AUDIO

JANUARY, 1959
50¢

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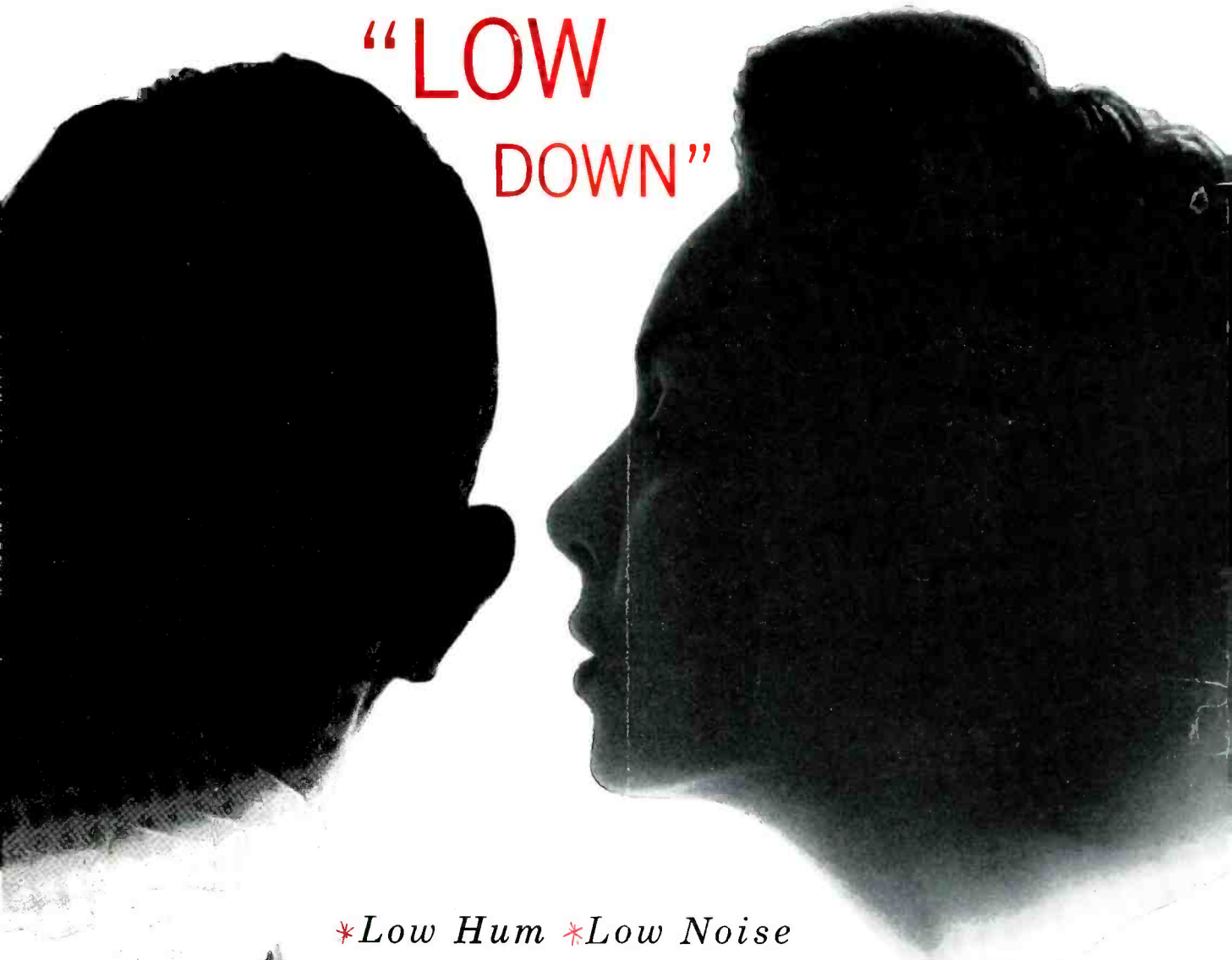

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To be more specific, let's outline a typical Hi-Fi audio amplifier circuit employing the RCA-7199. First, we'll use two 6973's, new beam power tubes by RCA of course, in the output stage. Then, with the pentode unit of the 7199 as a voltage-amplifier and the triode unit as a phase-splitter, we have a circuit that can provide a sensitivity of 1.2 volts for a power output of 15 watts with a distortion of less than 0.5%.

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That's just part of the "low-down" on the 7199. Your RCA Field Representative can give you much more information. Ask him or write RCA Commercial Engineering, Section A-91-DE, Harrison, N. J.

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AUDIO

ENGINEERING MUSIC SOUND REPRODUCTION

CONTENTS

COVER PHOTO—One of the many installations created by Allied Radio Corporation in the Chicago area. The system shown incorporates a Fisher Model 80T AM/FM tuner and preamplifier, a McIntosh MC-30 amplifier, James B. Lansing 001 speaker system, Garrard RC-88 record changer, and the Conrac Fleetwood 24-in. television receiver. Picturing as it does considerable charm in a monophonic setting, we look forward to learning how it will be converted to stereo.

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AUDIOCLINIC??

JOSEPH GIOVANELLI*

Note

Occasionally, letters intended for AUDIOCLINIC are sent to the magazine. While such letters are forwarded to me, they obviously cannot receive the prompt attention they would have received had they been directed to me, rather than to the magazine. When writing, always enclose a stamped, self-addressed envelope. This will facilitate a reply.

For the benefit of those not familiar with this column, I would like to state here that, regardless of the suitability of the material for inclusion in AUDIOCLINIC, your letters are answered personally. I indicate in each letter whether the material will appear in the column, and when possible, try to indicate the issue wherein your question will appear. Some of you do not wish your names used, in which event we use the question but with a different name and city. In no instance, do I print a complete address.

Some of you who live near this address have occasionally telephoned me for information. I would appreciate it if you would write your questions and submit them to me in that form. This will allow me to give them more consideration, and thereby ensure a more complete accurate answer.

I have received one or two letters in which the writers fear that, because of my interest in loudspeaker manufacturing, I can no longer be objective in discussing loudspeakers. You need not worry on this account. This is based partly on the fact that I am probably more critical of my own work than of anyone else's, and partly on the fact that the nature of the questions makes it hard to bias the answers. For example, if I were asked what speaker would be suitable for a "Super Blaster" type enclosure, there would be no reason for me to recommend an Audio-Tech woofer, for we don't sell our woofers separate from our complete system.

On this note, I wish you a Very Happy New Year!!

Peak Inverse Voltage of Rectifiers

Q. I have noticed that with a particular circuit I lose 25 volts across the rectifier tube. The power supply furnishes 400 volts. Since the voltage lost across the rectifier is only 25 volts, why can I not use a 150-volt selenium? L. D. Cranston, Providence, R. I.

A. Although the voltage lost across the tube is 25 volts, there is a time during the alternation during which the tube is not conducting at which the voltage between plate and cathode reaches something in excess of 800 volts. A selenium rectifier of the type you mention is not designed to take this kind of strain.

You are wondering now probably, why the tube will have this much voltage developed across it when the total voltage supplied from the power transformer is only 400 volts. For purposes of illustration, let's consider that a half-wave rectifier is used. This will simplify the explanation, but everything I say with reference to the half-wave circuit holds true for the individual diodes in the full-wave circuit as well.

Figure 1 shows a half-wave rectifier circuit, complete with filter circuit and load resistor. When the alternation of the supply

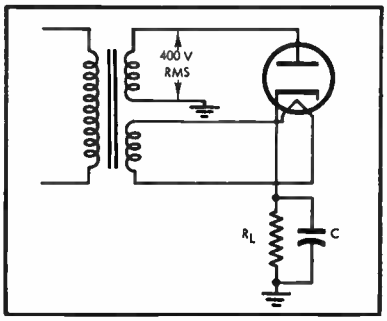

Fig. 1

line is such that the plate of the tube is made positive with respect to ground and, of course, the cathode, the tube is able to conduct. Because of the voltage developed across the resistor, the cathode becomes positive with respect to ground. This enables the filter capacitor to take a charge. Since the power supply voltage feeding the rectifier is 400 volts, the cathode is positive with respect to ground by roughly this amount. The plate will be slightly positive with respect to its cathode; the exact potential difference will depend upon both the load current and upon the internal resistance of the tube. Soon the cycle of the supply line reverses itself, and the plate is negative with respect to ground (to which one side of the line is connected) by 400 volts. Meanwhile, the purpose of the filter capacitor is to maintain as constant a voltage across the load as possible. This means that if the filter in this circuit is any good at all, very little loss in voltage will be noticed during the time the rectifier's plate is negative with respect to ground and cathode and, therefore, not supplying voltage to maintain the charge of the capacitor. In other words, even though the rectifier is now not conducting, its cathode is nearly 400 volts above ground. The plate of the tube is 400 volts below ground. The voltage across the rectifier is, therefore, 800 volts.

We have something else here which makes the problem even more serious. We say the voltage of the supply line in this case is 400 volts, and so it is, effectively. Effectively means here that this equivalent to the work which could be accomplished by 400 volts d.c. Remember, however, that the supply frequency is causing the actual voltage to vary widely. This means that in order for the effective voltage to be 400, there must be times where this voltage rises to a value higher than 400 volts. In fact, such is the case. This high point or peak voltage of a cycle can be determined exactly by multiplying the effective value (in this instance, 400) by 1.414. We can see that the peak voltage is approximately 565 volts.

This indicates that the filter capacitor will charge up to a value higher than 400 volts. If the current demand from the

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THE Garrard PAGE

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supply is great, the capacitors will not have time to charge to a value much beyond that of the effective value. If, however, the load draws no current, as would be true in an amplifier whose load is made up of tubes wherein the rectifier warms up before the rest of the tubes. It is possible for the capacitor to charge to its peak value. When the cycle reverses, it also reaches a similar peak above the effective value. Thus, the difference between the plate and cathode is twice the peak voltage of the line, which in this instance is almost 1150 volts. The rectifier should be capable of withstanding at least this much voltage in the direction opposite, or inverse, to that of its conducting direction. There should be some additional latitude for safety. This maximum voltage which a rectifier can safely stand is known as its maximum peak inverse voltage, and it can be found for each rectifier type by consulting a tube manual.

Distortion in Monophonic Discs

Q. I have been a record collector for a good many years, and, as you can imagine, have a great number of monophonic discs, in addition to a few of the new stereophonic discs. Because this stereo system is compatible, I use my stereo cartridge to play both types of discs. However, many of the monophonic discs are heard with a surprising amount of distortion as contrasted to their sound when a conventional, monophonic cartridge is used. What is causing this distortion and what can I do about it? James Blake, San Francisco, Cal.

A. There are several possible causes for the distortion of which you speak. One is that you are using insufficient tracking force. Some stereo cartridges are constructed in such a manner that they must track at or slightly above the prescribed force in order for the stylus to be properly oriented with respect to magnetic pole pieces. Failure to observe this precaution means that the cartridge will be too compliant, and the stylus will ride out of the grooves, rather than tracing them faithfully.

The second cause of distortion is a function of the monophonic discs themselves. Many of them are greatly overcut, especially at the high end of the audio spectrum. This will result in the inability of the stylus to stay in the groove properly. It tends to ride up out of the groove, regardless of tracking force. Any time that the stylus rides upward some vertical signal will be produced. Because of the nature of the system, this vertical component will transmit it to the loudspeaker. Most monophonic cartridges were specially designed to eliminate as much vertical output as possible, and for this reason, little, if any, of this form of distortion was detectable with your monophonic cartridge.

This trouble can be minimized by connecting the two sections of your cartridge in parallel, phased in such a way that the vertical output is cancelled. Most instruction sheets supplied with these stereo cartridges show a wiring configuration which will bring about this end. Naturally, if you wire this cartridge in this manner, you cannot achieve the stereophonic effect. What you will have to do is to wire a switch and mount it in some convenient place. This will enable you to switch from stereophonic sound to monophonic sound. If there is sufficient interest, such a switching circuit will appear in a future column. Æ

NEW LITERATURE

• **Newark Electric Company,** 223 W. Madison St., Chicago 6, Ill., is now distributing its 1959 catalog No. 69. Covering thousands of industrial-electronic, amateur, radio, television, and high-fidelity items, this new 388-page buying reference features extensive quantity price breakdown listings which are competitive with manufacturers' price schedules. Fully illustrated and replete with comprehensive descriptions, the catalog also contains a convenient products and manufacturers index to facilitate reference to specific items. Your copy will be mailed free upon written request. **A-11**

• **CBS-Hytron Advertising Service,** Parker St., Newburyport, Mass., is now distributing "An Introduction to Stereophonic Sound," the first of a series of "Stereo-Talk" bulletins, which tells what stereo is and how it works. The four-page publication describes how a stereo record is produced using the 45/45 Westrex system, and illustrates how the playback stylus motion is converted into separate signals for each channel. Components needed for a disc stereo system are listed and some typical questions on stereo are answered. Requests for copies should specify Bulletin E-305. **A-12**

• **Argos Products Company,** Genoa, Ill., announces Catalog No. C-58, a complete listing of the company's wall and corner baffles and high-fidelity speaker enclosures. This is an excellent publication for custom builders, irrespective of whether their work involves commercial installations or equipment for the home. The new Argos "Californian" series of pre-finished kits will he of exceptional interest to the hi-fi hobbyist. Your copy of Catalog C-58 will be mailed upon written request. **A-13**

• **Commercial Engineering Department,** RCA Electronic Tube Division, Harrison, N.J., has just issued a colorful 137-page book, the "Designer's Guide" to Preferred Tube Types, covering entertainment receiving tubes. Format of the handsomely-bound volume presents technical data in easy-to-read fashion. Color is widely used throughout the book to enhance readability and to highlight graphs and curves. Specially prepared for the men who design high-fidelity audio equipment, phonographs, radio receivers and TV sets, the book contains tube characteristics, dimensions, and base diagrams. Requests for copies of the "Designer's Guide" must be written on company letterhead.

• **United Catalog Publishers,** 60 Madison Ave., Hempstead, N.Y., is now releasing a 24-page industry-wide booklet which provides listings of all available panel, flashlight, neon-glow, automotive and multipurpose lamps. Incorporated in the booklet is a composite listing, arranged numerically, of lamps manufactured by Chicago Miniature Lamp Works, General Electric, National Carbon, Oxford Components, Radio Corporation of America, Raytheon, Tung-Sol and Westinghouse. Simply by checking the lamp number the user can determine at a glance the manufacturer, bulb type, base, voltage, current, and bead color. All bulb types are illustrated with physical dimensions. Requests for copies should be addressed to The Radio-Electronic MASTER at the address shown above, and must include a remittance of ten cents to cover handling costs.

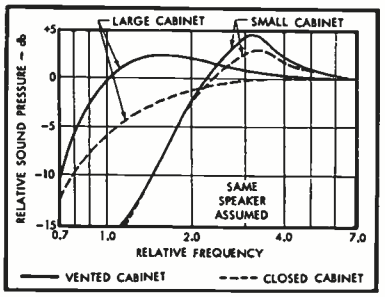
• **David Bogen Company,** P.O. Box 500, Paramus, N.J., includes its complete new line of high-fidelity equipment in Catalog 510 which is just off the press. Among new units listed are the Model DB230 stereo control center and dual 30-watt amplifier, Model ST662 FM/AM stereo tuner, and Model DB130A preamplifier-amplifier. Requests for copies should be addressed to the Advertising Department. **A-14**

LETTERS

Small-Box Loudspeaker Systems

SIR:

Lack of reaction to the article on improvement in "Air suspension" speakers by tube venting (November) would be disappointing. It was expected that the main theme might cause controversy. But Mr. Edgar Villchur's challenge (Letters, December) on another subject gives welcomed opportunity to explain our statement that "A large box always allows more and cleaner bass than does a small box." His thesis is that box air stiffness must greatly exceed speaker suspension stiffness, implying lower harmonic distortion, as air stiffness is more linear. We feel the whole story should also consider transient response and amplifier problems.



Curves here show how the smaller air stiffness of the large box allows lower system resonance. The inevitable 6-db-per-octave dropoff below resonance can be then set *below* the listening region instead of *in* it. Thus amplifier power or distortion will not increase to maintain flat output over the entire listening region.

He states that the cone sees the same impedance and elastic restraint whether with acoustic or mechanical suspension predominant, assuming final resonance the same. The point is that final resonance is not the same, the larger box giving lower resonance and lower cutoff. His and our speakers use linear, highly compliant suspensions.

It cannot be called an advantage to have speaker resonance in the listening range, as happens when high box stiffness runs resonance up to, say, 45 to 60 cps. Resonance is not noticeable *if* damping is critical or better. Here the small box again runs afoul of the laws of physics. If a requirement is flat response to resonance, or a little below (and who claims anything else!) the Q of the small-box system must be made considerably higher than 0.5, the figure for critical damping. In commercial low-efficiency small *closed*-box systems we observe a Q between 1 and 2, high enough to give detectable hangover. As pointed out in the November article, tube venting would improve damping by transfer of the vent radiation load to the cone.

For given sound output and frequency, the cone must move a certain distance. Assuming the same speaker suspension linearity, the small box cannot give less harmonic distortion. The cone still has to move the same distance, so distortion arising from the suspension cannot be lower. On the other hand, with a vented box the radiation from the vent contributes to the total so that cone movement is much less than in the closed box for the same sound output. Distortion from suspension nonlinearities then is at a minimum.

A more analytical paper on this subject by J. F. Novak was given at the AES Convention in New York in October, 1958.

PHILIP B. WILLIAMS and
JAMES F. NOVAK,
Jensen Manufacturing Company,
6601 S. Laramie Ave.,
Chicago 38, Ill.

Filter Design

SIR:

While Cdr. Harrison is to be commended in making things simple for the hobbyist in his RC filter design article in the November issue, I was rather sorry that he choose the least effective way of making them so.

In my article, "The RC Crossover Compromise" (AUDIO, July, 1957) I tried to make clear the limitations of this method. To explain this in yet simpler terms:

When multiple sections are used, if each contributes 3 db loss *at crossover frequency*, the total loss into each channel will be 3 db times the number of sections. To avoid such excessive loss, the respouse is "shifted" so the 3-db point of all the sections comes together in the right place.

But this shift then negates most of the advantage of using more than one section. A frequency one octave beyond crossover is the most revealing (and probably the most significant in performance). To demonstrate this, I have tabulated results of the method, assuming no interaction between successive sections, which a multiplication by 10 in impedance from each section to the next closely approximates.

No. of sections	1	2	3	4	5	10
db/section at crossover frequency, f_c	3	1.5	1	.75	.6	.3
Frequency shift needed (fraction)	1	.6435	.51	.435	.3855	.2681
db/section one octave beyond f_c	7	4.25	3.1	2.45	2.025	1.097
Total db at one octave beyond f_c	7	8.5	9.3	9.8	10.125	10.97

When these results are compared with a simple 2-section design, sharpened correctly with 6 db of feedback, even 10 sections of the above type do not equal the performance of the simple 12-db type, which gives 12.3 db at one octave beyond crossover (which is still 3 db).

The use of assumed non-interacting sections gives the best possible approach to a sharper cutoff—which is still far from good! If, instead of sections of increasing impedance, identical sections are used, with the same procedure of shifting the over-all 3-db point to come at correct crossover, the improvement at one octave beyond crossover, however many sections are used, never "makes it" from the 7 db achieved by a single section up to 8 db.

So deviation from the ideal of a non-interacting arrangement makes matters worse than the above table. Any way you do it, if you get the transition right at crossover, the rolloff for the first octave beyond is very little better than using a simple R-C combination only.

My point is, if you really want a sharper rolloff than a simple R-C combination can give you (using only a single section), you have to use a circuit with feedback. For those interested in the requisite data, my earlier article "Feedback filters for 2-channel amplifiers" (AUDIO, October, 1954) gives it, with supporting theory. Unfortunately, I don't have reprints.

NORMAN H. CROWHURST,
Audio Consultant,
216-18 40th Ave.,
Bayside 61, N. Y.

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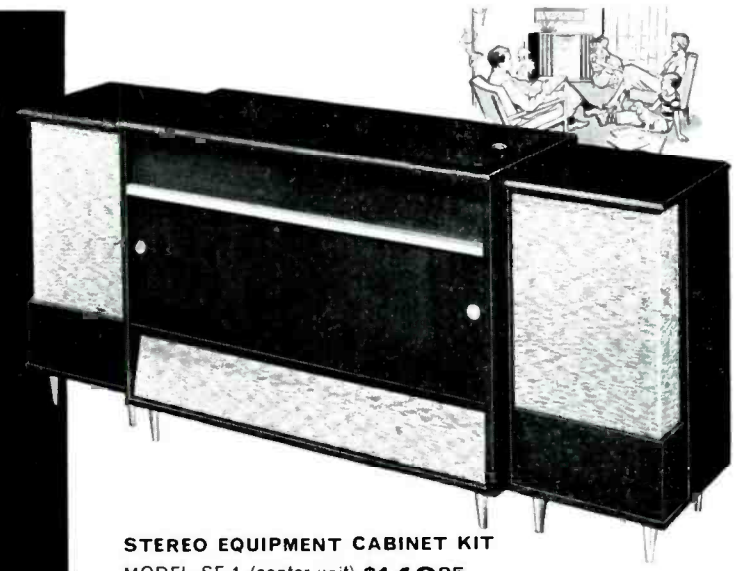

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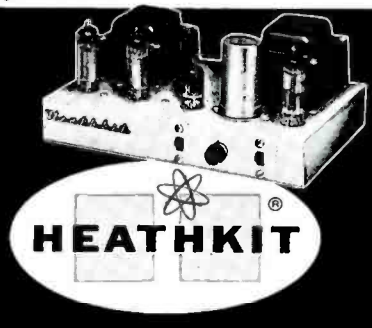

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Control your complete home hi-fi system right from your easy chair with this handsome chairside enclosure in either traditional or contemporary models. It is designed to house the Heathkit AM and FM tuners (BC-1A and FM-3A) and the WA-P2 preamplifier, along with the RP-3 or majority of record changers which will fit in the space provided. Well ventilated space is provided in the rear of the enclosure for any of the Heathkit amplifiers designed to operate with the WA-P2. The tilt-out shelf can be installed on either right or left side as desired during the construction, and the lift-top lid in front can also be reversed. All parts are precut and predrilled for easy assembly. The contemporary cabinet is available in either mahogany or birch, and the traditional cabinet is available in mahogany suitable for the finish of your choice. All hardware supplied. Shpg. Wt. 46 lbs.

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Putting together your own Heathkit can be one of the most exciting hobbies you ever enjoyed. Simple step-by-step instructions and large pictorial diagrams show you where every part goes. You can't possibly go wrong. No previous electronic or kit building experience is required. You'll learn a lot about your equipment as you build it, and, of course, you will experience the pride and satisfaction of having done it yourself.

"BASIC RANGE" HI-FI SPEAKER SYSTEM KIT

The modest cost of this basic speaker system makes it a spectacular buy for any hi-fi enthusiast. Uses an 8" mid-range woofer and a compression-type tweeter to cover the frequency range of 50 to 12,000 CPS. Crossover circuit is built in with balance control. Impedance is 16 ohms. Power rating 25 watts. Tweeter horn rotates so that the speaker may be used in either an upright or horizontal position. Cabinet is made of veneer-surfaced furniture-grade plywood suitable for light or dark finish. All wood parts are precut and predrilled for easy assembly. Shpg. Wt. 26 lbs.

MODEL SS-2 **$39.95**
Legs: No. 91-26 Shpg. Wt. 3 lb. $4.95

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Replace your present pickup with the MF-1 and enjoy the fullest fidelity your library of LP's has to offer. Designed to Heath specifications to offer you one of the finest cartridges available today. Nominally flat response from 20 to 20,000 CPS. Shpg. Wt. 1 lb.

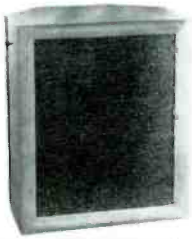
LEGATO HI-FI SPEAKER SYSTEM KIT

MODEL HH-1 **$299.95**

The startling realism of sound reproduction by the Legato is achieved through the use of two 15" Altec Lansing low frequency drivers and a specially designed exponential horn with high frequency driver. The special crossover network is built in. Covers 25 to 20,000 CPS within ±5 db. Power rating 50 watts. Cabinet is constructed of ¾" veneer-surfaced plywood in either African mahogany or white birch suitable for the finish of your choice. All parts are precut and predrilled for easy assembly. Shpg. Wt. 195 lbs.

"RANGE EXTENDING" HI-FI SPEAKER SYSTEM KIT

The SS-1B employs a 15" woofer and super tweeter to extend overall response of basic SS-2 speaker from 35 to 16,000 CPS ±5 db. Crossover circuit is built in. Impedance is 16 ohms, power rating 35 watts. Constructed of ¾" veneer-surfaced plywood suitable for light or dark finish. Shpg. Wt. 80 lbs.



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AUDIO *etc.*

Edward Tatnall Canby

Stereo Hoopla

I'VE BEEN WATCHING the stereo ads lately and I've been answering questions right and left, from the laymen and layladies all around me. I'm hoping, hard, that stereo doesn't come right out and kill itself dead, from sheer exaggeration, wishful thinking and a contempt for the average man's common sense.

In sheer irritation I've been cutting out clippings from the newspapers and magazines and I'm ready right now to come to a very impartial boil—indeed, I've been boiling away all over the place on and off for quite awhile.

I am now, of course, "sold" on stereo myself and am quite willing to spend all the time I must, in order to sell it in what seem to me to be its legitimate terms, in the interest of music listeners of all sorts. But I can't cope with the present competition in the selling department. I can only get mad at it, because it does stereo so much harm.

Stereo, like any other development, is less than perfection itself and always will be. In its early stages it has extra problems. In all its stages, from now until Doomsday, it will continue to be more complicated, more inconvenient, and to present more problems all around than plain, mono hi-fi. This is nothing to be surprised about, nor to avoid. A reasonable human being will accept it—if the game is worth the candle. People will go to a lot of trouble and plenty of inconvenience—*if* they are convinced it is worth their while.

Doomed Boom?

Well, it *is* worthwhile, in stereo. That's what a lot of us now understand. But how the public is ever to be convinced via the present all-out, three-pronged offensive upon common sense, I do not know. It works this way and all three prongs are deadly.

(1) Exaggerate stereo's marvels out of all sense and proportion. (*Pretty soon nobody will believe you—right or wrong.*)

(2) Play down stereo's complications, disguise the extras, as if they didn't exist. (*They do, and people find out quickly enough.*)

(3) Compromise the actual stereo equipment for convenience, as if stereo's basic necessities didn't matter. (*They do matter, if you want stereo itself.*)

Just push hard enough on these three points and you'll kill stereo as neatly as stereo photography was killed, a few years back. The parallel isn't as far-fetched as you might think.

I have been taking stereo photos since 1929 and am thus somewhat of an expert (and my pictures aren't bad, either). The medium is fascinating, rewarding, unusual, different—and somewhat limited. It requires a lot more technique than you might think, in the taking; it is inconvenient in the looking, via hand viewers (but the pictures are unbeatable, like nothing else on earth). Stereo projection, especially, is difficult and tricky. But it works and can be enjoyed immensely (as I have much reason to know), if you use common sense. But you must work at it, study it. Why not?

All of a sudden, around 1952, stereo hit the big time in photography. All of a sudden, the same three prongs went into high-power action. (1) It was marvelous—wonderful, etc etc. (2) It was so easy, so simple, so utterly fun. (3) You didn't need to worry about technical complications—just point your cheap camera and smile. For awhile, stereo buzzed happily. People bit, they believed, trustingly.

Now, the entire new stereo business has vanished. It took about three years, and we're right back where we were before the "boom"—with those who really know about it still in there, the reputable makers who have more faith (and had it before the boom) still confidently selling their stuff, the rest all gone.

The important thing is that *stereo pictures are still wonderful*, if you use your head, understand the problems, the challenges, the opportunities. Plenty of photographers do. I take nothing else and I will not give up because a mere boom went bust. It was a doomed boom, if you wish, because it was so grossly, horribly mishandled by the all-or-nothing boys. They got nothing, and it serves them right.

Is the same true of stereo sound's sudden big boom?

Is it boom and bust, here too?

All I can say is that, though the stakes are very much higher in this boom and the utility of the actual product much more general, it could happen here too, and may well happen if things don't settle down pretty soon to a more reasonable pitch of intelligibility and responsibility. Stereo is good, but it can be run into the ground easily enough.

And Say We Did. . .

Of course, stereo has to be sold. But, if I may turn to an old and very apt phrase, don't, please, sell it down the river. Somehow, we must inject a bit of sensible reason into all this stereo hoopla before it is too late.

Somebody will have to get together with someone else of a sane and reasonable temperament and set up a few rules and precepts as to what is good for the stereo industry—or else.

If all stereo sound is "superb," if Heaven-on-earth is available at all prices from $4,500 to $29.95, then our descriptive powers are in the usual and well-known advertising limbo and we might as well quit.

If there aren't going to be any extras admitted, if all problems are to be ignored, then we are being brave ostriches, hiding from something that won't hurt us a bit if we just look at it. Stereo problems aren't too much, if you face up to them and quit the ostrich act.

If we are to falsify the stereo effect itself by outrageous compromises, denying its very nature, then we can't expect people to accept the many legitimate compromises that can be made with profit and pleasure all along the line, getting the best out of each situation, reasonably and ingeniously. This can be done—but unscrupulous stereo equipment designing can kill the whole thing, and destroy the public's confidence in *useful* compromise—which, after all, is the very stuff of life.

Our present stereo troubles begin with violent exaggeration and, actually, this is the easiest to accept. People are well used to simple excess of verbiage. They discount it automatically, almost as fast as you turn it out. We can resign ourselves to the superlatives (and the dangling comparatives, the equipment that has "more," that is "better," than something always left unmentioned). We'll get along.

But when the complexities and the extras are deliberately camouflaged, things begin to get bad.

Stereo does, you'll admit, require two separate sound channels, one way or the other. What on earth is the use, then, of misleading or confusing the buyer on this basic necessity? But that is what I see, right and left, blatantly. It's easy. Just advertise a one-piece "stereo phonograph," with a one-piece price. Don't say much about that second speaker, or second amplifier-speaker. Just put it in *very* small type so it won't be noticed.

The promotor's urge towards this easy white lie can be measured neatly by the size of his small type. In some ads, it is virtually invisible. But a reputable advertiser shows a picture of the second system as well as of the first, with prices on both, and is content with no more than that harmless little sugar-pill word, "ONLY." *Only* $49.50 for the extra speaker— or maybe *only* $449.50.

Just take a look at the current stereo ads in the magazines, if you want to check me on this. How many of them make it absolutely clear as to whether a second system is required and, if so, what it looks like, contains, costs? Some do, many don't.

The general idea is as of old—let's not and say we did. Let's bamboozle the silly public. Well, some of the public can be fooled some of the time. . . .

Not So Separate

But there's a more serious matter, involving one of those unfortunate inconveniences of the stereo principle, the necessity for two separated sound sources. No separation, no stereo.

Is there any argument about this? Not much, between you and me. We take it for granted that if there's to be stereo we must present our ears with two speaker-sources. We must somehow achieve separation for any normal home listening.

Whether it is by eight feet or fourteen feet depends on the situation; if we are forced to, we might even haul in the speakers to a six-foot spread, but not one of us would be likely to call this less than a compromise, except in a very small room for very close-up listening.

And so I find myself almost speechless (well, not quite . . .) when I discover that the problem of separation is being widely "solved" in very much the same manner as that of extra cost. Just pretend it isn't there.

If speaker separation is an inconvenience (which it surely is), then let's just forget all about it. Or almost. Let's not and say we did. Let's have our cake and eat it too.

STEREO
STEREO AND MONAURAL

the experts say... in HI-FI the best buys are

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NEW STEREOPHONIC EQUIPMENT

HF85: Stereo Dual Preamplifer is a complete stereo control system in "low silhouette" design adaptable to any type of installation. Selects, preamplifies, controls any stereo source—tape, discs, broadcasts. Superb variable crossover, feedback tone controls driven by feedback amplifier pairs in each channel. Distortion borders on unmeasurable even at high output levels. Separate lo-level input in each channel for mag. phono, tape head, mike. Separate hi-level inputs for AM & FM tuners & FM Multiplex. One each auxiliary A & B input in each channel. Independent level, bass & treble controls in each channel may be operated together with built-in clutch. Switched-in loudness compensator. Function Selector permits hearing each stereo channel individually, and reversing them; also use of unit for stereo or monophonic play. Full-wave rectifier tube power supply. 5-12AX7/ECC83, 1-6X4. Works with any 2 high-quality power amplifiers such as EICO, HF14, HF22, HF30, HF35, HF50, HF60. Kit **$39.95.** Wired **$64.95.** Includes cover.

HF81: Stereo Dual Amplifier-Preamplifier selects, amplifies & controls any stereo source—tape, discs, broadcasts—& feeds it thru self-contained dual 14W amplifiers to a pair of speakers. Monophonically: 28 watts for your speakers; complete stereo preamp. Ganged level controls, separate focus (balance) control, independent full-range bass & treble controls for each channel. Identical Williamson-type, push-pull EL84 power amplifiers, excellent output transformers. "Service Selector" switch permits one preamp-control section to drive the internal power amplifiers while other preamp-control section is left free to drive your existing external amplifier. **"Its performance is excellent, and the operation is uncomplicated."**—HI-FI MUSIC AT HOME. **"Excellent"**—SATURDAY REVIEW. Kit **$69.95.** Wired **$109.95.** Incl. cover.

MONAURAL PREAMPLIFIERS (stack 2 for Stereo)

NEW HF65: superb new design, Inputs for tape head, microphone, mag-phono cartridge & hi-level sources. IM distortion 0.04% @ 2V out. Attractive "low silhouette" design. **HF65A** Kit **$29.95,** Wired **$44.95. HF65** (with power supply) Kit **$33.95.** Wired **$49.95.**

HF61: "Rivals the most expensive preamps" — Marshall, AUDIOCRAFT. **HF61A** Kit **$24.95,** Wired **$37.95, HF61** (with power supply) Kit **$29.95.** Wired **$44.95.**

MONAURAL POWER AMPLIFIERS (use 2 for STEREO)

HF60: 60-Watt Ultra Linear Power Amplifier with Acro TO-330 Output Xfmr.; **"One of the best-performing amplifiers extant; an excellent buy."** AUDIOCRAFT Kit Report. Kit **$72.95.** Wired **$99.95.** Cover E-2 $4.50.

HF50: 50-Watt Ultra Linear Power Amplifier with extremely high quality Chicago Standard Output Transformer. Identical in every other respect to HF60, same specs at 50W. Kit **$57.95.** Wired **$87.95.** Cover E-2 $4.50.

NEW HF35: 35-Watt Ultra-Linear Power Amplifier. Kit **$47.95.** Wired **$72.95.** Cover E-2 $4.50.

HF30: 30-Watt Power Amplifier. Kit **$39.95.** Wired **$62.95.** Cover E-3 $3.95.

NEW HF22: 22-Watt Power Amplifier. Kit **$38.95.** Wired **$61.95.** Cover E-2 $4.50.

NEW HF14: 14-Watt Power Amplifier. Kit **$23.50.** Wired **$41.50.** Cover E-6 $4.50.

MONAURAL INTEGRATED AMPLIFIERS (use 2 for STEREO)

HF52: 50-Watt Integrated Amplifier with complete "front end" facilities & Chicago Standard Output Transformer. **"Excellent value"**—Hirsch-Houck Labs. Kit **$69.95.** Wired **$109.95.** Cover E-1 $4.50.

HF32: 30-Watt Integrated Amplifier. Kit **$57.95.** Wired **$89.95.** Both include cover.

HF20: 20-Watt Integrated Amplifier. "Well-engineered" — Stocklin, RADIO TV NEWS. Kit **$49.95.** Wired **$79.95.** Cover E-1 $4.50.

HF12: 12-Watt Integrated Amplifier. "Packs a wallop"—POP. ELECTRONICS. Kit **$34.95.** Wired **$57.95.**

SPEAKER SYSTEMS (use 2 for STEREO)

HFS2: Natural bass 30-200 cps via slot-loaded 12-ft. split conical bass horn. Middles & lower highs: front radiation from 8½" edge-damped cone. Distortionless spike-shaped super-tweeter radiates omni-directionally. Flat 45-20,000 cps, useful 30-40,000 cps. 16 ohms. HWD 36", 15¼", 11½". **"Eminently musical; would suggest unusual suitability for stereo."**—Holt, HIGH FIDELITY. Completely factory-built: Walnut or Mahogany. **$139.95;** Blonde, **$144.95.**

HFS1: Bookshelf Speaker System, complete with factory-built cabinet. Jensen 8" woofer, matching Jensen compression-driver exponential horn tweeter. Smooth clean bass; crisp extended highs. 70-12,000 cps range. Capacity 25 w. 8 ohms. HWD: 11" x 23" x 9". Wiring time 15 min. Price **$39.95.**

FM TUNER

HFT90: surpasses wired tuners up to 3X its cost. Prewired, pre-aligned, temperature-compensated "front end" — drift-free. Precision "eye-tronic" tuning. Sensitivity 1.5 uv for 20 db quieting — 6X that of other kit tuners. Response 20-20,000 cps ±1 db. K-follower & multiplex outputs. **"One of the best buys you can get in high fidelity kits."** — AUDIOCRAFT KIT REPORT. Kit **$39.95*.** Wired **$65.95*.** Cover $3.95.

*LESS COVER, F. E. T. INCL.

