinante. In this album we range in Skira prints from Dali to Doré to Daumier, from Picasso to Goya. What an art show! Worth the cash just in the prints themselves. The commentary is excellent, by the Irish Cervantes authority Walter Starkie (who has done a very funny Irish-accented reading of the Don on records).

And the music is tops, too; nobody can turn out better Richard Strauss than Reiner, particularly in the longwinded works that can stand tensing-up and pulling-together. Makes an immense difference here—it's a long time since I've been able to listen to this piece all the way through without getting bored. If I believed in definitive recordings, I'd say this was one of them.

Festival. Chicago Symphony, Reiner.
RCA Victor LSC 2423 stereo

Fritz Reiner, I suspect, is not a man to be pushed where he doesn't want to go. For obscure, probably contractual or sales reasons, RCA has lately been setting him to work on pot-boilers and chestnuts, exalted and otherwise, and the results, for those who know Reiner at his best—say, in Strauss and Bartok—are definitely not good.

Here we have such over-ripe items as that eternal *Night on a Bare (Bald) Mountain,* the once-dismal *Marche Slave,* which just drags along impatiently nowadays, the *Russlan and Ludmilla* overture, the usual Prince Igor stuff, even a bit of noisy Kabelevsky. A festival of Russian corn, or so it comes out here. The Reiner approach to such music is hard, cold, fast, intense, without the compensating musical glow of his really fine conducting; you can't help but feel a certain clear resentment in this playing, vin the musicians themselves and via the conductor.

Funny—some famous conductors can do a fine job with this kind of potboiling. Ormandy, for example, with the Philadelphia. Not Reiner, and RCA had better try somewhere else.

The Virtuoso Liszt. Gary Graffman, piano. **RCA Victor LSC 2443 stereo**

This disc was an unexpected pleasure. Graffman is one of those powerhouse, prize-winning young pianists who get snapped up by record companies these days and I somehow expected a Liszt that would be all bang and whang, noisy and show-off. That's the current style.

Not at all. Graffman does, to be sure, play with a modern tension and a rather typical lack of subtlety in piano tone—gradations of pianistic color are now just about a lost art. Paderewski and Cortot might well call this playing crude, from their tonal point of view. But, in terms of our present acceptance, this pianist has an unusually good feeling for the old master of piano pyrotechnics; his playing is both sympathetic and musical.

Lizst, as anybody who has got to know him can say, was a serious and sensitive musician under the bombast. Anything less than purely musical understanding of his harmonies makes tinkling jargon, overblown nonsense, out of his best works. To overplay him is deadly, but even worse is to play him apologetically, playing down the showmanship. The clue to rightness in Liszt is in sheer musicality—for then, the stuff makes sense and sounds right. This is where Graffman is good.

The Graffman pianistic ear is perfect for the music's harmonies, no matter how thick the finger-frosting. His pedal never blurs, the sense is always matter-of-factly clear and taken for granted. (How many other quick-fingered pianists are stone deaf to it!) Phrasing, though not magically subtle as in the old days of Liszt pianism, is of a common-sense sort that gets Liszt over, makes the fancy piano figuration seem quite reasonable—as it is, played rightly. Proportion and balance of internal elements, the main tune against the decor, is always good.

Recommended, then, as an excellent introduction to the Liszt sort of piano music.

(You'll find here one side of assorted short items, including a Hungarian Rhapsody and the familiar *Liebestraum,* and the second side devoted to the Liszt piano arrangements of Paganini Etudes, including his variations on the famous tune also used by Brahms and Rachmaninoff.)

Schumann: Piano Concerto in A Minor. Van Cliburn; Chicago Symphony, Reiner.
RCA Victor LSC 2455 stereo

The music critic of the Chicago Tribune thought this was pretty fine, in its "live" performance in Chicago; in its recorded form, at least, I find it's not very fine at all. Don't like it much.

True, Cliburn has generally a right disposition for such music—but it takes much more than a mere suitability for the job to bring out what's in Schumann—who is surely the most difficult of the Romantics to project convincingly today. It takes, in effect, what Cliburn does not now have, a supremely experienced sense of Romantic drama, of phrasing and rubato, that tricky hesitation that makes or breaks a Romantic performance. Somehow, I keep feeling that Cliburn is counting time, not strictly, but as though inserting irregularities by rote. It isn't masterfully spontaneous, it doesn't carry poetic conviction and it doesn't jibe with Reiner's playing either.

Reiner, for his part, somehow manages to make this into another of his warhorse readings, done in the Reiner warhorse manner, which is to say with a certain impatience and irritability, as though to get it over with. His lack of poetry is prickly and hard, where Cliburn's is soft and unformed. Not a happy combination—they don't even get their timing right in chord afer chord that ought to coincide.

For all of RCA's impressively clean stereo, and in spite of a first rate orchestra and a fine piano, the piece comes off badly, Schumann's personalized idiom seems repetitive and even banal. It shouldn't.

Schumann: Piano Concerto in A Minor; Introduction and Allegro appasionato, Op. 92; Novelette in F, Toccata in C. Svjatoslav Richter; Warsaw National Philharmonic, Rowicki.
Deutsche Gramm. 138 077 stereo

Here is the sort of competition, from afar, that points up the domestic policies of our own record companies in respect to standard repertory—for though this record's sound is duller than RCA's, the orchestra is much less competent, the piano is not brilliant, its strings aren't even carefully in tune, I found this performance of the Schumann Concerto by the new Russian piano sensation astonishingly more alive and interesting than that by Cliburn and Reiner for RCA. It takes more than outward spit and polish to make fine Schumann, whether musically or technically.

It's simple enough. First, Richter—who will be coming to the U.S. soon and may be next season's big sensation—has a masterful way with the music. In the most unobtrusive manner he puts into it the very strengths that Cliburn lacks—his melodies really sing, with poetry, with melodic tension, with intuitively right shaping and balance. And second, the strange orchestra from Poland and its Polish conductor are with their pianist every step of the way. It's a fine collaboration in musical terms, even if the stereo impact is low and the mikes pick up too much piano and not enough orchestra.

There are dividends, too, especially the quite lovely concerto fragment in the form of an Introduction and a passionate Allegro, a piece that is fresh and new in its own right. Two solo piano pieces manage to find room on the record, too—altogether a musical bargain.

Grieg: Piano Concerto in A Minor. Liszt: Piano Concerto #1. Rubinstein; RCA Victor Symphony, Wallenstein.
RCA Victor LSC 2429 stereo

—Might as well lay on the axe here too, while I'm at it. This one, too, seems to me to be an excellent example of warhorse performance, musically full of fustlan, technically superb in its big sound, but nevertheless tired and un-fresh in far too much of the music.

Rubinstein's solo piano recordings of slightly less-than-standard repertory have lately been really excellent, displaying his best and most sagacious musical abilities. But here, in a piece that he must have played hundreds of times, he reverts to the old trouper. The Grieg just sags, in spite of all efforts to keep it alive and puffing. Sounds merely tedious and utterly dated, which it surely is if you play it this way. It needs a rest, as far as these performers are concerned. The Liszt "Triangle," with more scintillation and less length, comes out fairly

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

well, for Rubinstein is a master of its pyrotechnics, making them sound easy and offhand, as they should. Takes skill and experience; he has both.

Mr. Wallenstein is again the too-willing purveyor of musical conventionalities, as he has been for other companies. He doesn't get much out of this thin-voiced orchestral ensemble, whose strings sound particularly weak.

Tomas Luis de Victoria—Spanish Church Music of the 16th Century. Dessoff Choirs, Boepple. **Fantasy 8035 stereo**

Victoria didn't know it, but he was to become in this last century the father of the great revival of "early" music, even more clearly than Palestrina, whose name had always been around on our musical monuments. Victoria came back into prominence with the last of the Romanticists—they are still with us, as interpreters—and indeed his music was peculiarly "romantic" in its own mystically Spanish way. It lent itself marvelously to that slow, inspiring singing that swells up and dies away in religious ecstasy.

That style is an anachronism now; most music of the 16th centry has come down to earth for a more realistic, if no less musical performance. But Victoria's music was meant to sound mystical—far more than Palestrina's. And Victoria was a musical ham of the highest sort; he knew a telling effect and he used it whenever he could, again and again. He must have wowed them, in his days.

All this comes upon listening to this big, blow-up sound, a large chorus in a perfectly huge and resonant space, doing Victoria up in full cathedral style. (I was at the recording session myself—but I hear the result through my professional ears, and I hear an enormous space though I happen to know that it was neither enormous nor remotely cathedral-like!)

I suspect that, were this any other composer, there could be some criticism of this vast and bulky sound, the slow tempi, the mammoth expenses of choral tone. But in Victoria the music asks for it and can take it remarkably well.

The largest item is the Requiem Mass, rather long and unwieldy here, some of the sections on the tired side and occasionally a bit flat in the upper parts, the frequent Gregorian chant (solo voices) not always in tune with neighboring music due to the editting together of sections made at different times. Two short motets are livelier for the record listener—*O Magnum Mysterium* being virtually the patriarch of all well known 16th century works of this sort. The medium-long Magnificat, for dispersed choral groups, is lively and interesting in stereo effect, in twelve voice-parts.

As a member of Dessoff's board of directors I am currently urging the chorus to record with a smaller group; but in the case of Victoria the full chorus is acceptable as a specialty. A very impressive sound in its best moments.

Offenbach in America, Boston Pops Orch., Fiedler.
RCA Victor LSC 1990 stereo

Interesting. This recording was issued in mono form 'way back in early 1956—it probably dates, then, from 1955. This stereo version appears to be the original, made at the time, one of RCA's pioneer big-stereo experiments on two-track tape. Shows how a solid and forward-looking recording policy can pay off. Now if only Toscanini. . .

The stereo sound does, indeed, have a familiar ring to me: that big, overly-wide separation, spread 'way out, with a sort of vagueness (if not an actual hole) in the middle, the sound that so wowed us all in the early demonstrations. It still sounds good, if like an orchestra in Madison Square Garden. But newer stereo is much more precise in spatial location, with a better middle sense and, all in all, a more natural and simple effect.

P.S. Aha! I just proved that this is, in fact, the 1955 recording. The clarinet in one solo passage makes a slight break, a hiccup. It appears in both the 1955 mono and 1960 stereo versions.

2. Stereo Operatics

Mozart: Don Giovanni. Fischer-Dieskau, Kohn, Kreppel, Jurinac, Laefliger, Stader, Sardi, Seefried; Berlin Radio Symphony, RIAS Chamber Choir, Fricsay.
Deutsche Grammophon DGSO 7302 (3) stereo

This is a fine example of imaginative stereo miking, making use of un-stage-like close-up vocal recording to heighten the musical drama in its stereo form.

In addition, it is a mostly high-ranking performance of the opera, faithful to the tradition, vigorous and sincere in the acting and singing though the approach is somewhat softer and more serious than some of the more sparkling performances of the past. Fischer-Dieskau and Karl Kohn make a good pair of rogues, the Don and his servant Leporello; the others fall into their familiar attitudes, the coy peasant girl and swain, the jilted virago, the ever-so-virtuous pair of lovers (Anna and Ottavio) and the rest. John Brownlee, one of the greatest 20th century Dons, writes an amusing personal account of the role in the fine accompanying booklet, which has other good material plus the usual libretto in Italian and English.

Here, the close-up stereo miking of the solo voices is especially useful in two ways. First, it keeps the fast-moving action sharp and clear; distinguishing, for instance, between the two baritone rogues, the Don and his servant and accomplice, Leporello, who hold endless high-speed, half-confidential conversations at close range, often almost whispered. One of them is on the right, the other to the left, and thus all that happens is clear enough —you can tell them apart. So too, with other pairs of singers, with trios and with pairs of pairs; judicious separation makes their musical and dramatic roles clear.

Secondly, the grand Mozartean finales, where many characters sing together—six or so at a time—are made immeasurably more effective and easier to follow, amid all the cross-talk of different texts, by the stereo spread from right to left. In standard mono recording these multi-voiced finales are a jumble, the voices super-imposed on top of one another. Separation does much to restore the original musical effect.

* * *

A big stereo principle emerges from recordings such as this, namely, that whereas spatial *separation* is wonderfully effective in recorded opera, spatial *motion* is something else again, resulting more often than not in chaos or, worse, false and unexpected effects that can be ludicrous. There is no aesthetic value to the seeming spectacle of a dignified singer swimming sedately through the air towards you—or crawling grotesquely on his belly along the floor!

Remember that the stereo "stage" is at best only seven or eight feet wide as you hear it, in the area where the singers do their work. Only the most obvious and exaggerated stereo motions, then, can carry conviction and aid the operatic drama and music. They thus must be deliberately false to begin with, if they are to create an illusion of naturalness.

Distrust all record-company claims that so-and-so opera's normal stage movements are re-created in a stereo recording! It doesn't work; and it never will, except by gross simplification and plenty of illusion.

Renata Tebaldi—Operatic Arias. Orch. of Accademia di Santa Cecilia, Rome, various conductors.
London OS 25120 stereo

You'll find the famed Tebaldi in many a full-length operatic recording, but this single disc gives all of us a good chance to size her up in concentrated form. She is the reigning queen of Italian opera in most fans' estimation.

For those of us who are not regular patrons of the Met, Tebaldi shows up here as a ster-

ling singer, of impeccable sureness in the present-day style of opera performance and notably with a long-breathed sense of phrasing that makes her the envy of almost any singer you can name. Such breath control! Such confidence! And, of course, a fine sense of the somewhat special Italian dramatics, never too much, never too little.

In comparison with the great voices of the past, Tebaldi's is typically modern, which means to my ear that it has a whiter, less brilliant sound than the great ladies of the turn of the century, a slower, less regular vibrato, considerably less flexibility in fast passages, a greater restraint in the use of varying tone colors and in sheer, all-out physical drama. The older singers weren't afraid of real gusty chest tones, of sighs, breaks, shrieks (always on pitch); but that was another age.

Gluck: Der Betrogene Kadi (Comic opera). Soloists, Camerata Academica des Salzburger Mozarteums, Paumgartner. **Epic BC 1062 stereo**

The outside of this record is a real budget job, minus description of the opera and even minus the soloists' names (they are on the record)—but an all-important item *is* present, anyhow, the complete text in German and English; it runs economically onto the two sides of the inner paper liner. I took me to the nearest dictionary to find out more, and herewith oblige.

This was originally a comic opera with French text, the then-current rage, though it was performed at Schoenbrunn castle (the Versailles of Austria) for the Viennese court. Gluck's more famous and later French operas were composed for Paris itself, where one of the Austrian princesses, Marie Antoinette, had gone as the wife of the Dauphin, soon to be Louis XVI. Gluck was German, not French (born near what is now Czechoslovakia, lived much of his life in Vienna) but in the fashion of the day he wrote his serious operas in Italian and, later, in French.

Now—the opera itself. You'll find it quite a delightful short bit, the usual 18th century funny story of the Turkish harem, though here the plot concerns a "Kadi"—some species of potentate, I suppose—who lusts for wife No. 2 in the face of his furious No. 1, and is tricked into falling for an odious gal by a bit of hocus-pocus with Turkish veils. It's all over in no time, and he returns good-naturedly to wife No. 1, who shrugs her shoulders philosophically.

What interests me—and will you—is the music, and its style. Maybe it was composed to a French text, in supposed French opera-comique style, but what we hear today is a clear foretaste of the Beethoven-Weber Romontic opera, by-passing Mozart entirely. The German words, even though not the original, tend to emphasize this interesting musical similarity. Note that the date here is 'way back, 1761; Mozart at that point was just five years old—yet this suggests Beethoven! If you know "Fidelio" (and any of the Weber operas, too), you'll find surprising resemblances in the more serious arias here, in the simplicity of the melodies, the clear, slow pacing, so unlike Mozart.

Also, of course, there are solid touches of Gluck himself, as of his later and much bigger operas in French, "Alceste," the French version of "Orpheus" and so on.

Nice little performance here, lively and well sung—well acted, too, in the German dialog, which may serve you as a good German lesson. Only anomaly is the stereo sound of the spoken dialog, which is produced in the same big liveness as the music and accordingly seems to take place in some vast and murky dungeon! That's one of the hazards of stereo and hi-fi.

3. Nocturnes and Battles

Mozart: Notturno in D for 4 Orchestras, K. 286; Serenata Notturna in D, K. 239; Overture to "Lucio Silla," Interludes from "Thamos," K. 345. London Symphony, Maag. **London CS 6133 stereo**

Here's one of the nicest collections of odd Mozart to come out in a long while. It has

unexpected musical values, imaginative playing and perceptive use of stereo technique.

Side 1 has the stereo stunt stuff, out of the vast supply of small-scale entertainment music by the composer. One piece calls for four small orchestras, the other for a solo group contrasted with an orchestral group *ripieno* of strings and drums.

