AUDIO

APRIL, 1960
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APRIL, 1960 VOL. 44, No. 4

Successor to RADIO, Est. 1917.

AUDIO

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COVER PHOTO—Attractive installation in typical New York apartment. Designed by Stewart Hegeman, this installation features Harman-Kardon Madrigal ST-360 AM/FM tuner, Citation I stereo preamp, Citation II power amplifier, two EICO HFS-2 loudspeakers (designed by Hegeman), Rek-O-Kut turntable, Dyna-B&O professional arm and cartridge. Turntable cover is clear plexiglass, and is removed and stood on end when turntable is being loaded. During playing—or any time—the cover is a fine protection against kiddies or cats—the one at upper left is part Siamese, and is for real.

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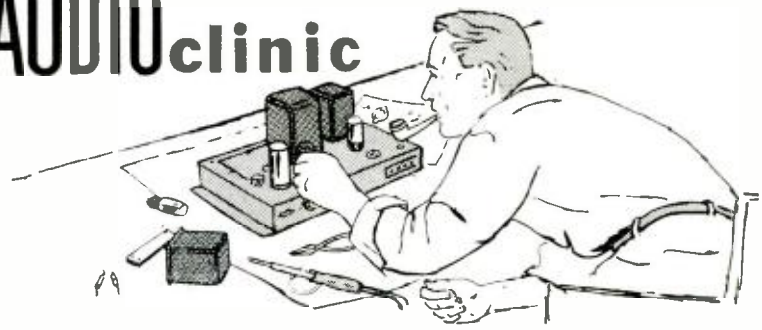
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JOSEPH GIOVANELLI*

Note

For the benefit of new subscribers to AUDIO, this column wishes to restate its policies.

1. Topics used in this column are taken from actual letters sent in by readers.

2. Any letter sent to the column at the address shown below receives a personal answer whether the material is suitable for the column or not.

3. Subject matters of columns is chosen with the idea of pleasing both new and old subscribers.

4. It is not possible to state in the personal answer to the correspondent in just which issue his letter will appear since columns are prepared well in advance of publication.

5. Please state in your original letter whether your name may be used in the column. No name is ever used without the permission of the writer.

6. Please send a stamped, self-addressed envelope to facilitate a reply.

7. Please write *clearly* and *distinctly*. It is regrettable but true that once in a while we receive a letter from which it is impossible to get any idea of what the writer wants to know.

The question now to be discussed was sent in by a new subscriber to AUDIO. It is so basic to the art of sound reproduction that it will extend beyond the length of a single column. This is a departure from the usual "Audioclinic" format in that normally two or three questions are delt with in a single column.

Measurements

Q. As a neophite in electronics and a new subscriber, I would appreciate an article on: 1. How to make measurements in audio systems. 2. Pitfalls to avoid in measuring. 3. What do the measurements mean? H. H. Gillman, West Orange, New Jersey.

A. Your question represents a fairly tall order, but here goes for what it's worth:

A brief discussion of measurements used in testing high fidelity equipment should start by saying that the average person will not want to bother with measuring anything. This is the problem of the design engineer. Of course, many who read this magazine are experimenters. For them such a discussion is in order.

There are certain basic measurements which can be made by the person servicing amplifiers and preamplifiers. Even if you do not design equipment but just service your own, it is a good idea to have an understanding of how these measurements are made.

In equipment failure the first thing to suspect is a bad tube. This is fairly easy to determine when the tube under consideration is a rectifier tube or an output tube. If it does not glow it probably means that the filament is open. Certain types of filament failure, however, cannot be detected in this way. Because some tubes in their normal operation emit little light, failure of the filaments in such tubes would pass undetected in the reflected light of the good tubes surrounding them. The best thing to do in such a case is to remove the tube from its socket and measure the resistance of the filament. The base pins which connect to the filament can be determined from your tube manual. (A tube manual, by the way, is an important part of the equipment you should have on hand, both for maintenance and design work.) Connect the terminals of your ohmmeter to the proper base pins and note whether you get a reading. A reading of infinity will indicate that the tube is bad. You should get a reading of a few ohms if the tube is good. The reading is always lower than you would expect when you know the current and the voltage at which the tube operates. The resistance of the filament is lower when cold than when it has begun to heat. The resistance rises rapidly when heating. The voltage produced by your ohmmeter may be sufficient to cause the filament's resistance to rise. This can be seen by the reading gradually moving upscale. Disconnect the ohmmeter from the tube for a minute and you will find that the tube's resistance has dropped once more.

There are other types of tube failures which can cause an amplifier to cease working completely or to work with low sound output or with serious distortion. Most of these failures can be best checked with a tube tester. This is easier to do than ever because so many drugstores and supermarkets are installing testers these days, thus eliminating the need to have this testing done by a dealer. In the event of equipment failure the first thing that should be suspected is tube failure.