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SHOW ME HOW TO SAVE 50% on 60 models of top-quality equipment as checked below. ☐ Hi-Fi ☐ Test Instruments ☐ Ham Gear.
Send FREE literature & name of neighborhood EICO dealer.

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Add 5% in the West.

Let's gleefully toss out the baby with the bath. All we have to do is to *bring the stereo speakers right up close together.*

Ah—so many practical problems can be solved that way! The closer the speakers, the less the inconvenience. While we're at it, we might as well eat all of our cake and put the two speaker systems straight into one cabinet. Wonderful simplification! Saves the entire cost of a second cabinet and brings stereo right down to a level with the ultra-convenient monophonic phono.

This isn't fantasy at all. Before my very eyes, these days, I'm seeing ad after ad promoting what purports to be stereo in a one-cabinet form. And here again, the boldness of the manufacturer is measurable by the degree of actual speaker separation that he promotes as his "superb, full stereo realism," for the living room.

In fact, if you were to go by the newspaper ads you'd conclude that virtually all of our fine, new stereo was housed in single cabinets. You see more pictures of single boxes than you do of two—because it looks better, cheaper, simpler. People might be scared of two—so don't show them.

The singles are of three sorts, adding more confusion, (a) single cabinets which require a second speaker, or speaker-amplifier, discreetly unmentioned or lost in small type; (b) single cabinets with "complete" stereo insides, including two speaker systems, already built-in, and (c) the same with optional (wise idea) plugs for attaching an outside second system. (That way, you might hope to *hear* stereo).

And to cap all of this, there is a new utter confusion resulting from our flamboyant sales baloney of past years—the multi-speaker "hi-fi."

Then, it was "has five speakers" and so it did, of all sizes, shapes and qualities. Now, it still has five speakers, or three or two, but nobody bothers to explain whether they are *all on one channel*, or divvied up between two channels. If it has two speakers, does it have two channels?

Who knows! I've already got into stereo discussions of no less than monumental confusion with people who start by saying "But I thought you only needed *two* speakers and this phonograph has three; so why do I have to get still more?" Oof!

More reaping of crops of confusion, more birds coming home to roost. It really is a mess, and the blame goes squarely to past and present publicity, which aims to sell but not to instruct. OK, sell away, but at your own risk.

Grades of Degradation

Now to be sure, there are grades of degradation in the picture, and even in this fine simplification involved in stereo speaker separation. A little bit of separation, for goodness' sake, is better than none at all. But if I may say so, the grades would seem mainly to be determined not so much by the maker's conscience, in respect to stereo effect, as by the dictates of cabinetry.

Yes, the big de luxe stereo "hi-fis," $500 or so, rare old woods, crafted and custom, manage to get a plausible separation, maybe as great as five feet or even a bit more. Depends on the cabinet. You don't measure the cabinet to fit stereo's needs, you measure your stereo to fit the cabinet. And if you purchase one of these costly behemoths (shades of C. G. Burke's "eclectic phonograph!") you may thus have most of the glories of superb (and true) stereo sound, provided you sit up real close, for a proper stereo angle. Fine for a small room (though most of them, of course, go into palatial living rooms dozens of feet wide and long).

But it's when we descend to the lower price levels—and to the bulk of presently advertised home stereo equipment—that the have-your-cake-and-eat-it boys really go to town. The lower the price, the smaller the cabinet, and the narrower the stereo separation between speakers. Compromise? The plain fact is that in large numbers of such machines there is no "compromise" at all; the speakers are simply mounted wherever the expediency of the moment allows, no matter how close.

I'll grant that there are many shades of practicality and quite some degree of legitimate compromise, given the circumstances —such ingenuities as the swing-out speakers mounted in the sides of the single cabinet, for slightly wider separation, or the curved reflector systems in some high-priced one-piece units; also the side-door reflectors, aiming side-mounted speakers forward at a reasonably wide separation (but not really nearly enough). These devices and others not so good tend to help with the basic separation problem. Other systems of auxiliary speakers do even more, but put them aside for another discussion.

You are almost shouting at me, by this time, that obviously the only answer to the problems of separation is two speaker systems in separate cabinets. Of course! Natch! That's what any sensible, component-minded audiofan will do without a second thought and it is the only way to have stereo separation without compromise at all. It's relatively cheap, too.

But the home "hi-fi" industry is bound and set to maintain its traditional forms through thick and thin (wide and narrow, I should say) and so it simply has to produce stereo out of one cabinet, separation or no. The wish is father to the thought—let's not and say we did. And the extremes of present non-separated stereo are something to behold, let alone hear.

It's so simple. One well-advertised stereo phonograph now is boasting about its two self-contained 8-inch speaker systems. They're mounted up front in a table cabinet side by side, angled outward a bit for finer stereo realism and all that. This is what I deduce, anyhow, from the ads I've studied. If I have things right, this machine is no bigger than most ordinary table models—it *is* an ordinary table model—and its two speakers, if in truth they are two-channel, are separated by perhaps half an inch at the edges! Their centers are all of nine or ten inches apart. Some living room stereo!

Now just how you are supposed to hear the superb stereo sound generated by these two speakers the ad doesn't say. Natch, you just listen. But, I suggest, if you will put your nose down on the table about seven inches in front of the speaker you may get some of the stereo effect. Or perhaps you'd do as well if you placed the machine exactly at a point midway between two blank walls about five feet apart (say, in a corridor) and stood at the apex of the reflected beams. Then you might get a distinct sensation of stereo separation.

In the average living room, I suspect, owners of this fine phonograph, though they may rejoice in the knowledge that they are listening to superb stereo sound, will actually hear none of it. But the darned thing plays music, after all, and what more do most people want? They'll never know the difference. *Or will they?* That's the big question.

Then, to pass on to other features, there's the advertised stereo phono—I think it's the same one—which boasts as a special stereo feature a separate volume control for each channel and a separate tone control. Now I ask you, does this or doesn't this render you speechless?

Here our engineers have been sweating their hearts out for months and months

Designed to meet the requirements of every specific space, budget, or decor problem—and every listening preference...

University

FAMOUS MEN OF MUSIC CHOOSE UNIVERSITY

University® offers four ways to stereo

1 ***Leading Metropolitan Opera Star Leonard Warren converted to stereo quickly, easily and inexpensively... using a compact Stereoflex-2* "add-on" speaker with his University "Troubadour"***

This approach solves many problems for those already possessing a full-range monophonic system, as well as those planning to buy one now with an eye to stereo later. Thanks to the *exclusive dual voice coil* woofer used in all University stereo-adapted systems, only one such woofer is needed to reproduce the *combined* bass below 150 cycles† of both stereo channels. Thus all three models of University "add-on" speakers provide a perfect match by *direct* connection to the original speaker system. Stereoflex-1* is well suited for bookshelf installations. Stereoflex-2, with its narrow silhouette, makes a fine end table. Model SLC* can be affixed to a wall or "lite-pole," its decorative fibreglas housing blending smartly with modern furnishings. Each can also be used with any brand monophonic system *not* having a dual voice coil woofer, by using a University Stereo Adapter Network Model A-1.

2 ***Discriminating music lovers may also enjoy magnificent stereo by simply connecting two University "add-on" stereo speakers to a single dual voice coil woofer* in a suitable enclosure***

This approach offers great versatility. Since the woofer's position in the room is uncritical for stereo†, it may be installed wherever most convenient . . . in a small suitable enclosure, or in a wall, closet, etc. The two "add-on" speakers can then be placed to provide optimum stereo reproduction, without upsetting existing room decor.

3 ***Noted maestro Fred Waring chose a pair of University RRL* Ultra Linear Response speakers for his stereo system***

When planning his recent cross country concert tour, *Hi Fi Holiday*, Fred Waring turned to University engineers for a compact, quality high fidelity speaker system that could overcome the acoustical deficiencies of the theatres and auditoriums in which The Pennsylvanians would be playing. The performance of the S-11 Ultra Linear Response speakers, mainstays for the system, proved so outstanding that Mr. Waring chose two of them for his own home. Two such identical speakers are an excellent stereo solution in rooms where they can be placed in reasonably symmetrical positions. All University systems are ideally suited for this purpose, because they are stereo-matched in production to within 1 db.

4 ***Internationally famed violinist Mischa Elman prefers his stereo all-in-one . . . he selected the fabulous TMS-2*, 'Trimensional' stereo speaker that in his words . . . "approaches the authenticity of concert hall performance."***

A totally integrated single-cabinet system, the TMS-2 literally adds a third dimension to stereophonic sound... the perception of *depth*. Designed to utilize the acoustical properties of the surrounding walls of the room, the TMS-2 performs far beyond the scope of other single-cabinet stereo speakers. Its ingenious combination of electrical and acoustical principles permits placement in a corner or *anywhere* along a wall... lets you and any number of friends enjoy exciting stereophonic sound from almost any position in the room.

WHICH WAY TO STEREO IS IDEAL FOR YOU?

You'll find all the answers in University's FREE *Informative guide to high fidelity stereo and monophonic speaker systems and components.* Here, you'll find complete information on: how to select and place the four major types of stereo speaker systems... how to adapt your present monophonic system to stereo... how to choose a monophonic system *now* for most efficient conversion to stereo *later*... how to plan economical "do-it-yourself" monophonic/stereo speaker systems. See your dealer today or write Desk R-S. University Loudspeakers, Inc., 80 So. Kensico Ave., White Plains, N. Y.

**Trademark and Patent Pending.*

†Bass frequencies below 150 cycles do not contribute to the stereo effect.

trying to manage two stereo signals from one set of controls; here, all of us critics, like me, (AUDIO, ETC, August 1958, p. 11) have tried to use dual controls and have long since given up—and now, this marvelous new phonograph presents us with separate volume controls as a special feature! I swoon at the mere thought.

And for Pete's sake, just tell me why anybody would want two separate tone controls, one for each channel? That's perhaps the zaniest stereo "feature" of the year. (Unless, of course, the idea was to use one tone control to touch up the FM half of an AM-FM stereo broadcast, degrading the FM signal to sound like the AM. Could use it for that.)

I've just had a horrible, ugly thought. *Now* I think I know why this phonograph is built in such a peculiar fashion. Rather than design a new stereo system, the company maybe had a bright idea: just mount two of the old-model phono chassis inside one cabinet, volume control, tone control and all. Hook up your stereo cartridge to both of them and you're in business, with special stereo features—*two* volume controls, *two* tone controls. I'll betcha. . . . Anyhow, it's a good way to use up surplus obsolete inventory.

Then there's the new portable AM-FM stereo radio system, two units and you can hold either of them in one hand, by the looks of them. For a moment, I thought that the single AM-FM unit was a complete stereo system; it has two speakers in it, after all, as well as two separate tuners, AM and FM. But this manufacturer does us a service by showing a second picture, the matching stereo amplifier-speaker unit, and in between the two is a small drawing showing both units hooked together. Thus incipient confusion is avoided here, at least for those who stop to look and read.

I object on principle to only one aspect of this particular ad—it reads, in part, "Stereo *radio* is here. . . ." and on the side it says "build a home music system around stereo radio." Well, maybe this is merely hopeful thinking. Stereo radio isn't here quite yet, I'd say. See last month. Doesn't say whether there's a multiplex outlet in this unit.

Useful Compromise

Enuf said for the moment. I seem to have let loose my spleen for this month, at least. If you want more info of this sort just open the pages of any magazine or newspaper. Stereo is everywhere, and misleading confusion goes right along with it, in every degree from mild to blatant.

I'll only add a few words of special emphasis, for fear that I may lead you off on an unintended track.

I'm not against compromise in sound reproduction and I'm not against "hi-fi" home equipment, non-component type, as such. I won't use it, nor recommend it, nor have I in the past; but I think it continues to have its place, especially in the lower price brackets, for those who have to have the simple sort of equipment to please themselves.

But compromise must be ingenious, constructive, honest, useful, if it is to be legitimate. Much home equipment is legitimately compromised in many ways, under the circumstances. The line between outrageous compromise and legitimate compromise is awfully hard to pin down, and the same applies to stereo.

No—I don't wish to wipe the standard home equipment off the scene, in favor of our own components. Impractical, unnecessary, impossible.

But I do deplore the extremes of compromise, the extremes of misleading, adver-

(*Continued on page 78*)

STEREO BY Grommes

The sighing wind . . . the rippling water . . . the roaring surf . . . each voice clear and distinct yet blending into the glorious symphony of the sea. This quality of living natural sound can be yours to enjoy with High Fidelity by Grommes . . . the natural tone of each voice . . . each instrument . . . the sparkling clarity and realistic depth of the live performance . . . high fidelity reproduction at its finest. Grommes Hi-Fi components are craftsman-designed and assembled with jewel-like precision . . . built to last for years of musical enjoyment. Beautifully styled in gleaming gold and white set in leatherette cases.

Visit your Grommes Hi-Fi Dealer . . . see and hear these exciting new Stereo High Fidelity Amplifiers, Preamplifiers and Tuners.

☐ Please send me Free Color Brochure featuring the new Grommes Hi-Fi Series.

INSTITUTE OF HIGH FIDELITY MANUFACTURERS

Grommes Div. of Precision Electronics, Inc. Dept. AU-1, 9101 King St., Franklin Park, Ill.

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EDITOR'S REVIEW

OUTLOOK FOR 1959

As we enter the new year, the one important problem awaiting solution is that of stereo broadcasting. That it will come is almost certain—in what form and when are still up in the air, awaiting FCC determination. Principal contenders in the stereo hassle are the systems known as the Crosby and the Halstead—both using FM multiplex, but in different manners. We still believe that a compromise would provide an amicable solution, though the Crosby partisans insist that it would degrade quality or decrease the stereo service area, or both.

Last month, RCA first and Philco later made proposals which will undoubtedly further delay any final determination, although it would seem possible that whatever is done in the FM/multiplex system need not be influenced by counter proposals involving only AM, as the RCA and Philco methods do. We have no details of the latter system, but RCA's proposal suggests the separate use of the two sidebands of an AM carrier with each modulated by one of the channels. As presented in the publicity releases, it would appear that RCA thought this to be a new and radically novel suggestion. We think differently. As proof, we quote directly the last item in the Editor's Report in the August, 1951, issue of Audio Engineering:

"One reader, Milton Sackin, writes to suggest the use of two channels of transmission to provide stereophonic sound in the home. These two channels could readily be transmitted over the stations which have both AM and FM facilities, and listeners with two receivers and two speakers could then receive sound which should be more realistic than that from a single channel.

"While the idea is not new—having been tried in Holland some years ago—we admit to having attempted to "sell" the idea to one of the New York stations with both outlets. Station agreed, program producer demurred.

"On the same subject—what is wrong with *this* idea? Two separate channels, fed by suitably spaced microphones, are used to modulate the positive and negative halves, respectively, of an AM carrier. Ordinary receivers using half-wave diode detectors would reproduce the output of one channel or the other, but since the microphones are reasonably close together there should not be much difference in the resulting sound. Stereo receivers would have two half-wave detectors, of opposite polarity, followed by separate audio and speaker systems. Thus no changes would be required in existing sets unless a listener wanted the additional advantage of stereo reproduction.

"One of the precepts of good engineering is that no equipment should be obsoleted by a change of standards. In view of recent color TV decisions, it appears that all standard-making agencies are not in agreement with this precept. We would, however, like to hear some experimental work on a dual-channel transmission."

As we now know, of course, AM/FM stereo broadcasting is "old hat" today, and many stations are doing it on a regular basis. We also know that we would revise parts of the earlier suggestion relative to reception of only one channel being satisfactory. However, any full-wave detector would provide a sum signal of both channels. Single-sideband transmission is not impossible, as we know, and we still believe that both sidebands could be transmitted with separate modulation on the two halves. Apparently RCA believes so, too, but we wish the experimental work could have been started some years ago—by now we would have stereo broadcasting, even though the FM/multiplex system is probably better in quality.

Calbest Electronics has proposed a system in which only the important stereo range components are transmitted by multiplex, the main channel—as in the Crosby system—transmitting the "sum" signal. Since the full audio spectrum is not necessary to establish direction, according to Calbest, this would permit the use of narrow-band FM-multiplex for the stereo-information channel, which would conserve channel bandwidth. It would seem as though there is considerable merit in this system, and we would like to hear it in actual engineering tests.

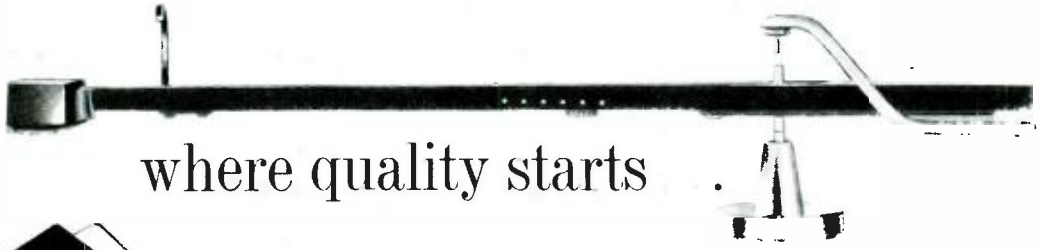
But—and here's the rub—this means more delay. Why not allow more experimentation, using *all* proposed systems? With the necessary availability of receivers the public could decide, even if the proposing companies had to provide, say, 1000 receivers at no cost for field-trial purposes.

One thing about hi-fi—it is never dull.

THE SPRING SHOWS

This month we have the Rigo show in Minneapolis, from the 16th to the 18th. In February we have three —Washington, D.C., San Francisco, and Los Angeles —the latter being the largest outside of New York. Largest in exhibitors, at least, even if not in attendance. We wonder how long *this* balance will continue.

The Washington show is at the Shoreham Hotel from February 5–8; San Francisco's is at the Cow Palace, February 6–9 (try to get to both of them, huh?) and Los Angeles' event is again at the Biltmore Hotel, February 16–23.



where quality starts . . .

and the music begins

Styled by Raymond Spilman

RIGHT at the beginnings of a stereo program . . . *the principle ingredient is quality . . . and, the finest quality is only possible with the incomparable STANTON Stereo-FLUXVALVE Pickup.*

For the music-minded—The STANTON Model 196 UNIPOISE Arm with integrated Stereo-FLUXVALVE Pickup employs a precision, single, friction-free bearing which adds **gentleness** to quality. Hermetically sealed in lifetime polystyrene, the Model 196 performs in a way no other pickup can equal. Here for the first time is a pickup with all of the compliance, frequency response and distortion-free performance for the highest quality music reproduction . . . and, it is fully compatible for both monophonic and stereophonic microgroove records.

For the technically-minded—Hermetically sealed, it is impervious to all elements. Exclusive replaceable "T-GUARD" Stylus assembly contains all moving elements and a high quality .7 mil diamond with precision polish and contour. Frequency response is flat within 2 db over the entire stereo recording range. Two balanced outputs for connection to low mag inputs of all preamplifiers no need for transformer or gain-stage device. Finger tip stylus pressure adjustment from 1 to 6 grams (recommended pressure is from 1-4 grams). Exclusive built-in magnetic discriminator uses 4 coil push-pull design—rejects hum and provides better than 20db of inter-channel separation. Entire assembly weighs only a fraction of conventional tone arms. Simple Uni-mount installation employs a single thumbscrew and bolt. Prefabricated signal wires. requires no soldering for normal installations.

Model 196 STANTON UNIPOISE Arm with integrated Stereo-FLUXVALVE Pickup $59.85

The STANTON Model 371 Stereo-FLUXVALVE Cartridge

Identical to the Stereo-FLUXVALVE built into the Model 196 UNIPOISE, the Model 371 is of true miniature design and can be installed into all tone arms with standard ½" mounting centers. Four terminal design provides complete versatility as it can be strapped for 3 and 4 wire stereo systems as well as vertical and lateral monophonic transcriptions. Ideal for converting to stereo, or for new installations. Fully compatible, on monophonic records the Stereo-FLUXVALVE will outperform all other cartridges except the original FLUXVALVE . . . on stereo records it is peerless!

Model 371 STANTON Stereo-FLUXVALVE Cartridge $29.85

"For those who can hear the difference" **FINE QUALITY HIGH FIDELITY PRODUCTS BY**

PICKERING & COMPANY, INC., Plainview, N. Y.

Have you read "It Takes Two To Stereo" by Walter O. Stanton? Revised edition now ready. Address Dept. A19 for your Free copy.

How to save 77 years

The boy Galileo sat in the sanctuary of Pisa's great cathedral, observing the movement of a lamp which had been set swinging by a sudden gusty draft. The chain by which it was suspended from the high ceiling was of such a length that the arcs decreased but slowly. Strange thing, though. No matter how far the pendulum swung, its movement consumed the same time. Galileo made a note of that. The year was 1581.

The old man sat at his writing desk, sixty years and a thousand disputes later, writing down a new theory. The regularity of a swinging pendulum might be combined with a spring mechanism to improve the unreliable clocks of that day. So Galileo scribbled on, and did nothing more about it. A number of years after his death Huygens took the notes and invented the pendulum clock. *Seventy-seven years had elapsed since the boy made the observation upon which it was based!*

The creative thinker today still need not have a specific use in mind when, by equation or formula, he branches off from the accepted to the hitherto unknown. The classic invention of this decade, the transistor, evolved in the Bell Telephone Laboratories as scientists sought a deeper understanding of semiconductors. On the other hand, another great invention, the feedback amplifier, came from the acutely creative mind of one Bell engineer faced with a specific problem.

Current Bell Laboratories activities—in such areas as data transmission, radar and submarine cable development—call for the coordinated efforts of all types of thinkers and all types of approaches. One type complements another.

Today, seventy-seven years would not have elapsed between the swinging lamp and the swinging clock pendulum—certainly not at Bell Labs, where ideas, though not rushed, are carefully advanced toward fruitful application in national defense, industry and communications. An important part of this harvest is the efficiency of America's telephone service, unequalled anywhere else in the world.

BELL TELEPHONE LABORATORIES

WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT

Simple Single-Cabinet Corner Stereo Speaker

The need for two speakers can be a strong deterrent against a stereo installation in very small rooms. This modification of a common cabinet type gives adequate separation when the listener cannot be more than about six or eight feet from the loudspeakers.

C. G. McPROUD

MANY A LISTENER is faced with the problem of accommodating two speakers for stereo listening in a room in which space is sufficiently at a premium that such an accommodation becomes practically impossible. Several solutions are, of course, open to the enterprising audiofan—the simplest being to eschew stereo at all. The use of two small speakers in enclosures of a cubic foot or so rarely gives adequate sound quality for the discriminating, albeit circumscribed, listener.

Already one or two manufacturers have shown speakers which depended on the reflection of sound from doors opening at the ends of a cabinet some five feet wide. When the doors are closed the cabinet appears to be a simple rectangular affair; with the doors open the sound comes from two sources with adequate separation for all but the largest rooms. The originator of this idea seems to be Bozak, with one such cabinet in the line. The cover of the December, 1958, issue of AUDIO showed a similar arrangement in a cabinet displayed at several audio shows by Bell Sound Systems, although Bozak speakers are also used in this demonstration unit. The new University "Trimensional" stereo speaker works on the same lines, although the doors serve to keep direct sound from the two mid- and high-frequency systems from being heard at their relatively close spacing, and thus restrict the sound to that which is reflected from the walls. The University model employs a single woofer—a two-voice-coil model which covers the range up to 180 cps, below which there is little or no stereo effect anyhow.

The two-voice-coil speaker is, so far, exclusively a product of University, and while the use of this model would simplify the entire problem, it must be admitted that many who are interested in constructing such a speaker enclosure might just possibly have other speakers available that would be suitable for the job at hand. There are some Stentorian models which have tapped voice coils, and these could be used if it were possible to keep the output circuits of the two amplifiers separate throughout. However, most systems will have a common ground, and this is likely to introduce some problems in phasing the completed unit.

Our Solution

Having available a corner cabinet which was of a suitable size for an installation of this type, we considered the possibility of using the adjacent walls as the reflecting media, thus providing an apparent spacing between the speakers of a somewhat greater dimension than the actual physical width of the cabinet itself. The cabinet—a Cabinart "Rebel IV"—measured 21 in. across the front which is admittedly far from sufficient separation even if the speakers could be mounted on the edges of the enclosure. *Figure* 1 shows the cabinet in a typical corner, and the drawing in *Fig.* 2 shows the actual dimensions of the unit. *Figure* 3 shows what happens when the speaker is placed tight up against a corner, with a separation of 30 in. At a listening distance of six feet, this gives the same angular separation as a 6-foot spacing does at a listening distance of 14½ feet. If a slightly wider separation is desired, the cabinet may be moved out from the corner an inch or so, with the separation increasing 2.8 in. for every inch outward the enclosure is moved.

The problem now centers around the choice of speakers, the crossover frequency, and the physical construction of the unit. Preliminary explorations indi-

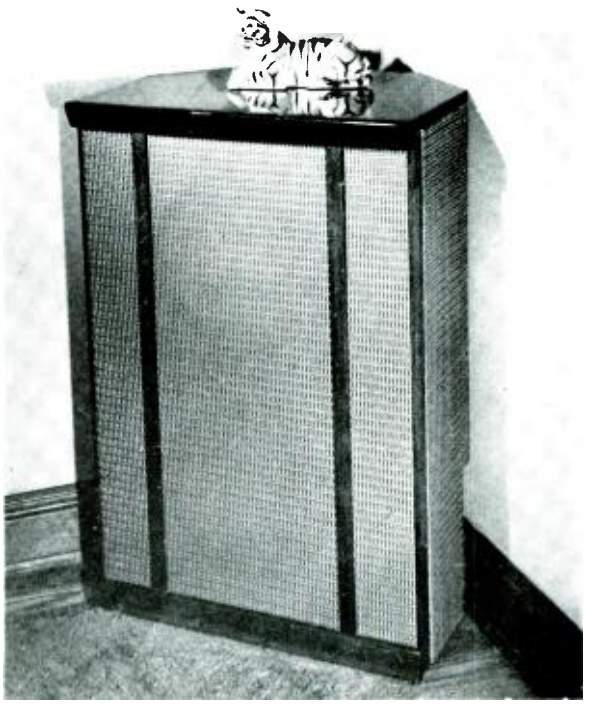


Fig. 1. Modified Rebel IV enclosure becomes a complete stereo speaker system in one cabinet.

cated that the only speakers that could be mounted in the grille-covered side panels of the Cabinart cabinet were those with a 4-inch dimension from front to back of the cabinet, which means the diameter of the speaker. Because of the demand for speakers with the largest possible cone area in the least possible height—without going to some of the impossible dimensions affected by one television manufacturer—a practical type of speaker is the 4 × 6 in. oval commonly used in automobile sets and in tape recorder cabinets where space is at a premium. Since a crossover at approximately 800 cps was contemplated, it was felt that these would be adequate.

In the woofer department, two 12-in. cones were selected because the cabinet was already cut for this size of speaker. Avoiding the extremely efficient—and more costly—models, Philips 9760M speakers were chosen as having a fair compromise with cost and efficiency. These units are rated at 20 watts continuous duty, have a voice-coil impedance of 6 to 8 ohms, and a frequency range of 35 to 18,000 cps. The efficiency is rated as 7 per cent.

The reason for the consideration of efficiency is that most of the small speakers—particularly those in the 4 × 6 inch category—have efficiencies in the range of 2 to 4 per cent, and if there were too much disparity in the efficiencies of the two units it would be necessary to pad the woofers down considerably. There was still some difference even with the cones selected, but the padding in the low-frequency section was only about 4 db for balance. For the high-frequency cones—choosing from the same manufacturer—model AD-3460M speakers were selected as being of a suitable size and efficiency.

It is probable that higher efficiency could have been obtained by the use of a small horn unit, but any such models that would have fitted into the space available had cutoff frequencies in the vicinity of 3000 cps, and while larger horns could have been fitted into the cabinet by notching and filling in the spaces around the horns themselves, it appeared to be a complicated procedure, and certainly more costly. We were only aiming for a stereo speaker of *good* performance, not a *superb* one.

Construction

The Cabinart Rebel IV enclosure is equipped with two grille-covered frames at the sides to cover the space between the cabinet proper and the side walls. The Rebel is essentially a bass-reflex unit, with the port taking the form of a ½-in. slot down the back. Low-frequency radiation from this slot is then channeled along the sides of the cabinet, being reflected in the corner, and reaching the front at the mouths of the two wedge-shaped "horns" formed by the walls and the cabinet sides. The major radiation from the cone is direct from the front. *Figure* 4 shows this slot, and at the same time shows a pattern of 5/32-in. holes—175 of them on each side—used in adapting this cabinet to the friction-loaded type of enclosure proposed by Goodman's engineers and described in June and July, 1956. These holes were drilled on one-inch centers covering an area of 6 × 24 inches on each of the side panels. This treatment reduced the height of the second peak, around 100 cps, and gave a smoother response than the original model when used with the test speaker, provided most of the slot was covered up. Note the on-off switch at the upper left corner of the figure.

The 4 × 6 speakers were mounted on small "baffles" made from illustration board (a fairly heavy cardboard used by artists and sign painters) about 5 × 7 inches in size, with the oval opening cut out for the cone area. These baffles were

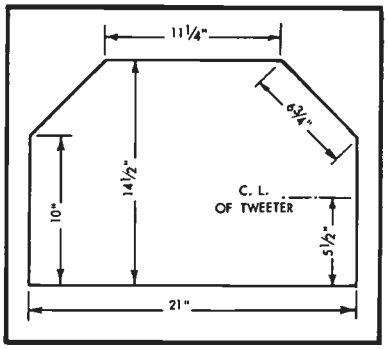


Fig. 2. Physical measurements of the Rebel IV enclosure.

sprayed black before installation, which was by four sheet metal brackets shaped so as to hold the front face of the baffle against the back of the grille cloth. *Figure* 4 shows the positioning of one of the 4 × 6 speakers—the other being mounted on the other side of the cabinet.

Mounted adjacent to the small speakers are two 10-ohm, 10-watt adjustable resistors which are used to balance the woofers and tweeters in each channel. Their location at the side of the cabinet alongside the tweeters was the result of a wrong guess—it was expected that, as is usual with horn tweeters which have high efficiency, there would be some necessary padding of the tweeters, and locating them in that position made the wiring simple as well as making the adjustments convenient of access. However, it was the woofer which needed padding in each case, but the location is still good, even if the wiring is more complicated.

A simple dividing network is employed with a single inductance and a single capacitor in each channel, giving a 6-db-per-octave slope on each side of crossover. Against our better judgment we employed electrolytic capacitors, since the values were quite high. The complete circuit of the electrical wiring is shown in *Fig.* 5. The formulas for capacitance and inductance are:

$$L = \frac{R}{2\pi f} \text{ and}$$

$$C = \frac{1}{2\pi f R}$$

where

R = voice coil impedance, and
f = crossover frequency

Thus for a 4-ohm tweeter and a crossover frequency of 800 cps, the capacitance value is 50 μf; for an 8-ohm woofer and the same crossover frequency, the inductance is 1.6 mh. However, better matching and better balance was obtained by using an inductance of 4 mh and shunting the woofer with an 8-ohm resistor, thus working the woofer as a 4-ohm unit. Admittedly this is not an efficient method of operating, but sub-

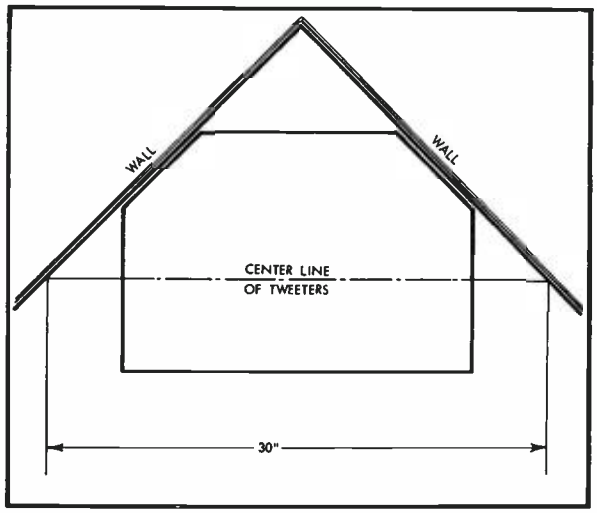


Fig. 3. Sound paths from the tweeters reflect from the walls, giving stereo separation adequate for close-up listening.

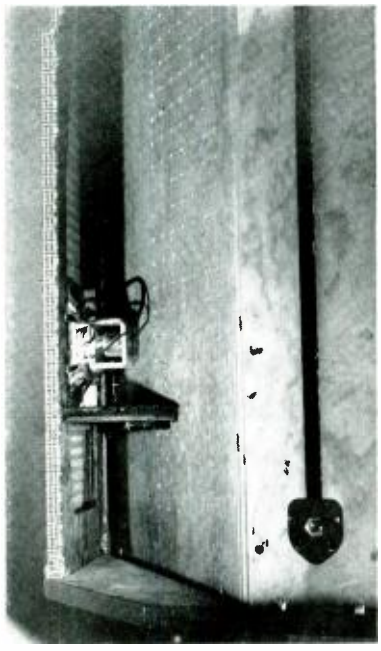


Fig. 4. Mounting of one of the two tweeters, a 4×6 oval Philips model. Note pattern of "friction loading" holes in the side of the cabinet, and on-off switch at top of slot, which is covered over on the inside except for 8 inches at the bottom.

jective listening proved it to be the optimum arrangement for these particular speakers and enclosure.

The dividing network capacitors can be 50-μf, 25-volt non-polarized units, Aerovox type NP-PRS. However, these will not always be found in jobber stocks and a simpler solution would be to use dual-common-negative units with each section having a capacitance equal to twice the required value (since the two sections are in series) and using only the two positive leads for the connections, disregarding the common negative. Capacitors of this type are rated at 150 volts, and the following numbers are catalogued: Aerovox PRS, Mallory 2N523, Cornell-Dubilier BBRD-101015.

The 4-mh inductors may be obtained ready wound from C & M Coils, 3016 Holmes Ave., Huntsville, Alabama—a newcomer in the field but one which has been needed for some time. Coils are available in small increments from .05 mh up to 1 mh, and in .25-mh steps up to 12 mh. They are wound of No. 17 wire, taped, and varnish dipped and baked. For the real do-it-yourselfer, 4-mh coils may be wound with 340 turns of No. 17 wire on a form made of wood circles assembled on a 1½-in. round core 1½ in. in length. The coil forms should be assembled using brass or aluminum screws, and only brass or aluminum screws should be used to mount the finished coils.

Final Adjustment

In order to make it possible to phase the completed speaker, the two channels are kept entirely separate in the speaker itself—using a four-terminal connection strip for the leads from the amplifier. Dual-channel amplifiers will have a common ground for both outputs, and even if separate amplifiers are used it is likely that there will be some point in the system where the grounding will firmly establish the phasing of the output circuits. Once the polarity of the speakers is determined, two of the four terminals can be connected together, and so a 3-wire connecting cable may be used to the amplifier. Phasing between woofer and tweeter in each channel is equally important, and is best done by putting an 800-cps tone on each channel separately and as the ear is moved from in front of the woofer to the tweeter there should be a continuous sound, with no null in between. When this condition obtains, the woofer and tweeter are in phase and should be connected permanently.

After each section is phased and the variable resistor adjusted for balance between lows and highs, both sections may be connected to the amplifiers and the stereo phasing checked. Feed a tone of about 500 cps to both channels in phase—preferably from a monophonic test record so as to be sure of the phasing of the source—and again move the ear, this time from in front of one of the woofers to the front of the other at a distance of about three inches from the cabinet baffle. The tone should again appear to be continuous as the ear is moved. If the speakers are out of phase there will be a null between them.

Once the phasing is completed the speaker is ready for use. Placed in a corner about 1 inch from the two adjacent walls, there will be a separation of approximately three feet, which is passable for listening at distances of not over six feet. The highs bounce off the adjacent walls and establish the stereo separation; the lows come from the center, since they emanate directly from the front of the cabinet with one woofer directly above the other. As a second stereo speaker system we have found this to be quite satisfactory, and while not comparing too favorably with a spacing of 8 to 12 feet, it must be remembered that the original specification was that the unit was to be used for close-up listening. Over-all quality is excellent.

Many enclosure types can be modified in a similar manner, and those with wider fronts will give improved separation. Suggested speakers of this type are the Electro-Voice Regency and Empire models, University Troubadour, and others of similar physical design. These, however, require cutting into the wood sides to install the tweeters, and would necessitate some means of covering up the openings.

This modification is not claimed to be the ultimate in stereo speakers, but it is believed that for its limited application it does give the effect desired with a minimum of space requirement. Æ

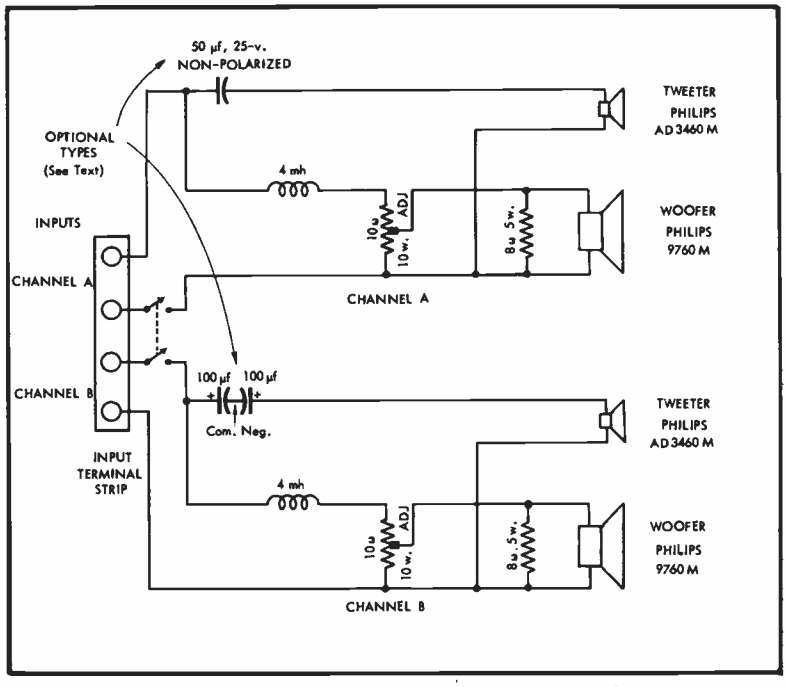


Fig. 5. Wiring of stereo speaker showing two dividing networks, balancing resistor, and on-off switch, which is reached from over the top of the cabinet.