In the first, the four orchestras actually comprise three "echoes" for one main orchestra. The four groups are neatly placed in stereo for a three-dimensional—not a two-dimensional—effect; the main group is in front, the first "echo" behind and to the right, the second a bit further behind and off to the left and the last "echo" still further back but on the right again. Since the entire function of these rearward orchestras is to repeat the end of what the front group has to say in each phrase—each repeat shorter than the previous one—the result here is unexpectedly charming and all that the playful Mozart could have wanted. How easy it was for this master to turn out disarmingly simple echoes, overlapping, yet without clashes in the harmony! It sounds easy, anyhow—it's just a nice little Mozartean suite, ending with a minuet and trio; but everything gets the ingenious echo treatment.

As for the *Serenata Notturna,* the Night Serenade, it gets a similarly imaginative portrayal of its own special space-challenge. In this one, the contrast is between the small solo group of four string players (including double bass) and the larger orchestra of strings and drums and stuff. You'll quickly find that the small group plays a game here—it produces a highly sophisticated sound, whereas the larger group is obviously intended as a bunch of musical peasants and confines itself to loud and platitudinous comment on the small group's playing, with much whanging of kettledrums.

It's an amusing contrast and London has made the best of it by putting the small group up forward, center. The large group surrounds it in the rear and to both sides for a pompously big effect, like an instrumental chorus. Excellent, and the piece hasn't been done as well before.

The second side of the record contains wonderful and serious music of symphonic proportions. The brief and early overture for *Lucio Silla* (aged 16) is soon over, but *Thamos* turns out to be top-drawer mature Mozart of unusual seriousness and expressivity, in the manner of the arresting statue music of *Don Giovanni* or the more solemn parts of *The Magic Flute* and the Masonic music. Remarkable, since we practically never get to hear these incidental items.

Altogether a most worthwhile and memorable Mozart record.

Britten: Nocturne, for Tenor and Orchestra; Four Sea Interludes and Passacaglia (Peter Grimes). Peter Pears; London Symphony, Royal Opera House Orch., Britten. **London CS 6179 stereo**

The *Sea Interludes* and *Passacaglia* are filler items here, taken out of the recent complete "Peter Grimes" recording. What is really interesting (since the Interludes have been heard over and over again before) is the *Nocturn,* as sung by the Britten specialist, Peter Pears. It is a kind of exalted recent sequel to one of Britten's finest earlier pieces, the *Serenade for Tenor and Horn* with orchestra, and like that work is a series of settings of various English poems from authors well distributed in time.

Unfortunately, this splendid performance is dismally marred by London's short-sighted packaging—not a single word of the texts is included and the long explanatory notes incredibly omit even their very titles and authors! Nor does the record itself help; the movements are cut continuously without band separations and without titles.

Pending some better information on what goes on here, I can only say that there are fascinating sounds in the work, fine singing, highly dramatic orchestration and some interesting elaborations of the Britten technique—at the beginning, the music is less tonal than any of his I remember hearing.

(*Continued on page 72*)

CHARLES A. ROBERTSON*

STEREO

Louis Armstrong: Louie And The Dukes Of Dixieland **Audio Fidelity AFSD5924**

With all obstacles finally rolled out of the way, the Dukes of Dixieland fulfill one of their fondest ambitions and march valiantly down the street behind Louis Armstrong. Actually, this is the second time they have paraded together, but the previous recording appears destined to remain in limbo indefinitely. Although the trumpeter's tone might seem dynamic and powerful enough to remove any obstruction, obtaining clearance for tunes selected at the first session proved to be too much. A wait of five years, plus a little bit of luck, may free them yet, according to Audio Fidelity's indomitable Sidney Frey.

To look on the sunny side, the preliminary baptism of fire and extra rehearsal time undoubtedly helped to bring about the fine temper of the later meeting held at New York's Webster Hall. It could be that the impasse also prompted Louis to a stunning series of improvisations on *Wolverine Blues,* as though to prove the folly of placing restraining labels and titles on jazz. He needs no encouragement to take liberties with a set of lyrics, however, and his vocals proceed with customary abandon. Somehow his claims of forgetting words seem suspect by now, but it does serve as a good excuse to make pop material sound like New Orleans. *Avalon,* for instance, is transported straight to the Gulf of Mexico.

Some of the best blues singers go down in defeat when forced to work with Tin Pan Alley tunes. Louis always manages to rewrite them as he goes along. With Snooks Eaglin, the blind New Orleans street singer, he shares the ability to reshape battered tunes into something fresh and authentic. When the occasion arises, as on *Sheik Of Araby,* he matches both the sharp satire of Billie Holiday and the robust humor of Fats Waller. But once Louis sinks his teeth into songs he thoroughly enjoys, such as the succulent *New Orleans,* and *South,* the aroma of home cooking fills the air. A vocal joust with Frank Assunto lifts his spirits even higher during *Bourbon Street Parade,* and his magnificent best pours forth on *Just A Closer Walk With Thee.*

Aside from being expansive hosts, the Dukes add support to the contention that Armstrong should depart from his regular routine more often. Papa Jac Assunto and his son Fred join forces on trombone to head the welcoming committee, but son Frank does the most to make his guest feel at home. As well as being a ready vocal foil, he gives Louis effective trumpet support, both in torrid chases and muted backgrounds. Jack Fuller, a new member who gained experience during five years spent with Jack Teagarden, is well versed in the traditional liquid tone and soaring lines of New Orleans clarinet style. Pianist Stanley Mendelsohn introduces *Sweet Georgia Brown.* Rich Matteson plays helicon, which provides the sonic treats of a tuba while moving with much greater rhythmic agility. Given this impetus and the swinging drive of Mo Mahoney, a recent arrival on drums, the Dukes step off to a lively beat.

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

When Armstrong performed for this label with his own group, the full impact of his trumpet playing was preserved intact for the first time. If anything, his tone appears to be even more brilliant and pure in this instance. Contributing factors are the spaciousness of the marching numbers and the deep, fullsome bass on *That's A'Plenty* and *Limehouse Blues.* The rich vibrato of his low register resembles the purr of a sleeping tiger and is wholly unmarred by distortion.

Several attempts to record New Orleans bands out-of-doors, either in the search for realism or due to difficulties in obtaining studio space, all have resulted in sound of poor quality however high the emotive content. By way of contrast, stereo placement in this case conveys the impression of an open expanse, despite the absence of ping-pong effects, while studio conditions ensure no frequency losses. Or to cite the views expressed by Mr. Frey, "I like a broad panorama of sound so that each of the musiclans is placed —and heard—according to where he'd actually be standing in a performance. Also, we record with very little reverberation. There's already enough in the room. And we get all the presence, intimacy, and warmth of sound we can so that the listener can identify himself with what's going on."

A good deal of the spaciousness extends to the monophonic version, and the band setup is outlined on the liner. Perhaps someday Joe Glaser will feel a twinge of conscience and permit Louis to record with an augmented Eureka Brass Band under similar circumstances.

Mahalia Jackson: Come On Children, Let's Sing **Columbia CS8225**

Brother John Sellers: Baptist Shouts And Gospel Songs **Monitor MFS335**

The leading light among gospel singers and one of her proteges demonstrate here many of the factors which make their chosen field a vital and moving force in American music today. As few audio fans are unaware of Mahalia Jackson's artistry and powerful voice, she needs no introduction, but the material programed is likely to be a new experience to most. The majority of the songs are of recent gospel origin and only two seem suited to secular fancy. One being the lively title tune, while the other is *Brown Baby,* a touching lullaby of universal proportions. The remainder permit the singer to affirm her faith once again, and the listener can only marvel at the sense of dedication which transforms each line of verse. The Falls-Wells ensemble, her staunch accompanying group, is arrayed in faultless stereo.

John Sellers spent boyhood years singing in churches and earned a featured billing as "Little Brother John" before reaching his teens. He toured with Mahalia Jackson and then went out on his own as a soloist at the age of seventeen. All of his previous LP's emphasize blues and folk songs, although the gospel sound is always evident. This time only the works he does best are heard, and his most satisfactory performance is the result. Thomas A. Dorsey, a prolific composer of gospel songs, contributes to the liner notes and also is credited with *Precious Lord, Coming Back Home,* and *Wooden Church On The Hill.* Sellers is the arranger of several older tunes, and blues collectors may remark the similarity between *I Had A Dream,* and Big Bill Broonzy's *Just A Dream.* In the stereo setting engineered by Dave Hancock, the organ playing of Ernest Hayes balances the piano of Herman Stevens. The guitarist is Mickey Baker, while Haywood Henry's flute interludes make that instrument sound as though it belongs. He deserves an invitation to use it on a jazz date.

Katie Lee: Life Is Just A Bed Of Neuroses **RCA Victor LSP2214**

After a session with the reigning purveyors of sick humor, a quick and reliable remedy is Katie Lee's healthy dissection of the language of psychiatry. The material was prepared by a grim body of writers, all showing signs of having rested on the bed of neuroses known as an analyst's couch. Each is peculiarly fitted to describe some specific problem and dispose of it according to Jung or Freud. Musical antidotes for such items as *Case History, Mental Blocks,* and *The Insecure Tango* are dreamed up by Ray Martin, who also conducts a roving band driven mad from wondering whether to ping or to pong in stereo. A guitar-picking life as a practicing folksinger has removed the last of Miss Lee's inhibitions, and she ends it all with a hearty *Get Well March.*

Duke Ellington: Blues In Orbit **Columbia CS8241**

Despite extensive changes going on in the orchestra, Duke Ellington's busy schedule continues unabated, and this midnight session took place last December in the midst of the reorganization process. It affords the always rewarding opportunity of witnessing the leader's creative powers at work on new men and ideas. One of his many qualities is the faculty to discern the best in a musician and use it to enrich orchestral textures. Certainly Matthew Gee has never been employed more advantageously than on baritone horn in *The Swingers Get The Blues Too.* A temporary replacement, he also plays open trombone solos on *C Jam Blues* and *The Swinger's Jump.* Booty Wood, another newcomer in the section, handles muted assignments and manipulates a plunger in ducal fashion on *Sweet And Pungent.* Jimmy Johnson, whose drum battles with Sam Woodyard were a feature of last season's festival season, carries on alone and finishes off his first entire LP with the band, driving it along splendidly.

Veteran members, of course, only need be let loose on the blues to exercise initiative. Johnny Hodges turns from rhapsodizing to match Jimmy Hamilton in furious forays. Ray Nance is the lone trumpeter, although reed and trombone sections for the most part are complete, and extends himself fully to meet all demands. Among the stereo treats is Ellington snapping his fingers as the sole accompaniment to Harry Carney's bass clarinet on *Blues In Blueprint.* As the Duke is still trying out new men and ideas, it is too early to determine how this effort will rate in the new order, historically speaking. It does assess high on the current market.

Bud Shank Plays Tenor **Pacific Jazz 4**
Charlie Barnet: Jazz Oasis **Capitol ST1403**

A pair of triple-threat reedmen are heard treating standards with respect for the melody and little regard for the current hard school of playing. Bud Shank is best known for his work on alto sax and flute, possibly because a goodly number of West Coast tenor players espouse a similar style, while the supply of experts on the other two instruments is limited. The chance to test accumulated ideas without interference from section mates or arrangers occurs on this LP. For the first time Shank confines himself entirely to tenor sax, leisurely applying polish to such tunes as *Thou Swell, I Never Knew, Blue Lou,* and particularly *Body And Soul.* Claude Williamson is the excellent conversationalist on piano, while Don Prell, bass, and drummer Chuck Flores complete the quartet.

Charlie Barnet is spending most of his time out California way, where he still etches a

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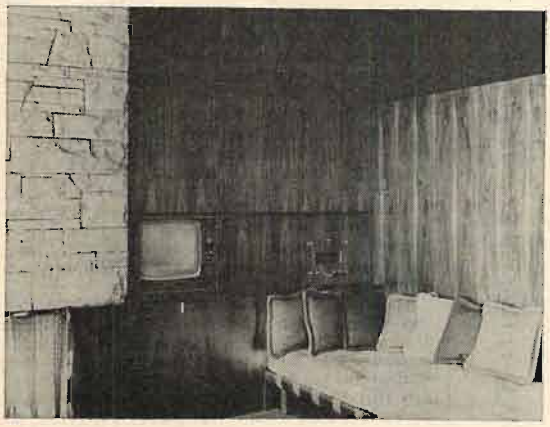

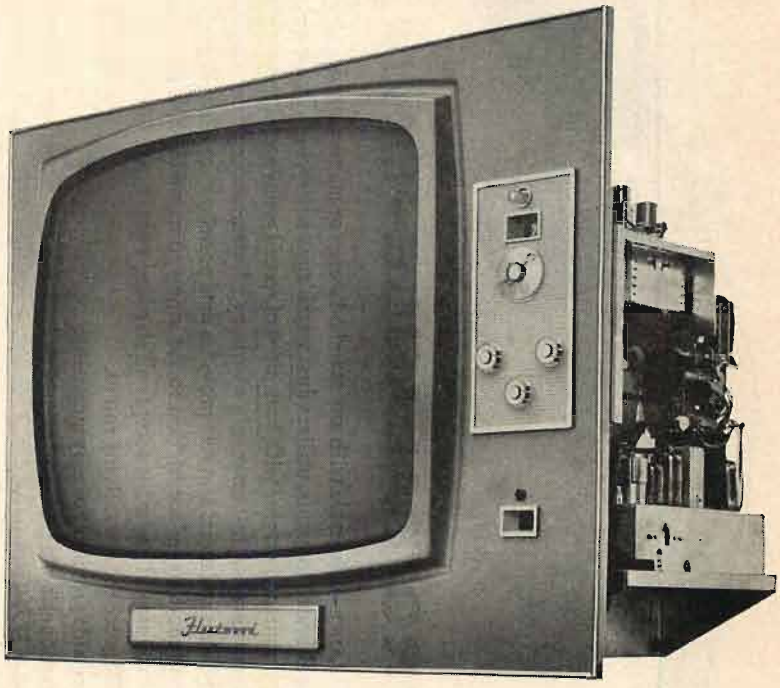

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lyric line with the warmth of Johnny Hodges and has lost none of his capacity to swing. About all the liner tells about the on-the-spot recording is that it was done on the spur of moment at a Palm Springs club. The three members of the rhythm section are unidentified, and Barnet almost disappears behind the palms himself. No mention is made of the fact that he switches from tenor to alto and occasionally to soprano sax, which he plays with the intonation and some of the vibrato of Sidney Bechet. But there is an accurate stereo picture of a typical night in a pleasant club, with the dancers enjoying themselves, and Barnet running through his own *Let The Good Times Roll, It's Only A Paper Moon,* and *Charlie's Blues.*

Larry Clinton: My Million Sellers
Everest SDBR1096
The New Glenn Miller Orchestra: Dance, Anyone? **RCA Victor LSP2193**

The name bands of the swing era continue to enchant the dancing public with distinctive sounds, and here are two of the best. Larry Clinton dusts off the old original arrangements, fattens them a bit for today's stereo market, and distributes the parts to a seventeen-piece studio band. His most popular hits are revived, namely the adaptations from the classics *My Reverie, Our Love,* and *Martha.* His special talent was voicing originals and arrangements so that they could be played by either swing or dance bands. Leaders of unswinging bands could always whip up a semblance of the real thing on *Dipsy Doodle, Johnson Rag,* and *Study In Brown.* The present band comes closer to swinging than most recreations, even though it must yield to a vocal group on *Satan Takes A Holiday,* and *Shadrack.*

Ray McKinley remains determined to keep the Glenn Miller legend alive and growing. Under his leadership, the band renews older numbers and adds new arrangements by Dean Kincaide and Joe Cribari. Among the revivals are Bill Finnegan's settings of *Adios, Sunrise Serenade,* and *Along The Santa Fe Trail.* The program holds to medium tempos for dancing, until McKinley takes the center of the stereo stage for drum solos on *Boomshot* and *Howdy Friends.*

Jackie Cain and Roy Kral: Sweet And Low Down **Columbia CS8260**
Poll Winners Three!
Contemporary S7576

The shining star throughout both these albums is Barney Kessel, the bespectacled Hollywood guitarist. Among the first to successfully integrate vocal sounds with instrumental in jazz, Jackie Cain and Roy Kral attracted a large following and their influence can be discerned in a wide assortment of later groups. Their arrangements are their own, worked out by Roy at the piano, and need bow to no other recorded performance for ingenuity and swing. Solos are created from a thorough knowledge of jazz and not copied from outstanding choruses originated by someone else. In addition to the title tune, two other Gershwin songs are included, along with such favorites as *Chicago, Mountain Greenery,* and *Experiment.* New pieces are Roy's *Wingin' With The Wind* and *Fun Life,* from "The Nervous Set." Old married hands as they are, the Krals have never sounded so well before—one reason being Kessel's presence in the accompanying quintet, and another that stereo is just the medium to make them feel at home.