Another piece of equipment which is of great value is a good voltmeter having a sensitivity of at least 20,000 ohms per volt. This instrument can be used to check plate and d.c. heater voltages in various parts of the circuit. The meter should have a maximum reading of about 1000 volts with several ranges below this reading. The lowest range should read one volt full scale. It is possible to add a rectifier circuit to the instrument which will permit measuring of filament voltages of those tubes heated by a.c., and to measure line voltage and other a.c. voltages which may be present. *Do not try to measure a.c. voltages whose value is greater than the*

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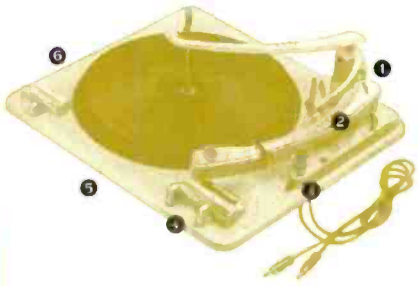
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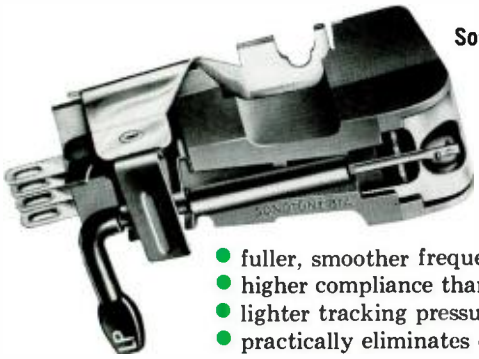
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Compliance	3.0 x 10⁻⁶ cm/dyne	1.5 x 10⁻⁶ cm/dyne
Tracking Pressure	3-5 grams in professional arms 4-6 grams in changers	5-7 grams
Output Voltage	0.3 volt	0.5 volt
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voltage breakdown rating of the rectifier used. While this instrument will measure a.c. voltages of the type described, it will not measure grid signal voltages with any degree of accuracy because the impedance of the meter is much lower than that of the grid to which it is attached, and this will load down the circuit This is especially serious if you wish to measure the frequency response of a voltage amplifier. All such measurements must be made with a special instrument known as a high impedance a.c. VTVM (vacuum-tube voltmeter). If all you intend to do is to service your own equipment, you probably can dispense with the VTVM. Your voltmeter and your ohmmeter (another piece of very important equipment) will be your most valuable tools. Some instruction manuals list the voltages and resistances which appear on the various tube base terminals, and may even list the resistances between these pins and ground. Unless otherwise specified, all measurements are made between a particular pin and ground. The help provided by such a chart is obvious.

It will be impossible for me to list here all the problems which may arise when servicing a piece of audio equipment, but I can say that there are various shortcuts provided by symptoms displayed by the faulty unit. Suppose an amplifier ceases working completely. If you see that the rectifier tube is not lighting up, it is virtually certain that this tube is burned out, and no measuring need be done. Suppose that your amplifier is operating but is very distorted. Suppose that you observe that the output tubes are glowing a violent red. You can assume that the bias resistor has shorted out or that the filters for the fixed bias power supply have shorted and must be replaced. It may also be that the rectifier supplying the fixed bias has failed. Much depends upon the circuit. If only one tube glows in this manner, you might suppose that the coupling capacitor which feeds signal to its control grid had shorted. When this happens, the d.c. plate voltage from the driver stage will be directly connected to the grid. Grids, you will remember, are supposed to be operated negative with respect to ground as a general rule. The d.c. voltage will make the grid positive, and this, in turn, will cause the tube to draw excessive plate current.

Home-built equipment is subject to other problems, especially when the builder is just learning. He may have trouble with solder joints. Such joints may seem good when the unit was first tried, but loosen during operation. Trouble of this type is often of an intermittent nature and is best traced by moving wires and components around rather than by more conventional measuring techniques. (I'll bet that this approach is more conventional than many of us would like to admit.)

Other troubles which can arise are created when components are overheated by excessive soldering times. Their values may change or they may become shorted or open. This is an important consideration when tracing the trouble in that kit you just finished or that amplifier you designed and built.

One measurement which is sometimes necessary is that of the amount of current flowing through a resistor. You could disconnect one end of the resistor and connect a milliammeter in series with the resistor and the connection to which it (the resistor) formerly went, but this is certainly unnecessary as long as you know the value of the resistor. The true value of the resistor may not be the value shown on it.

(*Continued on page 8*)

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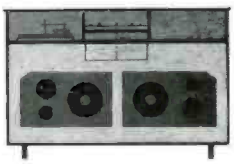
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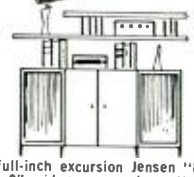
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See EICO's best buys in tuners and amplifiers on page 1.

LETTERS

Tape Noise Suggestions

SIR:

The January TAPE GUIDE article, "Improving the Signal-to-Noise Ratio," gave many good hints to the owners of tape recorders. Please allow me a few words of my own on this subject.

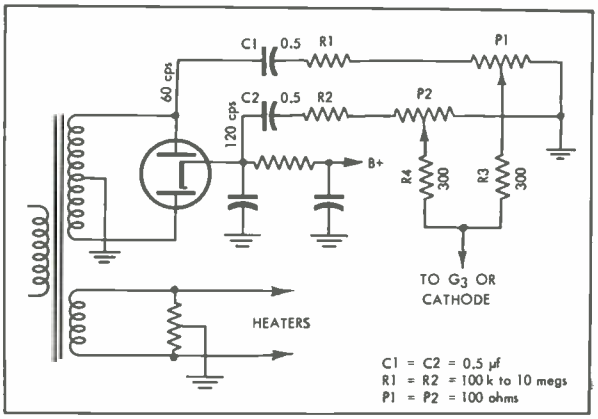
I believe the most important fact is the need for demagnetizing tools. People have brought tape recorders to me with the remark, "I just cleaned the heads and now it's hissing." You know it's so easy to make it hiss—just a little rag dipped in some cleaning solvent and the whole works wrapped around a magnetized screwdriver.