Direct-Reading Damping-Factor Meter

W. H. ANDERSON*

The importance of damping factor to modern amplifier design makes it desirable to simplify the measurement of this parameter at any frequency and at a wide variety of nominal impedances. The author describes an instrument which will do this.

THE INTERNAL RESISTANCE of any device is an elusive quantity to measure because we can generally only ascertain it indirectly as the quotient of the voltage change over the current change when the load is altered in some known manner. The inaccessible internal voltage generator is assumed to have a constant EMF. In the case of an audio amplifier, the load disturbance may react significantly on the internally generated voltage and doubts will be cast on the final results. This is particularly true in low-source-resistance units where small changes in load resistance do not suffice to give readable changes in load voltage and/or current and (perhaps in desperation) the load is taken from open circuit down to a value that will produce half the open circuit voltage. This latter value may be a fraction of an ohm which is far from a normal load.

If we quite arbitrarily take ten per cent (in the same general order as the speaker impedance change with frequency) as the maximum load change permissible, the reaction on the amplifier should not be excessive. On the basis of this assumption, a meter has been developed that will indicate the damping factor directly.

Noting *Fig.* 1, and taking a 4-ohm load case as an example, the VTVM can be adjusted to a full-scale sensitivity of 0.25 volts. The VTVM scale may be calibrated on a power basis with full scale at 1 watt. If the load is now changed to 3.6 ohms total as shown in *Fig.* 2, the total current will likely rise and the voltmeter across the 0.5-ohm resistor will also show greater deflection. If, however, we simultaneously shift the VTVM to a voltage dividing circuit as shown in *Fig.* 2, we could force the meter indication to be the same as before. If the source resistance were zero, the voltage across the 0.5-ohm resistor would rise to 10/9 its former value and, if R_1 were 10K and R_2 90K, a full-scale VTVM indication would just be regained by having the R_1 arm at its bottom position. At the other extreme, were the source resistance infinite, no change in load current would occur and R_1 would be at the top to give full scale indication. The dial on R_1 can therefore be calibrated in terms of internal resistance of the amplifier feeding the 4-ohm load. While the argument so far has been based on full-scale indications, it follows that all it is necessary to do is to make the voltmeter indications the *same* by adjusting R_1 when the decrement of load resistance is taken. Of course the VTVM scale may be calibrated in power units to a high degree of accuracy thus increasing the utility of the instrument.

These measurements can be conducted on whatever frequency component can be transmitted through the amplifier. At high frequencies, the internal resistance may indeed be an internal impedance but comparative checks will still be of value.

To make the instrument as flexible as possible, three additional terminations—8, 16, and 500 ohms are available. These have suitable voltage divisions so that 0.25 volt appears at the VTVM for a 1-watt amplifier output. When more than one load-resistance range is fitted, it is obvious that calibration in terms of internal resistance is no longer practical. Instead, the proportion $R_{load}/R_{internal} = Damping\ Factor$ is both more convenient and is in line with current terminology.

One watt full scale would clearly be inadequate to handle many amplifiers. Two more scales were added—10 watts and 100 watts full scale. This entails the use of quite husky resistors for the load and since the target accuracy for these items is 0.1 per cent poses quite a procurement problem.

The mathematical details of this approach to the problem are gathered together in an appendix and it is there shown that the damping factor obtained by this method is not a function of the particular load impedance used or what proportion of it is used. This simplifies the general design since only one measurement apparatus is required regardless of the number of different terminal resistances and power levels it is decided to accommodate.

* *484 Church St., Apt. 416, Toronto 5, Ont., Canada.*

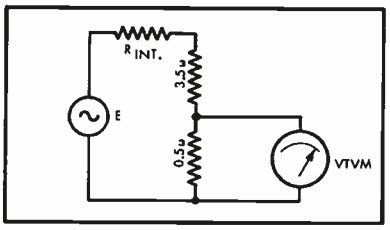


Fig. 1. Basic initial circuit based on the author's article in the September, 1958, issue.

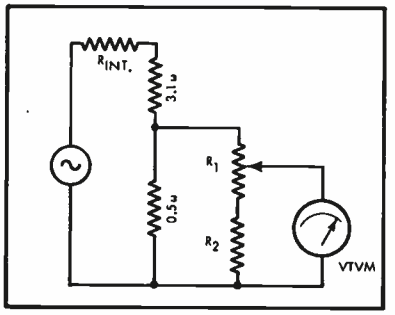


Fig. 2. Second step in measurement of damping factor involves changing of load by 10 per cent from nominal value.

Construction

Figure 3 is a schematic of the entire unit. Some small changes in expected values perhaps merit mentioning. On the 500-ohm position, the shunting of the power switch network on the 5.6-ohm resistor is significant, necessitating it being raised to the value shown. Similarly the $R_1 - R_2$ network tends to load the power switch network on the 10-watt position demanding small changes in R_4 and R_5.

Apart from the load resistors, the device consists of a 12AU7 in a conven-

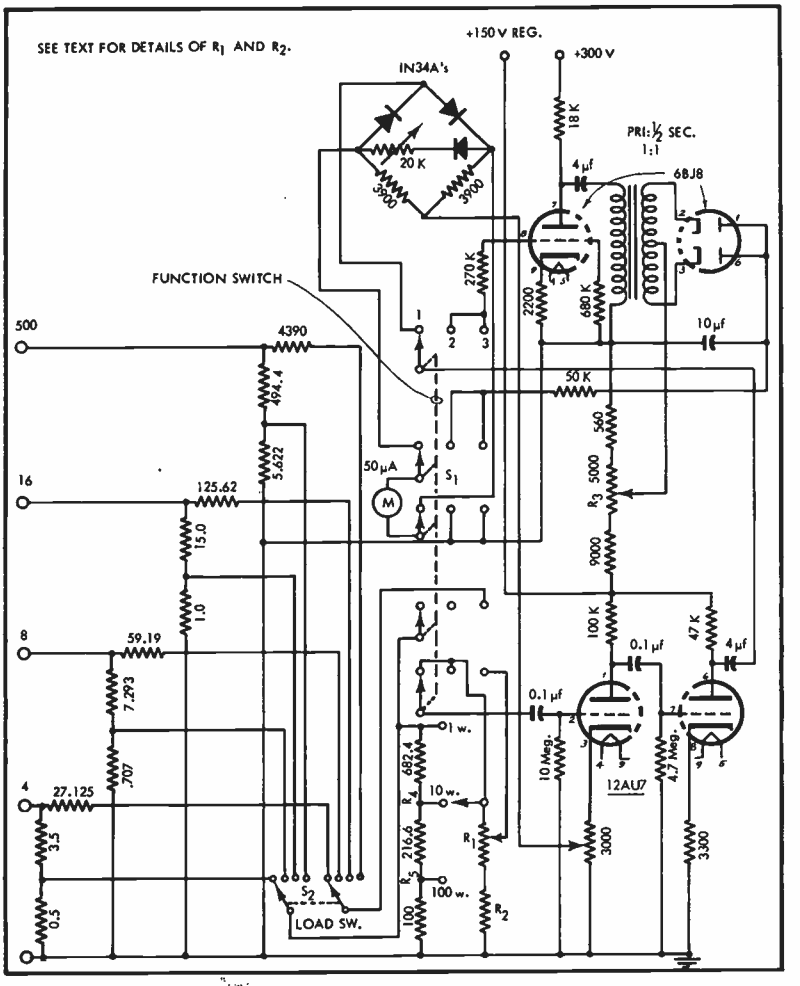


Fig. 3. Complete schematic of direct-reading damping-factor meter.

tional VTVM circuit with a full-wave rectifier to a 50 microampere meter. This will indicate power on S_1 (function switch) position one. On function switch position two, the 12AU7 acts as a normal amplifier driving another 12AU7 (two halves paralleled) which in turn feeds a full-wave rectifier with variable delay voltage controlled by R_3. R_3 is then set so that the microammeter indicates any convenient value—generally half scale. (NOTE: The schematic shows a 6BJ8, which incorporates a triode & two separate diodes.)

When the function switch is moved to position three, the 10 per cent decrement is taken on the load and the grid of the first 12AU7 is switched to the arm of R_1. R_1 is then varied to yield the same microammeter indication as before—this implies the same voltage to the amplifier as before—and the damping factor can be read off the R_1 dial.

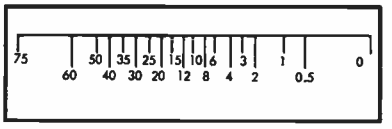


Fig. 4. Relative spacing of damping factor indications on meter dial.

The heart of the system lies in the selection of R_1 and R_2. The appendix shows that the *Damping Factor* $= (1 - K)/K$ where K is the fraction of R_1 that is below the arm. A few calculations on this basis indicated that, for reasonable dial spacings on R_1, a log tapered potentiometer must be used. Further reflection indicated that it is not necessary to have $DF = \infty$ on the scale and that it might ease the scale crowding to have the highest reading in the order of 100 which is adequate for most situations. Infinity will be suppressed if R_2 is more than nine times R_1. In the prototype unit, R_2 measures 89,980 ohms and R_1 is 9850 ohms. To keep in line with the mathematical development, it is necessary to *imagine* that R_1 is one-tenth the sum of R_1 and $R_2 = 9983$ ohms and R_2 is the balance, or 89,847 ohms. For a damping factor of 2, $K = \frac{1}{3}$, or the resistance between arm and ground (rest of circuit disconnected) will be *(9983/3) + 89,847 = 93,175 ohms.* On this basis, the instrument was calibrated. The relative dial spacings have been put into a straight line in *Fig.* 4 to give an idea of the dial resolution.

Figure 5 shows the damping factors as read from this meter at various power levels on a good commercial Class AB amplifier with voltage feedback. While these were taken at 1000 cps., the factors at 30 and 20,000 cps. are only fractionally smaller. The drop of damping factor when the amplifier goes from Class A to AB to B is clearly evident. This amplifier also has facilities to switch in negative current feedback if desired. The expected sharp drop in damping factor is quite obvious.

Early Developments

It might be worthwhile to mention several schemes that were tried and later abandoned in the development of this meter. Initially, it was thought that the VTVM (power meter) alone would be adequate to enable "matching" of the voltages. The changes of voltage were found to be so small for 10 per cent change in load resistance that the settings of R_1 were much too sloppy. Had this simple arrangement been satisfactory, it would have been possible to carry out the original intention of using electronic readout by switching R_1 and R_2 into a bridge operated from 60-cps a.c. and then use the VTVM to read out the position of R_1 as a damping factor. Later when it was found necessary to go to more elaborate means of voltage comparison, it was reluctantly decided to use a hand-calibrated dial on R_1.

When searching for a very sensitive voltage-change meter, the infinite impedance detector came to mind. This had to be abandoned for two reasons both associated with noise. To keep the grid noise down to a reasonable value, it was necessary to change from resistance-capacitance to transformer coupling to the detector. Even then the noise from the amplifier under test masked the

(*Continued on page 77*)

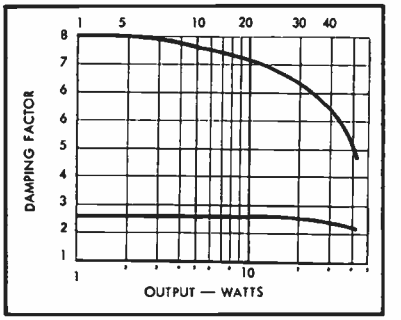


Fig. 5. Typical damping-factor curves measured on good Class AB amplifier at different power levels and two feedback conditions.

Transistorized Remote-Broadcast Amplifier

C. M. EDMONDS*

Simplifying the design and physical construction of a transistor amplifier provides an ideal remote unit for sport announcing and other single-microphone applications.

WE SUPPOSE that every day in this country some manager or supervisor turns to an engineer and says, "Design an electronic widgit that frumples every twenty minutes." And the engineer does. This remote amplifier didn't happen that way. The story has two parts. Both started nearly four years ago. The first part concerns Dr. John Victoreen (who founded the Victoreen Instrument Company of Cleveland, Ohio. Dr. Victoreen decide to build the best possible hearing aid. He formed a small group of technical men to work up a new hearing aid, to do it from scratch, to do it with transistors, and above all, to have a really good frequency response from microphone to ear button. It may jar a few of the high-fidelity engineers who read AUDIO to know that the research group of Vicon (the new company was formally Vicon Instrument Company of Colorado Springs) found nothing manufactured in this country at that time that had less than 10 per cent distortion at, say, 800 cps at a 1-milliwatt output. At that time the average over-all response (with controlled response in the microphone and buttons) was from 500 to possibly 2500 cps. Thus Vicon had a relatively simple job in establishing its design parameters. They were, essentially: a flat amplifier from 70 to 15,000 cps, and less than 3 per cent distortion at 10 mw output. The result is the six transistor amplifier shown in the attached drawing. Microphones and ear buttons proved to be much more of a problem. The best small microphone at that time was the crystal. It offered the widest frequency range, but was the most difficult to match to a transistor input. This particular problem at Vicon was compromised by using four crystal microphones, connected in parallel across the input stage.

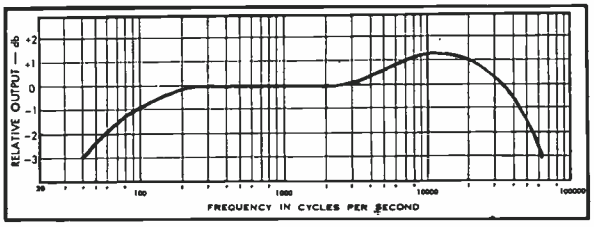


Fig. 2. Frequency response of completed amplifier compares with many a more conventional remote amplifier.

The ear button is a research project all its own. Some of the hearing aid manufacturers used buttons with resonance as high as 20 db at 1000 cps to get over-all high efficiency. Vicon finally settled upon the Danavox unit. This button, in the damped model, has a reasonably good response from 50 through 4000 cps.

At about the same time KCMS was adding AM to its facilities. We were planning to do a number of sporting events from Manitou Springs High School. This included some traveling to other schools in the league. It should be noted here that in Colorado very small school systems are the rule, not the exception. The high schools in our league average an enrollment of several hundred. These small school systems are lucky to have a football field; bleachers are extremely rare, never more than two sections; and press boxes (with or without power) are dreams of the journalism student's forthcoming college days. Thus we needed a light battery-operated amplifier and a short announcer. The announcer had to be short so as not to obstruct the view as he ran up and down the side lines calling the plays. The amplifier had to be low in microphonics because of the enforced activity described in the preceding sentence. This effectively ruled out the small battery tubes. What were the possibilities of transistors? Then we remembered that during our under-graduate days we had worked with Bill Holmgren, now Chief Engineer of Vicon. We talked with Bill

* *Radio Station KCMS, Manitou Springs, Colorado.*

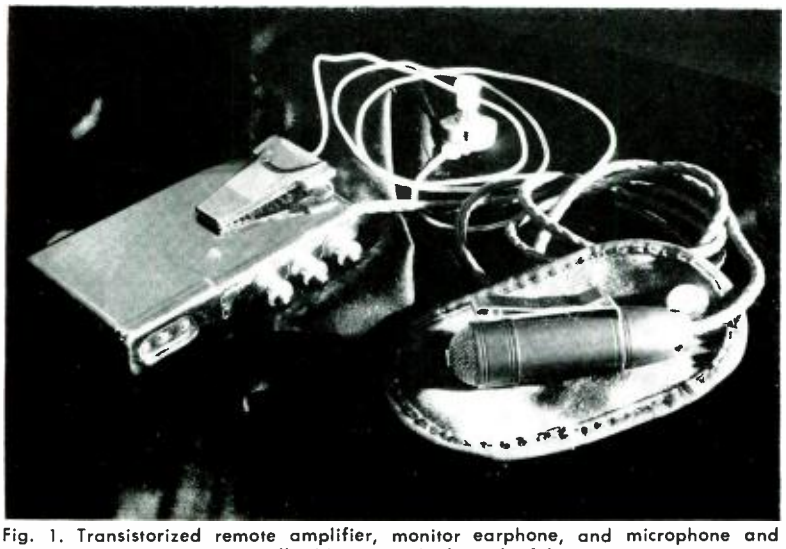


Fig. 1. Transistorized remote amplifier, monitor earphone, and microphone and case all add up to a single pocketful.

about the possibility of modifying the above described hearing aid to broadcast work. Bill supplied us with a model damaged in shipping to try out. Thus began a year of development work, the photos and drawing being the final result. The first attempt was to use the amplifier "as is." This had the push-pull output transistors with the collector voltage fed by two resistors. This worked very nicely around Manitou Springs. We tried it on our city council broadcasts. It produced some of the most intelligent sound we have ever done, and the average level of 1 milliwatt was adequate for local work. We found two objections to this, however. First, the average announcer felt silly holding out a case the size of a king-size pack of cigarettes for people to talk into during an interview. Second, the 1 milliwatt was satisfactory for local work, but Toll Test usually asked for more level on the out-of-town games. So the first major modifications

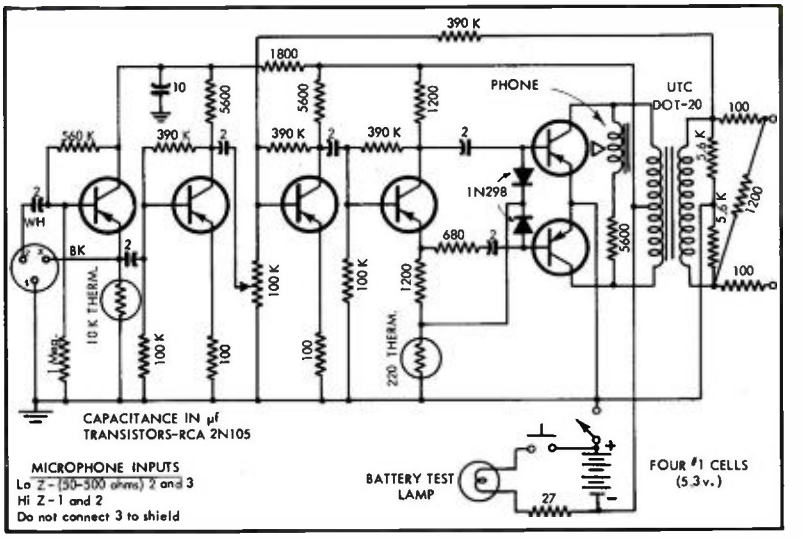


Fig. 4. Complete schematic of remote amplifier. Distortion is less than 2 per cent at + 12 dbm output, and noise is – 120 db. All transistors are RCA 2N105's.

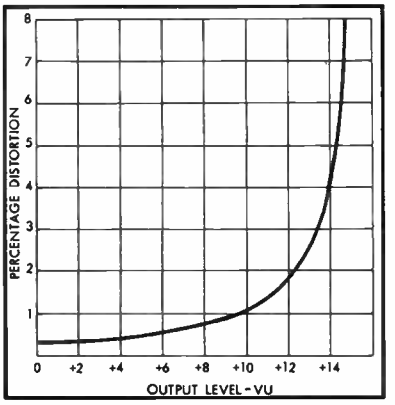


Fig. 3. Distortion of amplifier is sufficiently low for any voice application.

were to remove the four crystal microphones. This space was used to install a UTC output transformer. This raised the output to an easy plus 12 VU. It permitted a small pad to be placed between the output transformer and the line. The use of the external low-impedance microphone permitted the input stage to work at high efficiency. *Figure* 1 shows the final appearance of the unit —externally. Suddenly we had gain to burn. This was a problem. We would set the announcer up, turn him and the amplifier on, work into a dummy load with a VU meter, get everything set and send him on his way—only to have him nudge the gain control and be lost or horribly distorted. This brought about modification number three. We ran feedback from the output to the top of the gain control. Selectively we reduced the over-all gain of the amplifier to a point that only a really hot microphone and a loud bellow would overload if wide open. It also made a great improvement in the response, *Fig.* 2, and the distortion—less than 1 per cent from 50 to 15,000 cps, *Fig.* 3. Most of the improvement was on the low end. The feedback level selected works out in such a manner that a WE Salt Shaker, an RCA Jr. Velocity (incidently, the input of about 2000 ohms is high enough that it does not load a JV) or most of the modern low-impedance jobs produce a nice 0-VU level with an average announcer at a mid-point gain setting.

The earphone was too good for 0-VU output, however; it fairly rattled a normal person's ear. So we added a resistor to bring it down to a comfortable level. An unexpected pleasant result was the rising characteristic. It helped to understand the studio on "cue" in noisy remote areas. The little light bulb—a GE surgical lamp—to test the batteries was an original idea of Vicon. It's quite simple and most effective. Normal battery life is 200 hours plus; normal cost of batteries is $2.00 list. This figures out to around one cent per hour.

Another difficulty turned up during the fall. When the sun drops behind the Rockies in November in Colorado, the temperature will drop as much as 30° in an hour. This happened . . . and we were on the receiving end of a game from our home field. We grabbed our second amplifier and drove down to the field. It worked for about fifteen minutes

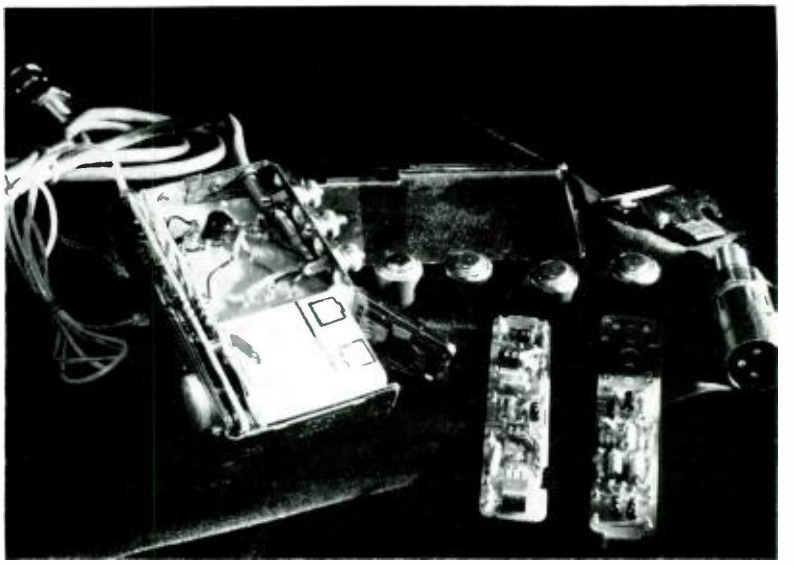


Fig. 5. Completed amplifier with some of the component parts shown separately.

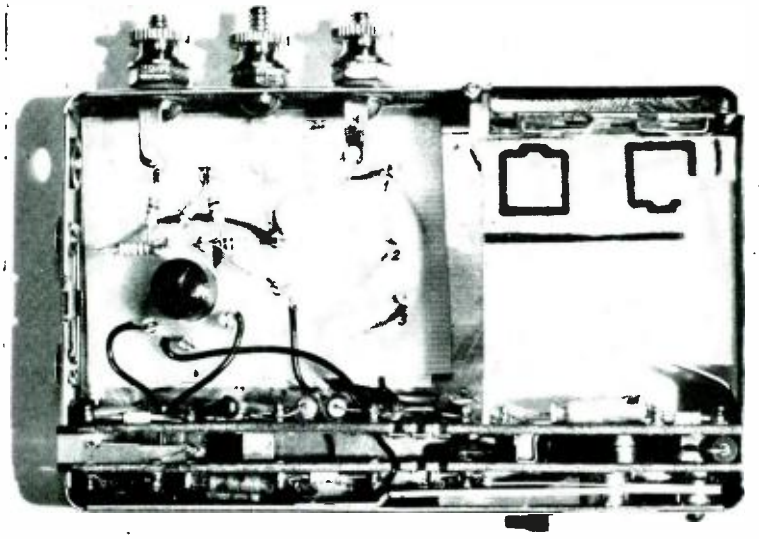


Fig. 6. Interior view of amplifier. Battery compartment is at right.

and then it too had 10 per cent distortion (or more). Bill then installed the second thermistor to help overcome this, but if you build one of these units, keep it in the shirt pocket on cold days, and on days the temperature rises over 110—well, that's our next research problem. In the next paragraphs you will find a complete technical description of the operation. We would like to thank KOA-AM-TV of Denver and the other Colorado Broadcasters who helped with field tests. Collins Radio, too, has assisted.

Theory of Operation

The amplifier consists of six selected transistors in the circuit shown in *Fig.* 4. The first stage is operated as a class A amplifier. It has a thermistor in the cathode for temperature stabilization. When a balanced low-impedance input is used, the signal is impressed on the base through a 2-μf capacitor (isolation of dc) and the emitter. When an unbalanced high-impedance input is used, the signal is impressed through the 2-μf capacitor and ground, so the first stage is then operating as an emitter follower with an input impedance of approximately 250 K ohms. This explains the note as to why the black wire must not be grounded. It would short the emitter to ground or no bias condition. The gain for the balanced input is approximately 10 db higher than for the unbalanced condition. The output of the first stage is coupled from the emitter to the second stage by another 2-μf capacitor. The second stage operates as Class A, with emitter degeneration as does the third stage which is coupled conventionally to the phase-splitter stage. Negative feedback, from two balancing resistors across the output transformer, is introduced to the top of the gain control at the input of the third stage. The phase splitter has a thermistor as a part of the emitter circuit to ground. The voltage drop across this thermistor is the bias for the final stage, which operates in Class B.

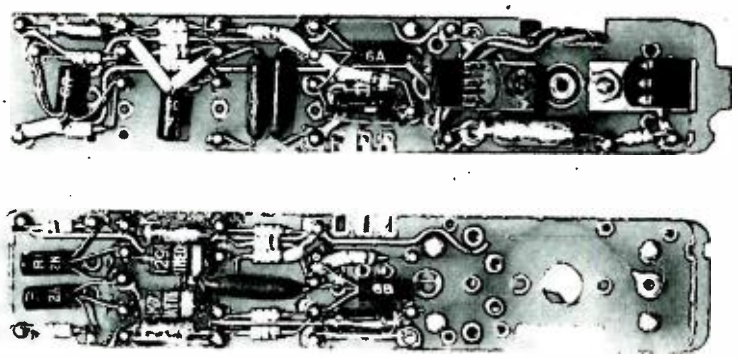


Fig. 7. Details of the two printed-circuit sections which are mounted back to back.

Again the themistor is for temperature compensation. The two crystal diodes serve to prevent the coupling capacitors from charging during the positive unwanted half of the signal. The volume to the earphone is reduced by the 5600-ohm resistor to give a comfortable level at + 6 VU output. The earphone is manufactured by Danavox Company of Denmark, is magnetic, and has a reasonably good response from 50 through 4000 cps. The resistor causes a somewhat rising characteristic. The amplifier will operate with less than 2 per cent distortion at + 12 VU. The distortion will rise rapidly at temperatures below 32° F or above 110° F. It is suggested that the amplifier be worn on an inside shirt pocket in freezing weather.

Operation

. Turn edge of amplifier with volume control up. Press button below volume control. If light glows inside hole, batteries have 12 or more useful life hours. Connect microphone, adjust gain control for comparable volume to regular telephone. This will deliver an average of + 6 VU to the phone line. (With most microphones this level is with the red dot by the button.) The amplifier will work with any microphone from 30 ohms through high impedance. For low-impedance mikes, connect the white wire to pin 2 of Amphenol or Cannon plug, black wire to pin 3, and shield to pin 1. *Do not ground black wire to shield.* For high-impedance mikes, connect white wire to center conductor and shield to outer conductor shield. Tape black wire so it is not connected to anything. Connect telephone line to two outside terminals (note that they are insulated from case with red fibre washers). Ground may be used but it is not required.

Construction

Figure 5, 6, and 7 show the internal arrangement of the amplifier. The two printed circuit boards are mounted back to back, spaced apart about ¼ in. The numbered terminals indicate microphone input connections. The rough symbols for batteries indicate the polarity in which the four units should be placed.

Conclusion

Several years ago we had the privilege of writing for this magazine. We concluded our article with a note that we would be pleased to answer any correspondence. Many engineers across the country dropped us notes with fine suggestions and ideas. We would like to end this article the same way. Between Vicon's Bill Holmgren and the author, we will try to answer your letters. Æ

New High Fidelity Loudspeaker Enclosure*

DR. W. J. D. VAN DIJCK**

A modification of the "organ pipe" type of radiator results in wide-band performance and good low-frequency reproduction from 8-inch speakers without the resonant peaks which usually accompany this type of enclosure.

IT IS GENERALLY KNOWN that a good loudspeaker enclosure must enable the speaker to radiate sound energy equally well over the whole audio-frequency range. This implies that the enclosure be so designed that it has several particular properties: the enclosure should depress the natural resonant frequency of the speaker which exists, usually, at about 50 or 60 cps, in order to remove the "boomy" low-frequency response and the consequent deterioration of the transient response of the speaker; the enclosure should handle the back radiation from the speaker cone in a manner which avoids destructive interference with the forward radiation, especially at the lower frequencies; and the enclosure should add no resonances of its own in the audio-frequency range.

It is also known that a more realistic concert-hall effect will result if the reproduced sound is made to approach the listener from a broad front, as in the original concert performance. This effect can be obtained by using two or more spaced loudspeakers, driven in phase with each other. What is not so well-known, however, is that the sound wave should approach the listener as if it emanated from a slightly elevated source. In a concert hall the normal to the sound front tends to dip into the absorbing audience, so that the sound emanates from an elevated virtual source, and this effect is usually enhanced by the reflection characteristics of the back wall of the concert stage. To obtain this effect in a home, therefore, the loudspeaker should be mounted at a moderate elevation above the listener's level, with the speaker axis tilted downwards slightly. A further benefit from this type of mounting is that there will be no obstructions between the loudspeaker and the listener, hence the high frequencies which radiate as straight beams from the speaker cannot be blocked by furniture or by other listeners; in many installations where the loudspeaker is placed near the floor, shadow zones for the high frequencies exist which make the high-frequency performance of otherwise high-fidelity equipment completely illusory.

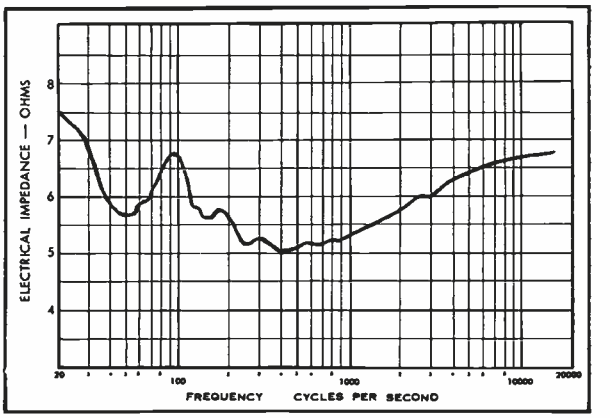


Fig. 2. Electrical impedance of the enclosure with a typical 8-inch speaker.

The conventional type of loudspeaker enclosure would be too large and too disfiguring to the average room if it were used in a manner which would satisfy all of these conditions, especially if the feature of multiple sources were desired. A study was therefore made of the possible types of smaller enclosures which would be satisfactory, and which could, in addition, be inexpensively and easily constructed. This study revealed that a small enclosure, whose fundamental resonance could be made to coincide with that of the loudspeaker cone, a radiating cross section about the same as the loudspeaker and whose volume could be closely coupled acoustically to the speaker, appeared to be the straight closed organ pipe. Although the general mathematical problem of computing the minimum volume for an enclosure of specified properties is extremely difficult, calculations made for different constructions of same resonant frequency and radiating cross section indicated that the closed organ pipe is the smallest enclosure or, at least, very close to the smallest enclosure possible.

The straight organ pipe requires some

(*Continued on page 69*)

Fig. 1. Two of the author's enclosures mounted on a wall in a position which would be suitable for stereo.

* U. S. Patent 2,810,448.

** *The Hague, Netherlands.*

Magnetic Counter—an Essential Component

JOHN E. TURNER*

Although somewhat more complicated than the use of a simple elapsed-time meter, many constructors will have many of the parts for this type of device in the "junk box" and will enjoy working out the details of construction indicated by the author.

SERIOUS AUDIOFANS almost invariably employ diamond styli in their music systems and, although their longevity is far greater than that of any other material known to the art, diamond needles do eventually develop flats which can damage the intricate pattern of grooves on LP records. The life of a diamond stylus is variable, depending on the quality of the material and the degree to which it has been polished. Estimates vary from 800 to 2000 hours; however, 1000 hours seems to be a good average.

It is recommended that styli be examined at approximately half-life and again at expected time of replacement. This, at once, presents the formidable problem of knowing just how long the stylus has been used. Most persons cannot rely on their memories to maintain a cumulative record of playing time, hence the need arises for the development of a suitable mechanical system to record this data. The primary requisites of such a mechanism are: 1) accuracy, 2) reliability, 3) convenience, and 4) no effect on the normal function of the music system.

* *Box 513, Boise, Idaho.*

Fig. 2. Top view of turntable showing flush mounting of counter.

The counter described below is the culmination of nearly two-years' development and testing and incorporates all the aforementioned requirements. The unit counts each record side as it is played and cumulative playing time is calculated by simply assigning an arbitrary value, 30 minutes, to each side. The playing time of most discs is well within the 30-minute period, thus allowing a safety factor.

The device illustrated in the accompanying photographs is specifically designed to operate with a Ferranti arm, but with some modifications can be adapted to function with most commercially available transcription arms. Although not attempted, it is conceivable that this counter mechanism can be used with an automatic changer, if desired. Because changers tend to be of more rugged construction they lend themselves better to a design involving a direct mechanical linkage, and possibly the photo-relay may be dispensed with. The purpose of this discussion will be to describe the installation illustrated in rather general terms and leave specific applications up to the ingenuity of the individual audiofan.

The counter installation consists of three main components: 1) magnetic counter, 2) photo-relay, and 3) mechanical linkage between the arm and relay. A complete list of all parts and components is included at the end of the article for the convenience of the reader.

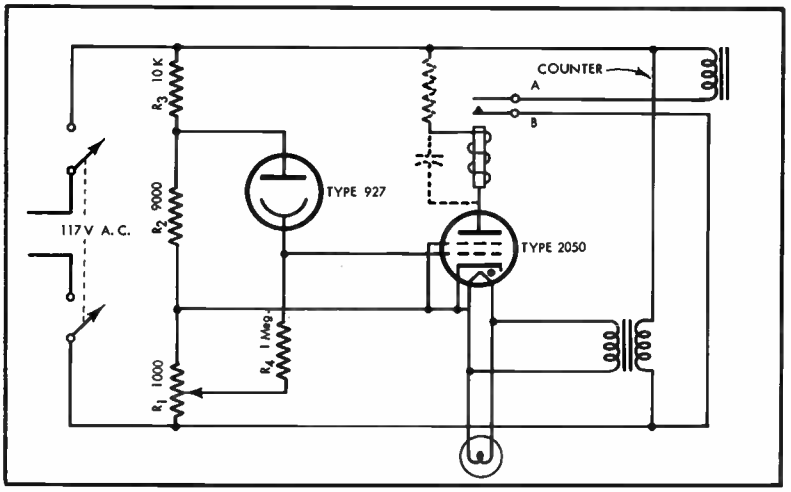


Fig. 1. Complete schematic of photo-relay circuit.

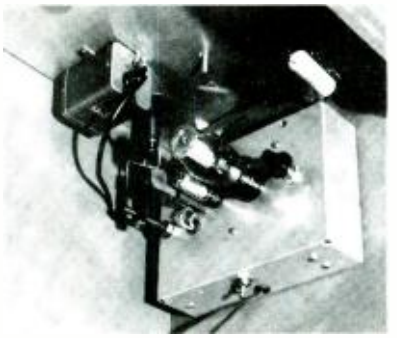


Fig. 3. Bottom view of mounting board showing mechanical linkage between photo relay and base of transcription arm.

This is, of course, subject to change depending on the design of the specific installation.

The magnetic counter should be of the reset type, for obvious reasons, and should have a minimum of four places. The component illustrated, it may be observed, has six figures. It was purchased for reasons of economy; this unit is standard and counters with, for example, only four figures are made only on special order and naturally the additional cost would be prohibitive unless one were purchasing a sizable number of units.