The motive for singling out Kessel rather than Shelly Manne or Ray Brown is his authorship of quotable liner notes, in which he sums up the album and fellow poll winners briefly: "Ray's the best bass player in the world. He's got everything—tone, time, choice of notes. I'm afraid we take him for granted, the way we do Shelly. Besides being a good drummer, Shelly listens to what other people are playing." As this is the third successive victory LP, Contemporary also takes the event for granted, recording the trio before the annual results are announced. But there is nothing cut and dried about the three originals, or the work on such tunes as *Soft Winds, Easy Living,* and *I Hear Music.*

Mose Allison: Transfiguration Of Hiram Brown **Columbia CS8240**

In switching from the Prestige label, Mose Allison takes the occasion to premiere another of the characteristic piano suites which established his reputation. Unlike earlier endeavors telling of a boyhood spent in Mississippi, the latest saga brings his story down to the present day with an entertaining recital of comic and tragic episodes. Hiram Brown is a naive and barefoot bumpkin before going to the big city. There he attains a certain amount of sophistication, becomes disillusioned, and finally undergoes the transfiguring experience which leads to maturity.

A brief synopsis such as this makes it all seem like so much Horatio Alger, at the expense of Allison's ability to sketch a sharp musical portrait. He conducts our hero down a dusty country road and through Gotham's byways with an apt choice of rhythms, or reveals budding aspirations in a tart vocal. Good stereo, bassist Addison Farmer, and drummer Jerry Segal all help smooth the journey. Some of the material was composed more than ten years ago, but the finishing touches were applied only recently. A section called *The River*, with the serene feeling of confidence which follows the climax, is a powerful piece of writing.

Just as Allison's suites are a fusion of various styles and periods of jazz, his treatments of standard tunes, on the reverse side, adhere to no set mold. A provincial twang as distinctive as that of any folksinger would keep his vocals from sounding conventional, regardless of intention. It may be sampled on *'Deed I Do* and *Baby, Please Don't Go*. But for modern and highly charged piano playing, try *Love For Sale*.

Pepe Romero: Flamenco Fenomeno! **Contemporary S9004**

Flamenco is native to Spain, but the art has become so widespread in recent years that a new guitar phenomenon may turn up in any part of the world. Aged fifteen at the time of this recording, Pepe Romero is a student at Hollywood High School and began playing the guitar when he was a three-year-old in Malaga, Spain. All of his formal training came from his father, a gifted concert artist, but the boy also listened to the gypsies around his home and soon learned the traditional rhythms of Andalucia. The family moved to California in 1957, and Pepe now has pupils of his own, including several experienced studio musicians. Quite possibly they supplied the extra touch of professional seasoning needed to prepare the youthful teacher for this exciting debut program. The brilliant variations expected of a flamenco performer flow from his fingers in an undiminishing stream, and the rhythmic pulse is sure and swift. Jazz students interested in the art of improvisation would do well to listen. The only written piece is *Noche en Malaga*, a a composition of his father, Celedonio Romero, based on the *Malaguena* rhythms popularized by Lecuona and Albeniz. Roy DuNann's engineering is close and intimate, and stereo brings the guitar right into the living room.

MONO

Blues By Lonnie Johnson
Prestige/Bluesville 1007

John Lee Hooker **Riverside RLP12-321**

As the attention record companies are currently giving blues singers brings more and more out of hiding, it is doubtful if the question of which one is "best" will be decided for some time to come. One of the latest to be rediscovered is Lonnie Johnson, who was tracked down at his janitor's job in a Philadelphia hotel and already has a new $500 electric guitar to show for it. His most valued recordings were made for the Okeh label with Louis Armstrong and the guitarist Eddie Lang, but the most remunerative were his own blues hits that sold as many as three million copies. After touring England in 1952, he drifted into obscurity and finally stopped playing.

A youth of twenty when he left his native

New Orleans, he returns to the studios a veteran of sixty, bringing along a dozen brand new blues prepared for the occasion. While not strictly in the rural tradition, his blues are authentic enough and this first LP barely scratches the surface of his vast repertoire. Hal Singer, tenor sax, and pianist Claude Hopkins lend idiomatic support, along with Wendell Marshall, bass, and drummer Bobby Donaldson. Prestige's new series is one of the few to place blues singers in a proper setting, striking, a happy medium between the jukebox sound of some companies and the antiseptic folk atmosphere of others.

John Lee Hooker departs from the country blues of his first Riverside LP, drawing up an urban renewal plan of his own while singing of life as it is lived in the big city. He even has a timely campaign song in *Democratic Man*. He also enjoys the dubious distinction of being told on the liner that he needs to be "freed from the burden of carrying the full rhythm load." Bassist Sam Jones and drummer Louis Hayes are employed for the task, but why the halfway measures? Hooker should be either left alone or assisted by an adequate small group.

Bob Wilber: New Clarinet In Town
Classic Jazz CJ8

While not precisely a new clarinetist, Bob Wilber has yet to obtain all the recognition he deserves, so perhaps there are reasonable grounds for the album title. As the liner notes bear his name, they are more accurate than most and soon correct any misconceptions. Wilber, who has played clarinet off and on for nearly twenty years, offers the explanation that two approaches and settings new to him are being tried out. But detection of the knowledge picked up while an understudy to Benny Goodman for two years is left to the alertness of the listener. It will be quite plain to many that his journey to Brussels as a member of Goodman's sax section also included a postgraduate course in clarinet technique.

Wilber finds other ways to express his gratitude, however, and his choice of Charlie Byrd as a partner recalls the association of Goodman and Charlie Christian, especially on three quintet numbers. The debt is repaid in full on *Benny Rides Again*, a sparkling tour de force by all concerned. Ellington comes in for attention on Dave Brubeck's *The Duke*, and his own *Upper Manhattan Medical Group*. The Goodman small groups were most creative when the leader was inspired by men of equal caliber. Wilber enjoys just such company in Dave McKenna, piano, George Duvivier, bass, and drummer Bobby Donaldson.

A larger ensemble permits Byrd to send regards to another guitarist on Django Reinhardt's *Swing 39* and *Django*. Augmenting the quintet are a string quartet and Tony Miranda, French horn, on arrangements by Dean Kincaide, which include *All Too Soon*, *Lonely Town*, and Mel Powell's *Clarinade*. The writing is a good contemporary example of the style pioneered by Willard Robison, who used strings more effectively thirty years ago than most high-priced arrangers for vocalists do today. This album will endure the test of time equally well, and Dave Hancock's engineering of guitar and strings is superb.

Horace Parlan: Movin' & Groovin'
Blue Note 4028
John Handy: In The Vernacular
Roulette R52042

By a coincidence not unlike the one which made these two youngsters members of the Charlie Mingus Jazz Workshop during the same period, the departure times of the first flights scheduled on their own brings them together once more. Horace Parlan grew up in Pittsburgh and studied piano with the same teacher as Ahmad Jamal, mainly to strengthen a right hand paralyzed by polio. Only two fingers and his thumb can be used, requiring him to depend a good deal on his good left hand. While the technique he has developed is unusual, it appears to impose remarkably few conditions on the growth of a personal style. At this stage, Parlan is too intent on

proving his ability to compete with other modern pianists. He makes a plea for simplicity on the liner, but allows his enthusiasm to overcome his better judgment in practice. Chalk it up to a program consisting mainly of standards and a desire to make an impressive debut. Next time, a few originals may help Parlan achieve his own aims and fulfill the great promise shown here.

John Handy, who worked with Randy Weston after leaving the Mingus nest, concentrates on originals and immediately makes known his individual concepts and capacities as an alto saxist. No holds are barred on his tussles with basic blues, the spirit of Charlie Parker, and Oriental themes, before the relaxing serenade, *Dance To The Lady*. Also participating are two other Mingus pupils, pianist Roland Hanna and the fine new trumpeter Dick Williams. The set is opened by *I'll Close My Eyes*, and closed by *I'll Never Smile Again*. Experience in clubs as a leader will season Handy, but admirers of his work with Mingus will be gratified by his current progress, if not by the quality of the recording.

Red Garland: Red Alone
Prestige/Moodsville Vol. 3

Erroll Garner: The One and Only
Columbia CL1452

The distinction between a jazz pianist playing to create a mood or for a crowd gathered for cocktails is subtle and depends largely upon the hour. Both of these artists exercise wiles appropriate to late evening listening rather than the brief period before dinner. With ample time to relax and stretch out, they eventually leave surface sentiment behind and work toward investing each song with the amount of sinew or persistence needed to overcome resistance. As befits the occasion, Red Garland ventures forth alone, making a first appearance unassisted by bass and drums. A firm left hand and a steady melodic sense keeps him on the primrose path during *These Foolish Things, The Nearness Of You, Nancy With The Laughing Face*, and other romantic ballads.

Erroll Garner is trying to force withdrawal of his present album, but whether the threatened court action is due to contract talks or the nature of the recording would be hard to say. The tapes have evidently rested in the vaults for several years, and the selections are more likely to instill a mood than impress. A trio format is employed to illumine *Once In A While, Dancing Tambourine*, and *Rose Room*. Garner fans who admire the pianist's work before it reached the eminence of the concert stage may need to move fast in order to collect a copy.

Coleman Hawkins with the Red Garland Trio **Prestige/Swingville 2001**

In view of the fact that Coleman Hawkins avoided settling into a convenient jazz category for three decades. Prestige should know better than to try and classify his latest effort. True the elder statesman of the tenor sax sums up the subject of swing in an opening statement on *It's A Blue World*, and engages in a spirited colloquy with Red Garland on the pianist's *Red Beans*. But the agenda also includes a moody and sentimental *I Want To Be Loved*, which the State Department might well consider forwarding to both Khrushchev and Castro. Following the short recess called to reverse the record, protocol is set aside entirely and the remainder of the session consists of a powerful exposition of blues themes. Just as Hawkins spanned the jazz scene throughout the years, he accounts for swing, moody ballads and the blues, covering in one fell swoop all three subdivisions in the Prestige line.

The new alliance proves to be one of the strongest Hawkins has yet formed. Not only does the pianist hold up his end of the partnership when soloing, but his accompanying block chords are timed to further reinforce the plump Hawkins tone. With the assistance of Doug Watkins, bass, and drummer Specs Wright, they make a formidable team, whose eloquence and rich sound sits well on any turntable. AE

New York High Fidelity Show

LIST OF EXHIBITORS

THE HIGH SPOT of the Fall season comes early this year with the opening of the 1960 New York High Fidelity Music Show at the Trade Show Building at 4:00 p.m. Wednesday, September 7. Exhibit hours are from 4:00 to 11:00 p.m. on Wednesday, Thursday, and Friday, from 11:00 a.m. to 11:00 p.m. on Saturday, and from 1:00 to 7:00 p.m. on Sunday, September 11. In addition to the ninety-two exhibit rooms listed below, two refreshment rooms are situated on each floor where exhibitors and visitors alike can rest their feet while feeding the inner men.

Now, everybody, let's go!

EXHIBITOR	ROOM
Acoustic Research	544-5
Acro Products	340
Advanced Acoustic Corp.	602
Altec Lansing	308
American Concertone	614
Ampex Radio	307-349
Apparatus Development	322
Audio Devices	501
Audio Empire	547
Audio Fidelity	601
Audio Magazine	404
Bogen-Presto	333-5
R. T. Bozak Sales Co.	509-10
British Industries	628-9
Capitol Records	409
Carnegie Hall	632
Conrac, Inc.	552-3
Cosmos Industries	420
Crosby Electronics	337
DuKane Corp.	303
Dynaco, Inc.	502-24
EICO	305-6
Electrophono & Parts	347
Electro-Sonic Labs.	315
Electro-Voice, Inc.	438-9
Ercona Corp.	515
Everest Records	646
Fairchild Recording	627
Fisher Radio Corp.	529, 534-37
General Electric Co.	325
Gernsback Publications	525
Glaser-Steers	445
Grado	344
Grand Award Records	444
Grommes	507
Harman-Kardon, Inc.	424
Hartley Products	518
Heath Company	623
High Fidelity Magazine	343
Integrand Corp.	506-8
Karg Laboratories	331
Kimberly International	430
KLH	339
Koss, Inc.	617
Lafayette Elect	320-21
J. B. Lansing Sound	552-3
Lectronics of City Line Center	332
London Records, Inc.	407
McIntosh Laboratory	433, 606
Marantz Co.	329-30
Minnesota Mining & Mfg.	522
Motorola, Inc.	426-7
Neshaminy	651-2
Norelco	542
ORR Industries	348
Paco Electronics Co.	526
Pickering & Co., Inc.	309-12
Pilot Radio Corp.	527-8
Radio Frequency Labs.	401
Radio Stations:	
WABC-FM	505, 512
WNCN	323
WRFM	605-11
WNYC	405-6
RCA	531-2-3
Reeves Soundcraft	441
Rek-O-Kut	328
Revere Camera Co.	316
Rizzo & Associates	412
Roberts Elect	345
Rockbar Corp.	541-6
Rockford Special Furniture	635
Roulette Records, Inc.	301
Sargent-Rayment	338-42
Scope Electronics Corp.	429
H. H. Scott, Inc.	640
Shell Electronics Mfg. Corp.	302
Sherwood Electronics Labs.	408
Shure Brothers, Inc.	428
Stromberg-Carlson	446-7
Superscope, Inc.	437
Tandberg of America	645
Tannoy (America) Ltd.	642
Telectrosonic Corp.	346
Thorens Company	327
Time Records	402
Transis-Tronics	500
United Audio Products	422
University Loudspeakers	633
Weathers Industries	600
Wollensak Optical Co.	318
Zenith	648-49-50
Ziff-Davis Publishing Co.	442-3

MUSICAL SCALE AS ENGINEERING TOOL

(*from page 23*)

D, E, F, and G, and a real attempt was made to standardize pitch. They were also given single-syllable names as a teaching aid. Γ was called *ut,* A was called *re,* B was called *mi,* and so on. The scale thus developed became known as the gamma-ut or gamut and is the basis of the modern scale.

The development of the gamut came at a time when most music was simple and there was no need for a versatile scale or for an acurate definition of pitch. The early Christian hymns were simple melodies of rather narrow range. The frequency standard in each monastery was the larynx of the monk who could sound the lowest note. That note was taken as Γ, and everyone set his own pitch accordingly.

As music became more complex, the gamut proved inadequate; and the octave was divided into more steps. The final result was the presently-used, equal-tempered chromatic scale, each octave having twelve equal steps called semitones, shown in *Fig.* 1. (On tuning standards, the semitone is sometimes further divided into one hundred "cents".) Equal-tempered means that the same frequency ratio exists between any two adjacent notes on the scale. Each pitch described by a letter is one whole tone above the preceding one except for the steps of B to C and E to F, which are one semitone each. The octave derives its name from the fact that there are eight letter pitches (counting the first and last) included.

The Decibel-Tone Relationship

The octave has been adopted as a log frequency unit for engineering work, but its popularity has been limited by its large size. The decade, a much larger unit representing a ratio of 10 to 1, is even less popular.

Since the frequency ratio of an octave is 2 to 1 and there are twelve semitones in each octave, the frequency ratio of each semitone is $\sqrt[12]{2}$ to 1 and of each tone, $\sqrt[6]{2}$ to 1. This produces one of those rare coincidences for which engineers live:

In sound pressure, or in voltage or current a decibel represents a ratio of $\sqrt[20]{10}$ to 1.

$$\sqrt[20]{10} = 1.12203$$

$$\sqrt[6]{2} = 1.2246$$

A tone is to frequency almost exactly what a decibel is to voltage or current. Any mathematics which can be used with decibels and voltage can also be used with tones and frequency. The small error involved (1 tone = 1.0034 db) does not cause trouble in ordinary calculations. Actually, this error has been tolerated for years in the use of 6 decibels to represent a voltage ratio of 2 to 1.

Application of Tones

The direct relationship between the tone and the decibel, and the fact that techniques used to solve problems concerning decibels can be used equally well when tones are involved, make the tone far superior to such units as the octave or deci-octave. Voltage and current are often directly or inversely proportional to frequency. If, when plotting graphs of voltage or current amplitude versus frequency, the amplitude is expressed in decibels and the frequency in tones, the two are effectively in the same units; and the mathematics encountered in many problems is simplified. The slope of the frequency of a single stage differentiator is +1 db/tn. Two diferentiator stages will produce a slope of +2 db/tn, and so on. The effect with integrators is the same except that the slope is negative.

If the practice of plotting amplitude/frequency curves on a "square" scale (1 db = 1 tn) is adhered to strictly, direct comparison of graphs is possible. It is not necessary for the scales of two graphs being compared to be equal; if the same scale relationship is used in both, the shape of the curves presented will not be altered. In cases of extremely great or small slope, a square scale cannot be used; but much of the advantage is retained if one scale is made a whole multiple of the other and a notation to that effect is put in a conspicuous place on the graph.