In addition to the tubes mentioned, one might also try the GE-6072. Another exceptionally good tube in the pentode class is the Telefunken EF804, with its golden grid. This is a long-life tube, with a guaranty of 10,000 hours, and it was designed for amplifiers requiring a tube with a low "flicker effect," such as might be needed in encephalographs, cardiographs, and so on. In general, the EF804 is identical in characteristics with the EF86, but the socket wiring is different.

Some improvement may be obtained by reversing the power plug. This is a trick that gives good results on almost any recorder. One leading German manufacturer (Eberhard Vollmer) uses DPDT switches on all components using a.c.—the three motors, solenoids used for braking the motors, relays, and so on. With these switches the user can change the polarity on any component. There is also a polarity reversing switch for the whole machine.

Even if one has access to Mumetal, he should stay away from machining or bending this material. Any bending or drilling (the material gets warm, if not hot) will result in a complete loss of the magnetic properties. If one does not know the proper heat treatment, he would be better off to use a tin can.

A hum-bucking potentiometer has the best effect when used on a separate filament winding. Sometimes reversing the filament wires helps a lot. In some cases a positive bias of about 25 volts brought to the centertap of the filament winding will be found helpful.



The drawing shows a circuit which gives excellent results in reducing 120- and 60-cps hum. C_1 and C_2 should be 1000- and 600-volt types, respectively. If the first tube has no separate suppressor grid, the connection may be made to the cathode (if it is not too heavily bypassed). R_3 and R_4 should then be changed to 1000 ohms. Before connecting C_1 permanently try both rectifier plates to make sure of obtaining the correct polarity for cancelling out the hum in the amplifier.

In many instances good results can be obtained by using a hum-bucking coil in series with the playback head. The coil can be of various dimensions, but I have found that a 1½-inch diameter coil consisting of 3 to 5 turns of No. 12 or 14 copper wire mounted close to a transformer or motor will do the trick well. By changing the position of the coil with respect to transformer or motor, it is possible to cancel out the 60-cps hum component induced in the playback head.

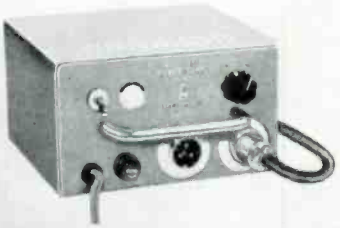
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AUDIOMAN NO. 7

Professional Audio Technician puts into practice the same principles of high-quality installation in his own home as he provides for his company's sound engineering customers.

HENRY E. RIEKELS, JR., of Muskegon, Michigan, has—apparently—a hobby. And he also has a business activity. Furthermore, he is in that ideal situation where his business and his hobby are one and the same. Proof of his very active interest in audio is shown in his home installation, part of which appears below, with the following equipment mounted on the rack, from top to bottom: Bell T202 tape recorder with two Bell RP120 preamps, the recorder being equipped with two 2-track heads; Fisher FM-40 tuner and 50-C preamp, Scott 299 stereo preamp-amplifier, custom-designed VU meter panel, patching jacks, and an Altec 400B monitor speaker. To the right of the rack, which is on casters for moving out for servicing and occasional changes, can be seen a Collaro RC54 record changer and a Rek-O-Kut LP743 with Pickering 190-D arm, on which he uses Pickering 260-DS and Fluxvalve 371-D cartridges. Above the phono shelf reposes some of his test equipment. Not shown, but in use with this system are a Fisher 50-F Hi-Lo filter system, and Altec 633 microphones, A333-A amplifier, and a pair of 604C Duplex loudspeakers in 606A cabinets.



The system was designed with thought for experimental purposes rather than for meeting the decor of the usual living or music room. The rack arrangement makes it possible to substitute another unit into the system for extended listening tests while keeping the entire operation in working order. The second stereo head on the tape recorder permits monitoring off the tape while recording, and can serve as an echo system when desired. The meters are used for balancing stereo channels and for monitoring various sources of material when patched for recording. The basic monophonic system affords background music for the rest of the house or as a monophonic listening system, in which case one or both of the 604C's are patched to it. It also affords a center-speaker source (left plus right) for stereo reproduction. The entire system is built along solid commercial lines, but still gives its builder many fine hours of serious listening.

Mr. Riekels has other hobbies too—in sports he goes in for sailing, waterskiing, ice skating, and hunting, but he also likes automotive activities, books, travel, photography, and—of course—audio. He attends most of the concerts and plays presented in his area, and while he does not play any musical instrument except the phonograph he does participate in Civic Opera and Theatre, and in the activities of the Junior Chamber of Commerce.

His current problem is the development of the ideal installation for sound reinforcement systems in roller rinks, where the ambient noise level is usually somewhat overpowering. When he discovers the solution, we trust he will make it the subject of an article for Audio. Æ



Rack mounting of standard components provides ideal flexibility for the experimenter.