Description

The photo-relay mechanism is of the conventional type which is activated by an increase in illumination. A brief analysis of the schematic (*Fig.* 1) shows that when light strikes the cathode of the photo-tube the current flow causes a voltage drop across R_4 and this in turn drives the grid of the relay tube (Type 2050) positive. The relay tube thereby becomes conductive and actuates the relay. If the resistance of the relay is not high enough it may be necessary to place a resistor in series with the relay and line voltage. The magnitude of this must be determined experimentally, but should be of such value so that the resultant current flow will not exceed either the rated output of the relay tube or the capacity of the relay mechanism. Occasionally it may be necessary to shunt the relay with a capacitor (1–5 μf) to prevent chatter. The values presented on the schematic will provide satisfactory operation under normal circumstances. The potentiometer, R_3, permits critical adjustment of the relay mechanism. This is in addition to the coarse adjustment provided by the design of the mechanical linkage. All this will be explained later.

All components, with the exception of the counter itself, may be mounted on a standard aluminum chassis (5″ × 7″ × 2″) providing an orderly and compact arrangement.

A 927 phototube was selected for this installation, in spite of the fact that it is designed primarily for sound reproduction work. The low anode current may be cited as its greatest disadvantage, as the adjustment of circuit values is perhaps rendered somewhat more difficult. Its advantages, on the other hand, are several: 1) low cost, 2) low voltage requirements, 3) good sensitivity, and 4) directional characteristics. It works very nicely with the illumination provided by a 6-volt bulb drawing only 0.25 amps.

Construction

A departure from conventional chassis layout will be noted in that the filament transformer is mounted inside. Normally this location would be frowned on as the usual position on top of the chassis favors heat dissipation. It was desirable, in this instance, to place the transformer inside so that the chassis might function as a shield to reduce hum pickup in installations where the leads to the arm are particularly sensitive to stray magnetic flux. This is typical of pickups which deliver a low-level output and is illustrated by the Ferranti unit. Thorough testing indicated that heating is not a problem with a 6.3 volt transformer since the load is comparatively small.

Fig. 4. Construction of shutter mechanism is illustrated by external view of photo-relay chassis.

The selection and construction of components, thus far, is quite routine. The design of the mechanical linkage, in contrast, will require more thought and ingenuity, but will be an interesting challenge to the experimenter. A brief discussion of the mechanism illustrated will outline the general principles involved and may provoke an inspiration which could be a decided improvement over the present system.

The fundamental considerations in the design of this linkage are two-fold: 1) it should be as light as possible so as not to interfere with the tracking of the arm, and 2) it should convey accurately the motion of the arm to the relay. The resultant mechanism consists of 1) the extension rod assembly, 2) the pedestal assembly, and 3) the shutter assembly. The extension rod and pedestal are machined from HRS; the bearing is the lower portion of a steel darning needle; and the shutter assembly is made of brass. These materials were selected because they are readily obtainable and easy to machine, cut, form and solder. Naturally, other materials will be entirely satisfactory if the mechanic has the means to work them.

The pedestal is drilled to receive the "needle" bearing with a clearance of approximately .005 to .010 in. It must be emphasized that the shutter assembly should be adequately supported, precisely balanced, and yet free to move at the slightest pressure from the arm. If these features are carefully observed, the interference of the shutter mechanism with the tracking will be negligible, in fact non-existent!

The shutter assembly is equipped with a yoke designed to engage the tang at the base of the Ferranti arm. It will be noted that the yoke is wide enough so that the arm fits rather loosely, so to speak. Nevertheless, as the arm tracks across the record, it contacts one side of the yoke and positively conveys its lateral motion to the shutter. When the arm is returned to its resting position the tang contacts the opposite side of the yoke and closes the shutter. It is imperative that the linkage at the yoke be rather loose so that the arm tang does not become wedged when the arm reaches its extreme position at the inside of the record. The "needle" bearing reduces friction to a minimum and the force required to move the shutter is negligible. (Actually, the force required at the stylus is even less since the arm functions as a first class lever with a decided mechanical advantage.)

Mounting and Adjustment

When all components have been constructed and assembled, the completed chassis is mounted beneath the motor board so that the shutter yoke engages

(*Continued on page 60*)

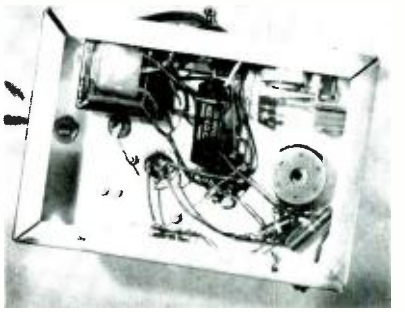


Fig. 5. Interior view of chassis emphasizes compact arrangement of components.

The Purple Cow

J. C. WITHERSPOON*

Every so often one encounters an amplifier which has been built by its designer with little regard for cost, but with the sole aim of creating the finest unit possible. Some of the design features in this example should be studied for their value in other applications aside from the over-all unit.

LOOKS "FUNNY," DOESN'T IT? It *is* "funny"! How can one expect good high-frequency response with the 4.7-megohm resistor for the plate load on the pentode section of the 6U8? That is a story of some length. The circuit under discussion is that of the "starved" amplifier, and is the first-stage section of this unit.

It should be noted from *Fig. 1* that the circuit operates in an unconventional manner. The pentode is starved for plate current and receives but little screen potential. The writer has used the old 6SJ7 tubes under similar operating conditions and obtained made-good gains of 3500 to 4500.

The plate of the pentode is directly coupled to the grid of the triode which is connected as a cathode follower. With this arrangement there is no Miller effect to add to the shunt plate-load reactance across the plate resistor for the pentode. This results in pushing out the high-frequency response of the combination far beyond what one might expect.

The output signal of the triode is in phase with the signal in the plate circuit of the pentode and therefore the pentode screen receives degenerative signal from the tap on the follower load resistor. Positive screen-grid operating potential is also obtained from the same tap. The extremely high gain of the composite tube is thus "plowed back" through the screen, trading gain for stability, wide-band performance and low over-all distortion. The composite tube envelope delivers a made-good gain of 100 and is only down 3 db at 40 kilocycles. Constructed as shown, this stage contributes almost no hum to the over-all output at full volume.

The stage was designed to make up for the high insertion loss experienced when using the IRC level control for Fletcher-Munson compensation. This loss at the mid frequencies is about 40 db. The maker of the control states that an amplifier operating without the control must have sufficient over-all gain so that comfortable room volume is obtained from a setting of the volume control such that the resistance to chassis ground from the moving arm tap is 1.1 per cent of the total resistance of the control.

The position of the tap on the cathode load resistor can be adjusted so that the screen of the pentode receives increasing amounts of negative feedback signal. In this way the gain of the amplifier can be adjusted to accommodate pickups of different average output voltages.

Care must be exercised in the construction of this first amplifier so as to provide full static shielding for the circuits of the pentode and triode sections. Use of d.c. for the heater is strongly recommended. The schematic shows one way of obtaining it by passing the 480-ma output-stage current through the heater. If hum troubles are experienced from strong electromagnetic fields, the 6U8 can be enclosed in a Mu metal shield or one turned out on a lathe from block or bar stock steel.

No effort was made to determine the minimum acceptable decoupling in the plate circuits. The writer wanted the ultimate—a "purple cow"—and economy was not a primary consideration. It was played straight across the board for safety and minimum noise and hum.

The Phase Splitter

The phase splitter is a conventional "long-tailed pair." It will be noted that both triodes receive the same operating voltages. The signal developed in the plate circuit of the triode to which the signal is first applied develops a signal across the cathode resistor and this drives the second triode because its grid is grounded by the 0.25-μf capacitor as far as signal is concerned.

The unusual part of the arrangement is that there is a potentiometer in the plate circuits of these triodes. This permits exact equalization of output signals by varying the made-good gains of the separate triodes. More or less load resistance can be inserted and removed from each triode of the inverter to accomplish this desired result.

This feature, together with the provision in the output stage for static balance of plate currents, results in minimum of total distortion.

This type of phase splitter is quite popular in European amplifiers and maintains its performance over a wide band.

The Exciter Stage

The plate loads for the exciter tubes are composed of triodes in a circuit configuration that resembles that of the cascode amplifier. More careful examination of the action in the stage will reveal the basic difference and the unusual capabilities of the same. The special features have been verified by experimental investigation from "jury rigs" of the circuit.

When there is a *positive*-going signal at the grid of the lower tube, there is an increasing plate-current demand. The increasing plate current on the side under discussion causes an increasing IR drop across all of the resistors in this circuit. It is therefore apparent that there is an increasing drop across the cathode resistor of the upper tube of the pair. This drop is of such phase or direction that the upper tube is then getting an increasing *negative* going signal.

We have just established that either side of the exciter is thus putting out a push-pull signal although the applied signal is single sided. Either side of the composite exciter delivers a single sided output signal.

In a true push-pull stage the plate current for class A operation will remain constant with applied signal and no overload even if the signals are d.c. The circuit being explained has this characteristic. The lower tube calls for increasing plate current under the before assumed conditions while the upper tube calls for a decreasing plate current in the same common circuit. With correct adjustment the plate current will remain constant as long as the signal handling abilitiy is not exceeded even if the applied signal is steady state or d.c.

Apparently the upper tube produces the signal by an IR drop across its dynamic plate resistance, the current remaining constant and the plate re-

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sistance changing as required to give the changing product—the output signal desired. This signal is taken from the cathode of the upper tube.

If all of the above is true, it would be expected that the stage would exhibit the tendency to cancel even harmonic distortion. That it does so can be shown easily with a 'scope and suitable single-frequency signal generator. With increasing signal a sine wave at the output of either side shows distortion as the overload point is approached. As this point is approached, the cathode resistor for the upper tube can be adjusted in value to obtain only symmetrical distortion in the output, which means that the arrangement is passing only odd harmonic distortion. Again this is physical support of the contention that the arrangement is a true simulation of the transformer-coupled push-pull output stage.

The schematic does not show this and the working circuit is not so arranged, simply because the use of equal (upper and lower) cathode resistors results in equal plate voltage distribution across the tubes. This, together with the fact that the final tests were satisfactory, resulted in the decision not to unbalance the cathode resistors for ultimate even-harmonic reduction.

Reference to the tube manuals will show that the 6SN7-GTA is quite capable of operating with plate potentials of 450 volts and that the permissible plate dissipation is such that the resistors could be unbalanced for ultimate reduction of the even-harmonic distortion. This would be done if it were necessary to enter competition with the design.

For "ultra-minimum" distortion, the upper-tube cathode-load resistor should be made to have a resistance equal to about 15 to 20 per cent less than that resistance of the lower-tube cathode re-

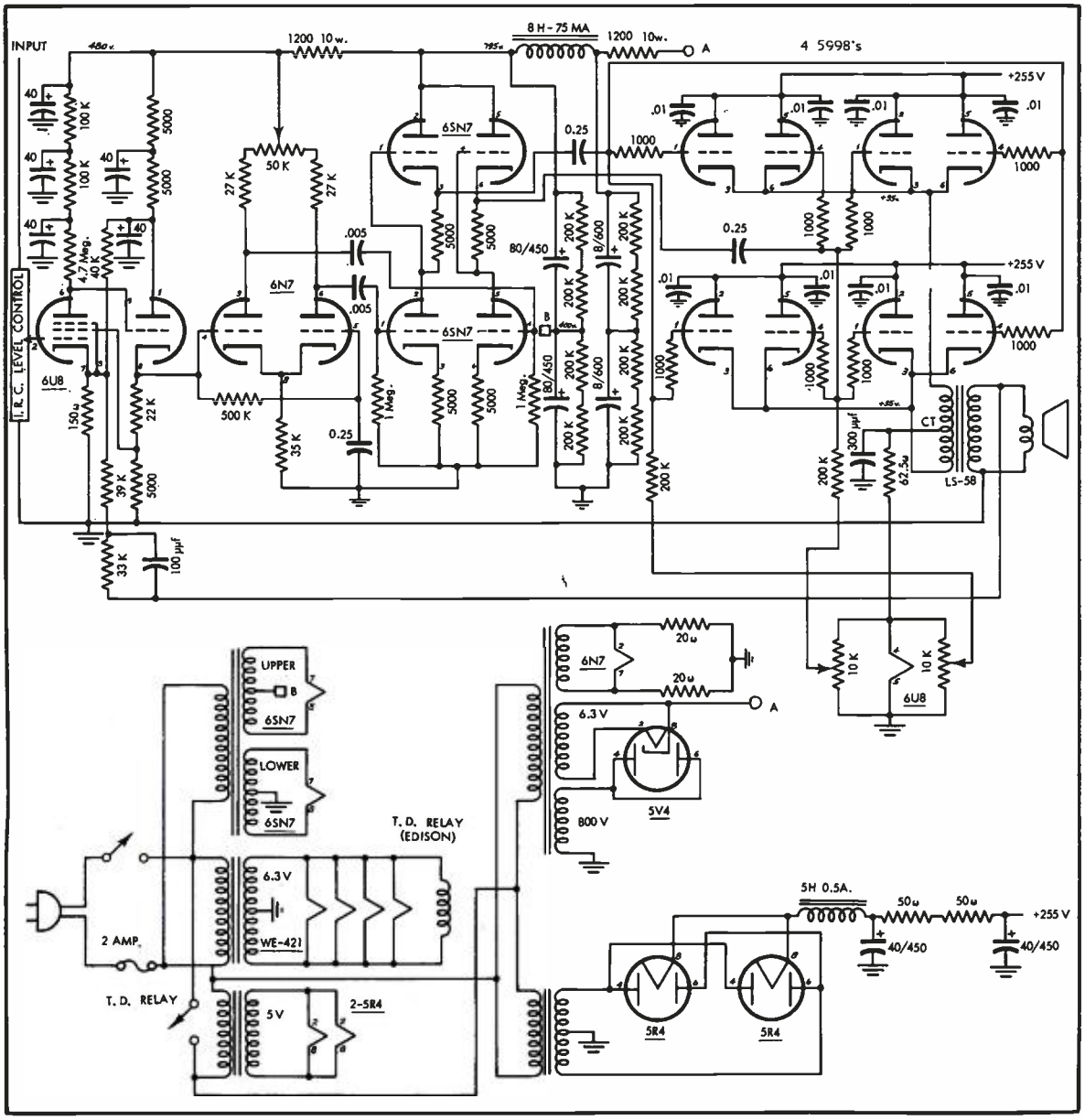

Fig. 1. Complete schematic for the "Purple Cow" amplifier which employs four heavy-duty double triodes in a cathode-follower output stage for reliable and high-quality performance.

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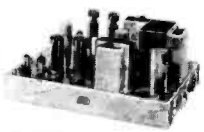

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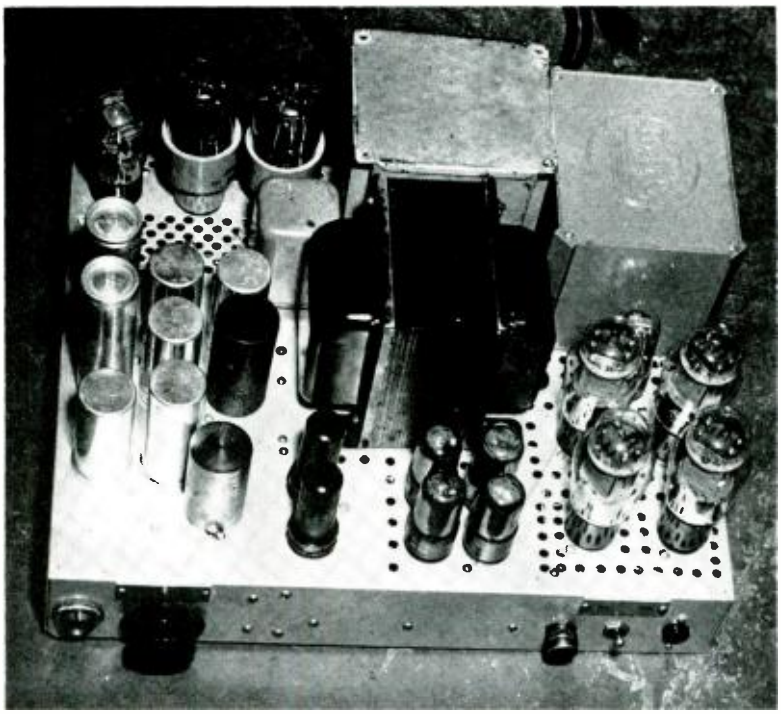


Fig. 2. Top-of-chassis view of the amplifier described by the author. Note solid steel shield over input tube just in front of the bank of electrolytic capacitor cans.

sistor. This again has been found true by experiment and trial.

It is interesting to note that the arrangement causes the curvatures of the grid-voltage/plate-current characteristics of the exciter tubes to be opposed just as these are in the transformer-coupled push-pull stage. Also note the additional degeneration present in the circuit due to the unbypassed cathode resistor of the upper tube.

Measurements show that for the same operating conditions at or near the overload point, the circuit described reduces the IM distortion by factors of from 20 to 90 per cent over the conventional resistor-loaded stage.

If these facts are true, as they appear to be, we may conclude that the complete exciter requires a push-pull signal for its operation and that when such signal is supplied, each half of the signal is converted at each side of the exciter input into a new push-pull signal. The separate output-stage grids are therefore excited by separate push-pull signals.

The Cathode-Loaded Output Stage

It is not necessary to "sell" the advantages of cathode loading. Our best engineering minds list but one disadvantage for this arrangement—that of the high excitation required at the input of the stage.

Several things can be done to overcome this objection and when these have been accomplished we have the ideal amplifier.

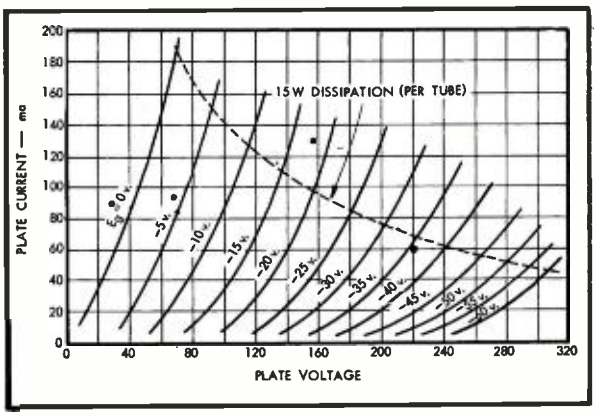


Fig. 3. Plate family for the 5998 tube.

One obvious thing to be done is to get the greatest gain possible from the stage. Since the stage is excited by a signal equal to the output swing plus the grid swing, we can reduce the grid swing required by selecting power output tubes having the optimum characteristics.

Figure 3 shows the plate curves for the Western Electric 421A, with which the writer was familiar. This tube is no longer made by W.E., but the Tung-Sol 5998 is essentially identical. Operating with a supply voltage of 220, the 5998 will swing 60 ma with 36 volts on the grid, indicated as the operating point on the curves. This would indicate that the 5998 would be an excellent tube for a high-power cathode-loaded output stage. (For still higher power requirements, one could turn to the 6528, which has an allowable plate dissipation of 30 watts per plate; or 60 watts per tube; another similar type is the 7242, with 100 watts rated dissipation in its single triode section.)

The working arrangement shown on the schematic shows each side of the composite output tube (four triodes per side) to have 32,000 micromhos of transconductance. The gain of the stage is from 0.8 to 0.9 over the working range. This simply means that practically all of the exciting or input signal is developed across the output transformer primary. This results in a cathode-loaded output stage that is relatively easy to drive.

Figure 1 shows the precautions to be exercised in handling the high transconductances obtained. The output tubes must not get the idea that they are plate loaded at some extremely high frequency or oscillation will result. All leads are to be kept short and close to the chassis. Do not neglect the decoupling shown at the grids and plates of the tubes.

There is one additional thing that we can do to decrease the excitation required in a cathode-loaded output stage and this trick picks up the efficiency quite appreciably. The reflected resistance from the speaker load should equal the dynamic plate resistance of the composite output tube. This is the practical application of the law that states that for maximum transfer of power the load resistance should be made equal to the generator resistance.

The U.T.C. LS-58 output transformer, when operated in the push-pull parallel hookup, will reflect a primary impedance of 1500 ohms with a 30-ohm secondary load. An 8-ohm speaker connected to this tap will be reflected across the primary as a 400-ohm load which is an exact match for the 5998 composite output, both halves.

The schematic, *Fig.* 1, shows an amplifier with the output stage having an idle

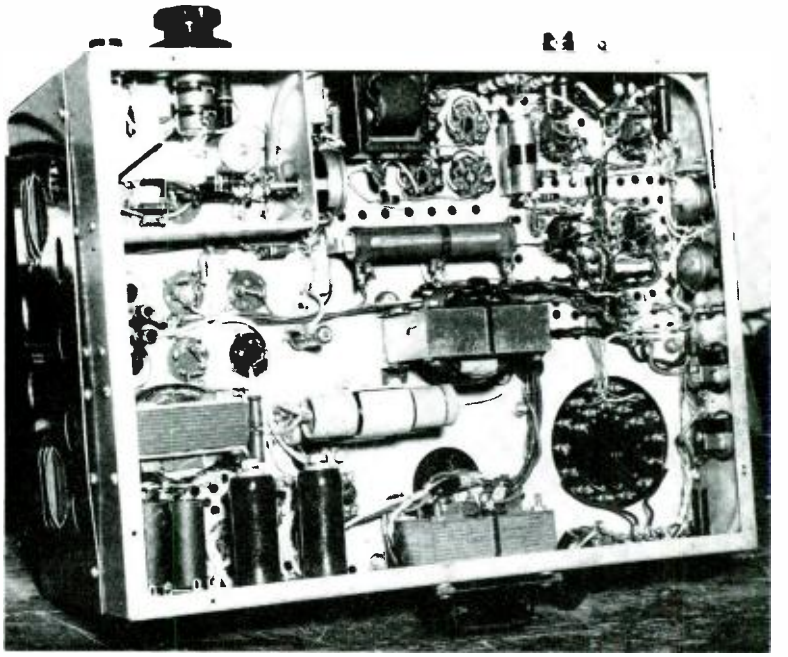


Fig. 4. Under-chassis view of amplifier. Actual configuration and parts placement will depend on power supply components selected.

dissipation of about 105 watts and with a maximum usable output of 46 watts—about 43 per cent efficiency. The output stage, while strictly class A, is quite efficient and takes no back seat to other acceptable circuit arrangements.

The 5998 tubes seem excellent in quality and very hard. The circuit was wired and the current balance arrangement set for no compensation. When the rig was first turned on, the plate currents exactly balanced and have remained in balance despite several hundred hours of subsequent operation.

The cathode-loaded output stage is used in the complete amplifier in a type of Williamson circuit. The IM distortion figures on the completed amplifier are as follows.

At 10 watts, 0.38 per cent; at 20 watts, 0.82 per cent; at 30 watts, 1 per cent; at 46 watts, 1.9 per cent. This data should establish that this cathode-loaded output stage with its special exciter has overcome the classical objection to the circuit.

Notes on the Complete Amplifier

The use of .005-μf coupling capacitors to the grids of the exciter stage seems out of order. It will be noted that the time constants of the RC coupling here and at the grids of the output stage differ by 10 to 1.

The small coupling capacitors were chosen by experiment. With the 100-μμf capacitor in the feedback loop disconnected, the feedback voltage over the five stages was increased until the amplifier oscillated. With .01-μf coupling capacitors to the inputs of the exciter, oscillation at a very low frequency appeared with 28 db of feedback. With .005-μf coupling capacitors, the feedback could be increased to 33 db before oscillation set in, this time at about 100 kc.

It was decided to have 18 db of safety factor and accordingly the over-all feedback around the five-stage loop was set at 15 db and this amount will be obtained if the schematic is followed with a similar construction. The over-all frequency response is flat down to 10 cps as determined by single-frequency checks.

Working into an 8-ohm resistive load, the amplifier reproduces a 10-kc square wave without appreciable distortion, but to obtain this end, the 100-μμf capacitor in the feedback loop must be used. It will also be necessary to avoid strictly the use of any of the carbofilm resistors or any similar resistor in the signal handling circuits as these are slightly inductive at high frequencies. These were used in the original construction but were replaced with composition resistors when "ringing" appeared on the flat tops of square waves in these tests.

The output transformer is a U.T.C. LS-58 and better results might be obtained by employing a special output transformer using grain-oriented core materials and designed specifically for this application. The author knows of

(*Continued on page 66*)

Record Lubrication has Considerable Effect!

JOHN F. FOX*

Unbiased comments on the efficacy of record cleaners, detergents, lubricators, are rarely seen. Herewith the information gleaned by one music-loving record collector who has spent a lot of time and energy in arriving at his own conclusions.

A MORASS OF UNCLEAR thinking often seems to engulf both advertisers of record potions and their quarries. A spray may be offered to "eliminate static," meaning that it will reduce the dust-attracting static electrical charge on the record. It may be bought with the idea that it will eleminate all the myriad little ticks that are actually caused by microscopic surface irregularities, because the buyer thinks of almost any extraneous noise as "static." Similarly, any preparation for use on records is apt to be called a "static eliminator," whatever it actually does, or a spray may be offered to "clean" records. Marvelous! By the same logic, spraying dishes with a violent smelling liquid and rubbing them briskly with a piece of dry flannel would clean them.

Let us make some distinctions. There are several things that can be done to an LP record. It may be *cleaned*. This requires that foreign matter be dislodged from the grooves and floated away in a fairly profuse amount of suitable liquid. Right now the most highly specialized and probably the most effective way of performing this particular action is to submerge the whole record in K-33 solution and massage the grooves with a suitable fine brush, thus positively washing away all foreign matter and leaving no residue behind. Washing is a fundamentally important part of record care, since whatever else is *put on* the record, particles already there may be ground into the soft plastic groove sidewalls by the stylus. But this is not necessarily a "static eliminator."

A destaticiser, as such, whether a spray, a liquid, a cloth, or ionized air, stops *additional* dust from being attracted to the record by the static charge ordinarily present on it—period. As with the washing, this will help to keep the noise level from becoming *worse*, but the little ticks that are always there (at the present state of the art of record pressing) will remain. Still another distinct function is lubrication, which is the primary topic of this article. At this point some readers may be thinking, "Huh? Lubricate a *record*?"

Not long ago a record dealer, apparently feeling himself very solidly established upon the summit of Mt. Sinai, laid down the law for me. "Records cannot be lubricated!" he thundered, and the awesome utterance resounded o'er the wind-swept plains. "Because if you did succeed in lubricating them, you obviously wouldn't get any music." This is what might be called the violin-string conception of the phonograph. People who think about reproduction from discs in these terms have a long way to go!

The idea that records cannot be lubricated, though on a completely different basis, can be found in high places. No less an authority than Oliver Read claims that, desirable as lubrication would be, the extremely high unit pressure that exists between the stylus and groove renders it impossible.[1] This view, in contrast to the more primitive violin-string myth, is very plausible and fairly logical, but requires additional empirical knowledge to establish its truth or falsity. Various substances—water, oils, grease, graphite—will lubricate up to various pressures; the question is, will *any* known substance lubricate at the pressures existing between record stylus and disc?

Typical Example

Some time ago, *High Fidelity Magazine*, in its "Tested in the Home" report on a certain record potion, concluded without much ado that the residue left by said potion *was* such a substance. For convenience let us call this preparation SPLASH, unless the editor thinks up a better name for it. (*He couldn't.*) Assuredly the most esthetically-packaged of all elixirs I have seen, the fluid is applied with a cellulose sponge and appears in every way frighteningly like soapy water. This is only a verbally economical description, of course. I have *no* evidence that SPLASH is anything of the sort, nor any idea what it really is. The report went on to say, however, with a cautiousness that turns out to have been more than justified, "How much stylus and record wear is reduced because of the lubrication may be debatable . . ." Apparently little attempt was made to debate it, even with the resources readily available in the Home. Some simple empirical observations which I have made in my home, at moderate trouble and expense, will be described, with some of their implications.

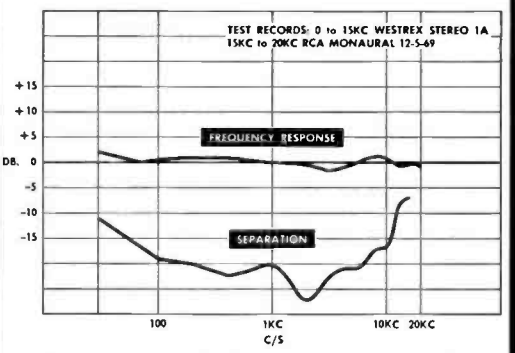
Inspired by the little booklet on the "Research and Development of SPLASH," but tantalized by the fact that the experiments (as to record and stylus wear) therein described proved nothing except that a record with SPLASH on it is at least not so bad as a record with dust and grit on it, I undertook to satisfy my own curiosity as to (a) whether SPLASH really does lubricate, which is not a foregone conclusion merely because it leaves some sort of deposit; (b) whether a certain other little-known but readily available silicone formulation, specifically developed to lubricate plastics in general and LP records in particular, actually did lubricate; and (c) approximately how much record and stylus wear is reduced by *lubrication*, other things being less extremely unequal! First I will outline my methods, such as they are. It is to be emphasized that this experimentation should be repeated with more rigor, somewhat after the manner of Harold D. Weiler, and the results reported here are highly tentative, but I feel that even these methods are sufficiently low in atrocity, and the results sufficiently dramatic, to warrant reporting them at this time.

It is obviously impractical to make tests like these under typical conditions, that is, under what *should* be typical conditions for anyone who cares. A diamond stylus in a cartridge of high compliance and low dynamic mass, in a good quality transcription arm, playing clean records, takes too long to get an

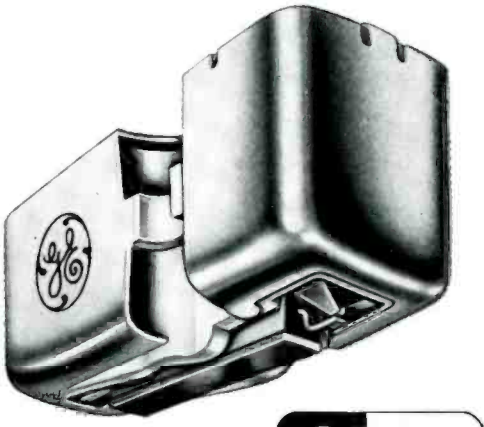
* *501 N. 12th St., New Hyde Park, N. Y.*

[1] *"The Recording and Reproduction of Sound,"* p. 170.

New G-E "Golden Classic" stereo-magnetic cartridge



Smooth response on both stereo and monaural records. Consistently high separation between stereo channels.



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amount of wear on it that can be accurately appraised even with a good microscope, calibrated slide, and so on. Fortunately, for the purposes at hand, it is not necessary for conditions to be typical. Although the added refinement of exact, absolute figures pertaining to current best conditions would be very interesting and valuable, the questions posed above can be answered quite well on a relative basis.

It can be assumed with a high, even if not ultimate, degree of validity that what reduces wear in a sapphire at 15 grams will help your diamond at 4 grams, and that if lubrication cuts the wear of an osmium tip by a large factor at 20 grams, it won't do your diamond, at 1 gram, *any* harm. There seems little reason for assuming (as one well-known person seemed to in a personal letter to the writer) that friction and heat suddenly cease to exist at *any* pressure. If a 6-gram stylus force produces *tons* of unit pressure at the point of contact, and thousands of degrees temperature, it is hardly likely that any tracking force, present or future, will be so low as to eliminate the high desirability of lubrication. Nor are smooth groove and stylus surfaces, important as they are, anything like an answer. Many bearings in machinery are amazingly smooth, and carry only a fraction of the unit pressure in question, but are religiously lubricated and would give lots of trouble if they weren't. And you can strike a match on a pane of glass, I believe. What happens to the styli under the conditions of these tests, atrocious as they necessarily are, can quite confidently be assumed to apply, on a relative basis, even to very good conditions. (There is already some evidence that this is the case.)

Test Procedure

The tests were carried out on a cheap manual player of bygone years, having a three-speed phono motor of the squirrel-cage variety, an extremely inexpensive arm, and a crystal cartridge with not unusably low compliance and a stylus assembly mechanically similar to that of the G. E. I carefully worked over and adjusted the turntable and arm, eliminating the most stentorian vibrations from the former, and rattles and rakish angles from the latter, and leveling the turntable from all sides, with a spirit level. I procured several simple, microgroove-only osmium styli, both for the sake of cost and to ensure getting done some day, which I revised and edited with a pair of pliers so that the stylus tip itself was perpendicular to the record surface, seen from any direction. I also straightened and simplified the stylus so as to minimize frontal oscillations and spurious resonances as much as possible. The turntable and the whole inside of the player, which has a lid, were vacuumed out and wiped down with alcohol to remove all dust and lint. The matter of a lid is very important, because otherwise dust will settle even on a de-staticised record while it is playing, introducing a highly potent and possibly erratic source of variability in the results.

The only microscope at hand was a toy microscope, but nevertheless one of the nobler of its type. Although its optical quality and mechanical aspects were pretty dismal, the most powerful of its three objective lenses probably provided magnification of something like 200 or 300 times, making the microgroove stylus tip appear just about like the photomicrographs in Harold D. Weiler's valuable little book, in size if not in quality. A goose neck lamp, beamed down at the side of the stylus tip being observed, provided good illumination of the flats as they developed on the tips of the styli.

Since these tests aimed to determine possible effects of *lubrication, not* confounded with the effects of dust and grit any more than could be helped, all records were frequently and assiduously washed in K-33 solution, "scrubbing" the grooves themselves with a soft paint brush while the record was totally immersed.

The first series of tests were done at 7 grams and 33⅓ rpm on records which, although admittedly not *new*, had seen little of any pickup other than the one-gram Weathers, and were in good shape. Moreover, the makers of K-33 do have the audacity to state that their product is unconditionally guaranteed even to remove all particles worn from the stylus! I am not certain whether they have thought carefully about instances of particles having been pushed into the plastic by the stylus and held there by mechanical forces (elasticity of the plastic), but it can be assumed that, while perhaps not ideal, the records used were quite satisfactory, since they were both bought at the same time at the same store, and both played about the same amount under the same conditions. Both records were good standard hi-fi favorites which reigned supreme for a long time, not some odd cut-rate discs with 20 per cent asphalt filler.

First one side was played until a clearly observable flat on the end of the stylus was seen. This took 24 plays. The record was initially cleaned in K-33 solution and *was* clean, as observed under a very powerful magnifying glass. All during the 24 plays the record was kept as clean as possible with a dampened paint brush.

Next another side, newly washed in K-33 was sprayed with one of the best known and widely used of static-reducing sprays, hereafter to be referred to as BLAST, rubbed briskly with a soft cloth as the instructions instruct, and similarly kept as clean as possible with a paint brush (dry, this time, lest any unknown chemical reactions occur between moisture and the static reducer). After a few plays the record did become very dust free and was easier to keep clean than the untreated record had been. Moreover, after 24 plays this stylus merely showed a large flat on one *side* and not quite as large a one on the other, but no flattening of the bottom. Thus it could be tentatively concluded that this anti-static preparation reduced the amount of foreign matter more than was possible even with the greatest of precautions otherwise, and thus reduced stylus wear, too.

This series of tests was concluded with 24 plays on one of the above sides, which had been assiduously washed in K-33, and treated with a little known but unique formulation consisting of a silicone of a certain viscosity dissolved in a highly inert and *absolutely* non-residual carrier, developed by a plastics-engineer-hi-fi fan specifically for lubricating LP records. Actually because of my being busy with something else at the time, the figure "24" plays is a minimum one, since I think I forgot to mark down a few plays, and also accidentally let the stylus run on the eccentric groove excessively before remembering to jump up and attend to it. There was of course no automatic gadgetry on this little player. But notwithstanding, this stylus showed only small, symmetrical, equal sized flats on each side, such as had appeared after about six plays on the clean, de-staticised record.

Accelerated Testing

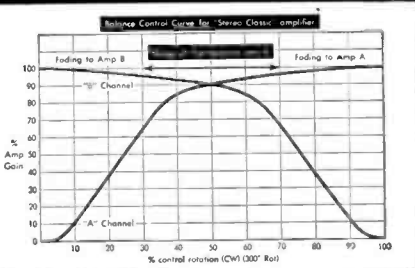
After this I began to crack under the tedium of playing 72 sides manually, and resolved that any future tests would be done by some more efficient method. I washed a new side in K-33, destaticised it with BLAST, and played it nine times at 20 grams and 78 rpm. (Sadist!) This really clobbered the stylus! Under the microscope it could have passed for a droodle of a horse's hoof.

Then, after washing again in K-33 I played the same side 9 times again with a new stylus, this time slathering on SPLASH before each play as the instructions recommend. Does lubrication make any appreciable difference in stylus life? I was aghast as I looked at the stylus under the microscope. Whereas the stylus playing the clean, destaticised record had been nicely decapitated, I wasn't sure I could even see any *flats* on the SPLASH stylus!

Not long after this I received a sample of a modified version of SPLASH, having

(*Continued on page 72*)

New G-E 40-watt "Stereo Classic" Amplifier

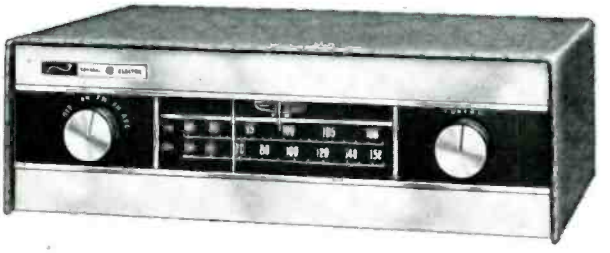


Versatile, convenient switches and controls. In this completely new and striking General Electric design you'll find every useful variation in stereo and monaural amplification, controlled swiftly and accurately. Balance control allows you to adjust for maximum stereo effect *without* overloading one channel when the other is cut down. New contour control boosts the bass smoothly, gradually, without increasing sound intensity. Each control handles *both* 20-watt channels.