Figure 2 shows a graph in which one decibel equals one tone. There are several varieties of commercially available semilog graph paper, such as 5 cycle × 70 or 3 cycle × 84, which can be used to produce a graph of this type. In the case of the 5 cycle × 70 paper, each ordinate division is a semitone. *Figure* 3 shows a graph in which direct frequency presentation has been sacrificed for the neat appearance and ease of plotting of a linear scale.

In loop stability studies, it is often helpful to be able to determine a phase characteristic directly from an amplitude characteristic. If an amplitude characteristic is straight for about six tones in both directions from a point in question and there are no lattice networks involved, the phase shift at that point can be derived from the slope:

$$\Phi = \frac{\pi}{2} M$$

where Φ is the phase angle in radians and M is the slope in db/tn, or,

$$\Phi = 90\ M$$

where Φ is the phase angle in degrees. The sign of the phase angle is the same as that of the slope.

Absolute levels of power and amplitude are commonly expressed in terms of decibels above or below certain convenient absolute levels such as one milliwatt (0 dbm), one kilowatt (0 dbk), or one volt (0 dbv). In the same way, tones can be used to represent frequency rather than frequency ratio. One convenient set of reference frequencies is one kilocycle, one megacycle, and one kilomegacycle. These are in 60 tone steps, making it possible to be always within 30 tones of a reference frequency. Therefore, the error produced by handling tones as decibels never exceeds 0.1 tone.

Occasionally an engineer needs to know the frequency of a musical note. Since tones can be handled as decibels, it is only necessary to know the reference frequency. The standard musical scale now in use is based on A = 440 cps. There is also a so-called mathematicians' musical scale which is 0.21 tone lower and is based on $C = 2^{10}$ or 1.024 cps.

Æ

HI FI ADDICT

(*from page 26*)

record groove and converts them into various forms of distortion and frequency response. The turntable is sometimes considered an integral part of the pickup, but it isn't really because they may be purchased separately, too, except when the turntable is a record changer."

Ours wasn't a record changer.

I've forgotten to mention that somewhere between the little speaker, pardon me—tweeter—and the turntable, we got a cartridge with a diamond stylus. (This use to be called a needle when I was young and didn't know any better.)

Well, anyway, we still didn't have a pickup arm and I finally got fed up with the whole state of affairs and bought one for my husband's birthday.

This completed our components, with the exception of an FM tuner which wasn't essential to the reproduction of recorded music.

In the meantime, back in the basement, my husband had been building a cabinet to house the two speakers. Now these speakers weigh together about 25 or 30 pounds; the whole speaker cabinet weighs about 300 pounds. And please don't ask me why. All I know is that it has something to do with pieces of wood to make the music go round and round and a load of insulation to cut down vibration.

Finally, two years after the beginning, the set was ready to test. More work was still needed on the cabinet, but essentially the system itself was completed. The whole thing was still in the basement but we used to sit down there in the evening and listen to records. We usually turned out the lights because the laundry tubs and furnace had a certain distracting effect on Beethoven's Sixth.

The First Finish

About this time, while the set was still in the basement, fellow audiofans learned that "Brooks has his system finished" and, at all hours of the evening, strange men would come to the door, staggering under the weight of amplifiers or speakers or turntables, and lurch to the basement to test them.

This testing business is a trying one for everybody except the hi-fi addict. From somewhere he suddenly acquires two or three obnoxious test records. These are made up of such sounds as little bells, big bells, gongs, shrill whistles, jungle bird calls, bongo drums, bass drums, and bass viols. You learn to steel yourself when you hear one of them being put on the turntable. You can tell it's a test record by the unctuous voice of an announcer asking "What is Hi-Fi?" or "Are you ready for an adventure in sound?" and then come the sound effects. I finally had to put my foot down about testing after nine in the evening because the children couldn't sleep through it and each morning looked as though they'd been through a bombing raid in the night.

The day finally came when the whole shebang came upstairs. It only took three men to get it up and they put the stair railing back when they finished, so it was relatively uneventful.

The cabinet was beautiful, a striking piece of furniture finished in blonde mahogany with black and gold grille cloth. And the sound which came from it was a revelation, heard now in a living room with proper acoustic effect. I was even more proud of it than was my husband.

An FM tuner has been added since then and we're beginning to talk about changing to stereo, but stereo could never sound better to me than our set did the first time we played a favorite record through it three years ago. Æ

AUDIOCLINIC

(*from page 4*)

tubes. I am second guessing you here. Assuming that I have guessed your actual problem, you should know that the tube manual shows the impedance recommended

for each type of output under the conditions it is to be operated.

In the AUDIOCLINIC for October, 1958, over the name Al Kerper, I describe a method for determining the impedance of the primary winding of an output transformer. Remember that the impedance from end to end of the primary winding is four times the impedance taken from one end to the B plus tap. If the transformer has ultra-linear taps, don't worry about them; they won't upset thiugs too much.

A Dynamically Balanced Tonearm

Q. If I were to manufacture a balanced tonearm, would it be more advantageous to obtain stylus force by spring tension or by a weight applied to the cartridge holder?

A. Before deciding whether it is better to weight the cartridge or to use spring loading to achieve a truly balauced arm, it is a good idea to know just what is meant by a truly balanced tone arm. When a tonearm is truly balanced, external forces which strike it from any direction are cancelled by opposite forces in the arm assembly. Let us assume that a force acts to move the arm in an upward direction. This same force is applied to the counterweight. The effect is an attempt to lift this weight. But lifting the weight and lifting the front of the arm will result in the arm's staying in one position. This can only occur when the mass at the front of the arm equals that of the mass of the rear—behind the pivot.

This is similar to saying that we have two people on a seesaw. When the weights are distributed just right, the seesaw comes to balance. Gravity acts to pull each end downward and the result is that no motion can occur. When the masses are unequal, however, the seesaw will gravitate downward in the direction of the heavier force because the downward pull from the other side of the fulcrum is not sufficient to oppose the pull of the heavier force.

This is also true for a balanced tonearm. The arm must be balanced for the particular cartridge with which it is to be used because cartridges made by various manufacturers will weigh different amounts. These differences in weight must be balanced out by means of the rear counterweight. The final balanced state means that the arm can be placed in any position and can exert no tracking force.

Now to the actual problem. To obtain the needed tracking force, some sort of weighting must be employed, the amount of which is determined by the tracking force. If the weight is added by placing weights on the cartridge holder, the balance we have so carefully worked out will be disturbed. After all, the increased weight just applied is the same as saying that we have replaced the desired cartridge with one which is heavier. To over come this unbalance, spring pressure, rather than weights, should be used. The spring pressure will overcome the downward pull of the rear counterweight to the degree desired, but it will not disturb the equality of forward and rear masses. The spring acts as a selective gravity system because its effects are noted only in front of the pivot.

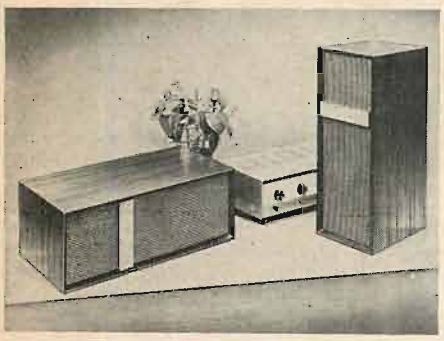
The tonearm balancing problem we have been discussing is made more difficult when taking into account horizontal drift and distribution of masses for horizontal balance. That is probably a subject itself, and since I've just about run out of space, it is just as well to leave this problem in somewhat incomplete balance. Æ

NEW PRODUCTS

• **4-Track Tape Recorder.** Moderate cost and quality performance distinguish the Sony Model 262-SL tape recorder. The 262-SL records 4 tracks monophonically and plays back 2 and 4 tracks stereophonically. Monophonic preamplifier, recording amplifier, and power amplifier are built in. Also built in is the second channel play-

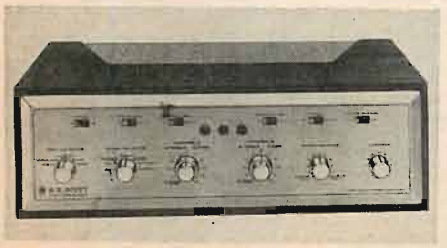
back amplifier. Features sound-with-sound recording which makes it useful for language and music instruction. Supplied complete with portable case, earphone, monitor speaker, dynamic microphone, and connecting leads for stereo playback. Also available as tape deck Model 262-D. Superscope, Inc., Sun Valley, Calif. **J-1**

• **"Minuette" Speaker System.** Designed to fit into a small area at a small price, the new Lafayette "Minuette" speaker system, Model SK-181, is ideal for expanding your present system into other areas of your home. It employs a 5" x 7" speaker in a



rear-loaded reflex type enclosure to provide a frequency range of 100–12,000 cps. Impedance is 8 ohms and power handling capability is 10 watts. The cabinet is finished in genuine walnut on four sides. Supplied with 6 feet of cable and a phone plug. Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y. **J-2**

• **Improved Version of Stereo Amplifier.** The new H. H. Scott Model 299B complete stereo amplifier is an improved version of their best selling Model 299. The improvements are in the nature of added conveniences and engineering advances rather than major redesign. For example, tape

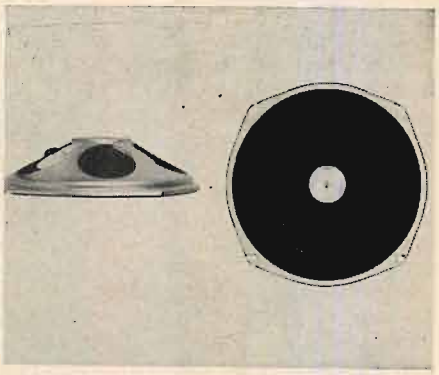


monitoring provisions and an extra high-level input for connection of an electronic organ have been incorporated. In addition, the output power has been increased to 50 watts (IHFM standards). Further information may be obtained by writing to H. H. Scott, Inc., Dept. P., 111 Powdermill Road, Maynard, Mass. **J-3**

• **Gray ST-33 Turntable.** Equipped with a precision hysteresis-synchronous motor, the Gray ST-33 turntable provides a high level of performance for playing 33 1/3 rpm stereo and monophonic records. Rumble is minimized by four live rubber shock absorbers and a polyurethane belt drive which isolates the motor both vertically and horizontally. The mounting plate is

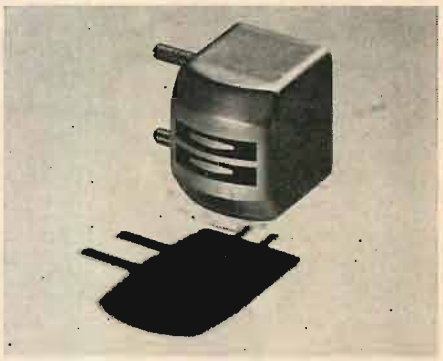
fabricated from ⅛-inch steel to add rigidity to the entire unit. A mounting hole is drilled in the plate to accommodate most 12-inch tone arms. Handsomely finished in "Sunset Gray" baked enamel with contrasting black and polished aluminum trim. Available as a kit with a smaller mounting plate (PK-33). The Gray Manufacturing Company, Special Products Division, 16 Arbor Street, Hartford 1, Conn. **J-4**

• **Inverted Speaker Design.** Featuring an extremely slim profile, the new "Magni-Magic" speaker by Utah is available in both the 8" and 6" x 9" sizes. The slim profile is achieved by removing the pot and magnet assembly from the back of the speaker and placing them inside the cone. Of special value for mounting in cabinets where space is at a premium, the



new speaker is claimed to achieve the efficiency and performance of conventional speaker designs. The magnetic circuit utilizes a dual-diameter Alnico V magnet in conjunction with a pure iron magnetic return circuit plus a self-centering pole assembly. Utah Radio & Electronic Corp., Huntington, Indiana. **J-5**

• **Four-Track Tape Head.** One of the smallest available ¼-track heads conforming to E.I.A. dimensional standards, the new Fidelitone tape head is designed to accommodate a wide range of electrical connections with different values of inductance. This, coupled with optional left or right-hand mounting, provides unusual flexibility and ease of installation. The manufacturer states that frequency response is flat up to 15,000 cps (with standard compensations) at 3¾ ips because of a novel tapered core design. Full information from Fidelitone, Inc., 6415 Ravenswood Ave., Chicago 26, Illinois. **J-6**



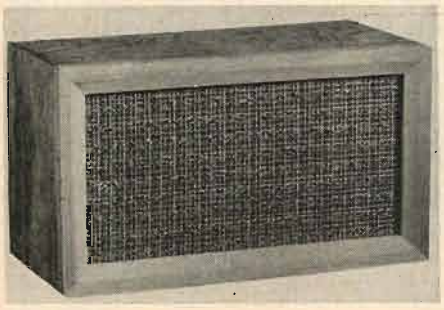
• **Professional Tape Recorder Series.** New Crown "X" all-electric control plus available remote control make the Crown International 800 series extremely versatile. Rugged aluminum construction, standard rack mount, plus satin anodized deep engraved panels clearly indicate professional quality. Featuring third head monitor with A-B and echo switch; three speeds with a separate motor for each speed; photocell actuated automatic

stop; synchronous capstan motor; patented differential magnetic braking; and provision for 10" reels with 14" reel capacity available. Frequency response at 15 ips, plus or minus 2 db, 30–30,000 cps with flutter and wow 0.06 per cent and noise ratio 58 db; at 7½ ips, plus or minus 2 db, 20–22,000 cps with flutter and wow 0.09 per cent and noise ratio 55 db; at 3¾ ips, plus or minus 3 db, 30–15,000 cps with flutter and wow 0.18 per cent and noise ratio 51 db. Harmonic distortion below 3 per cent measured by professional NAB standards. Crown International, South 17th St. & Mishawaba Road, Elkhart, Indiana. **J-7**

• **Fisher FM-50 Wide-Band FM Tuner.** Though moderately priced, the Fisher

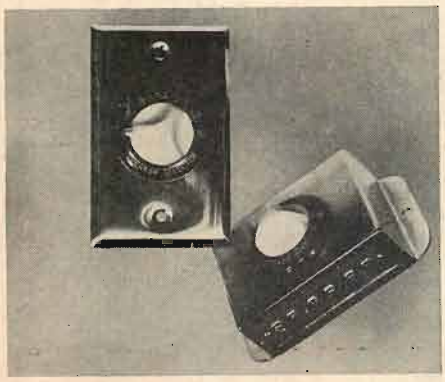
FM-50 offers features found in much costlier tuners. An exclusive feature of the FM-50 is the dual-purpose Micro-Ray Tuning Indicator. It can be used in the normal manner as a tuning indicator or, at the turn of a switch, it serves as a recording level indicator. A red warning band signals overload in a manner similar to a VU meter. Sensitivity is 1.3 microvolts for 20 db of quieting with 300-ohm antenna. Four i.f. stages are provided for high gain and selectivity at a bandwidth of 200 kc, 6 db down. A wide-band ratio detector, utilizing two matched germanium diodes, suppresses AM and minimizes distortion. Frequency response is 20 to 20,000 cps plus or minus 1 db (including standard 75 microsecond de-emphasis). Harmonic distortion is less than 0.8 per cent at 100 per cent modulation. Includes AGC, interstation noise suppressor, and local-distant switch. For further information write to Fisher Radio Corp., 21-21 44th Drive, Long Island City 1, N. Y. **J-8**

• **Unfinished 8-inch Speaker Enclosure.** Measuring only 10" × 16" × 9", the Homewood Model 6 fits on most bookshelves and is finish sanded on all sides to simplify placement. A pair of Model 6 enclosures, with appropriate speakers, can be used as midrange/tweeter satellites for a separately enclosed, non-directional bass speaker. Constructed of ½-inch plywood



with acoustic damping material installed at the factory, the Model 6 achieves a good level of performance with most 8-inch speakers. Ports are cut on either side of the main speaker cut-out to reinforce the low frequencies. Supplied with grille cloth framed in picture-frame type molding. Homewood Industries, Inc., 26 Court St., Brooklyn, N. Y. **J-9**

• **Speaker Selector Switches.** Control of up to three pairs of speakers in any combination is afforded by this newest addition to the Audiotex line of speaker-selector switches. Impedance is automatically matched as single units or pair



combinations are brought into play. Switches are simple to install, and are equipped with screw-type terminals to eliminate soldering. All models are in decorative brushed brass housings complete with matching hardware. Further information may be obtained from Audiotex Mfg. Co., Division of GC-Textron, Inc., Dept. FR, 3225 Exposition Place, Los Angeles 18, Calif. **J-10**

LETTERS

(*from page 6*)

writer is aware of, which is really germane to the subject and which, if correct, invalidates the whole idea."