AUDIOCLINIC

(*from page 4*)

The true value of the circuit resistance, as far as the actual circuit in which it is used is concerned, is the resistance of the resistor itself and that of the components which may be in parallel with it. Suppose you have a 3000-ohm resistor connected between cathode and ground, across which is connected an inductance whose d.c. resistance is 300 ohms. The true resistance is much closer to 300 ohms than it is to 3000, and you will find from calculation that the resistance is less than 300 ohms. True resistance of two or more resistances in parallel can be determined by dividing the product of all the individual resistance values by their sum. (Make sure that all resistances are expressed in the same quanties—i. e., do not multiply ohms by megohms.) Now we know the true resistance of the circuit. Leave the resistor in place and measure the voltage across it. Since you know the voltage and the resistance across which that voltage was developed, you can find the current by using Ohm's Law. (Current in amperes through a resistor is obtained by measuring the voltage appearing across the resistor and dividing it by the value of the resistor in ohms.) Since this method is employed almost exclusively, an ammeter is practically unnecessary. When an ammeter is desired, be sure that it has the lowest possible resistance. If the resistance is high, the voltage lost across the meter will be sufficiently great to affect the reading. To illustrate this, assume that the resistance of the circuit to be measured is 10,000 ohms. Suppose the resistance of the ammeter is also 10,000 ohms. Half of the voltage intended for the circuit to be measured will be lost across the meter and will, therefore, not be available for use by the circuit. Since it cannot get its proper voltage, it cannot draw the current it would normally draw. All current measurements create this problem to some extent but the extent is so slight in most cases that the error is unimportant.

Thus concludes this brief summary of the measurements most often made in connection with equipment maintenance. Next month we shall take up the subject of the measurements which are used to determine the performance of an amplifier. Æ

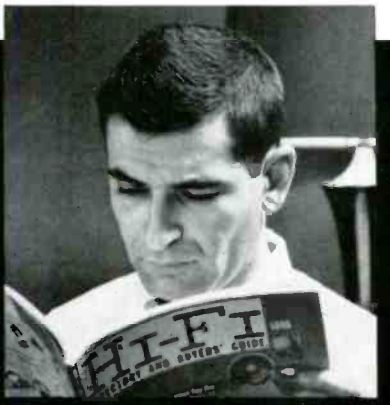
NEW LITERATURE

• **Radio Shack Corp.,** Boston 17, Mass., through its Industrial and Government division, has published a semiconductor buying and engineering guide suited to the needs of both the purchasing agent and the engineer. Included in the 24-page book are two listings of the semiconductors made by nine manufacturers—in sequence by parameter and function, and by transistor and diode type number. An additional feature of the catalog is a section devoted to dimensioned mounting diagrams. Requests for copies should be addressed to the I and G division. **D-22**

• **Electro-Voice, Inc.,** Buchanan, Mich., airs some highly informative discussions for radio, television and recording engineers in "Microphone Facts," a newsletter written by Lou Burroughs, E-V vice-president in charge of broadcast and recording equipment. Individual problems, case histories, and new ideas and developments are discussed, along with such subjects as microphone loading, directional characteristics, and new equipment. Requests for copies should be addressed direct to Mr. Burroughs.

(*Continued on page 63*)

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AUDIO ETC.

Edward Tatnall Canby

(1) TAPE— THE REPERTORY INDEX

I suppose that if I could hire me a professional market surveyor I might be able to report "from authoritative sources" as to the present status of tape in all its home-hi-fi forms; but the situation is so clearly undefined, so transparently muddy, so replete with claims and counterclaims (as people say when they are unable to state "we have it on high authority . . ."), that, well, I suddenly feel it's a good time to take a few moments out to describe the muddiness. Nobody in the tape business is going to do *that*.

I can remember the days when people from the lay public would ask me "shall I convert to LP, or do you think it really is worthwhile?" Now (and for a long time back, too) they ask, have been asking, "Is it worthwhile going over to tape?" Or, "I'm just starting a hi-fi system—shall I make it disc *or* tape?"

Such questions! There are two stock answers that may safely be given now as at any time during the last—say—four years, maybe five. They are in separate and very different areas.

1. Yes, tape records as played on a reasonably good—not the cheapest—tape deck or recorder, will provide generally somewhat superior performance in terms of tape-head signal *vs.* the signal from a comparable disc pickup.

The word "comparable" is troublesome, of course; it all depends on what you mean, for tape equipment (generally speaking, as usual) does cost more than "comparable" disc playing equipment and so you must decide first on your basis of comparison. But, taking both the reproducing units and the records themselves, I think we can grant a generally likely superiority in tape signals *vs.* disc, via all tape systems used to date including 4-track. Good points, for all tape, are its non-click, non-swish low noise level (good discs are virtually noiseless now, too) and in particular its generally wider dynamic range; also a certain softness, a trueness of sound that no doubt stems from the lack of *any* mechanical moving element, no matter how small.

2. In terms of musical repertory, tape is still in its pre-natal stage *vis-a-vis* disc.

I'm reminded of a priceless book on American music published about 1904 where the author states optimistically that though a few years earlier there had been only one serious composer in our country (John Knowles Paine, I think it was), now, in 1904, there were no less than four! Tremendous progress. So, too, the tape people are boasting that 4-track stereo tapes now run well up into the hundreds. True enough, and who wants more than a couple of hundred tapes, anyhow? But, just the same, you can't put aside the fact that on LP there are merely some twenty thousand or so titles available and probably more, of which a relatively microscopic number are also available in tape form.

Again, you see, it all depends. If you want a few pleasant tapes of the more familiar classics and some few selected specialties, as provided in the present modest but growing tape repertory, or if you like mood music, some jazz, show tunes, hi-fi noises and the like, you'll find all the variety you need on tape, and more every month. This is true *already*, regardless of which system you use. But if you are aware of the huge LP availabilities and the enormous monthly new release lists on disc, if you are hep on the wider areas of music itself—then you will not rely on tape right now. The *musical* choice is strictly limited, necessarily.