- Full 20-watt power output from each channel at the same time.
- No audible distortion at full power.
- Flat response within .5 db from 20 to 20,000 cycles.
- Outstanding sensitivity, extremely low hum and noise level.
- Inputs: FM-AM tuner (and FM multiplex adaptor), stereo and monaural phono cartridge and tape, auxiliary.
- Speaker modes: stereo, stereo reverse, single or two-channel monaural.
- Speaker phasing switch saves manual phasing. **$169.95*.**

New 28-watt Stereo Amplifier has similar features, except for speaker phasing switch. **$129.95*.**

...and new FM-AM Tuner



Top performance in a trim, modern cabinet. Receives even weak signals with unusually low distortion, hum and noise level. No audible drift. Visual meter provides center channel tuning of FM and maximum AM signal. RF amplifier stage in both FM and AM for increased sensitivity. FM multiplex jack for stereo adaptor. Built-in AM antenna; folded FM dipole included. **$129.95*.**

Model FA-11 (left) has russet lecther vinyl finish. Model FA-12 finished in willow gray vinyl. Both models are style-matched to the amplifiers. Cabinet removable for custom mounting.

*Manufacturer's suggested resale prices.

GENERAL ELECTRIC

See and hear the G-E "Stereo Classic" amplifier and tuner at your Hi-Fi dealer's now. For more information and the name of your nearest dealer, write General Electric Company, Specialty Electronic Components Dept., A159, W. Genesee St., Auburn, N. Y.

Elimination Networks for Hi-Fi Systems

Another flight of fancy from an apparent addict—he claims to HI-FI, but we have our doubts. Read it and form your own opinions.

DANIEL R. BUTTERLY *

HI-FI SYSTEMS have attained such an advanced degree of perfection in recent years that there is now widespread opinion among engineers and enthusiasts that little more can be accomplished by further research, and that the development of hi-fi equipment has leveled off to a state of near perfection.

There is, however, much room for fruitful research in the field of auxiliary equipment to provide additional refinements to the already existing systems, especially in regard to the problems of aural fatigue.

Such auxiliary circuits could, of course, be built into the equipment by the manufacturer; or, better still, be sold as separate units to be plugged in by the user, or, if necessary, wired in by a competent service man.

An example of such a useful adjunct to a hi-fi system is shown in *Fig.* 1. This device was developed by the author in response to a complaint made by a neighbor, who had invested twelve hundred dollars in a hi-fi system, and was fatigued by the sound of triangles, the musical instrument used to a great extent in swing music and Tchaikowsky. (A) shows the device developed by the author for the almost complete elimination of the sound of the triangles. The value of C_1 is not given, as this would depend on the associated circuitry, and may be best determined by experiment. (B) shows the connection in the circuit.

Another common complaint is that of excessive bassiness, or *juke effect.* This tone, which is present at all times whether the orchestra is playing a bass or not, is usually of the order of 85 to 125 cps, and is generally built into the amplifier to testify to the virility of radio announcers. Its elimination is extremely difficult, and may require a renovation of the entire hi-fi system, since it is likely to be built into the amplifier, preamp, speaker, cabinet, *and* record.

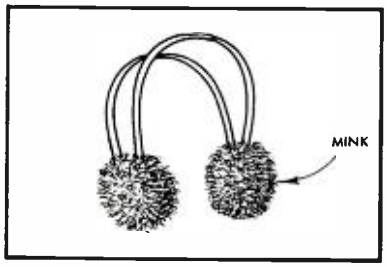


Fig. 2. Device developed to eliminate over-accentuated bass.

The author has devised a simple mechanical device to relieve aural fatigue resulting from this condition. *Figure* 2 shows a set of ear-muffs made by modifying a conventional hi-fi headset.

Our neighbor has demonstrated that his bass is so powerful that one can feel the breeze by placing his hand in front of the speaker cut-out. We suggested placing paper-weights on the desk to prevent letters and newspapers from flying around the room. This, however, is not always feasible, so the author has ingeniously contrived to take advantage of this effect where its elimination is prohibitively costly.

Figure 3 shows a rearrangement of a conventional hi-fi system, in which the breeze from the woofer is used to keep the power supply cool. The equivalent circuit of the speaker, enclosure, and acoustical or breeze effect, is shown in *Fig.* 3.

Another ingenious mechanical device was developed by the author. By placing a small obstruction (Bumper) on the voice coil of the woofer, we can limit its excursion to one-half, resulting in acoustical half-wave rectification. The rectified wave is then put through a time-constant network, developing a voltage, which in turn is fed to a relay in the power supply line. This circuitry is shown in *Fig.* 4.

Resistance R_1 is critical, and may be exactly determined by:

$$R_1 = 3.14f\left(\frac{\frac{h}{e^{-1}}, \frac{h}{e^{-2}}, \frac{h}{e^{-3}}, \text{etc.}}{B^2}\right)^{+\infty}_{-\infty} \text{使}$$

where B is *breee factor,* and the other symbols have their conventional significances.

For a first order approximation, where a high degree of precision is not required, one may write:

$$R = \frac{E}{I}.$$

By means of the circuit shown at (B)

(*Continued on page 77*)

* *114-104 227 Street, Cambria Heights 11, L.I., N.Y.*

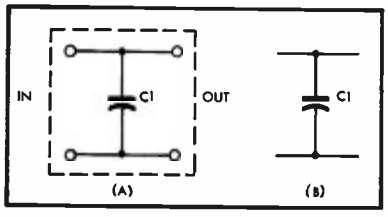


Fig. 1. Triangle-elimination network.

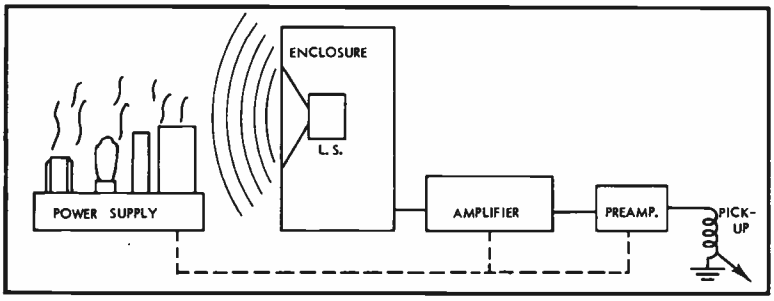
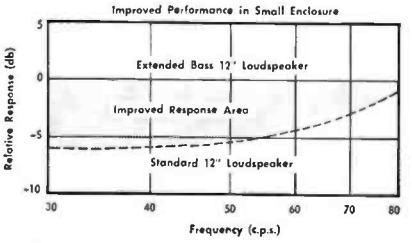


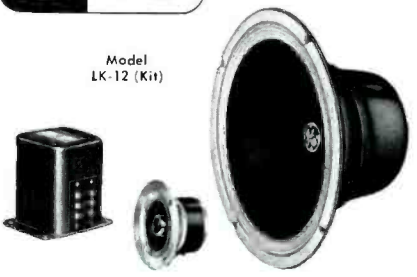
Fig. 3. Utilizing excessive voice-coil trovel to provide cooling breeze for amplifier.



New General Electric "Stereo Classic" Speaker Systems

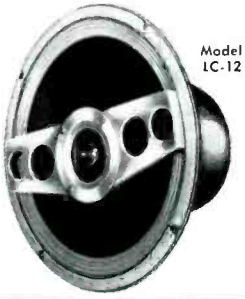
Hi Fi

Model LK-12 (Kit)



Model LH-12

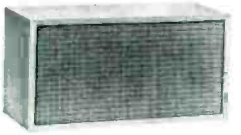
Model LC-12



"Stereo Classic" speakers are offered in three different forms: • Model LK-12 woofer-tweeter kit with crossover network for those who prefer a biaxial installation using their own enclosure. **$89.95*** • Model LC-12 coaxial speaker with crossover network. Same basic woofer with tweeter mounted coaxially in front. **$89.95*** • Model LH-12 speaker system. Separate woofer, tweeter and crossover factory-installed in a 2 cu. ft. wood enclosure. Available in mahogany, blond oak, cherry and walnut veneers. **$129.95***

G.E.'s new 12" Extended Bass speaker systems produce four times as much undistorted power at low frequencies (+ 6db) as standard 12" speakers in the same enclosure. These systems require amplifiers of only moderate power, since their efficiency is two to four times higher than comparable speaker systems. The new direct radiator tweeter provides unusually smooth response and exceptional sound dispersion at higher frequencies, without unnatural tone coloration. For overall flat response, we invite you to compare these speakers with all others.

...and Bookshelf Speaker System



Only 9" high, 17⅝" wide and 8⅜" deep, yet provides better low-frequency response than speakers tested in enclosures up to twice the size. Also offered as kit without enclosure. From **$49.95** to **$57.50***

"Stereo Classic" Equipment Cabinet

Long, low modern styling. Three spacious compartments for easy placement of tuner, amplifier and changer or turntable. Two large sections for records. Mahogany, blond oak, or cherry veneer finishes. 31" high, 39¾" wide, 17⅜" deep. **$109.95***

See and hear all the new G-E "Stereo Classic" components at your Hi-Fi dealer's now. For more information and the name of your nearest dealer, write General Electric Company, Specialty Electronic Components Dept., A159, W. Genesee St., Auburn, New York.

*Manufacturer's suggested resale prices.

GENERAL ELECTRIC

EQUIPMENT PROFILE

Sony Transistorized AM/FM portable radio—Fisher Model 400-C stereo preamp—Reslo "Celeste," "Symphony," and "Avon" microphones—Knight KN-120 AM/FM/Stereo tuner.

SONY TFM-151 AM/FM TRANSISTORIZED PORTABLE

Transistors have completely dominated the market for portable receivers, and many units little larger than a package of cigarettes have appeared and been well received. Before the introduction of the Sony TFM-151, all have been AM receivers, employing up to eight transistors, and accommodating small built-in loudspeakers.

The TFM-151, however, sets a new standard for quality performance in a transistor portable. It uses fifteen transistors in a unique assortment of PNP and NPN types—eight in the FM tuner section, three in the AM tuner, and four in the a.f. amplifier. The entire unit, shown in *Fig.* 1, measures 3×8¼×9 in. and weighs only 5½ lbs. It is powered by four "D" cells with a total of 6 volts.

The FM section, with its built-in telescoping antenna as well as provision for an external 75-ohm line, covers the range from 88 to 108 mc. It consists of an r.f. amplifier, mixer, and oscillator, followed by four i.f. stages with the last two doubling as limiters. Two germanium diodes follow as the discriminator, and its output is fed to a d.c. amplifier which varies the base bias on the oscillator to provide a.f.c. and also serves as an emitter-follower output stage for the FM section. All of the FM transistors except the d.c. amplifier/follower are PNP types.

The AM section uses a ferrite loopstick, with additional provision for an external antenna. The circuit uses a PNP transistor as oscillator-mixer, followed by two NPN transistors as i.f. amplifiers, and a detector using a diode. An additional diode aids in providing a.v.c. action.

A button-actuated switch channels battery to the desired section, and at the same time connects the volume control to the AM or FM outputs. The arm of the volume control is fed to a three-terminal strip, the other terminals connecting to the a.f. amplifier input and ground. The first two terminals are normally connected together with a jumper which may be removed to feed an external amplifier at tuner level.

The a.f. amplifier consists of two single-ended stages, transformer-coupled to a class B output stage, all employing NPN transistors, with a diode providing temperature compensation for the output stage. The output is 180 mw, which is adequate for the built-in 4×6 in. oval speaker. A jack permits use of an earphone, cutting out the speaker voice coil, which has an impedance of 3.2 ohms.

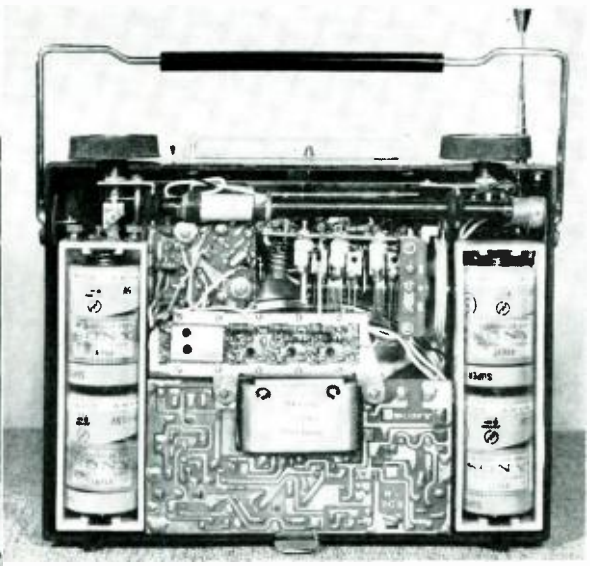
Performance

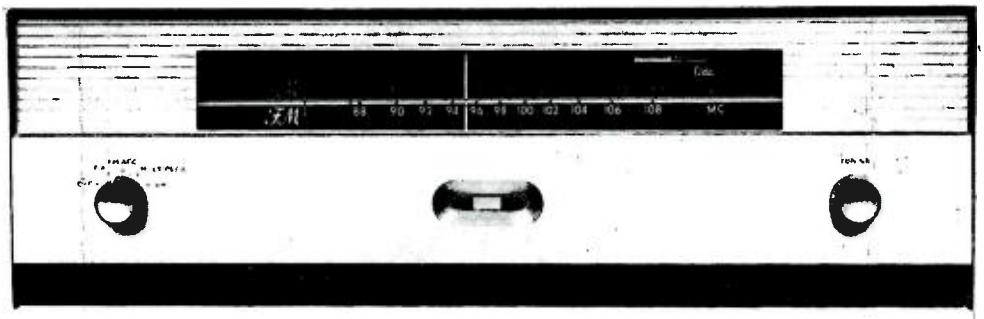
As a portable receiver, this Sony unit will compare favorably with any AM set we have ever seen with the possible exception of having somewhat less power than would be desirable if one expected to stage a dance at a weekend party at the beach or mountain cabin. For most uses it would be judged completely adequate, however. What *is* remarkable is the quality, particularly on FM. With the output from the terminal strip connected to an AUX input of a typical hi-fi system, the quality compared directly with a high-quality standard FM tuner was such that they could not be told apart. Even when the output from the speaker-circuit jack was fed into the system—thus using the entire a.f. amplifier—the quality was still excellent, and there was *no* hum. This was due, undoubtedly, to the feedback around the output stage from the secondary of the transformer.

Sensitivity is comparable with any good FM receiver, and a.f.c. action is better than most. AM quality was nearly as good, allowing for the sideband cutting of two i.f. stages—but distortion was at a minimum. There is apparently no drift, since once a station is tuned in it stays there indefinitely, even after hours of playing and hours with the set switched off.

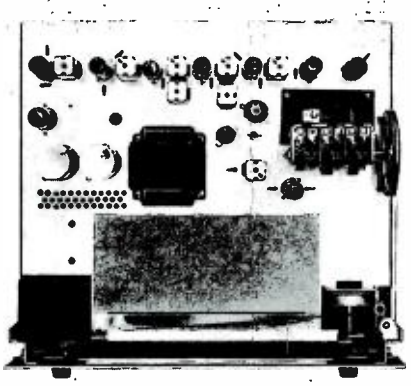
The Sony TFM-151 is the world's first transistorized AM/FM portable, and Sony deserves praise for both the design and construction. *Figure* 2 is an internal view of the printed-circuit construction. The AM "front end" is at the left of the gang capacitor, while the FM i.f. strip is the section just above the speaker magnet. The set could well serve for a model for any transistorized construction. A-24

Fig. 1 (left). Sony TFM-151 AM/FM transistorized portable. Fig. 2 (right). Interior of 15-transistor receiver. Note speaker magnet frame projecting through opening in printed-circuit panel.



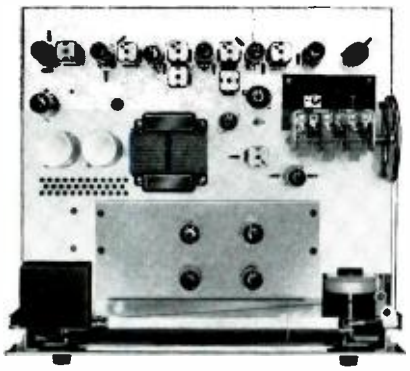


today's best high fidelity tuner has its future built in!



Top view of T250 showing provision for multiplex adapter (MA250)

MA250, Plug-in multiplex adapter



Top view of T250 with MA250 adapter-installed.

Inspired is the word for the new Harman-Kardon Ode, AM-FM tuner, (illustrated) and for the new Lyric, FM only tuner. They are superb single channel (monophonic) tuners—and they are the only high fidelity tuners which fully anticipate multiplex stereo broadcasts. Such broadcasts are already in process and substantial programming is expected early in 1959.

The FM front end in each tuner is a new "Shaded Grid" VHF tetrode which combines the low noise characteristics of a triode with the great sensitivity of a pentode. Both models incorporate the new Harman-Kardon "Gated Beam" limiter with zero time constant grid circuit and wide band Foster-Seeley discriminators. As a result, each boasts uniquely low distortion, superior impulse noise rejection plus uniform limiting and output at all signals. A new bridge type power supply permits the lowest modulation hum yet achieved and excellent signal to noise ratio. Incidentally, all of these characteristics are esseritial for consistent and stable multiplex stereo reception.

The Ode (Model T250) and Lyric (Model F250) are the only tuners designed to be completely integrated multiplex receivers. Each provides built-in signal, power supply and space to accommodate and operate a multiplex adapter. The Harman-Kardon MA250 multiplex adapter plugs directly into the tuner chassis. With it installed, the tuner becomes a one piece instrument, providing complete single channel plus compatible multiplex stereo reception. No external or additional adapter of any type is required.

A new electronic tuning bar is dramatically framed in the massive body of the tuners' escutcheon. It functions on both AM and FM signals. The tuners match the handsome brushed copper and black design of the new Harman-Kardon Epic (Model A250), fifty watt stereo amplifier. A combination of one of these tuners and the Epic represents high fidelity engineering and design in its furthest advance. It is the one system certain to be up to date years from today.

We invite your most critical examination of the new Ode and Lyric compatible multiplex stereo tuners at your Harman-Kardon dealer today. Prices of these new units are: Model T250, The Ode AM-FM tuner—$149.95 • Model F250, The Lyric, FM only tuner—$129.95 • Model TC50, enclosure for T250 or F250 —$12.50 • All prices slightly higher in the West.

harman kardon

HK-14

For complete information on these and other fine Harman-Kardon instruments, write to Harman-Kardon, Dept. A-1, Westbury, N.Y.

Fig. 3. The Fisher Model 400-C stereophonic Master Audio Control.

THE FISHER MODEL 400-C STEREOPHONIC AUDIO CONTROL

There has never been any question in the minds of well informed audiofans as to the generally high quality of Fisher equipment, and the 400-C Master Audio Control continues in the same tradition. This is an attractive self-powered unit requiring a cutout 4½ in. high by 14⅞ in. wide and extending back from the panel some 7½ in. It is available as a chassis for mounting in an existing cabinet as well as in wooden cabinets in various finishes, one being shown in *Fig.* 3.

This preamp-control unit has a number of unique characteristics, in addition to all of the normal facilities expected in a stereo control unit. One of the most interesting from the standpoint of the user who may have both changer and turntable is the equalization selector. Two PHONO inputs are provided—and the requirements have been considered thoroughly by the designers to give the utmost in simplicity of operation. One of the inputs has three degrees of equalization—RIAA, EUR, and LP, with the latter two functioning only for monophonic pickups. The RIAA position on this input may be used for either mono or stereo records. The second phono input has RIAA equalization only, and connections to two separate pickups may be left in place permanently even though the user has two record playing units.

The TAPE input is for connecting directly to the tape heads, and correct equalization is built in so that all controls will be centered in the 400-C. The MIC input is flat, and arranged to accommodate any high-impedance microphones. Both TAPE and MIC inputs may be used for stereo or mono, as desired.

Provision is made for three high-level inputs, all dual-channel, and selection between inputs is made by a push-button switch, with pilot lights indicating which input is in use. A rumble filter is provided, with low-frequency cutoffs at 20, 50, and 100 cps, and the loudness contour is selected by another switch which gives two degrees of compensation as well as a flat position.

The remaining controls are: channel balance, bass, treble, volume and power switch, and an output selector switch. The latter has six positions: normal and reverse stereo, channel A feeding both outputs, channel A feeding channel A output alone, channel B feeding both outputs, and crossover. This last is just what the name implies, with a 650-cps crossover network switched in so that the channel A output has the highs rolled off and the Channel B output has the lows rolled off, both being fed from the channel A inputs. This permits a stereophonic effect from mono sources, since the two speakers are reproducing different frequency ranges with a consequent distribution of the sound between the two channels.

The tone controls are the Baxendall type —which we prefer—and the contouring of loudness compensation is pleasant. Four a.c. output receptacles are provided, all being controlled by the power switch, and accommodating a total of 650 watts which should be adequate for two amplifiers and a turntable and/or changer.

All heaters (except that of the rectifier tube) are fed from d.c. which is provided by a selenium rectifier and a filter system consisting of two 1000-μf capacitors and a 10-ohm resistor. The plate-supply filter is a two-section RC type, and residual hum is better than 80 db below normal output of 2 volts for high-level inputs, and better than 60 db below the normal output for the low-level inputs. Tubes employed are: four ECC83/12AX7's, two ECC81/12AU7's, and one EZ80/6V4. The front panel is brushed brass, and is almost ⅛ in. thick. Cathode-follower outputs are provided for a tape recorder, feeding from both channels, and tape monitor jacks are furnished for use with recorders having feed-through connections built in.

Construction

Figure 4 shows the top and rear of the chassis for the locations of input and output jacks. The Channel A connections are on the top row and Channel B connections are on the lower row, except for the tape monitor jacks which are shown at the left of the top row of jacks. Level-set controls are used for the low-level inputs through the preamplifier, and for the AUX 1 high-level inputs. These are shown on the housing in front of the tubes, and are accessible from the top. Both preamplifier tubes, shown on the platform at the right, are shock mounted for complete freedom from microphonics.

The 400-C is a real joy to use. The switching is quiet, with no noise between switch positions; controls are quiet and tapers have been chosen for smooth operation. The controls have a firmness of feeling, which gives the same impression as when handling a fine car. Distortion is low—measuring around 0.1 per cent at a 1-volt output, and the equalizations of the two preamplifier sections in the model tested was closer than 1 db of being identical in both channels. All in all, we consider the 400-C to be one of the finest examples of preamplifiers we have been privileged to examine. A-25

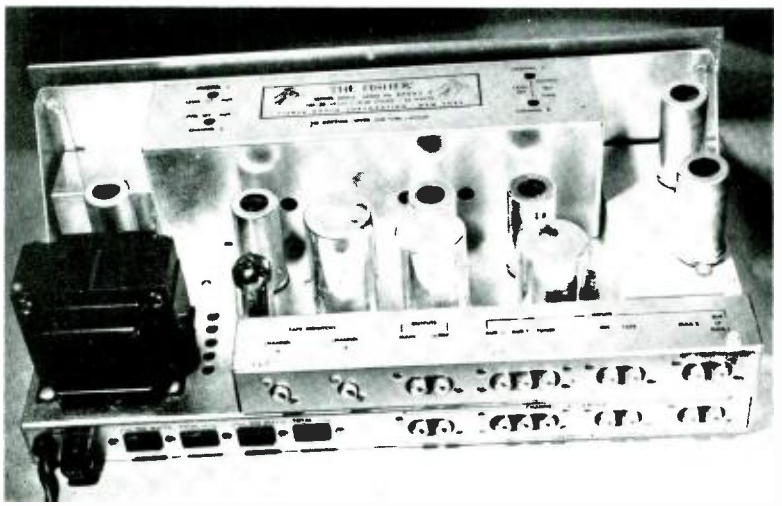
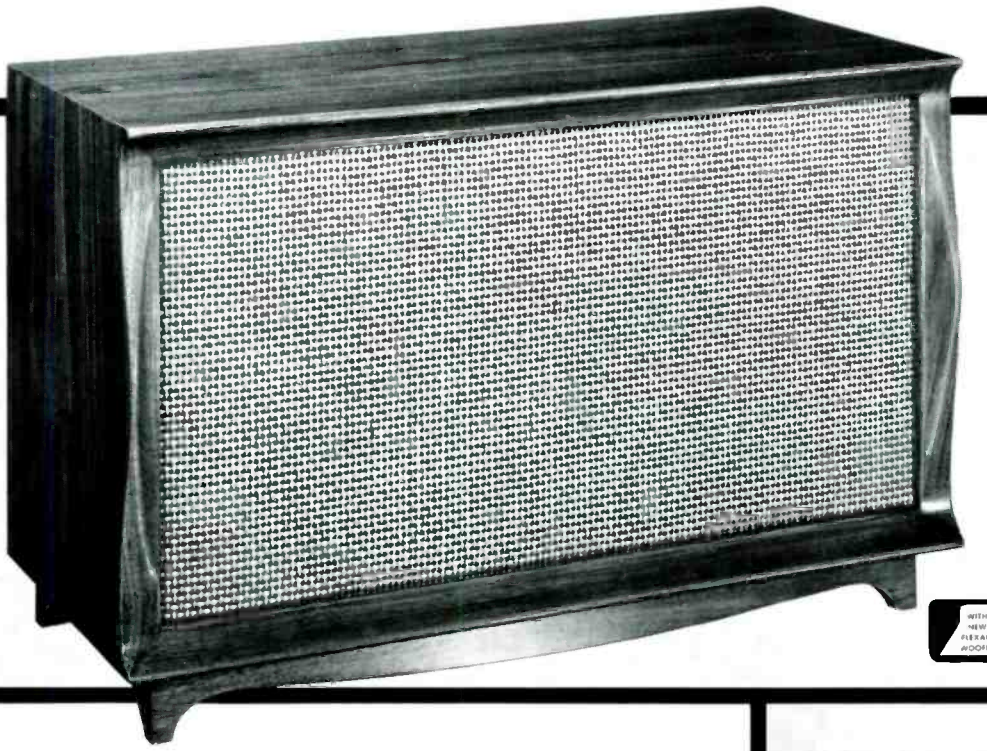


Fig. 4. Chassis view of the Fisher 400-C shows input jacks, level-set controls, and general layout.

Jensen's LITTLE **BEAUTY . . . WITH THE MIGHTY HI-FI VOICE!

NEW "TRi-ette*" 3-WAY HIGH FIDELITY SPEAKER SYSTEM



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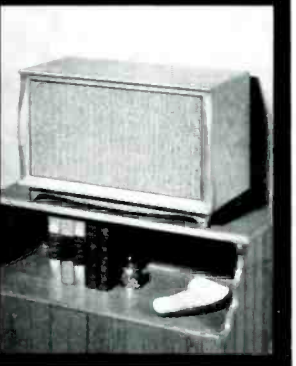

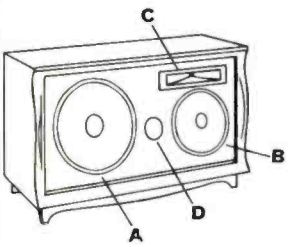

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Fig. 5. The Reslo "Celeste" microphone, with on-off switch in the base.

Fig. 6. The "Symphony," having a direct base plug and no switch.

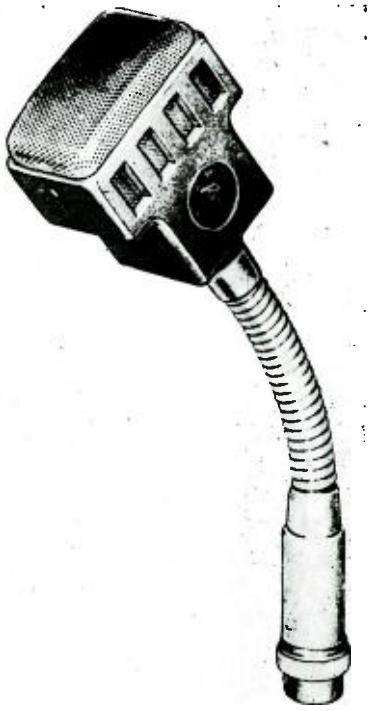

Fig. 7. The Reslo "Avon," a ribbon with a cardioid pattern.

RESLO RIBBON MICROPHONES

One can only begin a discussion of Reslo ribbon microphones by pointing out that they are small and attractively styled, offer a wide range of impedances to suit every requirement—in most instances with two different impedances being available in one microphone—and they perform "like a microphone should." These units are unique in one respect, that of having replaceable "ribbon cartridges," which makes it possible for the user to completely recondition a microphone with a minimum of time and effort. Furthermore, they are guaranteed for a period of three years—which is a good guarantee in any man's language.

Three models are currently available—the Celeste, with an on-off switch built into the base, as shown in *Fig.* 5; the Symphony, which has a more compact base fitting without the switch; as shown in *Fig.* 6; and the Avon, *Fig.* 7, which has a super-cardioid pattern. Each of the three models is available with three impedance ratings—low-impedance, designed for inputs of 30 to 50 ohms; medium impedance, for inputs of 250 and 600 ohms; and low/high, which may be used with 30–50 ohm loads as usually encountered in professional equipment, as well as into high-impedance inputs such as home-type recording equipment. With the latter two models, the impedance change is made simply by changing the cable and plug—the connections to the base of the microphone accommodate both of the available impedances. For example, when the low/high model is used with a professional recorder, the cable has two wires and shield. By simply removing the plug and replacing with another wired correctly to a single shielded lead, the microphone output is at high impedance. This is a great convenience when the microphones must be used with two different types of equipment. Changing from 250 to 600 ohms is accomplished the same way.

Another feature of interest is the ability of these microphones to have their response characteristics changed by the user in minutes. With each microphone are furnished two pieces of felt and a piece of varnished cambric. These are designed to fit into the rear protective shell of the microphone. For bass reduction, one felt is placed in the shell; for bass reduction with rear discrimination, one felt and the varnished cambric are used; for close talking use, a felt, the cambric, and the second felt are placed in the shell. These changes may be made in less than a minute. Front-to-rear discrimination is of the order of 20 db at 10,000 cps, becoming less as frequency is reduced. Without any of the auxiliary treatments the response is essentially flat from 20 to 15,000 cps. The Avon model is particularly well suited for P.A. use because of its cardioid pattern, the front-to-rear discrimination being of the order of 15 db to high and mid-frequencies.

The dural ribbon used in the Reslo models has a low mass, but is rugged. Furthermore, it is shielded from wind and breath effects by a nylon screen, a wire-cloth screen, and the external perforated shells, so they may be used outdoors safely. Because of the shock mounting of the ribbon cartridge in foam rubber, Reslo microphones are highly resistant to mechanical shock. Output is −58 db for a sound pressure of 10 millibars.

Anyone who needs a microphone for both low and high impedances will find the Reslo units answer the requirements excellently. We have used them in both applications and have found them to compare favorably with some models of much greater cost. And the two-impedance feature is obtained only at the cost of an additional cable and microphone plug. This has the additional advantage of preventing mistakes of setting impedances, since low-impedance inputs usually accommodate Cannon-type plugs, whereas high-impedance inputs usually are designed for coaxial connectors. A-26

Fig. 8. Desk-stand base will accommodate any of the Reslo microphones.

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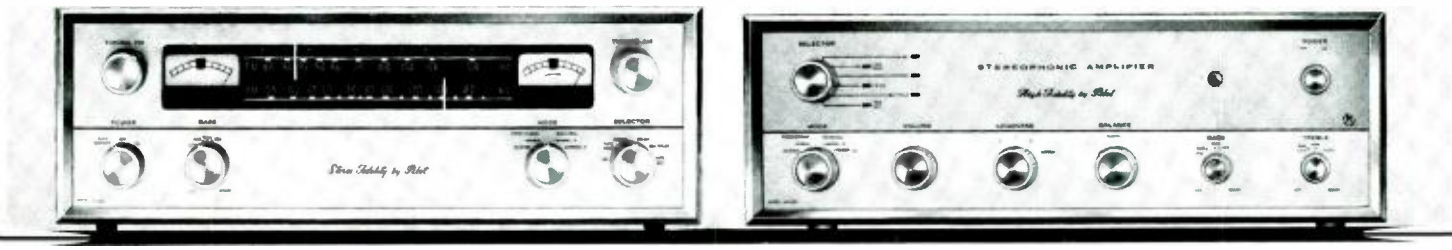

FA-680 Stereo FM & AM Tuner & SM-245 Stereo Preamp & Control Amplifier

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An increasingly popular choice is the illustrated combination of FA-680 and the SM-245.

The FA-680 is a true stereo tuner. The FM and AM sections tune independently. Two professional type tuning meters are used—a null-center type for FM and maximum swing type for AM. In addition to separate outputs for FM and AM sections enabling FM-AM stereo, the FA-680 also has terminals for multiplex FM-FM stereo, if and when adopted.

Through the use of a gold grid cascode RF amplifier, the 680 achieves 1 microvolt FM sensitivity. Extreme wide-band detectors, and other advanced designs are used to assure lowest possible distortion on AM and FM.

The SM-245 is a stereo (dual-matched) preamp-amplifier with virtually immeasurable noise and hum. There are stereo inputs for the 680 tuner as well as inputs with equalization for stereo and monaural records, stereo tape heads and recorders, and dual microphones. And there are special outputs for making stereo and monaural tape recordings.

The stereo power amplifier built into the 245 has a total, dual-channel power output of 40 watts for music waveforms (80 watts transient peak). Harmonic distortion is less than 1% at full rated output.

The FA-680 is priced at $199.50, and the SM-245 at $189.50. Both are supplied complete with enclosures, attractively finished in vinyl black and gold. Other Pilot components offer you a wide choice of stereo system combinations. See and hear them at your Pilot dealer, or write for complete details and specifications.

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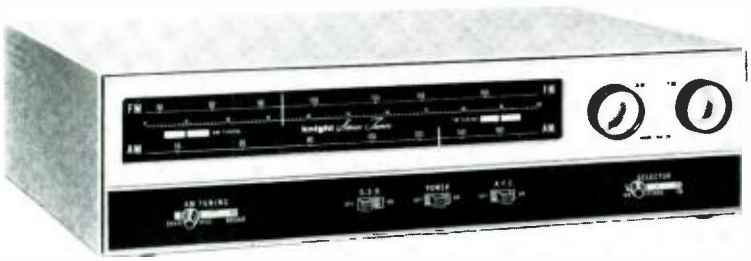

Fig. 9. Allied Radio Corporation's Knight KN-120 Deluxe AM/FM/Stereo tuner.

KNIGHT KN-120 DELUXE BASIC AM/FM/STEREO TUNER

New tuners seem to be introduced at the rate of about one each month, and aside from variations in appearance, quality of construction, and placement of controls, there is little to distinguish one from another. Performance is uniformly good, and while there are differences in sound quality, hum level, drift, and sensitivity, most of them use essentially the same circuits and many buy their i.f. transformers from the same source. But every so often something that is sufficiently new to warrant attention appears, and the Knight KN-120 Deluxe basic AM/FM/Stereo tuner is one of them. For in this model there is a radically new idea which we have never before seen applied to tuners, although all of us are familiar with the use of feedback in amplifiers—in fact, we rarely see an amplifier nowadays without feedback.

Before discussion of the physical and performance characteristics of the KN-120, the application of feedback to a tuner should be explained, for it is in this area of circuit design that this tuner is distinguished.

Reviewing briefly, most readers are aware that a.f.c. may be obtained by connecting—through suitable filtering circuits—the output of the discriminator to a reactance tube which controls the frequency of the h.f. oscillator in the "front end." The Foster-Seeley discriminator is so arranged that when properly adjusted its audio output is superimposed on a d.c. voltage whose average value varies as the center frequency of the i.f. channel is varied. When tuned exactly "on the nose," the average voltage of the discriminator output is zero; if the set is tuned to one side or other of exact center—which means that the carrier is not distributed symmetrically over the straight-line portion of the discriminator curve—a d.c. voltage is developed. A reactance tube is a voltage-sensitive device which varies its basic characteristic—either inductance or capacitance, depending on the actual circuit—as the voltage applied to one of its elements is varied. If the tube is connected across an inductance in the oscillator circuit, the frequency of the oscillator can be varied by varying the control voltage. Thus the entire circuit functions like an engine with a governor in which a speed-proportional control is exerted on the engine's throttle to maintain a constant speed at all times. In the FM tuner, the d.c. voltage from the discriminator is fed back in the proper polarity to correct oscillator frequency and thus to retune the circuits so that the i.f. signal is in the center of the i.f. pass band. As in any governor system, there must be some deviation in order for any control voltage to be developed, so it is not possible to provide a 100 per cent correction. However, in a well-designed set the deviation can be held to less than 20 kc with ease. For the usual a.f.c. circuit, therefore. it is only the average d.c. voltage at the output of the discriminator which is employed for the control, and the average is obtained by filtering in the return circuit. As a matter of fact, we have seen sets in which the filtering in the a.f.c. return was inadequate, and some low-frequency audio signal was present in the control voltage. The net result was that when the a.f.c. was switched on the low-frequency audio voltage in the control signal would try to move the intermediate frequency back to the center again with each signal variation, and since the discriminator can only detect frequency variation, the low-frequency output of the set was reduced. So every time the listener switched the a.f.c. on, the bass dropped out of the reproduction.

Supposing, however, that the *audio* output from the discriminator were to be fed back to the reactance tube. If there were no filtering in the line, and enough control voltage were fed back, the output would be reduced appreciably throughout the entire audio spectrum. However, if a controlled amount of the audio signal were to be fed back, it would serve the same purpose as any other type of feedback and should therefore reduce distortion and improve frequency response.