Apparently this, the fundamental issue, has now been cleared up to the satisfaction of all, although Mr. Avedon's reference to it seems to be inadvertent. In a mathematical derivation avowedly designed to show that isothermal conditions do not banish nonlinearity, he calculates absolute values of the air distortion in an extreme case (equivalent to ½-inch excursions in an AR-1) as:

Air distortion (isothermal case) = 0.37%
Air distortion (adiabatic case) = 0.42%

Since no more than 85 per cent of the elastic restoring force in an acoustic suspension system is normally in the air-spring, the contribution of the air distortion is reduced to 0.31 or 0.36 per cent, respectively.

I do not think that there are any speakers whose total distortion, at the bass sound levels involved, is not of the order of twenty times 0.36 per cent, and with the type of speaker in which mechanical suspensions constitute the controlling element at low frequencies—the condition that the acoustic suspension system was designed to correct—distortion percentages well over a hundred times this amount have been reported by public testing organizations.

4. The frequency-response curves published in the first article in which Mr. Avedon was a participating author showed no significant effect from filling the cabinet with an unspecified sound absorbent material. The curves in my answering article showed that removal of fiberglass from a standard AR-2 created a 6-db dip at 725 cps, and a 3-db broader dip at 1100 cps, plus general loss of smoothness.

The new frequency-response curves published by Mr. Avedon, however, are in agreement with mine. He takes his curve only to 1000 cps, but shows a 7-db dip at 750 cps and a somewhat reduced smoothness at the upper end with removal of the filling, which this time is specified as fiberglass. I could not ask for better agreement in experimental data.

As to the effect of fiberglass at low frequencies, I would like to summarize the results of Mr. Avedon's computations:

It is possible to choose an amount of fiberglass stuffing—the amount is not specified—such that the compliance of a speaker enclosure, and its effective cubic volume, is increased by 19.2 per cent instead of the theoretical limit of 40 per cent associated with isothermal conditions. I agree.

EDGAR VILLCHUR,
Acoustic Research, Inc.
24 Thorndike St.,
Cambridge 41, Mass.

Cooperative Student Training

SIR:

We read with interest your June editorial about the Shure education plan. You will be interested to know that Electro-Voice has had a cooperative student training program for almost ten years. We thought it was a good idea and we are glad to see others in the industry undertaking similar programs. An increased pool of competent engineers will benefit the entire industry.

Electro-Voice which has perhaps the highest ratio of engineers to production people in the industry has been founded on the philosophy of "an engineering company" and we are doing everything in our power to improve the supply of engineers familiar with electro-acoustic problems and raise the calibre of our own fine group.

LAWRENCE LEKASHMAN,
Vice-President, Sales,
Electro-Voice, Inc.,
Buchanan, Michigan.

Silicon Diodes

SIR:

In his letter of comment on my Silicon Diode article, Mr. Bruce R. Kaufman brings out an interesting point.

The idea of matching rectifier diodes for use in series strings was considered, but omitted from the article for practicable reasons. Today the manufacturers of silicon diodes rate their products most conservatively, and I feel that the 1N2071 is an outstanding example. I have yet to find one of these that will not handle a 600-volt P.I.V. In fact, I was recently informed of a case where a series pair handled an 1800-volt P.I.V. for a couple of hours before one of the units failed. Perhaps a matched pair would have gone on much longer before both failed.

I still hold that the P.I.V. ratings of multiple-unit strings are additive, but I must agree that conservative operation with an ample safety margin makes good sense. It would seem to me that the integrity of the manufacturer is important, although a 100 per cent guarantee would not make sense. Given a proper design that includes a margin for safety, diodes purchased "across the counter" should display an extremely high survival rate without the need for selection.

L. B. DALZELL,
1162 Fleetridge Drive,
San Diego 6, Calif.

CROSSOVER

(*from page 22*)

This may sound a little complicated, but once you have done it, you will find how easy it is. The feedback invariably obeys the rules!

In designing transistor circuits, it is more important than in tube circuits to watch the effect of all components or over-all linearity of amplification. This is another advantage of using the oscilloscope method of set-up: distortion is at once evident. The feedback component has to be *current* rather than the voltage required for tubes. But the impedance in the base circuit must be kept adequately high, otherwise this will produce distortion, as well as loading or modifying the response in the collector circuit.

For this reason you may find it necessary to use an emitter follower with a gain stage, providing a low output-source resistance with a reasonably high output voltage—or over-all voltage gain, so the feedback resistance can be high enough to satisfy these other requirements. Such a circuit is shown at *Fig.* 10.

18 db/octave Type

The same method could be applied to the hypothetical circuit of *Fig.* 18, the theory for which was developed in an earlier article.[6] This would use either two stages to get satisfactory buffer action between the three rolloffs, or interaction could be permitted between the nominally non-identical ones, so the over-all result comes out the same as the specified non-interacting ones. But a simpler approach is possible that also gives the correct response.

This consists of increasing the feedback around the two section type until the response has its unit slope, 90-deg. point at zero level (with a slight peak of about 1.25 db just inside the pass band). A further single rolloff at crossover then pulls the over-all response down to −3 at crossover, and the over-all shaping is correct (*Fig.* 11). Procedure is as follows:

The internal rolloffs are each set to a frequency that is half crossover for low pass or double it for high pass, so the 6-db, 90-deg. point, without feedback, is at this frequency. Then 12 db of feedback is applied to bring this to zero level at crossover. Alternatively, as with the 12 db/octave design, different combinations can be used, for which the scale of Fig. 13 can be used in the same way to aid in this step.

Finally, this feedback section is combined with a simple rolloff, external to it, and with minimum interaction, giving its 3 db point at crossover. Tube and transistor versions of this are shown at *Figs.* 16 and 17.

24 db/octave Type

The theoretically ideal 24 db/octave response can be achieved using the hypothetical circuit of *Fig.* 15. However, a mere glance at it shows its set-up procedure will get quite involved—and require a large number of components, since two feedback loops are needed in each channel. If any readers want to be academically correct, the scales of *Fig.* 12 can be used as a design-experimenting adjunct in the same way as those given for the 12 and 18 db/octave circuits.

But there is much simpler approach that gives 24 db/octave, with very little deviation from the ideal "constant resistance" characteristic. This uses a minimum of 18 db feedback (using identical non-interacting sections inside the feedback loop) with a frequency extension factor of $\sqrt{8}$, or 2.828. Other values for the 90-deg. point without feedback, the frequency shift, and the amount of feedback necessary, are given by the scale of *Fig.* 11.

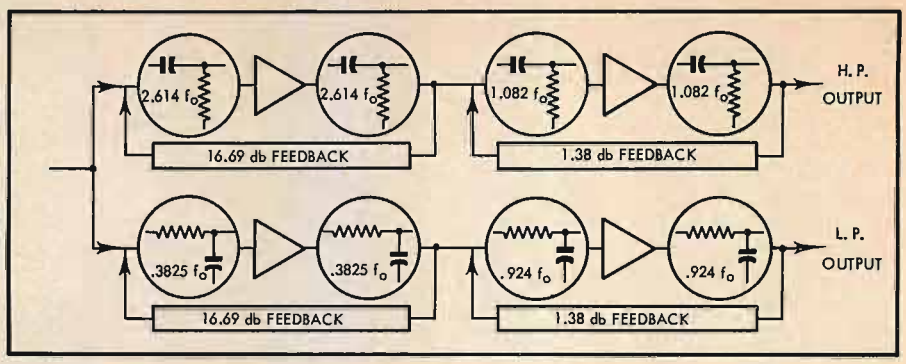


Fig. 15. A theoretical type of filter to give precise 24 db/octave response of maximum sharpness uses two feedback loops in each filter.

In this case it is advisable to check the final response before the external sections are added, which should have the 90-deg. phase shift at crossover and at +3 db (height of 2.82 in. for width of 2 in. on 'scope). Now adding two separate networks, one at the input and one at the output, yields the required response: −3 db at crossover, with the right slope (*Fig.* 14).

This simplified adaptation requires few more components than the 12 or 18 db/octave types, and the error in response is quite small. The greatest error

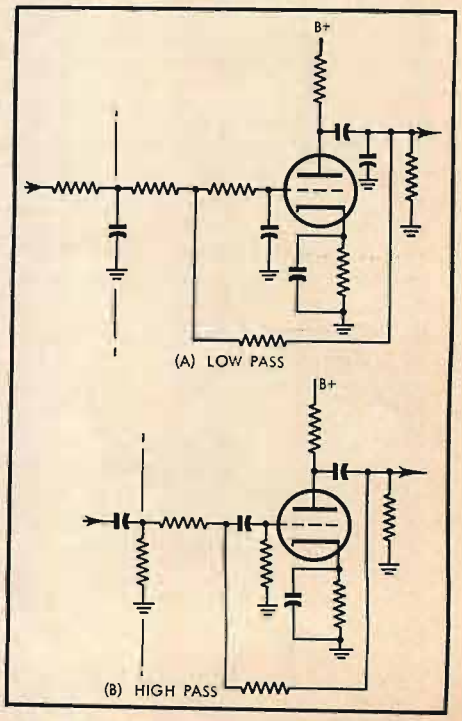


Fig. 16. Configuration of circuits for 18 db/octave filters using tubes. Extra stage is indicated by vertical lines separating it at front end.

occurs at frequencies above and below crossover by ratio $\sqrt{3}$ (1.73) where the attenuation is 0.3 db more than the ideal circuit would give. It is probable that a circuit based on the ideal would deviate by at least this much in practice, due to its greater complexity and the corresponding involvement in setting it up.

Figures 19 and 20 show tube and transistor versions of the 24 db/octave circuit, which can be built on this design method.

All these circuits should be designed bearing in mind that, while the feedback used operates to reduce distortion in the pass range, it is virtually non-existent for distortion reduction at crossover. Of course, an internal feedback loop can be used to linearize the stage if necessary, as well as taking precautions that the circuit values used do not run the tubes or transistors into unnecessary distortion.

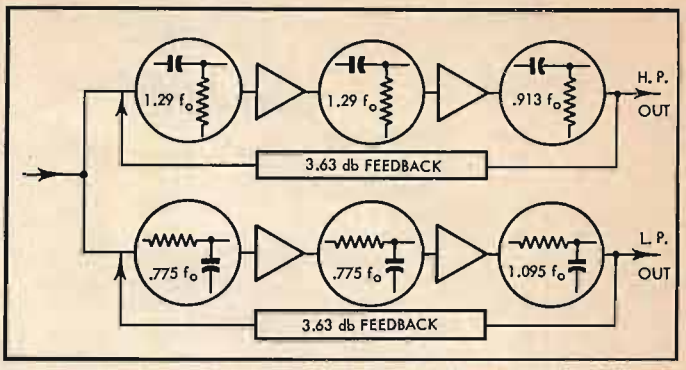


Fig. 18. One theoretical type of feedback filter to give 18 db/octave rolloffs.

Additional References

[1] Norman H. Crowhurst, "The RC crossover compromise." AUDIO, July, 1957.

Herbert Ravenswood, "Electronic dividing networks," *Radio-Electronics*, September, 1957.

Norman H. Crowhurst, "Loudspeaker crossover design." *Radio-Electronics*, July, 1952.

Norman H. Crowhurst, "More about filters." *Radio-Electronics*, April–May, 1953.

[2] Norman H. Crowhurst, "Basic design of constant resistance crossovers." AUDIO ENGINEERING, October, 1953.

[3] "Crossover networks for multiple speakers." *Service*, February, 1956.

[4] Norman H. Crowhurst, "Questions about crossovers." *Radio-Electronics*, July–August, 1956.

[5] Norman H. Crowhurst, "Choosing your crossovers." *Radio & Television News*, October, 1957.

Norman H. Crowhurst, "Multi-channel electronic crossovers." *Radio-Electronics*, December, 1957.

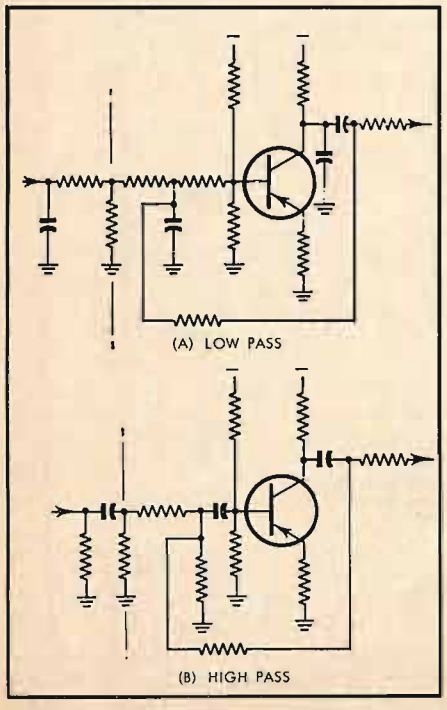


Fig. 17. Configuration of circuits for 18 db/octave filters using transistors.

[6] Norman H. Crowhurst, "Feedback filters for two-channel amplifiers." AUDIO, October, 1954.

[7] Norman H. Crowhurst, "The interaction concept in feedback design." AUDIO, October–November, 1956.

APPENDIX

Any two-section filter, without feedback, has a response that can be written

$$db = 10 \log_{10} [1 + ax^2 + x^4] \qquad (1)$$

where x is f/f_o for low-pass and f_o/f for high-pass, and f_o is the frequency of unit slope, 90-deg. phase shift. For identical non-interacting networks a has the value 2, and f_o is the 3-db, 45-deg. point of each network. For other combinations, f_o is the geometric mean between the two 3-db, 45-deg. points, assuming non-interacting types. For interacting types, see appendices to earlier articles.[7]

At the unit slope point, the attenuation given by Eq. (1) reduces to

$$db_\phi = 10 \log_{10} [2 + a] \qquad (2)$$

When feedback to the extent of a feedback factor F is applied, reducing mid-band gain by $20 \log_{10} F$, or $10 \log_{10} F^2$, the response modifies to

$$db = 10 \log_{10} \left[1 + \frac{a - 2(F-1)}{F^2} \cdot x^2 + \frac{x^4}{F^2} \right] \qquad (3)$$

By use of the frequency extension factor $x^2/y^2 = F$ (the square root of the feedback factor, this may be normalized to the new unit slope point, with feedback

$$db = 10 \log_{10} \left[1 + \left(\frac{a+2}{F} - 2 \right) y^2 + y^4 \right] \qquad (4)$$

At the new unit slope point, the attenuation given by Eq. (4) reduces to

$$db_{\phi f} = 10 \log_{10} \left[\frac{2+a}{F} \right]$$

$$= 10 \log_{10} [2 + a] - 10 \log_{10} F \qquad (5)$$

Thus the attenuation (or boost) at the unit slope point is raised in level by half the down the mid-band gain.
amount (in db) that the feedback cuts

For the identical non-interacting case, $F = 2$ for Eq. (5) to reduce to 3 db, and the frequency extension factor $\sqrt{F}$ is $\sqrt{2}$. The feedback required is $10 \log_{10} 2^2$ or 6 db. For other values, $F = \frac{a+2}{2}$.

The alternative approach for the 18 db/octave type is based on equating the factor $\left(\frac{a+2}{F} - 2 \right)$ in Eq. (4) to -1, so that when this is combined with a further non-interacting section, having its 3-db, 45-deg. point at the same frequency as the reference frequency for Eq. (4), the terms in y^2 and y^4 for the combination response disappear, leaving

$$db = 10 \log_{10} [1 + y^6] \qquad (6)$$

This requires a value of feedback, such that $F = a + 2$. For identical non-interacting sections, the feedback is 12 db, and the extension factor 2. For other cases the feedback is 6 db more than for the 12 db/octave type, and the frequency extension factor $\sqrt{2}$ times it.

The basis for the academically correct approach to the 24 db/octave case was given in ref.[6] The response reduces to the form

$$db = 10 \log_{10} [1 + y^8] \qquad (8)$$

The basis for the simplified approximation rests on using an amount of feedback that, combined with two external identical non-interacting sections, will yield the half-ultimate-slope, half-ultimate-phase-shift point at -3 db. This requires

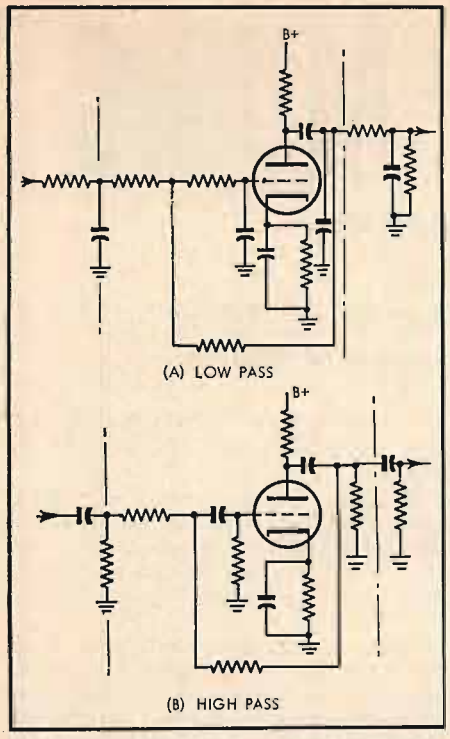


Fig. 19. Configuration of circuits for 24 db/octave filters using this technique with tubes.

$$db = 10 \log_{10} \left[1 + \left(\frac{a+2}{F} - 2 \right) y^2 + y^4 \right] + 10 \log_{10} [1 + 2y^2 + y^4] \qquad (9)$$

should reduce to 3 db at $y = 1$, or

$$\frac{a+2}{F} - 2 = \frac{3}{2}$$

reducing to $F = 2(a+2)$. (10)

This means the arrangement requires another 6 db more feedback, or 12 db more feedback than the 12 db/octave type, with twice the frequency extension ratio of that type.