It seems to me that the question of recorded tape or no tape in the home is basically to be decided on these two points in virtually every individual case (if we put aside home tape recording as an important but separate extra consideration). The extremes of available cash, the extremes of feeling as to the importance of the "best possible" sound and the best possible music, are positively huge among us. Each man must weigh his own emotions and his own money bags. It all depends on what *you* want out of tape as compared with disc, or as a supplement to disc. In every case, these points, as above, cover the basic clinching arguments.

Except for one, which at the moment is even more problematical than ever before, to paraphrase an ad in reverse. The future.

What I have said above can be nicely applied to the tape-*vs.*-disc situation at any time up to the present, and back to the first appearance of commercially released tape recordings. There have been relatively minor variations, up and down, as tape format shifted from one system to another. But throughout this period, and still at present, the situation has been unvarying in its basic shape—namely, that whereas virtually all new recordings are released simultaneously *in all current disc forms* (now it is mono and stereo; it has been LP and 78, or LP and 45), most new releases are *not* issued simultaneously on tape. An unavoidable fact.

Do not confuse this statement with its complementary opposite, that in this entire period *virtually all tape releases have been simultaneously available on disc.* A few interesting exceptions—not many—and some unimportant time differentiation, the tape or disc version released at a different time from its opposite number.

In other words, and to put it baldly, you can get just about every tape on the market in disc form too; but only a small percentage of discs can be had on tape as well. This is no criticism of the tape interests involved—far from it. They are working nobly to expand what they have (and in the various forms that have been available) into a reasonably representative catalogue of recorded material.*

But look at the contrast. When stereo disc started, it also faced the problem of availabilities. In the first few months, the situation was much like that in tape, only worse (since stereo discs were inevitably uneven in quality and playback equipment was even more unreliable at first). A handful of stereo discs, in duplications, mostly, of material already out in mono and/or tape. Yet since that time, the stereo catalogue has marched forward in a smooth upward curve of availability until now the stereo offerings are so enormous—on disc—that the mere difference of maybe eight or ten thousand titles is not vitally important; you can get *almost* anything on stereo disc now. And, anyhow, you can play your mono discs on the same equipment. The "plus" potentials are very great, the minuses relatively small. With stereo disc, as of now, you have at least a good chance to have your cakes, all sorts of cakes, and eat them too.

Is it any wonder, then, that people find tape a doubtful proposition—quite aside from the difference in systems, a vital and very difficult problem in itself?

Now I admit I've turned the argument around, put the cart before the horse. Admittedly, tape repertory isn't yet large *because* of technical problems and system rivalries, *because* of the false starts, the drastic changes, the complications, that have inhibited sales.

Wrong-Way Circle

From the business and manufacturing viewpoint, from the promotional viewpoint, repertory comes as a result of sales success, not beforehand.

But, alas, from the callous public's-eye point of view, the repertory has to be there first, or else. It's a vicious circle when it's revolving the wrong way. It's a bonanza when and if it can be made self-sustaining. That's the problem.

One major reason people didn't buy the Edsel was because other people didn't buy the Edsel. Some people didn't buy it because it was too new; still others didn't buy it because it wasn't new enough. How can you win? Better—how can you break out of this negative-type vicious circle, in any field? How about tape?

And so we come to the rival systems, of the past and the present and the future. The future of taped records is still explosive because, as of my present writing, the last word has not yet been said and more major developments are still on the way towards launching—maybe. If the Edsel didn't go, then maybe the Comet would do better, along with the Falcon. Different emphasis, different appeal, different economics, new name, new sales techniques. Try, try again.

I haven't a ghost of an idea, at this moment, whether RCA's cartridge tape will, or will not, have at publication time been

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* We do not feel there is a need for duplicate reviewing of the *music*, whether on disc or tape. United Stereo Tapes had, in its January catalogue sheet, 376 titles of all types of music. As soon as the mechanics can be set up successfully, all records reviewed will show the UST number with a symbol if a 4-track tape is available of that particular selection. If the tape is reviewed, the tape number will be listed first; if the disc is reviewed, the disc number will be listed first. However, neither RCA nor Columbia are in the United Stereo Tape family. Yet.—Ed.

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New HFS5 2-Way Speaker System Semi-Kit complete with factory-built ¾" veneered plywood (4 sides) cabinet. Bellows-suspension, ⅜" excursion, 8" woofer (45 cps. res.), & 3½" cone tweeter. 1¼" cu. ft. ducted-port enclosure. System Q of ½ for smoothest freq. & best transient resp. 45-14,000 cps clean, useful resp. 16 ohms. HWD: 24", 12½", 10½". Unfinished birch **$47.50.** Walnut, mahogany or teak **$59.50.**

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, 8 ohms. HWD: 23" x 11" x 9". Price **$39.95.**

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†Shown in optional Furniture Wood Cabinet **WE71:** Unfinished Birch, **$9.95;** Walnut or Mahogany, **$13.95.**