This is the principle of the Dynamic Sideband Regulation as employed in the KN-120 tuner. Some of the audio voltage from the discriminator (actually that from a cathode follower which offers a low-impedance source for the voltage being fed back) as well as the filtered d.c. voltage (which is proportional to the average deviation from center frequency) is fed back to the reactance tube to give about 10 db of audio feedback throughout the i.f. section and the discriminator. The result is that while the audio output is reduced by some 10 db, there is a considerable reduction in noise from weak stations, and the effect of over-modulation is reduced greatly. While FM stations by and large radiate a cleaner signal than is usually heard on AM, some of them do occasionally increase their modulation to improve coverage, and they may exceed the i.f. amplifier bandwidth in the tuner. There is a definite improvement in audio quality on most stations with the DSR turned on, and on fringe stations the signal-to-noise ratio is improved very noticeably. The FM section may be used without DSR, and with or without a.f.c., but since the operations are related, the DSR switch overrides the a.f.c. switch. Normal practice is to tune in a station with DSR and a.f.c. switches both at off; then switching the DSR switch to on also turns on the a.f.c.

General Description

Figure 9 shows the external appearance of the KN-120. Separate tuning knobs are used, and separate dial pointers and tuning indicators are used, as would be necessary on any AM/FM/Stereo tuner. In the lower panel, the lever switch at the left controls AM tuning, varying sensitivity and pass band for local, medium, or distant reception. At the right is another lever switch that selects the output fed to a pair of jacks marked OUTPUT on the rear apron—the FM jacks are normally connected to the FM circuit at all times. With this switch in the AM or STEREO positions, an AM signal is available at the OUTPUT jacks. One jack of each pair is fitted with a level-set control. The three slide switches on the front panel control power, a.f.c., and DSR.

Figure 10 shows the rear of the chassis removed from its case, which measures 4⅝ in. high, 15¾ in. wide, and 13⅛ in. deep. The case is steel, with a leather-like vinyl material permanently bonded to it. A multiplex jack is provided, and the built-in ferrite loopstick is mounted on a pivot so it may be oriented for optimum signal pickup.

In conclusion, it must be said that the DSR feature, along with over-all good design, results in a tuner which has adequate sensitivity and excellent audio quality. Furthermore, it is compact and attractive in appearance. A-27

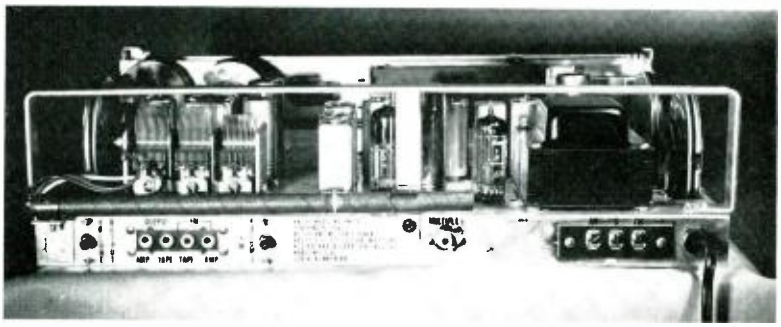

Fig. 10. Rear view of the Knight basic tuner.

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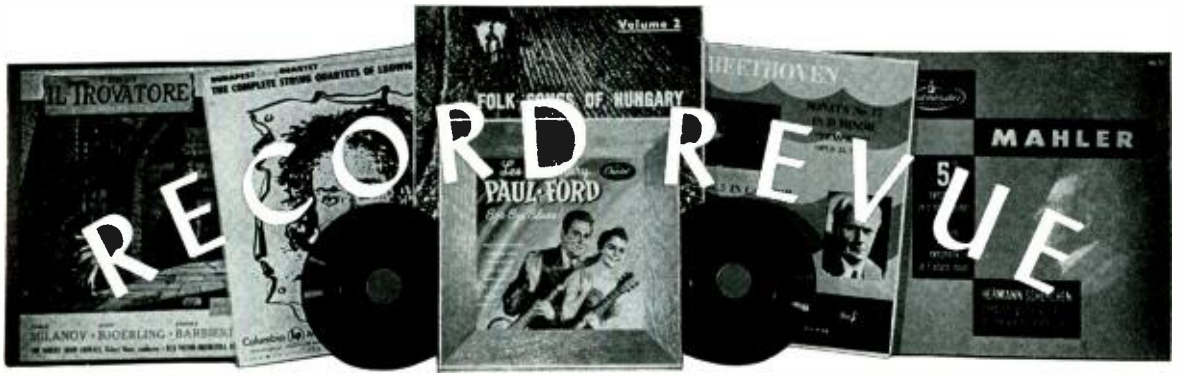

EDWARD TATNALL CANBY*

WHAT CAN STEREO DO?

Debussy: Jeux; Debussy-Ravel: Danse. Dukas: La Peri. L'Orch. de la Suisse Romande, Ansermet.
London CS 6043 (stereo)

The Debussy side of this disc is a top stereo prize, to please anybody and everybody; the Dukas side is interesting, if of lesser impact all around.

"Jeux"—Games—is a remarkably little known Debussy ballet score, the last orchestral work he composed, dating from 1912, well after the more familiar pieces. It is accordingly more concentrated, more modern, terse, and even better for hi-fi than the earlier scores. In this really wonderful stereo recording and performance the late-Debussy idiom, the colorful, bittersweet orchestration, are projected with no less than thrilling effect, for me anyhow. I am sure that hi-fi lovers without a trace of Debussy in their systems will enjoy it just as much. It's just a d— good record for listening.

"La Péri," the last work of Dukas, is mainly novel in that it *isn't* the "Sorcerer's Apprentice," the Dukas piece we always hear. It isn't as good, either, and it is much more longwinded, less original. A nice and tuneful chromatic score, not too far removed from the Scheherezade sort of music (and Dukas manages to steal a couple of Rimsky-Korsakoff themes, without noticing it), but it doesn't compare with the Debussy.

The third piece is a familiar early piano piece of Debussy, as orchestrated many years later by Ravel. A pleasant trifle, to fill out a side—and it's a pleasure, at least, to see a stereo side actually filled out, for once.

Grofé: Grand Canyon Suite. Phila. Orch., Ormandy. **Columbia MS 6003** (stereo)

This piece is generally deplored by lovers of classical music, but few musicians would deny the extraordinary effect of the instrumentation. The tunes are trite, the effects second hand, the romance forced, the style out of anybody and everybody familiar—but nevertheless, the piece is outstanding as an orchestral *tour de force.*

Stereo, by virtue of its way with the orchestra, makes a new wonder out the old warhorse. I expected to be bored, I listened with astonishment. Never has stereo's power to space out the insides of a piece of music been more nicely demonstrated.

Of course—you hear the same details in the mono version. But you don't *notice* them. The subtle differences in source, in hall reflection, scarcely important in themselves, still add up to a transparency and rhythmic polyphony that has never been achieved on any standard mono recording of the music and never will. (By polyphony I simply mean that in stereo you can sense the several strands of thought going on at once, in different parts of the orchestra, each made clear and separate from the others, yet simultaneous with them. Mono recording takes away the separateness of impact.)

Mendelssohn: Italian and Reformation Symphonies. Boston Symphony, Munch.
RCA VICTOR LSC 2221 (stereo)

In this one—particularly in the "Reformation" Symphony—it is the impact of an intense Romanticism, a Romantic ecstasy, that hits you via the immediacy of the stereo medium. I was immensely impressed by the "Reformation" (it is Symphony No. 5) in this playing though, generally, I find Munch on the chilly side in Romantic music. Maybe it's just the RCA Victor punch here—it's a splendid recording.

The "Italian," for some reason, doesn't hit me as hard. I suspect that the difference is with both me and the orchestra: the music is overly familiar and, by now, a bit stale and it's not the sort that can be played without the right enthusiasm and freshness.

Dvorak: Serenade in D Minor, Op. 44. Boston Woodwind Ensemble, plus cello and double bass.
Boston BST 1004 (stereo)

—And here, the stereo impact is largely in the sound of the hall. The smallish cluster of instruments is not importantly aided by the left-right distribution; it isn't that vital. But what does come through in stereo is the strong feeling that these players are directly before you, on a large stage within a large and resonant hall. That in itself, along with fine playing of a top-rank Romantic serenade (one of the best of all the Dvorak works), makes for good stereo listening.

As in so many other new stereos, this one is considerably shorter than the mono version of the same, which includes other music as well. Boston follows the now-familiar practice of spreading out over three or four stereo discs the contents of maybe two monos. Necessary, and worthwhile in the result—well-cut stereo grooves. (But I wish the price per disc would be equalized. To pay more for less hurts too much. If the stereo records are shorter, it's enough to have to pay the full mono price, let alone 20 per cent more.)

Gilbert and Sullivan. The Mikado. D'Oyly Carte Opera Co., New Symphony Orch., Godfrey. **London OSA 1201** (2) (stereo)

This is it! It didn't take me five minutes of listening to this new recording to decide that there still is only one way to do "G & S" and that is the D'Oyly Carte way. I didn't even bother to get out the recent Angel stereo recording of the same with the famed Glyndebourne opera company—it just isn't in the running.

I suppose there are plenty of G & S fans who will, as always, deplore these new fangled Mikados, one and all, in favor of the classic recorded version on 78, done in the late Twenties and beloved for two generations. Maybe so, maybe so. (In fact, I'm going to have to look that old set up for a direct comparison, one of these days, out of sheer curiosity.) But time flies and it's now thirty years later—and we still have D'Oyly Carte and the authentic tradition, as we did in 1928, some forty-odd years after the original. What more can you ask?

D'Oyly Carte, if you didn't know, was the original Gilbert and Sullivan company, perpetuated (like an eternal "South Pacific" or "My Fair Lady") from one generation to another, always in the family, carrying on the traditions and—incidentally—owning the still-unexpired copyrights; all other versions are unauthentic, and all other versions (excluding a great many worthy amateur productions) sound unauthentic, too. They ring false.

This stereo Mikado may not boast the most perfect group of D'Oyly Carte singers ever, but by golly, the old familiar types are on hand, mostly to perfection. The crusty, acid-voiced baritone High Executioner (he appears in some form in every one of the operas), the gravelly contralto, Katisha, the sweet young things (three little maids), all a-twitter and ever so British, the ponderous basso and the ecstatic tenor (always a bit strained in voice and never quite altogether in tune)—every familiar sound is here. Even the chorus, plus one of the best G & S orchestras ever but still under the same Isidore Godfrey.

What never fails to astonish me is the verve and enthusiasm that this company is able to summon up, year after year, decade after decade, lifetime in and lifetime out. Don't tell me the British aren't the most tradition-minded souls in the world! Personally, I'd go nuts singing nothing but G & S for ever and anon, but I certainly don't go nuts listening to these singers.

The stereo is excellent, and adds a wonderful sense of immediacy and presence to the production, without in the least posing problems of artificiality or falseness in the spatial sense. The soloists are placed exactly right, not too near, not too far, and they move just enough so that they aren't rooted to pedestals; you'll never worry an instant about their visual whereabouts. The chorus is in back, precisely where is should be (but not too far) and the orchestra—well, it's everywhere and very much in place musically.

I'm not even listing the Glyndebourne production here. It is wrong, wrong, so very wrong—and Glyndebourne is one of the finest "real" opera companies in the world. But this G & S, you see, isn't real opera; it's a stylized show type of its own, satirizing opera and plenty else, but never, *never* sounding like actual opera, never competing with actual opera either. Glyndebourne's Angel performance (a) sounds like real opera and (b) plays down to G & S, as though the ghosts of Mozart and Verdi and Rossini were on hand to deplore. Bad, You have to have faith in G & S to sing it right.

Note—there are other G & S stereo albums from D'Oyly Carte too; they'll all be done again, most likely.

Vivaldi: The Four Seasons.
(a) I Solisti di Zagreb, Janigro.
Vanguard BGS 5001 (stereo)
(b) Stuttgart Chamber Orch., Munchinger. **London CS 6044** (stereo)

These are two heartwarming recordings of this set of Italian concertos that has risen, since the war, from complete obscurity to be

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one of the favorite 18th century works. Both versions represent about the best playing of this sort of music available from their respective areas—Germany and the Adriatic Sea. Both are excellent stereos, technically and for the music itself. Both are "authentic" in their approach and in their complement of performers, a small string group with harpsichord plus two or three solo violins.

There have been horribly distorted performances of this music, and not infrequently either—a recording by the late Guido Cantelli comes to my mind as perhaps the most distressing of all. There have been stodgy, musicological-style playings, romantic, overblown versions. Our own symphony orchestras are inherently incapable of making sense of this kind of music—though they have tried. But here, at last, we have it as right as Mozart, and the variations from one to the other of these two recordings are what may be called, at last, legitimate within the style and period of the music.

Vanguard's recording is the lightest, the airiest, the most electrical. It has a cat-like quality—steel-springed, but beautifully under control, that is of the best in the Italian school of present-day string playing. (Zagreb is evidently more Italian than Germanic in its musical affiliations.) The soloists are sensationally good in their parts (one is a principal solo, the others more or less secondary.) The display of the successive sensons lulls, crackles, roars, bristles, sleeps, all within the strict 18th-century framework of musical expression.

London's from Stuttgart, within the same general tradition, is sweet and German. The tempi are slower, the music fuller, softer, rounder, the voltage generally lower but the amperage plenty ample. German Baroque playing (this is nominally what is called Baroque music) can be stuffy, heavy, plodding; it isn't, here—far from it. If you play this hard on the heels of the Vanguard disc it will seem a bit heavy-handed for about three minutes. Then, as you adjust to the feel of the performance, the heaviness will vanish.

An interesting stereo point, concerning both discs: these are of the 18th-century concerto type where the solo or solo group is contrasted and complementary to the larger "tutti" body of strings but not singled out in the later super-virtuoso fashion. The engineers accordingly have been able to place these solo fiddles in a much truer and more natural perspective than is possible when the concerto soloist is a big name with all the trimmings and plenty to show off about. Big-name solos must sound big—and they do, alas.

Most of the big concertos are now subject to stereo elephantiasis of the solo. I don't like it and doubt if I ever will—for it is not a necessity in stereo, as it was in mono recording. I hate to hear huge fiddles playing close-up in front of vast, distant orchestras; I dislike a ponderous piano that floats in midair before your very nose. I find more and more that stereo solos—all solos—are best when taken from a more concert-like position and in a concert-style volume balance. But, unfortunately, the practice of solo magnification isn't going to die easily.

And so there's nothing like the "little" solo, the semi-soloist, for good stereo! If his name is anonymous, or set, figuratively, in medium-sized letters, not big ones then he gets ideal stereo treatment from our present-day engineers. Try either of these recordings and you'll see exactly what I mean.

Berlioz: Symphonie Fantistique, Cento Soli Orch. of Paris, Fourestier.
Omega Disk OSL 9 (stereo)
Stravinsky: Petrouchka. Cento Soli Orch., Albert. **Omega Disk OSL 8** (stereo)

Here is an unexpected and quite startling new stereo series, in two examples, launched out of the blue by a company that hasn't to my knowledge had its nose in the classical disc catalogue before. The discs are, surprisingly, top rate. The sound is terrific and so is the engineering; the performances, by an orchestra that I hadn't heard mentioned before, are fresh, full of life, if (like many a French performance) somewhat on the erratic side.

The best of the two sonically is the Stravinsky—mainly thanks to Stravinsky himself, who is beautifully served by this opulent, full-bodied two-channel (?) stereo taping. One of the interesting things our ears begin to learn in respect to stereo these days is the quite different effect of two-channel and three-channel originals. Not all are clearly to be heard one way or the other—but a recording such as this one seems clearly two-sided, the emphasis on the right and left areas, with a relatively mild sense of straight-ahead middle. I do *not* by this mean that there is a "hole in the middle" by any means! (Now that my speaker phasing is usually right, I don't believe in holes in the middle any more. They really don't exist.) There is simply a feeling of "two-ness" here, an attraction for the ear towards both sides, which spread out beautifully to overlap in the middle and so complete the picture. This is superb for the Stravinsky score, which never got such a fabulously clinical inside exposition. The endless details of orchestration are so clearly, startlingly brought out that you will be fascinated for hours, given a bit of musical curiosity.

The famous Berlioz symphony, a bit less striking as stereo, is the better performance—it is a traditional favorite of French musicians, who put into it all the accuracy, the electrical quality, that it must have. (The Stravinsky performance is conducted by a young German conductor; he makes it sound German, with unusually slow tempi, a rather heavy quality. Interesting, even so.)

My congrats to Omega for a splendid technical job on both discs.

Berlioz: Corsair, Beatrice and Benedict, King Lear, Rob Roy Overtures. Philharmonic Promenade Orch., Boult.
Westminster WST 14009 (stereo)

Sometimes the best virtue of stereo is moderation—and it's worth money. You'll pay

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for it in this one, with good musical benefits.

What I mean is, that for much music, especially for the classical orchestra of the middle and late 19th century, a general overall sound picture is far more important than a clinical, close-up, spread-out look at details. In modern music from, let's say, 1890 on, the orchestra is minutely subdivided with a wealth of coloristic detail work. The earlier orchestra—especially Berlioz—has the detail work too, but it is definitely secondary to larger, over-all musical statements that must be heard full-size and as a whole. Too much stereo effect and you lose out in musical sense.

With which introduction I proceed to say that the relatively mild stereo of this recording is exactly right for the music. I've switched to my "mono" position (paralleling the cartridge leads) to note that superficially there isn't any enormous differences but that the small difference which is evident is good to the music.

The four Berlioz overtures here include an almost unknown one, Rob Roy, an early work that gets its first recording here. You'll enjoy it, if only for the main theme which, says my curious ear, is no less than the familiar Scotch tune "Scots wha hae for Wallace bled" —is that the right title? (Westminster's annotator doesn't seem to have heard it.) The British performance is impeccably musical, accurate, and on the whole, very British. Doesn't do this slightly over-dramatic French music a bit of harm!

(N.B. There's a companion overture disc with four more Berlioz overtures on it, WST 14008.)

Prokofieff: Peter and the Wolf. Garry Moore; Philharmonic Symphony of London, Rodzinski.
Saint-Saëns: Carnival of the Animals. Garry Moore, narr. J. and G. Dichler, pianists, Vienna State Opera Orch., Scherchen; zoo sounds.
Westminster WST 14040 (stereo)

This is an odd one! It's a composite, of course, mixing Vienna, London, America, and the Bronx zoo for a grand stereo pastiche that has me only partly impressed—but impressed, even so.

Take "Peter" first. Garry Moore tries hard to be the average Joe, avoiding the archness of most tellers of the Peter story in favor of an almost hard-boiled approach. Pretty sad, I'd say. "Peter" isn't that kind of piece. As for the stereo here—if there is any, then I can't hear it. Sure, there's virtue in moderation, as I have said already; but when moderation moderates to the vanishing point . . . anyhow, the performance itself—the orchestra—is nicely done. It's probably the same one issued in various other Westminster "Peter" formats, including one (mono) without any voice at all.

The "Carnival" is quite a proposition. It has been out before in mono form—but here, the actual animals are claimed to be recorded in stereo at the Bronx zoo! Well, maybe so, but if I am hardly aware of ducks to the right and wolves to the left, at least the animal sounds are real and out of live animals. Oddly enough, too, they go quite well with the Saint-Saëns music, which is decidedly not what I had expected. The alternation of living animals and musical animals proceeds smoothly via tape editing and the total effect is quite instructive.

Here, the music is plenty stereo at least as far as the two solo pianos are concerned; one is on each side of you and the contrast is musically interesting. The orchestra isn't spread out much but it doesn't matter. Nice playing, and Garry Moore is better here than in "Peter" even if the "verses" he recites are pale imitations of the clever set done by Ogden Nash (on an early Columbia LP).

Prokofieff: Peter and the Wolf; Lieutenant Kijé Suite. Boris Karloff; Vienna State Opera Orch., Rossi.
Vanguard VSD 2010 (stereo)

Toss this one in the pot too—it makes a nice contrast to the Westminster "Peter". Where Garry Moore tries hard to be butch, Boris Karloff goes back to the real fairy-tale tradition, booming out the story in rich, sepulchral tones, his voice surrounded by a huge space that is even bigger than the large musical hall in which the orchestra plays. (The two were done separately, of course). The performance of the music goes perfectly with the Karloff approach; it makes much of every detail, in a slow and impressive way; the wolf is positively frightening, grandfather hobbles slowly and implacably with Peter in tow, the cat is slimier than ever. (Well, you find a better word.)

Old "Peter" fans will find this recording a heartening throw-back to the first "Peter" of all, on RCA Victor 78's with the Boston Symphony and Richard Hale, who spoke at stage distance in what now turns out to have been a thoroughly Karloffian manner.

Beethoven: Symphony #6 ("Pastorale"). Columbia Symphony, Bruno Walter.
Columbia MS 6012 (stereo)

I suppose I've sampled a dozen versions of the Beethoven Sixth, the one with the thunderstorm and the bird songs, during this last year or so; not a one of them was able to get through to the music as it ought to be—and has been, in the past, under such leaders as Walter himself and Arturo Toscanini. (He did an early Sixth on 78's that has never been beat.)

Old Bruno Walter, as far as I'm concerned, has hit this particular jackpot on the nose. I haven't compared him to Toscanini (or to all the others) nor even to himself as of earlier recordings. Not important. This version, in stereo, is miraculously right where the others, one after the next, failed to get into the spirit, failed to make the tricky music and the even-trickier pastoral symbolism sound convincing, in performance.

No use saying more, except that I find the Columbia stereo just about ideal for the music. It could be done differently, of course. But this is *one* excellent way to take down the Sixth—and with such a performance to work upon, there wasn't much chance of its misfiring.

(You can have it in mono, but don't if you can help it.)

Mendelssohn: String Quartet in E Flat. Glinka: String Quartet in F. Westwood String Quartet. **Stereo Records S 7006**

I have postponed this record for months because when I first tried it the sound was so dreadful that I decided immediately it couldn't be *that* bad—it must be my stereo equipment.

Well, it isn't that bad—but it isn't good sound, either. Instructively enough, I was also sent the mono version of the record (different brand on this one, though the cover is the same) and I quickly found that part of the trouble is in the original tape—or perhaps in the music itself—a thin, wiry, unpleasant string sound, in both mono and stereo versions. It could be the quartet itself and/or the particular acoustics and mike placement chosen; in any case, I have never heard anything quite like this unpleasantness and I am not enthusiastic about it.

In addition, the performances are dominated by a very wobbly first violin, Louis Kaufman. No amount of engineering can repair that. The playing ensemble is poor, though the spirit is good.

Finally, the stereo record *is* distorted, and no doubt about it. Not the horrible distortion that I seemed to hear on my earlier stereo playing equipment but, rather, a mild, annoying, slight distortion that gets worse in the inner grooves, as might be expected. I am sure that this distortion will show up variably according to the cartridge used; with the best and most compliant cartridges it should be slight enough not to interfere with your musical listening.

I mention this record in detail mainly as an interesting example of the problems in current record listening. We always blame the record, but more often we should look out for our own equipment, in every aspect. Without the slightest doubt, for instance, a brilliant tweeter system and/or a very live room will exaggerate this slight distortion to the utterly impossible stage, whatever the cartridge. Without a doubt, too, a cheap phonograph of the sort that mercifully suppresses the highs won't even show it up at all.

One reviewer of this disc, in another magazine, praised it to the skies as a fine stereo recording. Wonder what equipment he used?

By the way, the two quartets are interesting music, one of them a pleasing hit by the pioneer Russian composer, the other a youthful and surprisingly mature quartet by Mendelssohn aged 14. The Society for Forgotten Music, which sponsors this series, did a good job on the musical choice of material.

Gluck: Alceste. Flagstad, Jobin, etc., Geraint Jones Orch. and Singers.
London OSA 1403 (4 stereo)

This is the stately opera in which Flagstad made her "final" appearance on the opera stage in New York, a good many years ago; I saw and heard her and won't soon forget the occasion, especially the moment when the great singer, wrapped in her long white robes and looking as large as the statue of liberty, tripped and almost fell down a stage mountain. The audience positively gasped, for Flagstad is and was a monumental singer *par excellence*.

The monumentality is still there, and so is the fine musicianship. Whether you enjoy this recording or not depends mostly on a rather tricky ratio, between your appreciation of the high plane of tragedy on which she projects the opera—she can't be beat on that score—and your distress at those inevitable high notes which the ageing lady squawks most painfully. (Lesser singers merely sing flat; Flagstad always hits the pitch exactly, even if it nearly strangles her.) If you can forgive her these, and if you are aware of the real greatness of her lofty concept, this is for you. It's not for most listeners, and that includes many who would prefer a more "authentic" and less grandly Romantic interpretation.

Opera fans should keep one important fact in mind here—this is not the usual French version of the opera but the original Italian version, written in Vienna before Gluck moved to Paris and the protection of Marie Antoinette (before she lost her head, of course). The older Italian opera style was lofty, serious, restrained—restricted, perhaps. The new Gluck reforms, applied to his own operas in their French revamping, allowed for more freedom, a more personal and expressive style. Flagstad is entirely right (and with her the rest of this cast) in pursuing the older, lofty ideal here. Interesting.

Liszt: Totentanz; Malediction. Alfred Brendel, piano, Vienna Symphony, Gielen.
Stereo Vox ST-PL 11.030
(The same, plus) **Mephisto Waltz #1, Czardas Macabre, Die Traurige Gondel, Unstern.**
Vox PL 11.030

These two Vox discs share a common catalogue number and a common cover—an uncommonly good looking one, by the way. They also share in common two largeish and unusual Liszt pieces for piano and orchestra, as above. I found these two works very interesting. Liszt, the ultra-arch-Romantic, is beginning to make a serious comeback these days, not only in his more familiar big pieces but in a large number of works that for a couple of generations have been pretty much put aside as inferior, longwinded, bombastic, overblown, and what have you.

They are bombastic, overblown, noisy, blatant, no doubt about it. Yet under all his noise and showmanship (which was very much what people enjoyed in those days), Liszt was always a strong musician and basically a good composer. Also a very modern one in ways that are only now beginning to emerge—he wrote a sort of semi-atonal chromatic music that actually was much nearer to modern ways of musical thinking that Wagner's more famous endlessly shifting harmonies. Liszt used his half-tone, chromatic melodies, his restless harmonies, in a tight, nervous, intense fashion—beneath the bombast—that listeners of his time could not appreciate in the terms we do today. These things can be heard as well in his lesser, un-

(Continued on page 67)

Ralph Bellamy, starring in "Sunrise At Campobello", listens to stereo on his Collaro changer and Goodmans Triaxonal Speaker System.

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STEREOPHONIC

Robert Prince: N. Y. Export: Op. Jazz
Leonard Bernstein: West Side Story
Warner Bros. BS1240

The music from two choreographic triumphs of Jerome Robbins is conducted by Robert Prince, a young Juilliard graduate whose own work was hailed by European critics after his premiere at Spoleto, Italy, and performances at the Brussels World's Fair. His orchestra is the one assembled for the "Ballets U.S.A." engagement at the Alvin Theater, where writers for New York papers called it a "stunning theatre work," and "a genuine work of art." Such jazz-tested personnel as Phil Woods, Ernie Royal, Sol Schlinger, and Georgie Auld are among the soloists.

Both composers understand jazz and are able to make valid use of its terms in larger forms. Prince writes from within the idiom, however, and *N. Y. Export: Op. Jazz,* after introductory measures, swings valiantly throughout. More than any other composer and the numerous leaders of big bands who have tried to elevate jazz, he respects the line of demarcation which distinguishes it from other musical styles. His writing is no patchwork of tired riffs and symphonic elements, but a thoroughly digested composition with a consistent design and a mounting climax.

Although the influences of modern jazz are most evident, the knowledgeable will see the Jimmie Lunceford section at work in the trumpet ensembles. And the wonderful *pas de deux,* with unerring strings behind a solo trumpet, could serve as an accompaniment for Bessie Smith or Mildred Bailey. Rather than a series of devices, Prince plainly values jazz as the creation of a host of talented individuals.

Leonard Bernstein's score for "West Side Story" is known to many theatergoers and is available on the original cast recording. Gathered here is all the ballet music from the prologue, *Dance at the Gym, Cool, The Rumble,* and the dream sequence. Bernstein utilizes jazz less often, as the story of Romeo and Juliet against the warfare of teen-age street gangs still sticks to some of the conventions of stage action.

That both men know the worth of space and intervals of silence makes the sound a treat for the audiofan. The ensembles are sharp and the percussion passages are cleanly outlined by a marvelous battery. It is regrettable that its release did not precede the proposed national tour. George Avakian supervised the recording and stereo gives it the movement expected in ballet.

Music Of The African Arab, Vol. 3
Audio Fidelity AFSD5858

Mohammed El-Bakkar and his animated troupe of singers and musicians gambol through another set of oriental tunes, fully as provocative as those in the two preceding volumes. At first hearing they convey an enveloping spirit of wild abandon, but once the exotic surfaces are breached the subleties of the basic rhythms become more clear. Originating at the crossroads of the Eastern and Western worlds, some patterns have counterparts in the *Raga* of India. Conversely, a jazz drummer would feel at home during the introductory bars of *Ya Sabeya.* The Islamic drums have a distinctive sound and the meter is accentuated by variations in their timbres, obtained by muffling certain beats. Quite a few modern jazz drummers have adopted these effects, taking them mainly from Afro-Cuban rhythm sections. But Art Blakey, Dizzy Gillespie, and Yusef Lateef have gone direct to sources in Africa. Ahmed Abdul-Malik, bassist with Thelonious Monk, is among El-Bakkar's friends and admirers, and hopes to receive a foundation fellowship to allow him to study music in Egypt.

Ya Waboor, an amusing depiction of a departing train, and *Raksat Africa,* featuring the leader's voice, are most effective. The great strides made by the stereo disc since this label placed the first on the market last spring are quite apparent. Certainly not an easy group to record, it is given good balance and the chorus contributes to a feeling of depth. A fifty-minute playing time is achieved with considerable dynamic range.

Ted Heath Swing Session London PS138

This is the most happily inspired Ted Heath export since he sent an album spotlighting each of his sidemen in this direction last spring. One reason is that his star soloists again have a free rein, another is the encouragement of a grateful audience at Kingsway Hall, and finally there is the all round excellence of the band which permits it to let loose without tripping over its own enthusiasm. The powerful brass and full-throated reed sections are deployed to good stereo effect on Gillespie's *The Champ, Blues for Moderns,* and *Fourth Dimension.*

The soloists step forward as saxist Ronnie Chamberlain plays *Eloquence,* by chief arranger Johnny Keating, and Bobbie Pratt shades his trumpet passages with a plunger mute on *Do Nothing Until You Hear From Me.* Trombonist Don Lusher luxuriates over *Solitude,* and his section mate Wally Smith is deftly affirmative on *I Got It Bad.* Stan Tracey, in taking over Frank Horrox's piano post, features his predecessor's *Etrospect.* Stereo sharply defines bassist Johnny Hawksworth's interplay with the rhythm section on *Pick Yourself Up,* and the drum pyrotechnics of Ronnie Verrell on *The Hawk Talks,* and *Rhapsody for Drums.*

The British leader likes to have his programs add up to a consistent LP. Sometimes they verge on the popular, a small excuse for my confusing his tossing of *Three Coins in the Fountain,* in a review of his last release, with that of Montovani, who does use stereo placement to define their descent. Anyway, this one swings all the way, playing a full thirty-eight minutes in a wide panorama of sound. Two photographs of the recording scene on the jacket show the relationship of the sections as they are heard in stereo.

The Song Of Songs
Audio Fidelity AFSD5888

A jazz interpretation of Solomon's *Song of Songs* may give rise to questions of propriety, but the answers are best left for each individual to decide. The nature of the work imposes certain limitations on the composer, Marty Rubenstein, pianist of the progressive jazz quintet which supplies instrumental interludes and backgrounds for a quartet of voices. To convey the spirited text without departing from its eternal qualities, he bases the score on familiar Hebraic themes and the traditional Shofar call appears in two of the six sections. By choosing rich and passionate melodies, he is able to write lean, spare lines and keep the arrangements functional. Both in these respects and in the lively tempos of the dances, there is a similarity to Prokofiev's *Overture on Hebrew Themes.* And Louis Armstrong, certainly, has treated some spirituals with more familiarity. Jack Noren, drums; Kenny Soderbloom, flute; Howard Davis, alto sax, and bassist Dave Poskanka complete the group.

Portions of the text are rearranged to be read by Shaunelle Perry as the maiden, Gordon Gould as shepherd, Charles Francisco as king, and Beverly Younger plays several parts as narrator. Stereo is used effectively, especially in the dream sequence to create an impression of voices coming from all directions. Louis Solomon and Paul Raffles are the producers.

Buddy Cole Plays Cole Porter
Warner Bros. WS1226
King Arthur: Aristocratic Swing
Audiophile Stereo 59

These two items are meant for people who attach importance to good piano sound. Another point where they are in accord is Buddy Cole's choice of a Bosendorfer to display his arrangements of a dozen Cole Porter melodies. Some fortunate individuals may have met the instrument early last year on a delightful Audiophile release, featuring Knocky Parker playing ragtime classics. They will need to be advised only that it sparkles just as convincingly in stereo, among the strings of an orchestra conducted by Pete King. It almost lifts the album out of the mood category. Cole expresses his satisfaction thusly. "It is simply a fantastic instrument. I have absolutely no hesitation in saying that only because of the Bosendorfer was I able to play some of the things on this album."

King Arthur plays two-handed piano in the swing tradition on Audiophile's second stereo disc. He forms a nicely integrated trio with Ray Kudrin, on bass, and drummer Andy Spriggs for an expert reading of *Perdido, Moonglow, Indiana, Blue Skies,* and a half-dozen others. It is not quite as impressive as Doc Evans' lively crew on the first release, but that is hardly to be expected. As a monarch, King Arthur is easily accessible and his talent of providing enjoyable listening is certainly achieved.

Felix Slatkin: The Military Band
Capitol SW1056
Les Brown: Dance To South Pacific
Capitol ST1060

At the head of a seventy-piece group composed of Hollywood musicians and delegations from service outfits, Felix Slatkin introduces Capitol's second release of popular stereo discs and displays another facet of his conducting experience, gained leading an Air Corps band while stationed at Santa Ana, California, during the war. A *Salute to the Services* medley awakens to *Reveille* and presents official versions of the anthems of each branch, tied together by a variety of drum corps rhythms from the eleven-man percussion section, before *Taps* and a mighty *Star Spangled Banner* at the close. There are six Sousa marches, with a squad of seven for the piccolo passage in *Stars and Stripes Forever,* and a task force of six tubas adds depth to *Under the Double Eagle* and *American Patrol.*

In dealing with an organization of such quantity, Slatkin never lets the quality deteriorate or the marching beat bog down. The first-rate sound has plenty of room on

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

the monophonic version, but stereo gives it additional space and dramatic impact.

Les Brown makes an eminently danceable album of the score of "South Pacific," by calling for new arrangements from Jim Hill, Don Bagley, Wes Hensel, Billy May, and Frank Comstock, and collaborating on several himself with Sonny Burke. From such an array of talent comes the expected flow of fresh ideas, paced by May's choice of cha-cha rhythms for *Bali Ha'i*, and all have due regard for the melody and a dancing beat.

"Sounds of the Great Bands (Capitol SW1022)," an album previously recommended in these columns, finds Glen Gray leading his Casa Lomans, recreated from Hollywood studio men, in recreations of the original hits of famous swing bands. Aside from the breadth given the sound of his sections and those of Les Brown, it is pleasant to discover that stereo depth is removing much artificial echo from popular recordings, on this and other labels.

"Black Satin (Capitol ST858)," designed for mood listening, slows George Shearing's piano down to an amble and surrounds it with the soft rustle of strings. An occasional Latin tempo rouses the rhythm section and the piano is nicely centered.

"Space Escapade (Capitol ST968)," a visit to the outer limits of the universe, offers Les Baxter's fanciful views on interplanetary travel. His strings are unimpaired by the journey and there are quaint, ethereal sounds.

"Carousel (Capitol SW694)," from the motion picture soundtrack, is conducted by Alfred Newman and features Gordon McRae, Shirley Jones, Cameron Mitchell, Barbara Rulck, and Robert Rounsville. Stereo gives separation to the vocal duets and the choral interludes are particularly appealing in stereo.

7th Avenue Stompers: Dixieland–New York! **World Wide MGS20005**

The name assumed by this studio group denotes, rather than geographical origin, a place where its members find employment. One of them is usually on the stand at the Metropole, a jazz emporium dedicated to dixieland in all shapes and sizes. On a good night, you might be lucky enough to hear the brand selected, under the leadership of drummer Bobby Donaldson, for this stereo project. It contains some of Buster Bailey's best moments and his clarinet solos, though full-blown, remain in good taste on *Fidgety Feet, Yellow Dog Blues,* and *St. Louis Blues.*

The muted trumpet of Emmett Berry is nicely relaxed on *How Come You Do Me Like You Do,* and Vic Dickenson is most tweedy, putting a grand burr on his trombone comments. Red Richards is pianist and Al Lucas plays bass. If you have your fill of horns popping out in unexpected places in the stereo pattern, the natural placement and depth found here offers a pleasant change. Engineered by Rudy Van Gelder, a balance is struck between wide separation and musical effect.