The error from making this simple approximation produces a response of

$$db = 10 \log_{10} [1 + \tfrac{1}{2}y^2 - y^4 + \tfrac{1}{2}y^6 + y^8] \qquad (11)$$

in place of Eq. (8).

Differentiating the error [the difference between Eqs. (8) and (11)] by y and equating to zero, the approximate maxima occur when $y^2 = \frac{1}{3}$ or 3. Substituting these values into the error expressiin shows the excess loss at these frequencies to be $10 \log_{10} \frac{44}{41} = 0.3$ db. Æ

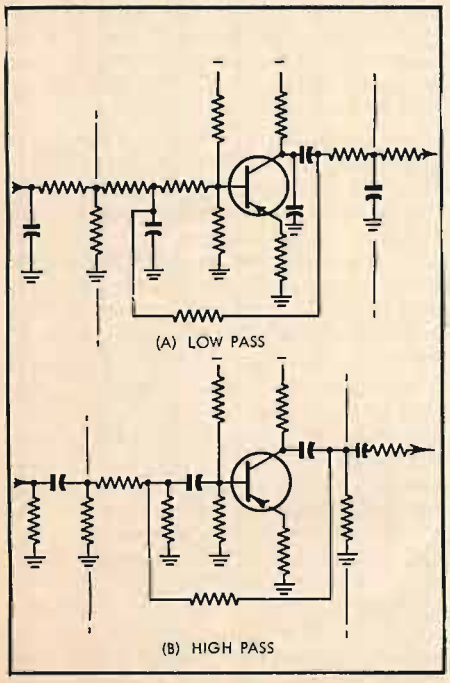


Fig. 20. Configuration of circuits for 24 db/octave filters using this technique with transistors.

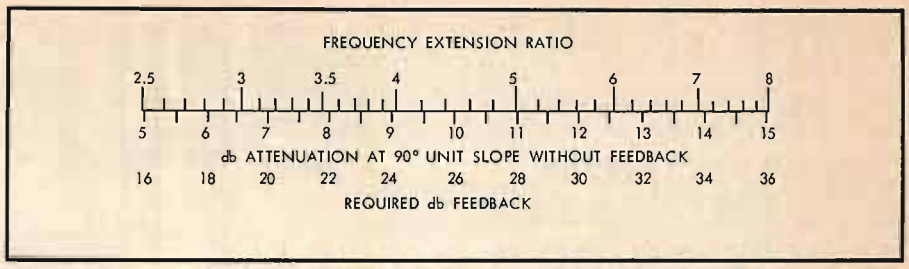


Fig. 21. Scale to aid in determining feedback relationships in simplified version of 24 db/octave filters.

ABOUT MUSIC

HAROLD LAWRENCE*

"And Everywhere That Mary Went"— One View of Background Music

IN A CLASSIC W. C. Fields movie about a prodigal son returning home to his parents' hut in the icy North, the late comedian prepares to go out into the cold to milk the deer. With his hand on the doorknob, he pauses to utter these words, "It ain't a fit night for man nor beast." Opening the door, he is hit in the face by flying slush.

I am reminded of this every time I visit the corner tailor shop. My first impulse is to duck aurally to get out of the way of the noise. The loud sounds filling the shop are created not by the steam-snorting presser, or the old-fashioned sewing machine, but by a table model radio set to near-maximum level. There is nothing to do but shout "Press" or "Clean," point to the deposited garment, and depart hastily. If I happen to hail a taxi, the chances are that the driver, too, is operating his radio at a hearty volume, loud enough to be heard above the clamor of Manhattan's traffic. The cab driver is on the whole cooperative when asked to turn off his radio, although he is one of the rare dispensers of processed music over which we can exercise some control. For in a world where music, whether of the radio or Muzak variety, is so much a part of our lives, it has become almost impossible to escape the ubiquitous loudspeakers.

Functional Melodies

During the past decade or two, an increasing number of hotels, factories, retail stores, art galleries, rest rooms, and countless other public places have been wired for sound. The design of virtually all new office buildings, "luxury" apartment houses, air terminals, theatres, and so forth, includes built-in music. It would seem that the aim of hotel operators, businessmen, and industrial magnates is to saturate their areas with background music. Industry reports, for example, tell us that output is increased and errors reduced when music is piped into the plant. Muzak's program director once gave out his recipe for work-with-music in *The Saturday Review* (Sept. 28, 1957): "When the employee shows up in the mornings he's usually in good spirits, and, accordingly, the music is relatively calm. By ten-thirty, he's getting a little tired and feels a bit of tension, so we hit him with something that will give him a lift. Around noontime he's looking forward to lunch, which calls for melodies in a more relaxed mood. Then toward the middle of the afternoon, fatigue is likely to set in, and once more we pep him up with something rhythmic, usually with an even stronger beat than in the morning."

Similarly, Muzak's services cover other public functions such as transportation (Hawaiian songs are programmed on Hawaiian-bound flights), finance (banks are not what they used to be), dining, swimming, and so on.

There is nothing anyone can do about the rising tide of background music, so enthusiastically supported by market surveys and efficiency experts. Nevertheless, many regard piped-in music as an intrusion, though their opinions are obviously not shared by the majority. However, since "there is nothing democratic about a captive audience" (as William Schuman, president of the Juilliard School of Music pointed out), a minority report is in order.

One of Detroit's finest hotels has lined its elevator interiors with full-length mirrors. When you are riding with several passengers, you can almost forget about the glass, but when you enter the elevator alone in the early morning, it can be a trying experience. It's difficult enough to have to face yourself in the bathroom mirror while shaving, but to see your reflection from different angles is really unfair. To add to this, the hotel management has installed Muzak (the term is used generically) with the result that you are bombarded with optimistic arrangements of popular songs all of which seem to say, "Smile, darn you!"

An art gallery on Fifty-Seventh Street, now presenting an exhibition of French paintings, including the works of Dufy, Renoir, Redon, and Vuillard, has recently installed a wired music system. The choice of music could not be more incongrous: the loudspeakers fill the small gallery with mediocre versions of popular songs, thereby breaking the mood which the artist intended to create in the mind of the viewer.

Advertisements notwithstanding, commercial jet planes have not yet succeeded in keeping the noise of the engines from the passengers, although the degree of insulation is high when one considers the tremendous roar and squeal produced by the jets. Many of the airlines have now equipped their cabins with wired music, but it is seldom effective when the plane is airborne. Most of the time, the reproduction is distorted, suffers from wow, and makes for an unpleasant whine in the background. Ou one particular flight, the pitch waver was so pronounced that it sounded like a 45-rpm record being played off-center on a normal-spindle turntable.

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Random Noise

The air is contaminated not only by commercial piped-in music but by other factors as well. On a recent Antarctic expedition, it was reported that, with the exception of the captain's quarters, the sound of rock 'n roll discs penetrated every corner and hole of the ship throughout the crew's waking hours. The pattern is probably true of all our military outposts, submarines, and surface vessels.

The boom in portable transistor radios has also swelled the ranks of the music intruders. At Lewisohn Stadium concerts, it is not unusual to see someone in the audience listening to a radio program while a performance for which he has paid to attend is being given at that very moment.

The car radio played on important role in the career of a record promotion man. Whenever one of his firm's records was being broadcast by one of the local disc jockeys, he would raise the level of his sporty convertible's radio to maximum output, and in order to enable everyone within a twenty-block radius to hear it.

It is interesting that with the increasingly wider dispersion of Muzak and other media, the public has come to take music in the air for granted. Half-an-ear listening is the result. But, as Max Frankel recently reported from Moscow in the *New York Times*, it is impossible for even the most insensitive ears to remain indifferent to "the blaring of loudspeakers pouring forth a din of martial rhythms and inspirational lectures into trains, ships, parks and public squares." A powerful Russian literary journal has finally raised its voice in protest and inaugurated an anti-noise campaign with the slogan, "That those who want to listen can listen and those who don't should be spared the noise."

It looks as if those on this side of the Iron Curtain who don't want to listen may be forced to follow the lead of Time, Inc. In the magazine's new building, air conditioning outlets in the ceilings contain "a noise maker giving off a low, controlled hum." This noise was created deliberately to combat the noises produced by the "pool" (offices separated by movable partitions): namely, the sounds of voices, telephones, typewriters, and teletype machines. On a smaller scale, why not design a portable transistor hum-maker for individual anti-noise and anti-wired music use? *Æ*

LIGHT LISTENING

(*from page 14*)

outfit that the other bands of his day have not been able to maintain. Then too, he has never indulged in ornate styles that would tend to date the band. Never having heard the band in person, I was surprised to discover what tape is able to do for the sonic punch in a typical Brown full ensemble attack. Discs have not revealed the solidity you can get today when this band meets a well-designed tape head.

The selection of music in this set reflects the band's intimate association with the swing era. With the exception of Billy May's *Lean Baby* and a show tune from "Bells Are Ringing," most of the material has had years of service. The Goodman favorite *King Porter Stomp* rubs shoulders with *Moten Swing* and Ellington classics such as *Take the "A" Train* and *I'm Beginning to See the Light*. Add the Ralph Burns *Early Autumn* featured by Woody

Herman, along with George Shearing's *Lullaby of Birdland* and you have a lineup that could do credit to any swing band. A feature that will be welcomed by any listener with sensible spacing of stereo speakers is the absence of adolescent gimmicks both in the arrangements and the orchestra's seating plan.

Bells Are Ringing—Original Soundtrack
Capitol SW 1435

In transferring this hit musical to the screen, M-G-M has captured most of the flavor of the New York production. Judy Holliday again plays the lead she created on Broadway in this story of the elaborately comical role a telephone answering service operator can play in the life of a client at PL 0-4433. Dean Martin handles the romantic songs at that exchange with unpretentious aplomb. The Jule Styne songs, including two new ones written for the film, take on higher gloss with the studio orchestra under the direction of Andre Previn. The best use of stereo occurs in the dance sequence midway through the tune "Just in Time" as Judy Holliday and Dean Martin move from speaker to speaker in an old-fashioned patter routine.

George Melachrino: Music of Victor Herbert
RCA Victor LSP 2129

Many light music fans have been conditioned to the Mantovani and Kostelanetz treatment of Victor Herbert's music. Heavy commercial drive in every phrase has been part of their trademark. After the first fifteen minutes of this album, I was ready to admit preference for the low-pressure method Melachrino used in a dozen of the more familiar operetta melodies. The realism of this spacious, made-in-England recording doesn't need souped-up arrangements to sell the music. Impressively low in distortion, this is one of the smoothest pop recording jobs on any label in recent months. The term "pop" is a bit out of place in this case because the illusion of depth in the clever handling of the *March of the Toys* is equal to that of the best symphonic stereo recordings. This one is worth hearing even if Victor Herbert's output doesn't hold a sanctified place in your heart. AE

RECORD REVUE

(*from page 51*)

If you buy this, insist that you want a "libretto" or text from London, and make the dealer inquire for you. Somebody ought to tell London. . . .

Grofé: Grand Canyon Suite.

Beethoven: Wellington's Victory (The "Battle Symphony"). Morton Gould and His Orchestra.
RCA Victor LSC 2433 stereo

This is rightly billed, and sold, as a Stereo Spectacular. It's all of that, if not too much more. But what surprised me here was the good show put on by Mr. Beethoven, whose musical battle is between the Duke of Wellington and Napoleon's French.

I'll let the Grand Canyon pass; you can figure for yourself how it'll sound in Morton Gould's enormous stereo. I went straight to the big fight. The *Battle Symphony* is regularly castigated by music critics as a piece of junk, unworthy of its great author. Perversely, I myself have had a small warm spot for it in my own affections, ever since I first heard it on records back in the Thirties. A wonderful and truly Beethovanian little set of variations on *My Country 'Tis of Thee* was part of its charm, for me.

But more was simply in the fact that this was an honest piece which did exactly what it intended to, put on a mock musical battle. After all, the original was written for a monster mechanical orchestra, twenty times the size of our puny carousel "organs"—why, indeed, should it sound like the *Eroica* Symphony? It sounds like a musical battle, and it's an effective one in Napoleonic terms, complete with military marching, drums, guns, cannon, plus *God Save the King* representing the British and *The Bear Goes Over the Mountain* (as we know it) representing the French.

In stereo this battle-axe of a showpiece suddenly takes on a dramatic genuineness that you would not suspect via the one-dimensional format, for how, after all, can a musical battle be one-dimensional? Here, the English are in one speaker and the French in the other, and the battle is all over the place! In good old-fashioned style, the armies draw up at parade attention before the fight begins; we hear splendid pipings and drum rolls, first on one side and then the other. Then the cannons roar, the muskets rattle, the Bear goes over his Mountain slower and slower, in the minor, as the French are defeated, and to cap the victory, God Saves his British King in the abovementioned noble set of variations.

It's a lively show, come into its own in stereo, and if you are inclined to disapprove of Mr. Beethoven, you'd better not try; oddly enough, the whole thing reeks of Beethoven from beginning to end and you won't for an instant be able to forget who was responsible. No need to, really.

4. Quartets, Quintets

The String Quartets of Franz Joseph Haydn. (a) Op. 71, #3; Op. 74, #2, #3. (b) Op. 71, #1, #2; Op. 74, #3. Griller String Quartet.
Vanguard VSD 2033, 2034 stereo
(*also mono*)

Haydn: String Quartets Op. 54, #1 and #2. Amadeus String Quartet.
Angel 45024

Haydn quartet nomenclature is painfully hard on the eyes (as above) but the music is good for the ears, decidedly. You're not likely to exhaust the supply of these quartets in your casual listening—there are eighty-odd, composed over a long span of years, and even the very earliest, virtually the first true string quartets ever written, are masterfully composed. There's a little serenade movement from one of the very first that is often heard in restaurant and mood music form, for instance. (It's better where it belongs, with four solo strings.)

Vanguard's Griller Quartet is the leading British group, mature (1928), seasoned, in today's fast-moving musical world a pleasingly old-fashioned quartet with a big, poetic sound, rather lush, a reverent musical approach that makes the most of every musical detail in relatively leisurely fashion. The Haydn Quartets don't suffer at all under this treatment—indeed, it avoids both the overly high-power speed treatment and that slightly prim, overfussy sound that are often associated with Haydn quartet playing today. Perhaps there is more intensity of playing to be found in the work of other quartets—Budapest, for instance—a longer line and more subtlety of phrasing; but the Grillers make up for this in warmth, humanity, and vigor. Their playing is excellent for inquiring minds who want to know what quartet music is like under good home listening conditions.

Angel's Amadeus Quartet is a younger group (three of them were five years old when the Griller was founded), nominally British but actually three-quarters Austrian; its name is Mozart's middle name. Its playing is correspondingly more of a contemporary sort, leaner, somewhat drier and less Romantic, with more emphasis on over-all shape and structural details, less on leisurely melody on the loose. In corresponding fashion, Angel's recording is drier, closer, the string tone more edgy and leaner than Vanguard's for the other group.

Stereo (in Vanguard) is important in defining the space in which the music is played, rather than as a means for separating the instruments. (They don't spread out in a straight line, in any case.) You won't worry as to whether the cello is heard on the right or the left—it's unimportant. What counts is the stereo room-realism. That's plenty, and it justifies a great deal of excellent chamber music stereo, right down to single instruments, in a realistic space.

Mozart Quintets. Griller String Quartet with William Primrose, viola.
Vanguard VSD 2060/61/62 stereo

These three LP's came in after I had written the preceding account of the Griller's Haydn, anl they can share much of that description. The discs are available separately, in stereo or mono, and include five Quintets plus the *Adagio and Fugue in C Minor, K.546* (played by the Quartet).

What is extraordinary about these Quintets is their lateness and, consequently, their full maturity. The earliest has a "K." number in the 400's and the last is one of the few final Mozart works with "600" identifications. The Quintets began thus, when the long series of Mozart Quartets was practically ended, and represent the very top of Mozart's expression.