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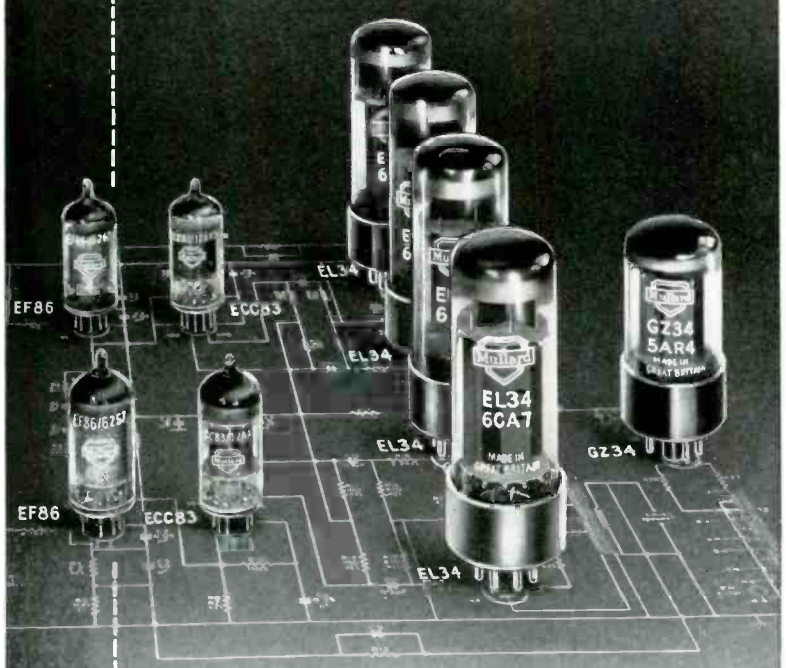
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challenged in public by a new rival system that has been under development for this very purpose (and in the expected opposite corner), involving tape that is half as big, goes half as fast, probably takes up a quarter the room and will even work on a species of "changer" if rumors are right. (A printed account appeared in mid-winter, perhaps a handily inspired official "leak.")

At least, it is possible to speculate on its impact even before it becomes available, if it ever does. In any case, this is one more new "system" and to please the public, to go over with a real splash, it clearly will have to be *really* radical, enormously attractive, breathtakingly new. Anything less will die a quick death at this advanced date. How will we know?

Catalogue Padding

Now I have an interesting idea to throw at you in this connection, stemming from what has already been said. A major splash in the field of records—any type at all—can be measured objectively in one highly effective way that is virtually proof against tampering and wishful advertising—the available repertory.

Indeed, there is no better economic index for you and me, if we really want to know how well a new project in this area is actually going. It is practically infallible, because anybody with his head where it belongs can see straight through even the most devious sorts of hocus-pocus that can be applied to it with intent to brighten a not-so-bright picture.

Repertory, over the months and years, depends on successful sales. Big sales: growing repertory. Small sales: much padding.

True, you can "pad" a small catalogue with an actual flood of new releases, artificially pumped out in order to stimulate sales; but this can't last. Not even the biggest companies can keep it up for very long.

Of course, you can pad your catalogue on paper, and this is often enough done. But anybody can spot such a padded catalogue in seconds. It tells its own story even better than an un-padded list that is true to size.

How to pad? Just take a single recording, say, with three different short works on it, list it first under three composers, three orchestras; then list it again under a batch of helpful categories (padded catalogues are always intended to be helpful), like "Symphony," "Strings," "Modern Classics," "Mood"—your helpfulness is limited only by your powers of invention.

You can list your records under nationalities—"Spanish"—and the like. List 'em under Solo Artist, under Conductor, etcetc. And be sure to assign a separate catalogue number for each speed or type, say 7½ ips and 3¾. That'll double your entries, straight through!

In no time, you see, you can build a handsome 50-page catalogue of availabilities out of a dozen or so hard items. Easy. But if you want the opposite just take a look at Mr. Schwann's current LP disc catalogue. It is now so boiled down that you have to learn the abbreviations by heart, and there are *very* few duplicate entries. That is a real catalogue.

The Reviewers' Index

It's easy to spot the situation by this handy index. You don't even have to read between the lines. But I have still another system of my own that is perhaps even more effective as an indicator of record-sales success. It won't work for you, but it keeps me *au courant* very nicely, without even a look at a catalogue or into a store.

(Continued on page 38)

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the tape that cost $9,000,000 to perfect!

Soundcraft Tape with the new FA-4 frequency adjusted formulation. Designed to meet the unlimited challenge of the most exciting new era in recording history!

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CHESTER SANTON*

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

STEREOPHONIC

Dick Schory: Music To Break Any Wood
RCA Victor LSP 2125

Several months having elapsed since the first disturbance took place in Chicago's Orchestra Hall (Music for Bang, baa-room and Harp LSP 1866), percussion impresario Dick Schory and RCA recording director Bob Bollard decided recently that the hall had recovered sufficient equilibrium to withstand another assault. Once again, the relatively shallow stage of the hall was covered with about a hundred percussion instruments of varying temperament. Unlike the previous session, when sonic honors were evenly distributed among the dozen men of Schory's ensemble, the starring role was now assigned to the individual in charge of an innocent-looking circular monster making its debut in Orchestra Hall—a six-foot gong, said to be the only one of its kind. Heard in action, the mild whisper of the hammer blow does not prepare one for the vibratory saturnalia that follows. With stereo providing an added quantity of oxygen, the gong begins to glow as the area of vibration widens to its full dimension. As they say in the Irish theatre—it's a daarlin' sound!

In order to gauge over-all improvements in this second Schory release, I sampled it next to Bang, baa-room etc. which was taped back in June, 1958. Impressive cleanliness is easy to notice in this newer album with excellent presence maintained at what appears to be a slightly greater miking distance. Although a word such as "lyrical" is seldom used in discussing percussion projects, the vibes and gently swinging harp lend it just that quality in tunes that include *Speak Low* and *Autumn in New York*. LSP 1866 still has the edge in weight of big-drum sound delivered in two-channel unison but Schory's latest enjoys better cutting facilities and that gong is sure to hold your attention for the thirty seconds it takes to deliver its message.