Bob Gibson: There's A Meeting Here Tonight **Riverside RLP1111**

At a time when the mother lode of folk material is heavily mined, Bob Gibson deems it inadvisable to stand still in his chosen field. The youthful singer, back at his base in Chicago for this program of sixteen numbers, is able to alter a song with additional verses or transform it by virtue of his lighthearted personality. Most of the titles are old and familiar, but his audiences have learned to expect surprises. *Easy Rider,* descended from an early blues, has new lines and a different rhythm. He is witty on *There's a Hole in the Bucket,* sorrowful in a tale of the *Titanic,* and embarks with gusto on *This Train,* and *Joy, Joy.*

There seems to be some doubt as to just how much stereo contributes to a folk session, involving two or three artists. With John Frigo, bass, and Earl Backus, guitar, adding support to Gibson's banjo or twelve-string guitar, I enjoyed this disc, as I have those produced by Elektra. However, the experience differs from that provided by larger groups, where an effect is felt at once, and comes with the gradual discovery that most performances sound flat on a single channel. Bill Stoddard and Bruce Swedien of Universal Recording are credited with the engineering.

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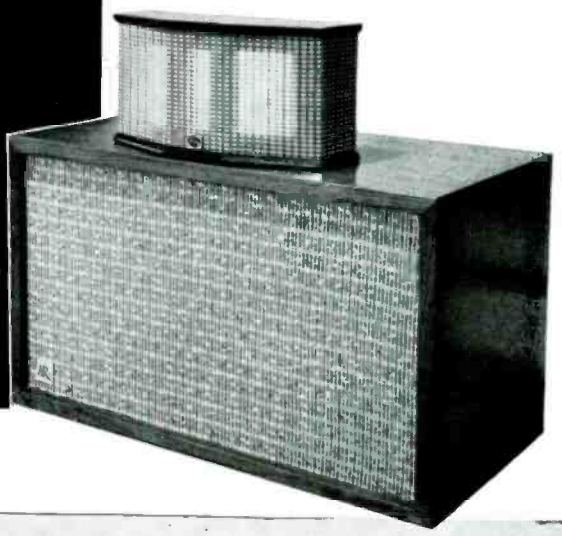

The latest results of unbiased comparison tests offer proof-positive that the best sound doesn't necessarily come from big equipment wearing big price tags. Our $27.50 Realistic ELECTROSTAT-3 Tweeter was best-rated over tweeters costing $150! Our combinations of the Realistic ELECTROSTAT-3 with Acoustic Research's magnificent AR-1 and AR-2 speaker systems were best-rated over speakers costing two and three times as much! So, simply by wanting the very best sound at low cost, you can have it . . . by adding the ELECTROSTAT-3 to your present good speaker . . . or by purchasing either of the rated-best combinations shown here.

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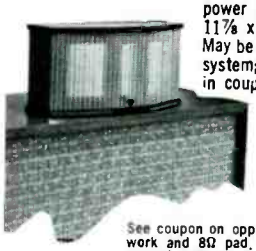
Reproduces 5,000 to beyond 25,000 cycles of pure music, not just measurable sound! Three electrostatic elements in wide-angle 120° dispersion, built-in AC power supply. Complete in compact 11⅞ x 5⅞ x 4½" finished cabinet. May be added to ANY good speaker or system; see accessories below and in coupon on opposite page.



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INSTALLATION ACCESSORIES

See coupon on opposite page. With AR-2 use 8Ω network and 8Ω pad. With AR-1 use 16Ω network — no pad. With most other speakers: match impedance, use network and pad.

BEST SPEAKER COMBINATIONS!

REALISTIC ELECTROSTAT-3® TWEETER *and* ACOUSTIC RESEARCH'S AR-2 SPEAKER SYSTEM

AR-2 Specifications:

Cabinet size 13½"x11"x24"; 10-inch acoustic-suspension woofer; 1.1 lb. Alnico 5 magnet and two 5-inch tweeters; L-C crossover network, 2000 cps; amplifier requirement 10-20 watts; ± 5 db 42-14,000 cps.

Special Combination Price

INCLUDES: AR-2; E-3; 8-ohm crossover network kit; pad attenuator

Unfinished	Blond or Mahog.
$111.95	**$118.50**
$11 Down $10 Mo.	$12 Down $10 Mo.

REALISTIC ELECTROSTAT-3® TWEETER *and* ACOUSTIC RESEARCH'S AR-1 SPEAKER SYSTEM

AR-1 Specifications:

Cabinet size 14"x11⅜"x25"; acoustic-suspension 12-inch low-frequency mechanism; 8-inch mid-and-high frequency unit; woofer magnetic circuit of 3.3 lbs. Alnico 5 and 6 lbs. Armco iron; amplifier requirement 20-30 watts; ± 5 db 31-13,000 cps.

Special Combination Price

INCLUDES: AR-1; E-3; 8-ohm crossover network kit

Unfinished	Blond or Mahog.
$189.50	**$199.95**
$19 Down $14 Mo.	$20 Down $14 Mo.

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730 Commonwealth Ave., Boston 17, Mass. 167 Washington St., Boston 8, Mass.
230-240 Crown St., New Haven 10, Conn.

Chicago Symphonic Band, Album 2
Sumco R002

Especially organized for a series of recordings to acquaint music students with scores available from the Summy-Birchard Publishing Co., Evanston, Ill., the Chicago Symphonic Band is drawn from radio-televison stations and the ranks of the Chicago Symphony. James Neilson, director of musical organizations at Oklahoma City University, is guest conductor of a program listing two stimulating marches, George Kenny's *Coat of Arms*, and *Marche de Concert*, from West Texas State's Houston Bright. Winner of the 1956 Ostwald Award for original band literature is *Fanfare and Allegro*, composed by Clifton Williams. Two pieces in early 18th century style are William Latham's *Il Pasticcio*, in the form of an Italian overture, and his *Three Chorale Preludes*, based on familiar themes used by Bach. William McRae contributes a lively *Caprice*, and the percussive *Pan-American Samba*. Latin rhythms also pulse through Fred Kepner's *Cuban Fantasy*, a three-part suite with an idyllic middle section dedicated to the sea.

As before, the band plays with snap and precision on numbers of a type not overly recorded. Engineered by Bill Putnam of Universal Recording, the stereo disc has breadth and depth, along with uncompressed dynamics.

Cyril Jackson: Afro-Stereo
Counterpoint CPST5561

Acting as guide on a percussive tour of Latin America, Cyril Jackson is most interested in calling attention to underlying rhythmic patterns brought over from Africa. Carnival songs, ritual dances, voodoo chants and melodic meringues from a number of countries are among his examples. Although the equipment was set up in the West Indies, a typical street samba is imported from Brazil and a wild war chant comes from the Ivory Coast. In addition to supervising the recordings, Jackson is apt to take over as drummer or lend his voice to a chorus of celebrants marching down a road in Trinidad.

His investigations go beyond the confines of big cities and a comparison is made between a Havana rhumba and that played in rural districts. He also locates a santos, filled with the cries of birds, and a holiday conga line. Varying from track to track, the miking is never close enough to startle. The notes catalog the many drums and their distinctive timbres, making them easily located in stereo.

Sports Cars In Stereo
Riverside RLP1101

This collection of the sound of sports cars in action is dedicated to those individuals unappeased by the snippets found on nearly every stereo demonstration disc. The 1958 Sebring Grand Prix of Endurance is viewed from four vantage points and the racers move from left to right on the corners, bends and straightaway. The direction is reversed as the motors spring to life and brakes squeal during technical inspection. According to the notes, it took engineer Ray Fowler a day and a half to complete the stereo microphone setup and some of the hazards of using portable equipment under field conditions are described. There is no narration and only the expert will identify all the participants. But to realize what is meant by a test of endurance, listen in stereo to the shifting of gears on a curve. A monophonic memento of the event, including interviews with drivers, is available on "Sounds of Sebring 1958," (Riverside RLP5011). The stereo master was cut at Olmsted Sound Studios.

MONOPHONIC

Lucky Roberts: Happy Go Lucky
Period RL1929

Alton Purnell: Funky Piano New Orleans Style
Warner Bros. W1228

While the bright young men in charge of discovering talent for record companies look in some unlikely places, no more than subway fare is needed to locate Lucky Roberts in Harlem. Once a boon companion of James P. Johnson and Fats Waller, he is one of Duke Ellington's favorite pianists to this day. A pioneer of ragtime and influence on a whole school of New York pianists, his recorded literature is slight and this visit to the studios is a welcome event. With Garvin Bushell keeping company on alto sax and clarinet, his relaxed style is as comfortable as a worn pair of bedroom slippers on *Runnin' Wild, Ballin' the Jack,* and *Wild About Harry*. Next time, some of his own tunes should be requested. Dave Hancock engineered the session and a stereo disc is available.

Another of the older line of pianists to place his name on an LP as leader for the first time is Alton Purnell, known for the part he took in the bands of Bunk Johnson and George Lewis. Disregarding an album title only remotely descriptive of his primitive art, much of his program emerges as unpruned rhythm and blues of the sort infrequently heard today. This is due to the presence of an unidentified tenor saxist, who plays in the robust, extroverted style of Plas Johnson. Purnell sings on eight numbers, including *Pine Top's Boogie, C. C. Rider,* and *Yellow Dog Blues*. Collectors of blues piano will find the price of admission repaid by *Yancey Special,* and his own *Buster Anderson's Blues.*

Jack Teagarden: Big T's Dixieland Band
Capitol T1095

Tiny Grimes: Callin' The Blues
Prestige 7144

Two past masters of the trombone highlight this pair of offerings. Recorded during a stopover in Chicago last April, Jack Teagarden's band introduces some fresh material worked up during its tour of the country. For a leader who has recorded every dixieland warhorse, as he testifies on the liner, this is no easy matter. Mike Simpson contributes a robust *Rippa-Tutti,* and Don Ewell engages in a surging tribute to another pianist on *Walleritis*. Teagarden's voice is wordlywise on a blues exercise, *Casanova's Lament,* world-weary on *Weary River,* and completely appealing on *Someday You'll Be Sorry*. His playing is eloquent and supple on *Doctor Jazz, Mobile Blues,* and *China Boy*.

The clarion call of a J. C. Higginbotham chorus was one of the most exciting sounds of swing and made him the most vaunted trombonist of that era. Since then players of greater technical facility have surpassed him at rapid tempos and a period of relative obscurity preceded his weekly appearances this season at a televised jazz party. In spite of its lack of organization, some viewers discovered that there is more to jazz than a series of slick phrases. If he no longer speaks with the same force and assurance on the swingers, his plaint on a slow blues is still strong and highly personal. Fortunately, only *Airmail Special* is not a blues, and he is superb on *Blue Tiny*. As guitarist and leader, Tiny Grimes is only slightly more organized than the television program, but pianist Ray Bryant and Eddie Davis on tenor sax help out admirably.

Guatemalan Marimbas! Capitol T10170

Invented, perfected, and introduced in Guatemala, the marimba possesses a long and harmonious joint history with the wood of the land, an attribute accountable for the name and pleasant sound of the Maderas de Mi Tierra orchestra. Its members play the dulcet-toned instrument as though they were born to it. Director Higinio Ovalle Bethancourt leads them in a dozen native melodies, full of engaging rhythms and vivid tropical colors.

Travelogues have spread the group's reputation beyond Central America and it enjoys the sponsorship of the country's president. Produced by J. H. Flickinger on a visit to Guatemala City, the lifelike recording is bound to introduce it to numerous audiofans. His monophonic effort meets all their requirements and the liner states that he also brought back a stereo version. Those who miss it on the first time around are likely to meet it on a stereo disc shortly.

Gil Evans: New Bottle Old Wine
World Pacific WP1246

The third Gil Evans album since he began his latest cycle of band arranging early this year is as convincing an indication of his talent as its forerunners. His choice of tunes ranges from *St. Louis Blues* to Charlie Parker's *Bird Feathers*, in competition with recorded performances long regarded as jazz classics. In reshaping them for a studio group of fourteen men, he outfits them in bright modern textures, using the full tonal palette of surging brass, French horn and tuba. None of their basic jazz qualities is impaired in the process, as is so often the case, due in great measure to the main soloist, Julian Adderley, whose sinewy alto sax roves freely through *Lester Leaps In*, *Manteca*, and *'Round About Midnight*. The only other reed player is Gerald Sanfino, spelled by Phil Bodner, on bass clarinet, piccolo or flute.

The collaboration is a creative and happy one, as Evans' score benefits from the fertile imagination of Adderley, whose soaring flights take on in turn an added sense of form. Rarely heard with a big band, his warm tone fits in snugly and his playing reveals a continuing development. The titles are taken in chronological order, separated by transitional passages, and Evans, on piano, is backed by guitarist Chuck Wayne to lead in to *King Porter Stomp*. Trumpeter June Coles introduces *Willow Tree*, and Frank Rehak's trombone is heard on *Struttin' With Some Barbeque*. George Avakian supervised the session during his brief sojourn at this label. Æ

COUNTER

(*from page 29*)

the arm tang. The chassis is supported by two round-head wood screws and tightened securely through two 5/16-in. holes drilled in the top of the chassis. Since the unit is equipped with its own switch, the relay mechanism may be connected directly to the power source. In the installation being described, switched a.c. was available at the amplifier chassis and was utilized for convenience.

The adjustment of the counter is rather critical, but not difficult to achieve. If all records were cut to the same distance from the center hole, adjustment would be no problem at all. The fact is, however, that the last playing groove on some discs is cut very close to the lead-out groove and naturally it is desirable to keep the counter from operating until the final notes have been played. On other records where the music is cut only about two-thirds the normal distance, the lead-out grooves may not be cut so close to the center hole. With rather haphazard adjustment it is then possible that the counter will operate when a full-cut disc is played and not function at all when a shallow record is on the turntable.

The following procedure will facilitate the proper adjustment of the relay: Rotate the potentiometer to a point about midway between the extreme clockwise and counter-clockwise positions. Select a pressing with playing grooves cut within 9/32 in. of the label. (London LLP239, Beethoven, Symphony No. 3 in E-flat, side one, is a good example). With the turntable in

a stationary position rest the pickup in approximately the last playing groove and move the pedestal toward the center of the record, making certain that the tang engages the right side of the yoke, until sufficient light falls on the phototube to operate the relay. Now, pick up the arm and return it to the rest position to turn off the relay. Start the phonomotor and advance the arm once again toward the center of the record and play the last ¼ in. or so of the record. If the counter is actuated too soon, or not at all, make the fine adjustment with the potentiometer, rotating it clockwise or counter-clockwise as required.

Return the arm, once again, to the rest position, turning off the relay, and exchange the Beethoven record with a second disc—this time, one with a comparatively large lead-out area (MMS 72, Bach, Chromatic Etude for Harpsichord, for example.) Now, test the functioning of the counter on this record, playing the last fraction of an inch of the recorded music. You may find that the counter may not operate as sufficient light does not fall on the phototube to render the relay conductive. It will be necessary to readjust the potentiometer to obtain adequate IR drop to drive the grid of the 2050 positive. Finally, try the first pressing once again to ascertain if the new setting causes the counter to trip too soon. As was stated, the final adjustment is rather critical and it may be necessary to change the discs back and forth a few times until a satisfactory setting is obtained.

As a final note it is suggested that the terminals of the magnetic counter be shunted with a .01-μf capacitor to eliminate the annoying pop in the speaker when the counter is actuated.

Once installed and adjusted, the magnetic counter assembly will prove to be a valuable addition to the high-fidelity music system of the serious audiofan. Its benefits will more than repay the modest investment of time and money.

Æ

PARTS LIST

1—Veeder-Root Magnetic Counter, Flush Mounting, (Series #T-1205)
1—aluminum chassis (5" × 7" × 2")
1—octal socket
1—3-pin miniature socket
1—Phototube, RCA Type 927
1—Gas Tetrode, RCA Type 2050
1—1000-ohm potentiometer, 2 watt
1—SPST relay
1—Filament transformer, 6.3 volt, 1.5 amp.
1—Bulb socket
1—Bulb, 6.3 volt
1—10,000-ohm ½-watt resistor
1—9100-ohm ½-watt resistor
1—1-megohm ½-watt resistor
1—DPST toggle switch
3—2-lug terminal strips
Miscellaneous hardware—machine screws, nuts lockwashers, grommets, hook-up wire, etc.

ABOUT MUSIC

West Point Revisited

HAROLD LAWRENCE*

IN THE HISTORY of extra-musical sounds on LP, we have heard the roar of sports car engines, the woosh of jet planes, the downpour of tropical thunderstorms, street noises, heart beats, and bird calls. But the biggest impact on the record market was made by a gun, specifically a French siege cannon, vintage 1761, of the type used by Napoleon during his 1812 Russian campaign. This weapon was recalled into service after a century's retirement in order to carry out a musical, rather than a military mission. As such, it played a vital role in making Mercury's recording

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

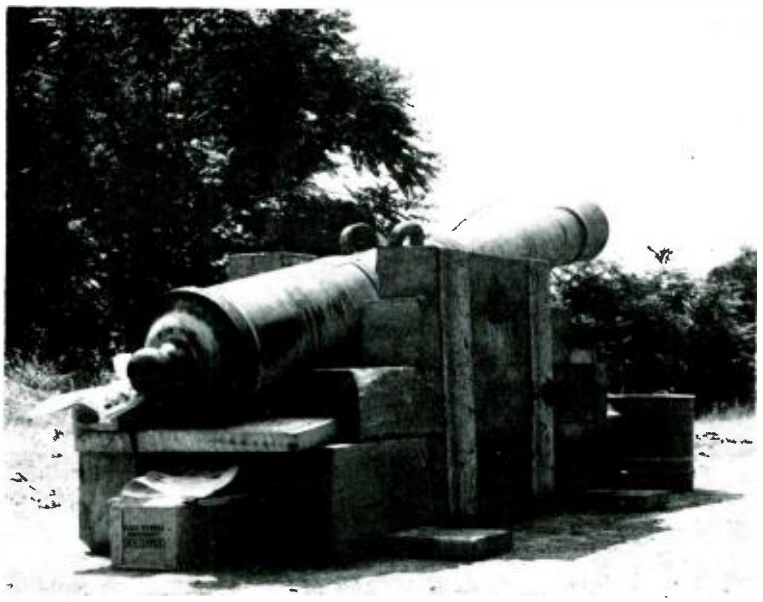


Fig. 1. The 180-yeor old connon used for the stereo remoke of the 1812 Overture.

Fig. 2. The outhor, second from right, shows his nerve ot first shot of the 12-pounder.

of Tchaikovsky's *Overture 1812* (in its original scoring with cannon and bells) the best-selling LP of the past two years. In audio shows throughout the land, the shots of this now-famous cannon resounded in the booths and corridors, even out-roaring the steam locomotives. At the New York High Fidelity Show (1956), for example, hordes of visitors squirmed their way into the Mercury exhibit room to hear the 16 cannon shots and the clamorous bell-ringing at the climax of the *Overture 1812*, staying on to listen attentively to Deems Taylor's description of the manner in which the "effects" were synchronized with the musical track.

The monophonic version of *1812* was recorded by Mercury late in 1954, only months before the company began its three-channel stereo recording program. With the advent of commercial stereo tapes and discs, plans were made to re-record the work in stereo. Finally, in early April, 1958, Mercury returned to Minneapolis where Antal Dorati conducted the Minneapolis Symphony Orchestra and the University of Minnesota Brass Band in a repeat performance of the redoubtable warhorse for the benefit of the stereo microphones. The following month, Mercury's crew scaled the heights of the Riverside Church to capture the sound of the Laura Spelman Rockefeller Memorial Carillon (AUDIO, July, 1958). And in mid-July, Mercury revisited West Point for the third and final stage of its 1812-stereo expedition.

On that hot and muggy day, six shots were fired and recorded in stereo. The site of the firing was near Building 706 and Delafield Road at the U. S. Military Academy, West Point. For the stereo edition of the *Overture 1812*, the cannon previously used in the monophonic version was passed over in favor of a larger weapon. After carefully studying the matter, Gerald C. Stowe, Chief Curator of the West Point Museum, settled on a 12-pounder siege cannon built in Douay, France in 1775. The inscription near the muzzle reads, "Le Constant" (The Faithful). It is more than likely that this field piece is a veteran of the Napoleonic Wars. Later, it was purchased by the Mexican government and used against American troops at the battle of Contreras on August 20, 1847, at which time it was captured and brought to the United States, eventually taking its place alongside the other war trophies at the West Point Military Academy. The Academy, incidentally, is one of the few places in the world where such field pieces are kept serviceable.

Two factors dictated Mr. Stowe's choice: size and solidity. The size of this muzzle-loaded cannon promised a truly enormous blast. Equally important, there was practically no danger of cracking, despite its 183 years; the bronze construction guaranteed that.

The cannon having been selected, a naval-type carriage was then built for the firing base. Since the old artillery piece weighed over 3000 pounds, heavy oak timbers had to be employed as shown in *Fig.* 1. Coarse black powder of a century-old battle formula was placed in one- and two-pound paper bags, and the cannon was moved from Trophy Point to the firing site.

By the time Mercury's recording truck had arrived on the scene at 8:00 a.m. on the day of the firing, the roads nearby had been blocked off and an ambulance and safety crew were standing by. Taking no chances, the driver parked the truck behind Building 706. The three microphones used for the original three-channel, half-inch tape masters were strung from ropes

(*Continued on page 71*)

NEW PRODUCTS

• **Tape Stroboscope.** A stroboscopic disc which, when placed against running tape, indicates the correct (or incorrect) speed of a tape recorder, has recently been introduced by H. & T. Company, P. O. Box

6011, Montgomery 6, Ala. The disc is mounted on watch-type bearings to eliminate drag. Total weight of the assembly is only five ounces. The disc indicates three speeds—3¾, 7½, and 15 ips. It must be used in conjunction with a 60-cps a.c. light source. **A-1**

• **EICO Stereo Preamplifier.** Available in both kit and factory-wired form, the new Model HF-85 preamplifier is a complete stereo control system in low-silhouette design adaptable to any type of installation. Frequency response, measured from high-level inputs with tone controls electrically flat, is stated to be ± 0.3 db from 5 to 200,000 cps at any output level up to 3 volts r.m.s. Intermodulation, determined by 60 and 7000 cps input at 4:1, is 0.07 per cent,

and harmonic distortion is 0.1 per cent, also at 3 volts output. Tone control ranges are 15 db boost and cut at 10,000 and 50 cps. Independent level and tone controls in each channel may be operated together with a built-in clutch. Separate low-level inputs are provided in each channel for magnetic cartridge, tape head, and microphone, with high-level inputs for FM and AM tuners and for FM multiplex. Each channel is also equipped with two auxiliary inputs. Further information will be supplied by Electronic Instrument Co., Inc., 33-00 Northern Blvd., Long Island City 1, N. Y. **A-2**

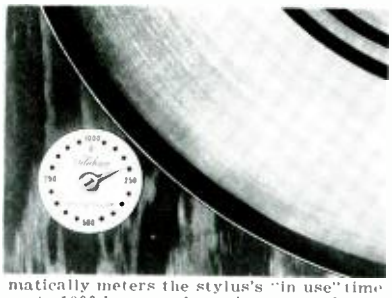
• **Bozak "Urban" Cabinets.** Clean of line and modern in style, the new "Urban" series of speaker enclosures supplement

Bozak's established Contemporary and Provincial designs. Like other Bozak cabinets, the Urban enclosures are infinite baffles. Available in two sizes for the Bozak B-302A (illustrated) and B-305 speaker systems, both Urban enclosures are offered in a choice of finishes, or unfinished when it is desirable to match existing furniture or panelling. Further information will be supplied by the R. T. Bozak Sales Company, Darien, Conn. **A-3**

• **Tape-Head Cleaner.** Known as the Walsco "Kleen-Tape," this device permits the cleaning of recording heads in two minutes without the use of tools, and without disassembling the tape recorder. The Kleen-Tape is a specially impregnated fabric tape on a standard reel. In use the reel is placed on the recorder in the normal

manner and is "played through." The cleaning formula with which the fabric tape is impregnated dissolves and removes iron-oxide accumulation, also picks up dust and other foreign materials from the head. The tape can be used over and over. Manufactured by Walsco Electronics Manufacturing Company, 100 W. Green St., Rockford, Ill. **A-4**

• **Telechron Needle Timer.** Now available to manufacturers of high-fidelity phonographs, coin-operated machines, and other types of record players, the Need-L-Minder timer accurately clocks the playing hours of a stylus. The dial-type indicator auto-



matically meters the stylus's "in use" time up to 1000 hours and requires re-setting to zero only when a new stylus is installed. Manufactured by Clock and Timer Department, General Electric Company, Ashland, Mass. **A-5**

• **Bulk Tape Eraser.** This heavy-duty degausser will handle any tape reel up to and including 10½ ins. in diameter. The field generated is strong enough to erase any tape without rewinding or flipping the reel. In operation, the reel is placed over the spindle on the eraser and rotated until each segment passes over the field area several times, then lifted off slowly

and removed to a distance of at least six feet. The degausser incorporates two transformers drawing 6 amps at 110 vac, an on-off switch, and a line fuse. Dimensions are 6¼" × 7¾" × 3½". Carrying catalog No. ML-120, this unit is available from Lafayette Radio, Jamaica 33, N.Y. **A-6**

• **Turner Microphone.** A dynamic microphone of the lavalier type, the Model 22A "Acoustic-Vent" embodies a new Turner-developed engineering principle introduced by company engineers as "a unique bass reflex which produces natural low-fre-

quency response." Specifications of this broadcast microphone are stated as: Frequency response, 60 to 20,000 cps; Output level, −90 db for 50 ohms impedance, −84 db for 200 ohms impedance. The unit is cased in aluminum with neutral gray non-reflecting enamel finish. For more information and complete technical specifications, write direct to The Turner Company, 909 17th St., N.E., Cedar Rapids, Iowa. **A-7**

• **Program Equalizer.** Developed for use by broadcast stations, recording studios and motion picture producers, the Type G-801 Program Equalizer is a low-cost device which requires only 3½ inches of rack space. Impedance is 500–600 ohms and insertion loss is 14 db. Low-frequency control is adjustable in 2-db steps to provide up to 8 db boost at 100 cps, and to

provide attenuation in 2-db steps from 4 db to 10 db at 100 cps. High-frequency control is adjustable in 3-db steps to provide both boosts and cuts of 3 db and 6 db

at 5000 and 8000 cps. Literature is available upon written request to Magnasync Manufacturing Co., Ltd., 5546 Satsuma Ave., North Hollywood, Calif. **A-8**

• **Roberts Stereo Tape Recording System.** Designed primarily for serious home recordists, the 90-S Stereo Recorder and the matching A901 Recording Amplifier make up a complete stereophonic record-playback system engineered to professional standards. The 90-S incorporates an amplifier, preamplifier, VU meter, and playback speaker. It is driven by a hysteresis-synchronous motor which holds wow and

flutter well within professional equipment tolerances. The A-901 is equipped with a VU meter for second channel monitoring, microphone input, and built-in two-way speaker system. The 90-S may be used separately as a complete monophonic recording system, with the A-901 added later on when stereo recording is desired. Lightweight, easily portable, the companion units are electronically matched and designed with identical physical dimensions. Complete technical specifications will be supplied by Roberts Electronics, Inc., 1028 N. La Brea, Hollywood 38, Calif. **A-9**

• **Sherwood 60-Watt Amplifier.** Featuring an efficient combination of six Type 7189 output tubes in push-pull parallel, the Model S-1060 is a complete audio control system and power amplifier mounted on a single compact chassis. Among its features are a "tube saver" B+ time delay relay, d.c.-heated preamp filaments, and output-tube balance control. The S-1060 offers the same flexible controls incorporated in the well-known Sherwood Model

S-10001I. These include a 6-db presence-rise switch, equalizer control, bass and treble controls, "center-set" loudness control, loudness compensation switch, 12 db/octave scratch and rumble filters, phono level control, tape-monitor switch, and selector switch for five inputs, all on the front panel. Frequency response is stated to be 20 to 30,000 cps ± 1.0 db, and intermodulation 1.5 per cent at full rated output. Output impedances are 4, 8, 16 ohms, and a cathode follower is provided for recording. Sherwood Electronic Laboratories, Inc., 4300 N. California Ave., Chicago, Ill. **A-10**

THE PURPLE COW

(*from page 35*)

no such transformer available at this time.

A signal of 0.1 volt at the input will drive the amplifier to its full output of 46 watts, 19.2 volts across 8 ohms. With the level control full on, the idle noise and hum output is about 80 db below full output. Despite the high over-all gain this is a very quiet amplifier, and this quality is appreciated during the soft passages of musical compositions.

The power supplies are not all that could be desired as these were set up from the scrap box materials available and adjustments required were made as shown by knocking down the output voltages by use of dropping resistors. Since the amplifier is class A throughout, it is understandable that such an arrangement is entirely satisfactory. Any further unorthodoxy apparent in examining the power supply and the heater arrangements was brought about by necessity; the components employed were those at hand and their use is reflected in the unusual circuitry associated with them.

The 5V4 rectifier experiences peak inverse voltages slightly in excess of its rated capabilities over about 30 per cent of the cycle but has given no evidence whatever of being in trouble. A third 5R4GY would avoid this problem.

Any amplifier using the IRC level control must have its over-all gain so adjusted that the output is balanced at whatever level is desired—loud or soft. If the amplifier has too much gain the output will be too heavy or "bassy" and it will sound dull and uninteresting. If there is insufficient gain the output will be thin and lack body, tending to sound shrill.

One practical means for proper adjustment of gain in using this control is to make sure that there is sufficient surplus over-all gain in the amplifier in the first place and then operate with the control wired in as required. Additional attenuation can be inserted with a composition resistor located between the input terminal and the high side of the IRC control. The value of this resistor is then chosen by trial, and the correct value results in having the output balanced regardless of the setting of the control. The illusion obtained as the control is operated to reduce the volume is that the music is simply being played more softly but that all of the instruments are being reduced in volume alike.

The performance as judged by listening tests is pleasing, crisp, and sparkling, with robust body and abundant clean bass. Record or needle scratch is so low that listeners often make unsolicited comment about its absence.

What is next expressed is the writer's personal opinion and will not be debated. Since the damping factor is very high indeed there may be some who might inquire as to the desirability of reduction by using a series resistance in the voice-coil circuit. No good speaker operating in a correct enclosure will require this treatment. The writer uses a Bozak system and these systems require no such series resistance. The amplifier must "boss" the speaker for best reproduction, and it accomplishes this best with high damping factors.

To simplify the presentation of the circuit on the schematic the exciter and inverter stages are shown as being composed of single triodes. The photographs do show that these stages are made up from triodes in parallel. This is done to reduce the effect of reflected plate and grid shunt reactance due to the Miller effect always present when coupling triode amplifiers into triode amplifiers. By this means the high-frequency response is carried out to extreme limits.

Acknowledgement

The author acknowledges the assistance of Mr. Donald Ismert who assisted in the "jury-rigging," performed all the measurements, and did the necessary photography. **Æ**

PARTS LIST

2	8-μf 600-volt electrolytic capacitors
5	10- to 40-μf 50-volt electrolytic capacitors
2	80-μf 450-volt electrolytic capacitors
2	40-μf 450-volt electrolytic capacitors
1	300-μf 150-volt electrolytic capacitor
3	0.25-μf 600-volt paper capacitors
8	.01-μf disc ceramic capacitors
2	.005-μf disc ceramic capacitors
1	100-μμf mica capacitor
2	20-ohm ½-watt resistors
1	150-ohm ½-watt resistor
8	1000-ohm ½-watt resistors
4	5000-ohm ½-watt resistors
1	33,000-ohm ½-watt resistor
1	39,000-ohm ½-watt resistor
2	100,000-ohm ½-watt resistors
10	220,000-ohm ½-watt resistors
1	470,000-ohm ½-watt resistor
2	1.0-megohm ½-watt resistors
1	4.7-meg ½-watt resistor
1	5000-ohm 1-watt resistor
1	22,000-ohm 1-watt resistor
2	27,000-ohm 1-watt resistors
1	35,000-ohm 1-watt resistor
1	5000-ohm 5-watt resistor
1	1200-ohm 10-watt resistor
1	18,000-ohm 10-watt resistor
1	40,000-ohm 10-watt resistor
1	62.5-ohm 25-watt resistor
1	50-ohm 50-watt resistor
1	50,000-ohm wirewound potentiometer, 3 watts
2	10,000-ohm wirewound potentiometers, 1 watt
1	IRC Loudness Control

1 Edison Model 501 time delay relay, 45 seconds
1 6U8 tube
2 6N7 tubes
4 6SN7 tubes
4 5998 tubes
1 5U4G tube
2 5R4GY tubes

NOTE: Many transformer and choke combinations are possible. It is suggested that the constructor consult with his parts supplier before beginning work on the power supply. The author can furnish transformer part numbers and manufacturer's name to any interested parties. Æ

RECORD REVUE

(*from page 54*)

familiar works, perhaps even more clearly than in the old favorites.

It was a mixed pleasure, then, to have to turn away from this interesting stereo disc in order to listen to the rest of this excellent Liszt program vin the mono recording. In addition to the two big piano works with orchestra, it has on it four important piano pieces which go along beautifully with the big items. The mono disc is a model exposition of specialized little-known Liszt; the stereo version is a truncated part of it.

Maybe you'll think—looking at the Vox covers—that these piano items are merely a bit of extra window trimming, to fill out the mono sides. They are listed on the cover to be sure, in *very* small type, which just might create that impression in your too-impressionable mind.

I'll have you know then, as a commentary on stereo extremes today, that the four extra pieces add up to *a total of a half hour of music*, less only 45 seconds! The entire stereo disc, with the rest of the music on it, the two big pieces, runs to only thirty one and a half minutes, something like two minutes longer than the sum of the "little" pieces on the mono disc.

This, then, is one thing that stereo can do for us. For the price of a mono disc you get here almost exactly twice as much music (and worthwhile music, too) as you do on the stereo disc, at a higher price. This, I'd say, is going a wee bit too far, speaking in general terms.

(Yes, I know: it was either all the piano pieces, or none of them—and what could poor Vox do about it? I dunno; I only know that if we *must* have shorter stereo discs, we shouldn't pay more for them.)

Mozart: Horn Concertos (Vols. I, II). James Stagliano; Zimbler Sinfonietta. Boston BST 1002/3 (stereo)

These four Mozart works, now great favorites, have been through quite a history in this recording, appearing first on a single standard disc, then on Livingston stereo tapes (two, as I remember) and now on two stereo discs. As you can see, the price of the music has ranged the gamut from high to low.

They are good stereos and I am quick to admit that though I didn't like the sound much in the original mono version, I was pleasantly surprised by the improvement in naturalness in the stereo tape, which was one of the first good orchestral stereos to be made available in the line of Mozart. These values have carried over into the Boston stereo discs, with very little, if any, loss of quality in relation to the tape. (Alas, that's not true of all stereo tapes now appearing on disc.)

There have been more eloquent performances of the four concertos (notably by the famous British hornmen, the Brains, Dennis and Aubrey), but these are pleasant enough, if a trace on the stiff side. Not enough to bother a musician and perhaps the Brains were a bit too mannered and intense, anyhow.

Sound Talk

by J. J. Noble
Chief Engineer, Electronics

SIGNIFICANCE OF FM TUNER SENSITIVITY

The most sensitive tuner can often fail to bring in clearly a distant station received by less sensitive tuners. All a statement of sensitivity indicates is the strength a signal must have at the receiving antenna to provide a useful output from the tuner. Thus, the logical assumption that the more sensitive tuner will perform better on weak or distant stations than the less sensitive tuner is not necessarily valid. In fact, because of a phenomenon called "regeneration," some of the so-called "sensitive tuners" don't perform up to their stated sensitivity specifications.

Regeneration is caused by coupling between circuits of differing power levels. It may take place through electro-magnetic linkages of adjacent current carrying parts, electro-static coupling between elements of differing voltage potentials, or conductive coupling through common connections such as the power supply and chassis ground paths. Perfect as the electrical design may be, the tuner's physical construction and the arrangement of its component parts ultimately determine the degree of regeneration. Poorly controlled assembly and wiring methods can so strongly affect performance that two tuners of identical design assembled under differing conditions will perform differently.

When a receiver is tuned to a very weak station, the automatic gain control circuit (AGC) increases gain or sensitivity to maximum so the weak signal picked up by the antenna may be multiplied as much as a million times. If even a minute amount of this amplified energy is introduced into the input stages through coupling, the resultant regeneration causes still greater amplification, with an apparent increase in sensitivity. Regeneration, however, tends to change the band pass characteristic, making the tuning action sharp and critical. The resulting distortion renders the tuner useless for high fidelity reception of all but moderately strong signals.

Degree of regeneration and constancy of band pass characteristics cannot be determined through specifications or visual inspection. Accurate measurements can be obtained only in a properly equipped laboratory or—a practical method for the prospective purchaser—through critical listening tests of the tuner's ability to receive weak stations. When selecting your next tuner, make sure the sensitivity is *real*, not just *statistical*. Try the "weak signal test" with several tuners of different make and compare performance.

All Altec FM Tuners are certified to comply with the restricted radiation requirement of the FCC.

Bob and Ray Throw a Stereo Spectacular. Bab, Ray, assarted RCA bands, etc.
RCA Victor LSP 1773

The pickings at RCA have been sort of thin in my department, lately. I sent especially for this one, in a kind of desperation. Thought it might be spectacular.