In addition, there is the extra richness of color and texture given by the pairs of violins and violas (the cello on the bottom) to add more interest. If you don't know Mozart well, you could at first think of these Quintets as light-hearted in many spots—you would be right, but very wrong if you concluded that this meant superficiality. Mozart's most hysterically gay music often is a part of his most intense musical expression; the final *Quintet in E Flat, K. 614,* is a superb example.

Haydn: Quartet in C, Op. 76 No. 3 ("Emperor"). Mozart: Quartet in C, K. 465 ("Dissonant"). Paganini String Quartet.
Kapp KC 9045-S stereo

The Paganini group, named after the four "Strads" it plays, which were once owned by Paganini himself, is an American-born quartet that has enormous competence and technique, a mellifluous tone (aided by the instruments, of course) and for my ear, a certain ineffable slickness which, in places, amounts to superficiality.

I don't mean superficiality in any but a relative sense, for quartet playing is a very exacting art with enormously high standards of execution. This is a masterful quartet in ensemble and technique and no two ways about that. But there is, nevertheless, a certain softness of phrasing, a lack of dramatic shaping of the ideas and, above all, an unawareness of the really great and mystical moments in these works, that makes this playing top-drawer, for this music. I note particularly the lovely Haydn variations on his own Austrian national anthem, the Emperor's hymn, and the almost magically simple sequences in the slow movement of the Mozart—they are "just played" here, impeccably, instead of projected with intimations of awesome greatness. It can be done, and has, but not this time.

5. Horns and Pipes

French Horn Masterpieces. James Stagliano; Paul Ulanowsky, piano.
Boston BST 1009 stereo

I question the word "masterpiece" in connection with many of the juicily Romantic items on Mr. Stagliano's program, but otherwise I find this as pleasantly hornful a record as you'll run into, showing off the professional sound of the instrument most admirably. Almost all of the pieces are slow and dreamy (a few fast, blatty items, for contrast) and the horn—particularly in stereo—comes from far, far away in that peculiarly spaceless manner that is its greatest asset. Nice recording.

The piano is good too; it ought to be, with the accomplished Paul Ulanowsky at the keyboard.

Color Contrasts. The Horn Club of Los Angeles.
Capitol SP 8525 stereo

My first thought, when I put on the Mendelssohn *Song without Words* that graces the

opening of this LP, was of a herd of walruses—those dozens of wallowing walruses that appeared on a cover of *LIFE* some time back.

It's the darndest thing the way specialists like to specialize. Here, you have a braying, blatting, honking herd of French horns and the sound is not only of the utmost virtuosity but of the most curious strangeness. All that's missing, alas, is music, with the exception, as I hear the stuff, of two echo-effect pieces by those ancients Lassus and Palestrina, both of which works I've sung in their original vocal form. Fine music and not at all bad in the horny format, even if minus the essential words.

The rest, Mendelssohn-Walrus aside, is professional horn stuff. How can so much be written to say so little? It does, of course, project every known virtuoso effect in the horn repertory and a good many more which surely no man has before imagined, for you don't often get to hear a herd of walruses—horns, pardon me—all by themselves in this fashion. Very curious, I'll have to admit, if not exactly, as Capitol claims, a "startling showcase."

The Festive Pipes—Five Centuries of Dance Muisc for Recorders. Krainis Recorder Consort.

Kapp KC 9034-S stereo

This is an excellent recording of recorders. These recorders, of course, aren't Ampexes but those beaked, blow-into-it wooden flutes that have been revived so happily in recent years, after a brief century or so of extinction. There's a whole consort of them here, from sopranino down to bass and great bass, six types in all, and they play extensive music ranging all the way up to the Eighteenth century, beginning in the Thirteenth, which was a lively time for recorders.

This collection takes it cue from the fine records of the Belgian Pro Musica (Archive). The sequence of pieces affords plenty of listening variety and color, with breaks provided via percussion instruments and solos, between the recorder ensemble pieces. The playing is as good as you'll find, authoritative, very musical anl technically virtuoso throughout. The music ranges from the wild, raw little dances of the sophisticated Thirteenth century through the ineffably lovely melody of John Dowland, and in geography from England to Germany and Spain. AE

CIRCUIT SENTRY

(*from page 28*)

shorted, the feedback voltage disappears, and the gain of the amplifier as measured from the input to the grids of the output tubes is increased. If an amplifier normally uses 10 db of feedback, there is a 10 db increase, or three times the normal voltage gain. For a given signal input to the amplifier, this higher gain causes a higher signal voltage at the grids of the output tubes, and a higher plate current. The plate dissipation is thereby further increased.

In order to protect the output tubes from this type of fault, a circuit has been devised which in the event of a short in the speaker line removes signal voltage from the grids of the output tubes, thereby rendering the plate dissipation the same as under no signal conditions.

Circuit Arrangement

The new circuit is shown within the dash-line area in *Fig.* 1. In this figure,

from the input to the grids of the output

V_1, V_2, and V_3 constitute part of the regular amplifier. V_{1A} is a voltage amplifier, V_{1B} is the phase inverter and driver, and V_2 and V_3 are the push-pull output tubes. The *new* circuitry is that associated with V_4 and V_5. V_4 is a duodiode triode 6FM8, and V_5 is a 6AU6 pentode.

The operation of the circuit is based on the balance achieved under normal operation between voltages derived from the signal voltages at points (B) and (C) in *Fig.* 1, and the fact that this balance is upset when a short occurs at (C).

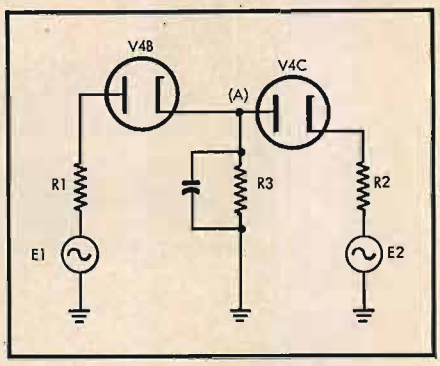


Fig. 2. Simplified comparator circuit arrangement.

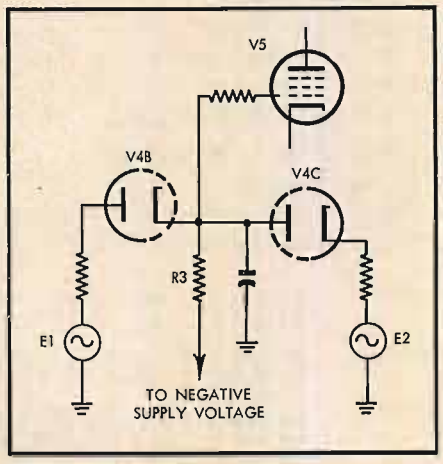


Fig. 3. Adding a fixed negative bias to the circuit of Fig. 2 provides a control voltage to the pentode shown.

An equivalent schematic is shown in *Fig.* 2. When $E_1 = E_2$ and $R_1 = R_2$, the d.c. voltage at (A) is zero with respect to ground. If E_1 is greater than E_2, the d.c. voltage at (A) is positive, and with E_2 greater than E_1, the d.c. voltage at (A) is negative.

It is desirable, of course, that under trouble-free conditions, $E_1 = E_2$ over the whole range of input signal levels to the amplifier. E_1 and E_2 are derived from voltages at points (B) and (C) of *Fig.* 1. Since these voltages are within the negative feedback loop of the amplifier, the ratio E_c/E_b remains constant over a wide variation of input signal levels, tube characteristics, line voltage variations, and the like.

The circuit of *Fig.* 2 is now modified by connecting the resistor R_3 to a negative supply voltage, as shown in *Fig.* 3.

Now the d.c. voltage at (A) is negative for $E_1 = E_2$ for all levels of E_1 and E_2. Under conditions of a short or a heavy overload at (C), E_1 is much greater than E_2, and the negative bias voltage is of such value as to make the resultant voltage at (A) either zero or slightly positive. The d.c. voltage at (A) is connected to the grid of the 6AU6 and its plate is connected to the plate of the amplifier driver V_{1B}, (*Fig.* 1). Under normal conditions, the negative voltage at (A) is sufficient to hold the 6AU6 well beyond cutoff so that its effect on the operation of the amplifier is nil. With the output shorted, the grid of the 6AU6 is at zero volts with respect to ground, the tube draws a relatively high plate current and

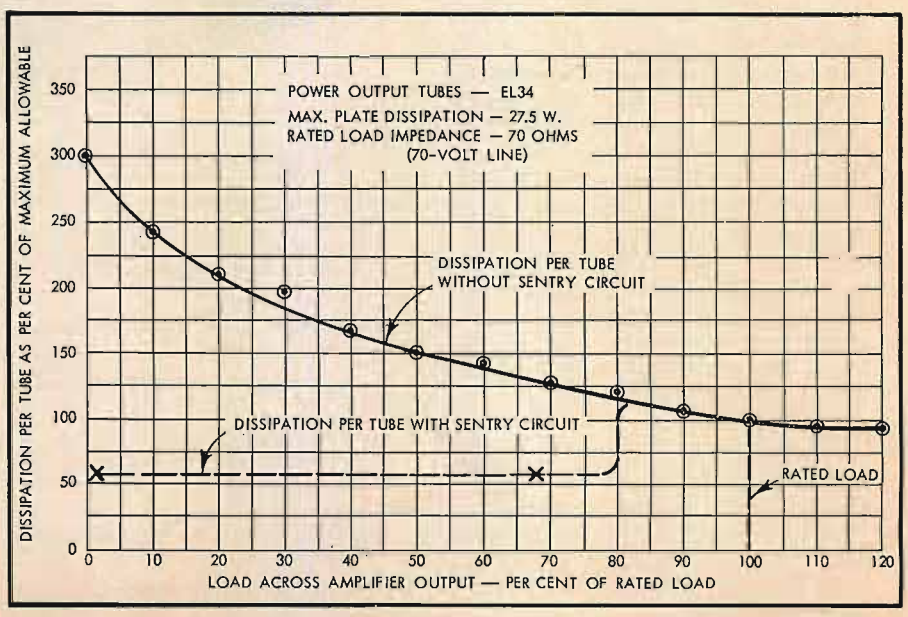


Fig. 4. Curves showing effect of sentry circuit on dissipation of output tubes. Data taken with Fanon Model 3370 amplifier and with constant input signal.

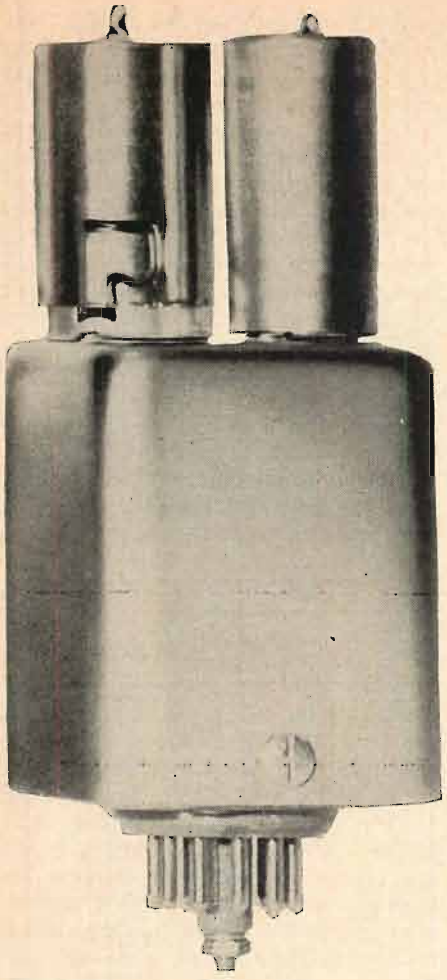


Fig. 5. Complete "Circuit Sentry" is housed in small plug-in unit.

due to the voltage drop in R_4, the plate voltage of V_{1B} is brought down to a very low value, limiting sharply the audio output of the tube. The dissipation of the output tubes under this condition, even with maximum signal input and the speaker line shorted to ground, is practically the same as it is with zero input signal.

Since under normal conditions the 6AU6 tube of the protective circuit is operating in the cutoff region it has no effect on the operation of the amplifier, and therefore no adjustments whatsoever are required when the protective circuit is added to the amplifier.

If a fault in the speaker line is intermittent, and if continuous signal is being fed to the amplifier, as from a phono or radio, for example, the circuit will lock-in in the blocked condition (no signal on grids of output tubes), thus protecting the amplifier against recurring faults. After the fault is cleared, it is necessary to hold the volume control at zero for approximately ten seconds for the circuit to restore itself to normal.

Figure 4 is a plot showing the effect of the protective circuit for varying degrees of overloading. The data for these curves were taken with a constant input signal—the input required to drive the amplifier to maximum output under normal rated-load conditions. The curves show the dissipation in the output tubes as a percentage of maximum allowable dissipation versus the load as a percentage of rated load—with and without the protective circuitry. The curves show that when the load across the output falls to approximately 30 per cent of the rated load, there is severe danger of overdissipation. With the protective circuitry, there is no possibility of overdissipation under any conditions.

The circuit discussed above is offered in the form of an optional plug-in assembly unit for the Fanon P.A. amplifier models 3335, 3345, and 3370. *Figure* 5 is a photograph of this plug-in unit. As mentioned above, no adjustments are necessary. The unit is merely plugged into a socket provided for this purpose, as shown in *Fig.* 6. AE

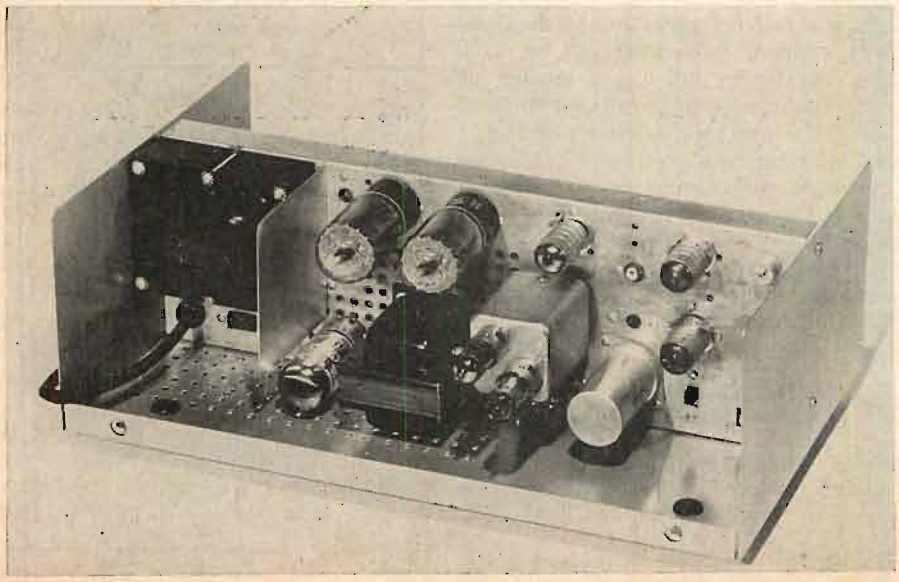


Fig. 6. Fanon Model 3345 amplifier with "Circuit Sentry" module plugged into socket provided.