Burt Buhrman: And The Pipes Will Play
Columbia CS 8193

Leaf through the two pages devoted to organ recordings in the pop section of the latest disc catalog. Search through the listings all the way from Bob Anderson to Klaus Wunderlick. I don't think you'll find a stereo record of a Wurlitzer organ that can match the qualities of this brand new Columbia release. Collectors of outstanding pipe organ discs scarcely need to be reminded that the Mosque in Richmond, Virginia, was the scene of some pretty wild recording sessions when LP's were coming into their first heyday. If you have associated this particular Wurlitzer—one of the best in the country—with scrambling novelties, you may be surprised to discover what it can do in standard tunes played with poise and taste by Burt Buhrman. His choice of voices stresses a natural quality of easy sweetness that I hadn't heard in previous recordings made in the hall. The miking focal point is close enough for good spotting of the organ sections without loss of room liveness. A honey of a record.

Jose Greco: Flamenco Fury
✪ MGM ST 3741

Does trouping experience play a role in the proceedings when a Flamenco troupe invades a recording studio? Most Flamenco sessions capitalize on an impromptu atmosphere and this one is no exception. As usual, the guitars set the pace and mood. The singing, dancing, hand clapping, and snapping of fingers proceed as if improvised at the moment. Yet it is soon evident that the Jose Greco troupe has a polish and flair that you won't find in Flamenco performers just getting established in theatres and night clubs. You certainly won't uncover this finished style in a group thrown together for a recording date. Greco's band has that easily coordinated attack that comes only with daily performance.

MGM has employed a logical method in placement of the three guitarists. The men work right on mike. Given standard playback conditions, they frame the activities of the rest of the cast. Then, no matter what the dancers decide to do, the guitars can still be heard with ease in their vital role.

Lenny Herman: The King of Stereo . . . On Broadway
✪ Livingston 4T-1

Midnight in Vienna
✪ SMS S-18

Some tapes compel close attention. These two items sound at their best when played as background at a party already in a reasonably advanced state of progress. Listen to either one of them on the morning after and you may find yourself wondering what you heard in them the night before. Mr. Herman's quintet, certainly high seniority in the stereo recording field, has a built-in bounce that is a tradition in unpretentious cocktail lounges from coast to coast. The style of this group (Lenny Herman, accordion and vibes; Alan Shurr, sax and clarinet; Earl Comfort, bass and violin; Stan Scott, drums and Charles Shaw, piano and organo) is fairly easy to predict after the first few tunes from Broadway shows. The occasional vocal harmonizing is not meant to be taken too seriously. It's there mostly to trigger a similar reaction on the part of the listener.

If you have difficulty resisting schmaltz the way they handle it in Vienna, the SMS tape should find you a happy victim. It features a nonchalant orchestra of a size that could take care of a large cafe as they know them over there. Conductor Victor Hruby, on the evidence presented here, appears to be rather an indulgent fellow. He allows the orchestra to run through these melting operetta medleys by Robert Stoltz and Ralph Benatzky in a somewhat off-season manner. The authenticity is there but the drummer, at times, gets away with a tempo that almost becomes his own property. Stereo spread is ample and the atmosphere of relaxation may appeal to those who feel that many of our name orchestras have too much chromium coldness in their performances of light Viennese stuff.

Stanley Black: Friml and Romberg in Cuban Moonlight
London PS 191
✪ UST 70010

At a time when some listeners are beginning to feel that they've heard everything, Stanley Black, the noted British keyboard maestro, has decided to put Friml and Romberg operetta favorites into discreet Latin tempos. My trip to the turntable with this one was not without some muttering because both of these composers had managed fairly dignified careers on the stage. I started with the *Serenade* from Romberg's "Student Prince" and the muttering evaporated. Here were the cleanest upper highs I had ever encountered on a London stereo disc. Black uses a bell-like percussion section to carry some of the melody. The presence of the sound, even on paper-cone tweeters, seems almost too good to be true. Old hands familiar with some entries in the London catalog may be tempted to suspect a canny modification somewhere in the treble curve, but the usual clues of the past do not show up in Black's orchestration. The choice of tempo throughout the record is on the slow side in order to give Black the leeway he needs in his low-register work.

Les Compagnons de la Chanson
Capitol ST 10227

Ames Brothers: Hello Amigos
RCA Victor LSP 2100

Both of these vocal groups, in their latest releases, are looking for greener pastures outside the sphere that established their reputation. The French team has added a lot of "foreign" material to their book of Gallic favorites, but the strong point of the album is the English version of The Three Bells—their best-seller to date. The rest of this collection, recorded in France as part of the Capitol-of-the-World series, embraces a balalaika-oriented song from along the Volga, a Brazilian carioca, a gondolier's serenade, and a folk song from Israel. Except for the numbers where a certain amount of commercial gravity is expected by their fans, Les Compagnons retain the familiar breeziness that first thrust them into the limelight ten years ago.

In Hello Amigos, the Ames Brothers have joined forces with the noted Latin American composer and arranger Juan Esquivel in order to enlarge their horizon to the south. Together, they introduce a new solidity to Latin American showmanship. The masculinity of inflection heard in previous Ames recordings is retained here even though the lyrics are delivered in recently-acquired Spanish. Cast in an admittedly subsidiary role, Esquivel is not able to indulge in the orchestral fireworks that set apart earlier releases such as "Exploring New Sounds" and "Strings Aflame." Neither can he be accused of blandness as he spreads out a potent beat across the area defined by loudspeakers used for stereo. Every attempt was made by recording engineer Ray Hall, working in New York's Webster Hall, to extract maximum robustness in the sound of quartet and orchestra. An occasional sibilant is enlarged slightly in the process. The songs range from moonlight material to well-lit chachas with particular stress on compositions introduced during the forties—one of the busier periods for these Latin exports.