It is a spectacular dud, if you ask me. Good Lord! How long can this Bob and Ray stuff be dragged out? There are a batch of half-baked, unmotivated, three-quarter-horsepower interludes here, something about Doctor Ahkbar and His magic Castle, in stereo dialogue (well, let's call it that), larding together a straight out-of-the-mill batch of RCA feature items, from Melachrino and Henderson to Abbe Lane and Belafonte. *They're* OK.

Come to think of it—this must be a stereo sampler. Well, did you ever! Bob and Ray threw up such a smoke screen of inanity that I failed to recognize . . . well, whaddya bet it sells a million copies. Not a million-and-one, though. *I* won't buy it.

Monos that Missed our Boat

(Note: The following were duly reviewed by me and put into print—only to be cut out in the final tailoring of the magazine. Purely arbitrary—it is usually a matter of which item is the right size to cut, in number of lines. So here they are, and as good as ever.)

Bach: Organ Music. (Taccatas and Fugues in C, D mi., F, Fantasia and Fugue in G mi.) Fernanda Germani, organ af St. Laurens, Alkmaar.
Capitol-EMI G-7111

Four of the biggest Bach organ pieces are played on this record and the splendid old Dutch organ in the cheese market town of Alkmaar is a glorious instrument on which to play them. (Deutsche Grammophon has also recorded the organ, with the blind organist Helmut Walcha—see Archive catalogue).

This organist with the Italian name, about whom I have no information, does a good job on these big works, playing with sturdy energy and sureness, a fairly metronomic beat. The recorded sound is good, but two minor failings must be noted, (a) there are some unfortunate tape "edits" to be heard, where none should be audible, and (b) the organ is out of tune in some stops. (It's in tune for Deutsche Gramuophon.) Don't know what got into EMI.

The organ as now restored is almost exactly as it was rebuilt in 1725 (using many much older pipes)—the music was composed within a few years of this same date. Good combination!

Mendelssohn: Organ Sonata #4 in B Flat. Widor: Organ Symphony #6 in G Minor. Albert Schweitzer, organist.
Columbia ML 5290

Though Schweitzer was long known as both a Bach specialist and a Bach organist, actually his musical training was at the extreme opposite, in Paris of the late nineteenth century where the high-Romantic school of French organ music was at its prime, following César Franck. In his recent recordings Schweitzer has gone back to this school—his last was of César Franck—and his playing immediately strikes a more authentic note. The Schweitzer Bach is now rather fundamentally out of style (though still timelessly noble in conception) but the Schweitzer Mendelssohn and Widor is right on the beam.

The organ here isn't specified but it is decidedly not a "Baroque" or "Classic" instrument! Quite right. This is music in the Romantic tradition, for a big, blurry, grandiose organ replete with swell boxes and masses of nicked pipes, imitating a large orchestra in its impact if not in tone color. Schweitzer's fast movements on this organ are somewhat stiff-muscled and far from fluent and even with tape editing (we can assume), there are slips of the finger and the foot. But Schweitzer always did play that way; he's been the horror of the academic organist for a half century! The slow movements show him at his best, a really noble

and expresive musician who can bring out the most profound emotional levels in the music where others merely play the surface, impeccably. A grand old man, no doubt about it.

The Psychology of Sexual Relations. A Conversation with Dr. Theodor Reik on Love-Feeling and Love-Making.
Helicon 101

(Helicon Records, 95 Valley Rd., New Rochelle, N. Y.)

This sounds sexy and it is in its way; there are even a number of spades called spades. But I found that the genial Austrian expert's English (he's one of the original Freud circle, most of whom split away from Freud later) is so difficult to understand that perhaps a printed version of his remarks would be easier to follow. With that very thought in mind, the promoters of this record have included a complete verbatim transcription, word for word! Which bring up the question —why a record at all?

Well, for two reasons I guess. One, you meet an important personality in the field, "in person." Two, you get, via the way in which he emphasizes words, sentences, ideas, a more accurate conception of what he thinks than via the plain printed word. But it's hard work listening, though interesting.

Two of his younger associates, husband and wife, she American, he Austrian (I guess), do the questioning, in a rather too "prepared-script" fashion. Nothing unrehearsed here, though Dr. Reik is entirely at ease with his broken English. A good deal of the stuff is reasonably platitudinous; but I suspect the experts, and some of us, will note special aspects of Dr. Reik's own approach, differing markedly with some of the more smug "marriage books," so widely advertised. **AE**

SPEAKER ENCLOSURE

(from page 27)

modification, however, since it also resonates at odd harmonics of its fundamental frequency. A system of frequency-dependent damping is needed which would broaden and depress the pair of low resonant frequencies of the coupled speaker-enclosure system, and which would also vary in such a manner that the higher frequency resonant responses would be properly depressed. This type of damping can be obtained by tightly coupling the speaker to the enclosure and by creating about five or seven lengthwise channels in the straight organ pipe. The effect is improved if the material used to form the channels is somewhat sound absorbent. Additional benefits result from this channelized construction: not only do the partitions produce a more rigid structure, but they also make it possible to construct the enclosure easily with its cross section shaped into a flat rectangle. The latter feature avoids bulkiness, and permits easy installation of the enclosure along the walls, or even behind the walls of the room.

In order that the speaker and the enclosure be tightly coupled, the speaker is installed at the closed end of the enclosure where the sound pressures are the greatest. This end, which is made into the top of the enclosure so that the speaker will be elevated, is widened and tilted forward to make room for the

speaker. As a result, the direct radiation from the speaker is projected in the desirable downward direction. The upper end of the enclosure is curved, making the structure more rigid. The position of the speaker, the tilt of the speaker, and the curvature of the end of the enclosure are designed so that the higher frequencies emanating from the back of the speaker can be reflected into the absorbing channels of the enclosure.

A photograph of a dual-enclosure system is shown in *Fig.* 1. The open ends of the five channels are noticeable. The depth of the enclosure is only a few inches so that a mounting behind the wall could have been effected.

Figure 2 is the impedance characteristic of the speaker-enclosure system. The 8-inch speaker used has a natural frequency of about 60 cps. This resonance has been removed, and the pair of resonances due to the tight coupling to the enclosure appear at about 20 cps and 100 cps. They have been broadened and are very depressed. The third harmonic of the straight organ pipe at about 180 cps is visible, but the amplitude is so low that it has no audible effect; the fifth and seventh harmonics are just measurable, and higher ones are absent.

The sound radiation from the system is so good, even at the lowest frequencies, that the small speaker suffices for intensities well above the comfortable listening level. The response from strong transients is free from any audible sys-

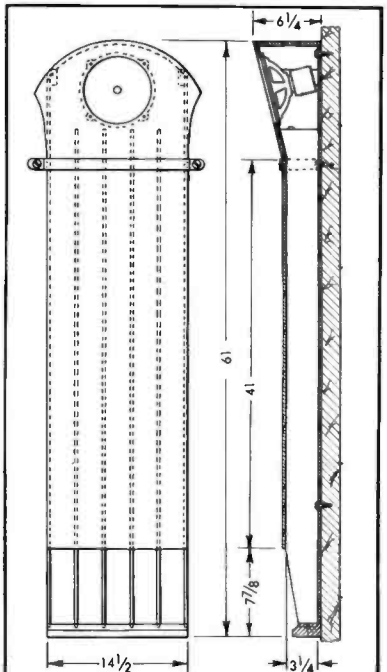


Fig. 3. Outline and sectional drawings to show dimensions of enclosure. Partitions are ⅜-in. Celotex or similar softboard.

tem resonances, and the lower cut-off frequency has been measured to be at about 20 cps.

Figure 3 shows the construction as outlined in the patent drawings, together with the important dimensions. The dividing partitions are of 3/8-in. Celotex or similar material.

The detailed description of the construction of this new high fidelity speaker enclosure is given in the recently granted Patent No. 2,810,448. It is expected that the enclosure will be marketed in kit form since the construction is exceedingly simple and free from the precision requirements of comparable quality, but larger and more intricate, reflex-type enclosures. Æ

ABOUT MUSIC

(*from page 63*)

hung between trees. The microphones were later covered with handkerchiefs to protect them from the blasts. Damp newspapers were used for wadding, and the first charge was rammed down the barrel. The fuse was lit, and all hut a few intrepid souls moved away from the cannon, plugging their ears.

The first shot, *Fig.* 2, was a resounding success. The aftermath of the explosion reverberated in the valley below. For the next shot, a slightly larger charge was employed, and the position of the microphones altered somewhat. Shots 2 and 3, however, were marred by a metallic ringing that was eventually traced to an oil tank located several yards from the left microphone. The gun crew rolled the offending tank down a hillside and got ready for the next shot. This one was free of the ringing but lost its "punch" because of improper wadding.

By now, it was time for lunch. Wilma Cozart (Mercury's young vice president in charge of the classical division) fetched a very large picnic basket from the car and we all settled down to Southern fried chicken, deviled eggs, chocolate layer cake, fresh fruit, and soft drinks. As there didn't seem to be any waste cans in the vicinity, someone jokingly suggested putting the refuse in the barrel of the cannon. This turned out to be precisely what Curator Stowe recommended, to our amazement, a few minutes later: "It's perfectly all right, the cannon will pulverize it."

Now the cannon, with its garbage and damp-newspaper wadding, was loaded for the fifth shot. In the wake of the blast, chicken bones, cardboard plates, and apple cores floated down upon us in burnt-flake, pulverized form, and we were too busy brushing off the fall-out to evaluate the sound of the explosion. After a sixth shot, it began to rain, and the drops splattering on the sensitive Telefunken microphones made further recording impossible.

On re-hearing the tapes in New York, it was decided to use the very first shot, because this one had the biggest "boom" of all. The cannon tape and the carillon recording were edited, synchronized musically with the symphonic performance, and a two-channel stereo tape made from the various three-channel stereo masters. The two-channel master transfer from the original three-channel tapes was made in a single step, utilizing a 10-position console and five tape machines. Æ

RECORD LUBRICATION

(from page 38)

written the manufacturer that SPLASH, although it did produce dramatic results in reduction of stylus wear, was almost unusable with low-pressure pickups since no matter how the record was cleaned and no matter how many times it was played, the pasty residue left by SPLASH would never fail to lift the stylus right out of the groove about a third of the way through the record, and also seemed to cause a subtle loss of low-amplitude high-frequency components of background instruments. This modified SPLASH was designated "Formula 141" and was a little more watery, sweeter smelling, and whitish in color, instead of amberish as is the case with the regular formula. I bought a new record (Lure of the Tropics), washed it in K-33, massaged several layers of SPLASH 141 into the grooves, and played it nine times at 20 grams and 78 rpm, re-applying the SPLASH 141 before each play, of course. Sad to say, the reduction in the body of SPLASH 141 as compared to the standard solution reduced its ability to lubricate in like measure, for this stylus, although not worn so much as the stylus used on the record side that had merely been destaticized, had nevertheless begun to flatten on the end slightly. In listening and general use tests with my ESL C-1 in Pickering arm, buildup on the stylus was much less troublesome, and if care was taken to put on a thin layer, could be largely eliminated. The question of low-amplitude high-frequency components I was unable to decide. I spent quite a while playing side 1 of Lure, with and without SPLASH 141. There could be no question about 99 per cent of the orchestral effects. Any good, straightforward razzle dazzle effect cut through with its full measure of razzle dazzle, no doubt about that. As for the harmonics of background instruments, the more I tried to decide whether there was any effect on them, the more I became convinced that I could not decide, paradoxical as this may seem! On this matter, your own ears will have to be the judge.

Finally, I *washed* Lure again in K-33, *de-staticised* it with BLAST, and sprayed it with the silicone plastic lubricant, thus using three specialized preparations for three distinct functions. Nine plays at 20 grams and 78 rpm produced only what looked like polished spots on the sides of the stylus, or very small, equal flats. I have since tried out one of the radioactive clip-on devices as a substitute for spraying with BLAST and it has produced very gratifying results as a reducer of the static electrical charge. I

have not had a chance to test actual stylus wear under these conditions, and will not have such a chance for some time.

This silicone spray is in many ways a remarkable substance. Since most readers will never have seen it, it might be relevant to describe it; also, I have more information on what it actually is than I do on other products. It comes in a large (12 oz.) white aerosol spray can with a somewhat special nozzle that produces a very fine, cloudy mist. The mist itself, in striking contrast to some sprays, is just about odorless. It lands on the record in tiny droplets, of about the viscosity of a light oil, but unlike oil, which refuses to wet the mirror-like surface of the record, these droplets gradually spread out and cover the surface with a transparent and slippery wetness which, far from drying or gumming or even collecting on the stylus, stays wet and unchanged and the stylus just skids in it. You can (but shouldn't, for other reasons) apply it in a depth which, with anything the least bit gummy or waxlike, would stop the sound cold in one revolution, and the stylus will stay in solid contact with the groove walls right through to the end. And the sound? Highs? Presence? To suggest such a thing is, of course, contrary to all the hallowed dogmas that surround record care, but with silicone spray, when you think you detect a slight difference in the sound, it is in the direction of being cleaner, wider range, more transparent, and less harsh! In two years of using this on all my records, I have yet to have the remotest suspicion of even the most minute loss of anything—except maybe distortion. Not that it eliminates huge amounts of distortion. This is a tool for perfectionists. But right from the first time I used it, I was assailed with the feeling that the sound *was* a little bit sweeter and more "transparent," and on one or two of my records I was even surer. Logically, this is not hopelessly mystic. With high friction between stylus and groove wall, the jewel will be pulled every half cycle, and spurious energy will be imparted to the stylus assembly which may not be quite taken care of by even a new set of damping blocks. Similarly, minute noise-producing surface irregularities will be more likely to just push the jewel vertically up or down, without at the same time "twanging" the stylus assembly, as it were. I do remember one instance in particular where the noise level of the dry, destaticised record was quite high, and was markedly reduced by lubrication.

Cautions

Every silver lining has a cloud. (Well, almost.) In the case of record lubrication, although the effects so far as the diamond and the vinylite are concerned

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appear to be unequivocally beneficial, the very property of lubrication gives rise to potential pitfalls in other departments. For one thing, if any significant quantity of the silicone were to get on the idler of a turntable, WOW! This is fairly obvious, and can be circumvented by spraying the records a good distance away from the turntable. Not so obvious is an instance such as recently came to light in the writer's system. In the ESL cartridge, both the damping and the compliance depend upon the friction between two tiny latex rubber sleevings and the vertical shaft on which the coil is mounted. Yielding to a temptation which I think might affect other users of the silicone spray, namely, to apply it very liberally, I unwittingly subjected this bearing to about nine months of infiltration by the silicone with perhaps some of the carrier materials. It eventually came to light that the lower bearing was not functioning, the shaft turning freely in the latex and leaving only the sleeving at the top of the shaft to provide restoring force and damping. Fortunately, the ESL factory tells me that they can dissamble the cartridge and replace the latex, but my experience serves as a helpful reminder: with the silicone spray, do as the literature on it says, and apply it *very* sparingly, so that there is only a dew of globules cast over the record surface. The stylus will then spread it in the grooves; the silicone is so efficient that very little is needed to lubricate. The above should make it clear that, in advocating the lubrication of records, I am not professing to know *all* of the *ultimate* consequences of using any particular product. For my part, I intend, after getting my cartridge fixed, to go right on using the silicone spray, from now on being careful to use only a thin film of it. I want to re-emphasize that the silicone spray, no matter how heavily it is applied, does not "gum up" a cartridge or anything else. It stays liquid and slippery until after some time it disappears, leaving no visible trace, although the inventor assures me that the invisible film of silicone is still there, and functioning. It never hardens or accumulates. It just lubricates anything it comes into contact with, that's all! It seems to me not too likely that any other cartridge than the ESL would be affected. Previous experience with a Viscaloid damped cartridge appears fairly conclusive on the point that Viscaloid is little, if at all, affected by the spray, even in excessive quantities. Thus the G.E., Audax, and most cantilever type variable reluctance cartridges should be immune to these lubrication side-effects. I believe that Pickering cartridges 140, 240 et al, of that vintage already use silicone grease for damping, packed around the stylus and held in by a piece of neoprene, so it would seem unlikely that these cartridges would be affected in any way, although here again I cannot be dead sure, not being a chemist. In a recent Fairchild design, the damping appears to be accomplished by a viscaloid block rather than the rubber membrane through which the stylus bar protrudes. These are only guesses based on moderate knowledge however, and those desiring to make doubly sure should write the manufacturers of the cartridge and record potion in question. Eventually advertisements of potions may include statements to the effect of, "unconditionally guaranteed to be compatible, chemically and mechanically, with all known phono cartridges," but until then any such guarantees will have to be obtained on an individual basis. Although the writer believes that in the vast majority of cases no difficulty of any kind will be encountered if the lubricating material is not applied in excessive amounts, the present article should not be taken as a guarantee of this.

Conclusions

In view of the tangible results described in this article, as well as what seem to the writer to be fairly inescapable common sense considerations, it appears that the grounds for reasonable doubt as to the high value of record lubrication are not extensive. The quality of sound that can be obtained from a disc reproducing system is vitally dependent on near perfect roundness or ellipticality of the tip of the jewel—flats cause that type of raspy distortion that has always seemed to me to be the worst sounding of all distortions, bar none! At 6–8 grams on a dry record even a diamond, although it may "last" a long time, gets substantial flats in a mere 150 hours or so, and with all the diamond dust from these flats ground into the groove wall where the shoulders of the stylus tip run, future diamonds are likely to be worn with ever increasing efficiency since the dust from a diamond, embedded in plastic, makes an abrasive surface that can scratch a diamond. Lubrication of this surface will greatly reduce the rate at which particles are removed from the diamond, and probably reduce the likelihood of their becoming embedded in the plastic as they are removed. With lubrication, they may be expected to slip to one side or the other of the point of contact of the passing stylus. Even if a particle should get caught under the stylus and pushed into the plastic the lubricant might, perhaps aided by capillary action, seep gradually in between the particle and the plastic. The latter, thus lubricated, would be less able to hold the particle rigidly in place, and as a result of all the above effects the conditions for efficient wear of diamond styli would be

eliminated to a great degree. If styli can be made to last longer, then the amount of money available to a given audiofan for the important purpose of stylus maintenance will provide a higher minimum standard of fidelity, in frequency response, low noise level, and freedom from distortion.

From the standpoint of the disc, the logical consequences of lubrication are no less interesting. Vinylite is thermoplastic, if the injunctions on some LP jackets to keep them away from sources of heat mean anything. On a dry record, the points of contact of the stylus are said to reach extremely high temperatures, as they might certainly be expected to. Thus the points of contact will tend to cut little tracks for themselves which would pass right through any steep-fronted modulation the amplitude of which was comparable to the dimensions of the tracks. With lubrication, the temperature of these points of contact should be reduced, thus lessening this cut-through effect on low-amplitude high frequencies. Therefore, if the high-frequency response of a good record appears to be even slightly better with lubrication, there is some logical reason to expect this.

The LP record is really an amazingly tough article. How it manages to last any time at all on these sapphire meat-axes in leatherette-covered suitcases that most people use nowadays, passeth my understanding. But it may be assumed that a good many of the readers of this magazine would like to have their records do better than just not fold up completely. Lubrication provides a means of slowing down the deterioration of sound on discs to the practical vanishing point. In my experience since lubricating all my records, the amount of use that a record has had seems hardly to be a factor any more. Original fidelity being equal, the record I got yesterday has no special advantages, in relation to sound, over the one I've been playing over the last six months. (Don't worry, record companies, I still go right on buying records, spurred on, if anything, by the feeling that they are so permanent.) I can, in general, turn a person loose in my collection, to pick the *music* he likes, confident that any disc he picks (except a few inherently low-fi items bought for sentimental reasons) will be of demonstration quality, not marred by that harsh sound that makes people say polite things but think "I like my Magnamuddyboom mahogany console better." In its long-term effects in preserving the demonstrability of favorite demonstration records, in its drastic increase in stylus life, and sometimes even in a further heightening of the sonic purity of the latest white-hot sensation, lubrication is a potent tool for those who want their sound maximally clean. Æ

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ELIMINATION NETWORKS

(*from page 40*)

in *Fig.* 4, which we call the Total Elimination Circuit, all of the flaws in a hi-fi system are drastically reduced. When relay RLY_1 is open no acoustical energy will emanate from the speaker, resulting in an over-all improvement of the tone quality of the entire hi-fi system.

Æ

* Chief Engineer.

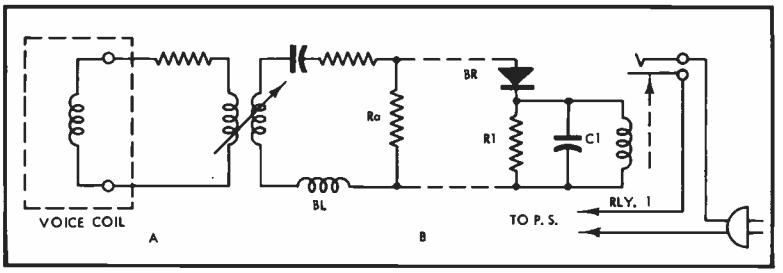


Fig. 4. Feedback-type network to actuate cut-off relay.

DAMPING-FACTOR METER

(*from page 23*)

readings as the effective value of a half-wave (at least) of signal was being integrated. With the capacitor-input full-wave rectifier now employed only the peaks are sampled and the noise problem is greatly reduced. Even so a noisy or hummy amplifier will show up in fluttery meter readings when one is trying to set R_s. Some relief can be attained by using a meter with heavy damping.

Both germanium diodes and a 6AL5 were tried in the two rectifier applications. For the power meter, the 6AL5 evidenced excessive Edison effect current and the crystals were used. For the comparison voltmeter, the crystals were slightly unstable especially with large delay voltages but no trouble is experienced with the 6AL5. (Perhaps silicon diodes would be the answer here).

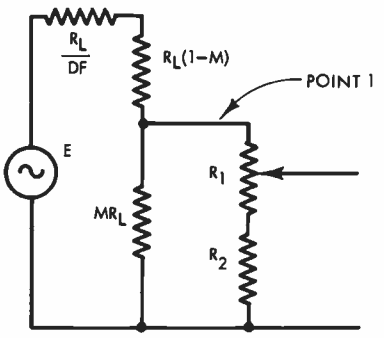
Separate binding posts are used for each resistance termination in conjunction with a load switch (S_2). It was considered unwise to expect that the large currents (5 amps in a 4-ohm load for 100 watts) could be handled by rotary switch contacts without trouble with resistance change.

One of the prime requirements was free circulation of air around the power dissipating resistors and this was accomplished by mounting them on a panel which stands off from the rear of the instrument proper.

Acknowledgment

It is a pleasure to acknowledge the help and interest in this project given by Mr. B. Buller when he was one of my senior students at the Ryerson Institute of Technology.

APPENDIX



$R_1 + R_2 \gg MR_L$

Voltage at point $1 = E\dfrac{M R_L}{R_L + R_L/DF} =$

$$E\frac{M R_L}{(DF\,R_L + R_L)/DF} = E\frac{M DF}{DF + 1}$$

When a 10 per cent change is made in R_L, the $(1-M)R_L$ portion of the load is reduced to $R_L(.9-M)$
The voltage at 1 now is

$$E\frac{M R_L}{R_L/DF + R_L(.9-M) + M R_L} =$$

$$E\frac{M R_L DF}{R_L + .9R_L DF} = E\frac{M DF}{1 + .9\,DF}$$

The fraction (at the arm of R_1) of this voltage *read* is $\dfrac{R_2 + K R_1}{R_1 + R_2}$ where K is fraction of R_1 between arm and bottom terminal. Voltage read is

$$\frac{R_2 + K R_1}{R_1 + R_2}\,\frac{E M DF}{1 + .9DF}$$

but K is chosen so that this equals $\dfrac{E M DF}{DF + 1}$

*audiofacts

The case of the vanishing ghost

To the TV viewer, a "ghost" is a faint, unwanted image, slightly displaced from the main picture. But although many home recordists are not aware of it, tape recording has its phantoms, too. In this case the "ghost" is a faint sound or "echo," displaced from the main signal. The audio engineer, who is very sensitive to even the slightest imperfections in recorded sound, calls this *print-through*—the magnetic echo that is induced from one layer of tape to the next on recorded tapes during storage. These print-through signals increase gradually with time and are accelerated by unfavorable storage conditions. Eventually, they can build up to annoying proportions.

Audio Devices engineers have been working on this problem for several years and have come up with *two* very effective solutions which can be used separately or in combination, to dispel the elusive "ghosts" of tape recording.

The first solution, pioneered by Audio Devices and announced to the trade last year, was the introduction of a new tape formulation which is highly impervious to print-through. This Master Audiotape reduces print-through by 8 db compared to ordinary tape—making it entirely negligible to even the most critical ear after years of storage.

The second solution, first "unveiled" at the Audio Show in New York, is the new Audio "ECHORASER"—a simple, inexpensive device which attaches to a tape recorder and removes up to 9 db of print-through from any recorded tape without affecting the recorded signals. Mounted between the supply reel and playback heads, it automatically wipes off the echo while the tape is being played back—adding new brilliance and clarity and reducing background noise.

For complete information on this new development, write to Dept. AA, Audio Devices, Inc., 444 Madison Avenue, New York 22, N. Y. Ask for Bulletin 500.

*one of a series

Therefore $\frac{R_t + K R_l}{R_l + R_t}$ must equal $\frac{1 + .9DF}{1 + DF}$

Now if $R_t = 9 R_l$ $\frac{9R_l + K R_l}{10 R_l} = \frac{1 + .9 DF}{1 + DF}$

Solving, $K = \frac{1}{1 + DF}$ or alternatively $DF = \frac{1 - K}{K}$

Since M disappears, the proportion of the load used for measurement is not significant unless it were to be made zero or unity. Æ

AUDIO ETC

(*from page 14*)

tising, that are now making up the bulk of mass stereo publicity. The unpleasantness extends into the component field, which is not exactly lily white in these respects though far better than the mass-production area.

Nobody can hope to purify stereo advertising and stereo equipment design to the point of utter perfection and honesty. But something had better be done towards at least a thorough house cleaning, or stereo really will be doomed.

Here, just to amuse you, are two ads I copied down recently out of a swank magazine. Just the words, not the fancy pictures. One cost almost $500. The other was $180. The pictures were pretty.

What struck me as interesting, though, was the different approach of the copy writers. One of them had this to say:

The voice of music, heard stereophonically, speaks of the sound of life, recreates the original performance (gotta get that in. . .), *adds such dimension to pleasure that the simple act of listening is an enobling experience."*

Somebody burnt a quart of midnight oil on that one. Sounds awfully noble to me, but it doesn't tell anything about the speaker separation. In fact it doesn't tell you anything at all of any practical use. "Speaks of the sound of life," my eye! The sound of life, by the way, will cost you 180 bucks.

The other ad, for a much more expensive stereo console, was decidedly more to the point and I commend both the writer and the company, which happens to be Pilot.

"The new So-and-so, with its companion model 180 speaker (straight to the essential point, you see. . .) *is a complete stereophonic system of identifiable components—the very same demanded for custom stereo installations. Locate these instruments in any room of your home, tune in an FM-AM stereo broadcast, and. . ."*

Well, better leave it there. The rest is a bit sticky. Nevertheless, and in spite of a bit of pardonable exaggeration, this ad is what I call a reasonable one under the circumstances, as is the equipment itself. Maybe it isn't what you would buy (and your component system will be cheaper, part for part) but it does have the essentials and it lists them, part by part, in the specs and the description. It will not mislead the gullible public in any serious way through it isn't exactly a thrift item.

If we could just get a bit more straight honesty into stereo advertising and into stereo building too, we would build up a whale of a lot more confidence in a system that is worth the confidence. Is it not? as the French say. Or as we say—right? Æ

IHFM INITIATES HI-FI CONSUMER PROGRAM. A consumer program to gain support for component high fidelity has been initiated by the Institute of High Fidelity Manufacturers. Known as the Institute of High Fidelity, membership in the program costs ten dollars yearly, and entitles consumer members to a monthly confidential news letter concerning advance reports on product development, engineering data, test analyses, book reports, magazine digests, and the like. Members also receive a test record or test tape with a stated value of $9.75. A six-month subscription is given to the subscriber's choice among a number of hi-fi magazines, as well as a free copy of a well-known hi-fi book. The Institute will also maintain a book-order department which will sell books to members at a 20 per cent discount. Charter subscribers will receive wall certificates and lapel pins indicating their membership.

Industry Notes . . .

STEREO DISCS DEFINED. At long last the engineering committee of the **Record Industry Association of America** has issued a definition of a "true" stereophonic disc. Approved by the RIAA board of directors, the definition states: "A true stereophonic disc record has two distinct orthogonal modulations derived from an original live recording in which a minimum of two separate channels were employed." The RIAA has recommended that all records conforming to this definition be so identified on the label and container Manufacturers have also been asked by the RIAA to designate discs which are not stereophonic as "monophonic" or "monaural."

B.I.C. NET AT RECORD LEVEL. Present rate of sales is highest in the history of **British Industries Corporation,** according to Leonard Carduner, president. Both profits and sales for the first nine months of 1958 hit new highs. Net earnings in the period ending September 30 were $358,313, or $1.22 per share. This compares with $343,356, or $1.17 per share, for the same period last year, based on present capitalization. Sales increased to $5,589,789 from $5,045,613.

EIA PLANS STEREO STANDARDS. Dr. W. R. G. Baker, engineerirg director of the **Electronics Industry Association,** has formed a stereophonic radio committee within the EIA to develop a set of standards for broadcasting stereo sound. Primary function of the group will be to establish a set of standards which, in the opinion of the industry, as represented by the EIA, represents the most economical method of serving the American public, according to Dr. Baker. He stated that the system to be chosen must have three primary qualities, namely: It must be compatible so that sets can receive regular FM programs as well as stereo broadcasts; it must be easy for the public to buy, and it must not be expensive.

FM SET SALES ON UPGRADE. Reflecting the country's expanding interest in high fidelity music, sales of FM receivers will top half a million during 1958, according to Ben Strouse, chairman of the NAB FM Radio Committee. Addressing a luncheon meeting in Washington, Mr. Strouse pointed out that there are now 565 commercial FM stations on the air compared with 533 last year. Largest builders of FM receivers are **Granco Products, Inc.,** of Long Island City, N. Y., and **Zenith Radio Corporation,** Chicago.

GLASER-STEERS EXPANDS. In order to satisfy a need for larger quarters brought on by growing public demand for the GS-Seventy Seven high-fidelity record changer, **Glaser-Steers Corp.,** manufacturer, is expanding production by moving into a new and larger plant at 155 Oraton St., Newark, N. J. According to Julius Glaser, president, the new facility will provide an expanding laboratory for research and development, a mechanized assembly line and a larger quality control department. In addition, the new plant will include a modern finishing and painting department, as well as expanded shipping and receiving facilities.

HI-FI CONCERT. A "Live vs. Recorded" concert will be given January 10 at New York's famous Carnegie Recital Hall. Sponsored by three companies in the high-fidelity field—**Acoustic Research, Dynakit,** and **Concertapes-Concertdisc**—the program will be presented by the noted Fine Arts Quartet. Sound of the live instruments will be instantaneously alternated with reproduced sound from stereo tape. The professional recording equipment and techniques of Concertapes will be used to make the tape, which will be reproduced through two Dynakit preamplifiers and Mark III amplifiers, and two Acoustic Research AR-3 speaker systems. Tickets are $1.05, and may be obtained directly or by mail from the Carnegie Hall box office.

ADVERTISING INDEX

A HYSTERISIS SYNCHRONOUS TURNTABLE KIT FOR 49.50

Check these outstanding features, they're exclusive with Gray at this LOW price

- ☐ Special hysterisis synchronous motor provides constant speed and lowest wow, flutter and rumble content.
- ☐ Heavy machine ground 12½" turntable platter with micro polished ⅞" shaft rotates in a super oilite bearing with noiseless nylon underfacing thereby guaranteeing freedom from vertical movement...a stereo prerequisite.
- ☐ Customized slip-proof, stretch-limited composite belt offers vibrationless link between motor and platter edge.
- ☐ Shock-proof motor mount is adjustable in 3 planes to compensate for lifetime movement and wear.
- ☐ Sturdy mounting plate offers maximum shielding. Easy to level and center because it extends past the platter and motor structure.
- ☐ Micro precision parts pretested for accuracy in sub assemblies.
- ☐ Assembly time 25 minutes or less with simple tools.

GRAY 33⅓ RPM SINGLE SPEED HSK-33 TURNTABLE KIT

Here's an exciting project for anybody who wants professional performance at a low kit cost. Gray engineering and custom mass production techniques now make this wonderful value possible. You'll be pleasantly surprised at how easy it is to fully assemble —and have ready for monaural or stereo operation—this studio designed turntable.

Also available at low cost . . . turntable bases in finished and kit form.

See and hear Gray high fidelity products at your favorite quality dealer.

Manufacturers of the world famous Gray tone arm.

GRAY *our 67th year in communications...*

High Fidelity Division

DEPT. A1 • 16 ARBOR STREET, HARTFORD 1, CONN.

the case of the stereo HUMMMMMMING BIRD *or* MAGNETIC *vs* CERAMIC

You may have been reading many controversial advertisements as to the merits of various stereo cartridges . . . namely, the magnetic version vs. the ceramic version. Qualified claims are made by their manufacturers . . . and most are accurate. But how a specific cartridge *sounds* in your stereo system is really the criterion. Let's consider the real facts:

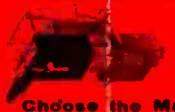
IT'S A FACT! Audio Engineers agree that magnetic stereo cartridges are excellent, costly . . . but burdened with *hum*. Tests prove that the new Electro-Voice Magneramic cartridge is completely hum-free. No motor or line hum can possibly be introduced to mar soft record passages, because the Magneramic is *non-inductive*.

IT'S AN ENGINEERING AXIOM! The simpler the design of a precision product, the less chance there is of manufacturing defect. Magnetic stereo cartridges are far more complicated than the comparable Electro-Voice Magneramic stereo cartridge. With E-V, you are assured years of trouble-free, high fidelity stereo performance.

IT'S POSITIVE! When the Electro-Voice corps of 60 engineers began intensive scientific stereo studies, they had the choice of either designing a magnetic or a ceramic cartridge. Knowing that two of the most vital factors for true audio reproduction were lack-of-hum and trouble-free performance, they took the positive approach and produced a stereo cartridge incorporating simple elements permitting positive, stable control for uniform output.

And so, with the advent of stereo, Electro-Voice introduced an entirely new concept in ceramic cartridges . . . a true high-fidelity series . . .

THE E-V MAGNERAMIC



which will consistently outperform the best magnetics and do away with the "hummingbird" in your stereo system.

Choose the Magneramic . . . a new improved E-V stereo cartridge which plugs directly into magnetic inputs. See why it's the choice of so many FM stations for critical stereo broadcasts:

- ✓ NO HUM
- ✓ BEST CHANNEL SEPARATION
  Over 25 db isolation between channels
- ✓ HIGHEST COMPLIANCE
  Horizontal and vertical compliance equal to or surpasses the best magnetic cartridges
- ✓ WIDEST RANGE FREQUENCY RESPONSE
  Far in excess of any monaural (monophonic) or stereo record
- ✓ FLATTEST RESPONSE TO WESTREX 1A VELOCITY CURVE
  From 20 cps to beyond audibility
- ✓ HIGH 20 MILLIVOLTS OUTPUT
  All the voltage you need . . . and then some
- ✓ PROVEN SUPERIOR
  for conventional monophonic records as well as stereo records
- ✓ SOLD ON MONEY-BACK GUARANTEE
  We invite you to try an E-V Magneramic, with E-V's unqualified guarantee backed by over 30 years as a manufacturer.

Give the Magneramic a thorough listening test. If for any reason you aren't completely convinced of its superiority, your FRANCHISED Electro-Voice dealer is authorized to give you a full refund.

Step up to the excitement of stereo . . . step up to Electro-Voice Stereo . . . the industry's standard. Over a half-million in use, more than the total of all other stereo cartridges combined, attest to its acceptance as stereo's standard. Choose either the E-V *Magneramic* for magnetic inputs or the E-V *Standard* Stereo Cartridge for non-magnetic inputs.

21 MD with 0.7 Mil Diamond Stylus, net $19.50; 26 MDST Turnunder with 0.7 Mil Diamond Stylus, and 3-Mil Sapphire Stylus for 78 R.P.M.'s, net $22.50; 21 MS with 0.7 Mil Sapphire Stylus, net $9.90; 26 MST Turnunder with 0.7 Mil Sapphire Stylus, and 3-Mil Sapphire Stylus for 78 R.P.M.'s, net $12.90.

GOOD STEREO DEPENDS ON THESE VITAL FEATURES: FREQUENCY RESPONSE, 20-16,000 cps flat (Westrex 1A); ELEMENTS, 2 PZT Ceramic; OUTPUT VOLTS, 20 mv. Nominal; COMPLIANCE, 2 x 10^{-6} cm/dyne; WEIGHT, 3.4 Grams; TRACKING FORCE, 4-6 Grams; CHANNEL SEPARATION, 25 db at 1 KC; MOUNTING, EIA (RETMA) Standard 1/2"-7/16" Center; STYLUS, .7 Mil (Diamond or Sapphire); OUTPUT TERMINALS, Standard .050 Connectors; IMPEDANCE OR LOAD, 22,000 ohm or higher magnetic input.

See your High Fidelity Specialist or write Dept. AD-2

STEREO STANDARD

Electro-Voice®

INC., BUCHANAN, MICHIGAN

Over ½ Million In Use . . .
MORE THAN ALL OTHERS COMBINED