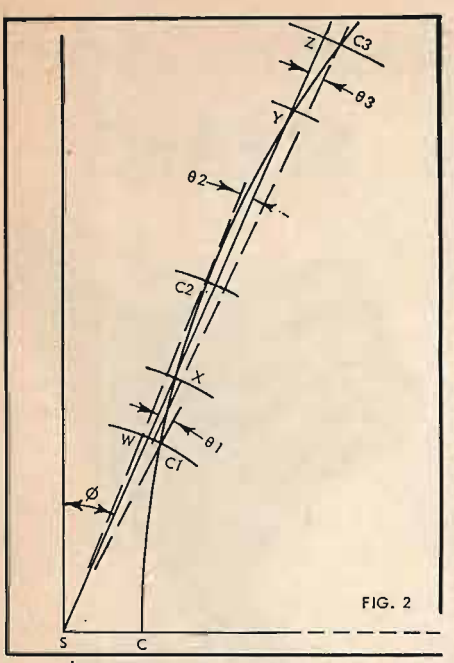


FIG. 2

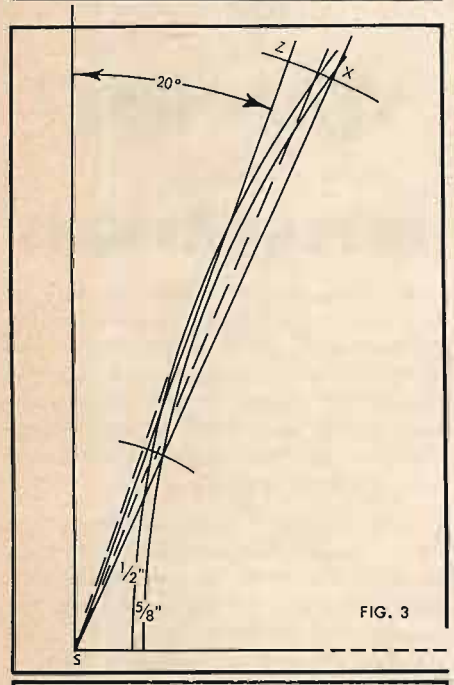


FIG. 3

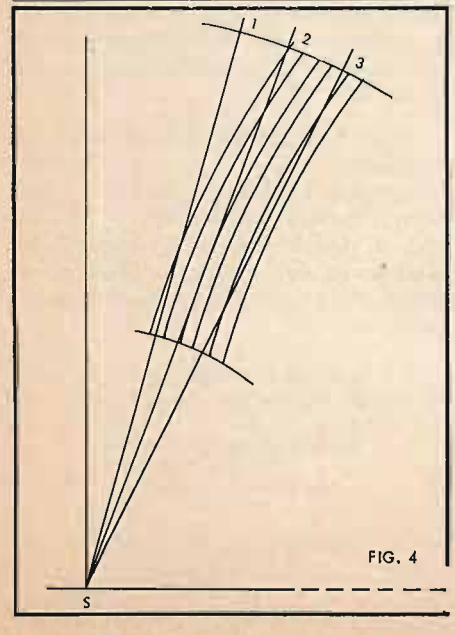


FIG. 4

TRACKING PROBLEM

(*from page 24*)

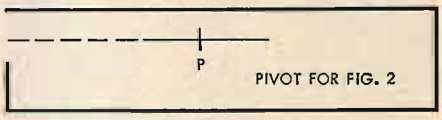
radius of SC_2 which is the angle C_2SZ which is labeled $\theta 2$. At radial distances equal to SX and SY there is no tracking error.

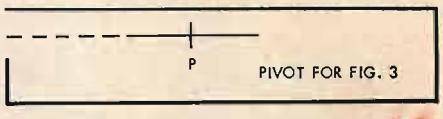
In *Fig.* 2 it can be seen that $\theta 1$, the error at the minimum radius, is somewhat greater than $\theta 3$, the error at the maximum radius. Since the maximum permissible tracking error for a given distortion level is roughly proportional to the radius, the case illustrated is less than optimum. This brings us to the problem of optimizing the offset angle and the overhang distance. We may now apply some dimensions to the problem. The arm under discussion has a pivot to stylus distance of 9½ inches and the desired minimum and maximum playing radii are 2 inches and 5¾ inches respectively. A number of concentric circles are drawn with P as the center. Each circle represents a different overhang distance. For simplicity only two of these are shown in *Fig.* 3. These represent overhang distances of ½ inch and ⅝ inch. Line SX is drawn to show that ⅝-inch overhang is too great since the error at minimum radius is the same as at the maximum radius. It may be seen from inspection of the plot that the error at the minimum radius would be greatly reduced if the minimum radius were increased just slightly but since we wish to maintain low distortion in to a radius of 2 inches let us try an overhang of ½ inch. When we have drawn an offset line SZ and measured the resulting errors we find that $\theta 1$ and $\theta 2$ are about 1 deg. and $\theta 3$ is about 3 deg. These are about one half the permissible standard of 1 deg. per inch radius suggested by Seagrave.

The actual determination of the optimum offset and overhang can be made very rapidly by drawing a number of concentric circles representing a range of values for overhang as shown in *Fig.* 4 and selecting the correct one by swinging a straight edge around point P. Shown in *Fig.* 4 are three trys at an offset angle. Line 1 is at too small an angle, giving only one point of correct tracking and excessive error at other radii. Line 3 gives a choice between only one point of correct tracking or two points of correct tracking with excessive error at small radii. Line 2 gives a reasonably good solution to the problem.

This quick selection by eye may not be as rigorously accurate as the mathematical method, however, from the practical standpoint the difficulties in knowing the actual direction of motion of the stylus and the setting of the cartridge in the arm to an accuracy greater than that which the desirable offset can be determined by the method described tend to make more accurate methods academic. The fact that the determination can be carried out with only a few drawing instruments makes it most useful.

Other information may be obtained from the graphical analysis. It can be seen that the errors in tracking are indicated by the divergence of parts of an arc from a straight line, therefore the error can be reduced by shortening the arc or flattening it. It can be shortened by increasing the minimum radius or by decreasing the maximum radius. If the arm is to be used only on 12-inch records it might be profitable to increase the minimum radius to 2½ inches with the result that the tracking error over the remaining part of the record could be even further reduced. If the length of the arm is adjustable the curvature of the arc may be reduced by increasing the length of the arm to the maximum that can be accommodated.





The reader may believe that because his pickup arm does not have any adjustments that it either doesn't need any adjustment or cannot have adjustment applied even if needed. Neither of these beliefs is necessarily so. Because there is a variation between various cartridges in the relative locations of the mounting holes and the stylus it is possible that the pivot to stylus distance will not be the same as the manufacturer had in mind when he designed the arm. If a different offset angle is needed it may be possible to "steal" a few degrees by slotting the mounting holes in the cartridge or by similar subterfuges. In any case it takes just a few minutes to investigate the situation and it may well result in greatly reduced distortion from your records. Æ

Fig. 2. (Top) Graphical diagram for a phono arm with offset.

Fig. 3. (Middle) Preliminary steps in obtaining optimum offset angle by the graphical method.

Fig. 4. (Bottom) Optimum tracking angle can usually be determined readily by inspection with this graphical construction.

AUDIO ETC.

(*from page 14*)

binaurally out of doors. That experiment of mine dates from March, 1953, and still hasn't got anywhere with the Audubon Society. (But then the Country Dance Society still hasn't put out an LP record, preferring the tried-and-true 78's. I attempted to sell them on LP about that same era.)

So—if you want earphones with two channels, by all means take up my limbo-hobby, true binaural recording. It's terrific, almost as good as that other limbo-hobby, stereo photography, which I continue to practice with much joy. And binaural is easy now, what with four-track portable recorders that'll get you two hours of hi-fi twin-channel earphone sound on a single roll of tape. My old Magnecord of 1953 did 15 minutes on the same, and weighed hundreds of pounds, in two big cases.

Ear Strain and Eye Strain

But what of stereo itself, via earphones, as now being recommended so opportunely?

Well, I won't deny that it is interesting. It does present an arresting and novel kind of sound. And especially when the stereo recording is of the multi-mike, multi-channel original sort, as in the bigger RCA Victor jobs. You have, in such cases, a whole raft of ears on each side of your head, or rather, on extensions. Your silly sound-sensers are out on stalks (made of metal) maybe a couple of hundred feet apart. Most inconvenient, as to hearing. Sometimes, too, you find your multiple ears facing in various directions all at once. One pair of ears faces East and West while another aims North and South. Some of your ears are only a few feet from a singer's nose; but then again, a few more of them are off somewhere in distant space, hovering.

This, you see, is stereo technique. It has astonishingly fine values, new ones being worked up every day. As you know, I'm all for stereo and I'm always the first to be distressed when people say, "What junk." It is *not* junky, stereo sound. It is a terrific thing, on every level of sound-listening from the crude to the cultural.

But it isn't meant for earphones. It is less and less earphone-prone each day. Stereo, once and for all, depends upon loudspeakers, and is intended for loudspeakers.

In the phones, most of the time you hear (if you will listen analytically) two quite unrelated recordings of the same sound. The two blend very nicely as far as content goes—they are the same. But as to physical sound, they remain discrete and separate. The two ears are simply unable to relate the differing reverberation and delay patterns afforded by the widely separated and multipled "ears."

Via earphones, you do *not* get a stereo blend. You achieve a fine sense of space, but it's out of focus, like a stereo picture that won't quite register, or better, like a pair of stereo photographs of the same general scene but differing details, unassimilable by the eyes. Interesting sound. But for more than casual and short-term listening, very false and very disturbing to the inner-ear equilibrium.

In a word, if you don't look out you'll get seasick.

I'll admit to only one possible reservation in my mind, as far as this earphone stereo listening is concerned (aside from what follows below). A good many of the European recordings we import today are made with the relatively mild techniques of the M-S or the cross-mike schools of thinking; two mikes placed in a single physical housing or at a single spot in the recording hall, aimed directionally at heavy angles to each other. Cross-mike aims mostly diagonally; M-S has one mike bi-directionally aimed sidewise and the other, cardioid, aimed straight ahead, the resulting pair of signals being matrixed together to derive right and left channels.

In these techniques, where the stereo effect is, shall I say, relatively gentle, it is possible that earphone listeners will be able to relate the two reverberation patterns well enough to achieve some ear-synthesis and thus a "two-eared" sense of space—though I quail at trying to think just what would be involved in literal hearing terms. Don't bother—just listen. But in all other techniques, particularly multi-channel, multi-mike recordings, earphone listening is just plain false—false to the ear mechanism itself, which tries to relate the sounds and cannot.

Under such circumstances, ear strain and fatigue would seem to me to be as inevitable as eye strain when the two eyes cannot function properly together.

3. Electrostatic Lamb

I've treasured a worn little clipping for many a moon, hoping to remember it, come AUDIO deadline time, and it is now at last before me, mostly illegible—but I've figured it out again. Bless me, I forgot to note what magazine it got clipped out of. But judging by the looks of the paper, it came either from *Harper's* or the *Atlantic*. I hereby and freely give credit to *both* magazines, and to any other that might be the original printer, in order to be on the safe side. Whoever printed it ought to have informed AUDIO on the spot. The thing has to do with Mary and her lambkin, and it reminds me of my own days at ex-WABF, the radio station that has now physically become WBAI of the Pacifica Foundation, in New York.

Anyhow, WABF had a "penthouse studio" which was indeed just that, a converted two-story duplex apartment, with wall-to-wall carpeting and a fine inner stairway, complete with more carpeting and an ornamental curved railing of shiny brass. Now, I'm one of these electrostatic people. In winter, I need take only a couple of steps on a thick rug to generate thousands of volts. It drives me crazy. At cocktail parties I'm always shocking the kind hostess off her feet, and some of my sparks have been known to light up a dark room.

Every time I travelled up or down that WABF stairway, which was dozens of times a day between studio and offices, I got me a whale of a shock off the brass rail. I finally evolved the Canby shock-on-shock treatment: if you reach boldly out and whack the approaching metal object as hard as you can, the sting of the whack is great enough to override the electrostatic shock.

So I whanged away at that railing until my fingers were black and blue. I still do the same in other places, though not to obliging hostesses on thick pile carpets.

The poem I hereby quote, with the above blanket credits, is thus of very special appeal to me. It was submitted to the other

magazine by Mr. Frederic B. Viaux of Troy, N. Y., who is, or ought to be, a reader of AUDIO, I'm willing to bet.

Mary had a little lamb
Its fleece electrostatic
And everywhere that Mary went
The lights became erratic.

It followed her to school one day
Electrons all ajingle
It made the children's hair rise up
Set finger tips atingle.

The teacher tried to turn it out
Her body was not grounded
The spark was seen for miles around
And she's not yet rebounded.

What? You say that's an ancient saw that everybody must have seen a million times? Well, I withdraw my magazine credits in that case, but I still love it. I'm an old electrostatic lamb myself. Æ

NEW LITERATURE

● **EICO (Electronic Instrument Co., Inc.),** 33-00 Northern Blvd., Long Island City 1, New York, has just published a 28-page catalog describing its complete line of monophonic and stereophonic equipment, test instruments, ham equipment, citizen transceivers and radios in both kit and wired form. The new 4-color catalog contains pictures, detailed descriptions, specifications and prices on every item of EICO equipment as of May, 1960. Also available from EICO is an illustrated 4-page booklet entitled, "Stereo and High Fidelity." The booklet presents a clear definition of stereophonic sound and discusses stereo program sources. One section is devoted to describing various combinations of component set-ups. Also discussed are design principles of stereo components using various EICO components to illustrate the principles. Both catalogs are free at local EICO distributors or directly from the company by writing to the address given above. **J-14**

● **Lafayette Radio Electronics Corp.,** 165-08 Liberty Ave., Jamaica 33, New York, will mail on request its 1961 catalog listing the latest electronic and stereo equipment. The 1961 catalog contains over 320 pages and includes Lafayette's own equipment in kit form or completely assembled, as well as the latest stereo components of all major manufacturers. In addition there is a wide selection of radio and TV components and accessories, citizen band equipment, tools, books, optics, cameras, public address systems, and parts. **J-12**

● **Bogen-Presto Company,** Box 500, Paramus, N. J., announces three new publications covering much of the equipment in its broad line of high fidelity and professional products. The first publication, number 520, describes stereo receivers, tuners and amplifiers. Full color photographs, as well as performance data and prices, are shown for each model. The second publication, number 521, covers the complete line of Bogen-Presto turntables. The third publication, number 910, is an 8-page catalog on "Presto 800 Series Professional Tape Recorders." The tape recorders described in the catalogue include models instantly convertible from ¼" to ½" tape. **J-11**

● **Arrow Electronics, Inc.,** 65 Cortland St., New York 17, N. Y., announces the availability of their new 1960–61 HI-FI, Stereo and Amateur Radio Catalog. This 154-page catalog lists components and systems and gives full coverage to high fidelity and ham equipment. Requests for the catalog should be sent direct to the company.

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Rates: 10¢ per word per insertion for noncommercial advertisements; 25¢ per word for commercial advertisements. Rates are net, and no discounts will be allowed. Copy must be accompanied by remittance in full, and must reach the New York office by the first of the month preceding the date of issue.

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

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

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

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

RENT STEREO TAPES—over 1,500 different—all major labels—free catalog. Stereo-Parti, 811-H Centinela Ave., Inglewood 3, California.

WANTED: Back issues of Audio Engrg., J. SMPTE, J. Acous. Soc. Am. Electronics. Wireless World, Radio and T. V. News, Communications, Electronic Engineering, Tele. Tech, I. R. E. Trans on Audio, Sound Recording, and Reproduction, and Wireless Engineer. Send list of issues available and prices to: R. L. Farris, 3101 Routh Street, Dallas 4, Texas.

HEWLETT-PACKARD audio oscillator, 20-20,000. E. Johnson, Montgomery Road, Middletown, N. Y.

Altec M-11 mike system, latest D cartridge, $175.00. Fairchild 541-A cutter, $100.00. Bias assembly for PT6 Magnecord, $10.00. DB meter panel with multiplier, $20.00. Pickering 190D arm, $15.00. 4 30/60 Daven pads, $6.00 each. M. E. Boyd, 903 Salmon Drive, Dallas, Texas.

WANTED: Microphone: Capps CM 2001, Stephens C2-0D4, or Altec M-21; Tape Transport for 14 inch reels. Douglas Boyvey, P. O. Box 732, Balboa, California.

McIntosh C-8 preamplifier, self-powered with mahogany cabinet, excellent condition, $55. R. G. Stevens, 1005 Irving Street, San Francisco 22, California.

MAGGIE: Come back please, can meet you at Room 518, New York Hi-Fi Show. M. S.

Industry Notes...

AMPEREX COMPLETING NEW WING Completion of a 13,000 square foot wing was announced by Frank Randall, president of Amperex Electronic Corp. The new wing is expected to permit marked increase in production of their successful line of frame grid tubes.

STEREO FESTIVAL AT GROSSINGER'S. A new promotional approach formulated on the premise that the consumer would be more receptive if component stereophonic sound were brought to his native habitat made an excellent first impression at a three-day Stereo Festival at Grossinger's. Participating in the Festival were Bogen-Presto, United Audio Products, and University Loudspeakers. The Festival was such a fine success that Grossinger's is considering making it an annual affair.

ELECTRO-VOICE PURCHASES FEATHERIDE. The acquisition of the "Featheride" Phono Pickup and Cartridge division of Webster Electric Company was announced by Al Kahn, Electro-Voice president. The transaction becomes effective September 1, 1960. The newly acquired products will be marketed as Electro-Voice Featheride cartridges and tone arms.

Industry People...

Rene Snepvangers is the new Director of Engineering for Electro-Sonic Laboratories, Inc. He will be responsible for all technical activities in the company's high fidelity and industrial divisions. The holder of many patents, Mr. Snepvangers is perhaps best known for his development of the LP record. . . . **Harold A. Goldsmith** has been appointed as president of the Bogen-Presto Division of the Siegler Corporation. He succeeds Joseph N. Benjamin who resigned. Mr. Goldsmith was the co-founder of Magnetic Amplifiers Inc. which recently merged with The Siegler Corporation. . . . **Donald F. Kehn** has been appointed as advertising manager for the Commercial Products Division of Stromberg-Carlson. Prior to joining Stromberg-Carlson Mr. Kehn spent several years with advertising agencies in New York City.

ADVERTISING INDEX

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