Marjorie Meinert: Vive La Difference
RCA Victor LSP 2124

One of the satisfactions of reviewing recordings just before they go on public display is the occasional opportunity to run across a promising new talent. Listen to the enthusiastic performance of this young lady at the console of the Lowrey electronic organ in her first release for the label and you'll understand why RCA has scheduled four more Marjorie Meinert albums in the year ahead. Tunes associated with Paris take on new bounce as

(*Continued on page 60*)

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EDITOR'S REVIEW

THE VALUE OF STEREO

TOO OFTEN we hear someone say that "stereo is just no good." And if we were to judge by some of the demonstrations we have heard, we would have to agree with him. On the other hand, however, we have heard many excellent demonstrations—in fact, we actually live with what we would call an excellent stereo installation. But that does not alter the fact that some stereo reproduction leaves quite a bit to be desired, not only as to the stereo illusion itself but also in the actual reproduction quality.

Without doubt there has been too much material recorded for the sole purpose of showing off the stereo effect—just as early sound movies outdid themselves to show off sound or just as early Technicolor pictures presented a real jumble of colors just to prove that they could reproduce color. If we are able to listen to the show-off material for what it is worth and then go on to good music reproduction there would be no harm in it—for in general it does show the novice what stereo can do. But just as we would tire of continually looking at landscapes with brilliant splotches of color here and there or an assemblage of guests at a mid-Victorian ball with bright colored coats and gowns, so also do we become tired of ping-pong games, bowling exhibitions, or such material. Unless we are real fudnicks.

During a recent high fidelity show, our Mr. Canby conducted an aural survey of the various exhibit rooms and he came up with the report that of around a hundred rooms, forty two of them had the two speakers out of phase. We were once offered an apology at a demonstration because "one of the speakers had something wrong with it." After being assured that we would try to make allowances for the defective speaker, our hosts commenced the demonstration, but the music played for only about six bars when we said "Stop, the speakers are out of phase." Of course it didn't sound right—if you leaned six inches to the right, all the sound appeared to come from the right speaker; six inches the other way and all the sound appeared to come from the left.

Now we haven't the slightest objection to anyone listening to the showoff stuff if he likes it, and certainly the history of hi-fi has been fraught with those who listened only to "sounds," rather than music. As a matter of fact, if one can obtain an emotional equivalent of music by simply looking at an oscilloscope or a pair of meters, that's his business. But when he attempts to inflict this sort of demonstration material upon the average listener who may possibly enjoy music for itself alone, he then builds up in this listener a dislike for high fidelity as a whole. On the other hand, those of us who practice hi-fi have a responsibility to the newcomers which suggests that we should do our best to give as nearly perfect demonstrations as our own equipment and the state of the art will permit.

We would like, for example, a demonstration record made up with the first part of the music—say, for five minutes—in monophonic reproduction, with a gradual transition over a few minutes more into good stereo, perhaps at a critically chosen point in the music. We would like to demonstrate such a record with the listeners blindfolded or at least in a dark room so they could not see two speakers. During the monophonic portion of the record, the sound would most certainly appear to come from the center—then at the crucial moment it would begin to spread out. We firmly believe that this would be a real eye-opener to the uninitiated.

Exactly such a demonstration can be presented by anyone having a continuously variable blend control —simply start a stereo record with the control clear over to the mono end, then gradually shift it to the stereo end. There is no appreciable change in the quality, yet the source seems to spread out smoothly and gradually from a point to a complete coverage of the "stage." However, not all control units provide for blending, so a record would solve the problem completely for everyone. Then, too, there is the listener who always hears his orchestra from the top of the second balcony—a wide stereo spread is completely unreal to him, for he visualizes an orchestra as a point source, practically.

Then there is the problem of the speakers being spaced too far apart, usually due to the room arrangement. Not all rooms are ideal for stereo reproduction, that is certain, but if the speakers must be separated by more than a normal distance, it is time to consider adding a center speaker. With the correct amount of "right plus left" added in the center, the stereo illusion is often heightened, and it is the only solution that comes to mind for the wide room. So one of the main problems in stereo reproduction is still the room, but with some experimentation the serious listener can usually work out a satisfactory arrangement—in our own case the speakers are separated by about eleven feet, with a bay window in between, but we feel that we have solved the problem to our own satisfaction as well as to that of most of those who heard it. *Some* solution is always possible.

RETURN OF THE STREET SINGER

Back in the '30's, one of the familiar programs on the radio was The Street Singer, a "baritenor" who had a wide tonal range and a consistently pleasant repertoire. This man was Arthur Tracy, who has been away from show business for about ten years, but who has recently recorded a nostalgic disc for Audio Fidelity. Perhaps it is partly nostalgia, for many of the songs come from that era, but we find this disc very exciting. Tracy, who can sing in ten languages, still has a marvelous voice and superb diction and he is a welcome change from the current crop of male voices. It is not the function of this page to discuss records, but this one deserves—in our opinion—some special mention. Presumably one or the other of our reviewers will catch up to to it next month (we only heard it a few days ago on the day of its general release), but *we* think it is not only on extremely pleasant record but also a great comeback, after all these years, for a great voice.

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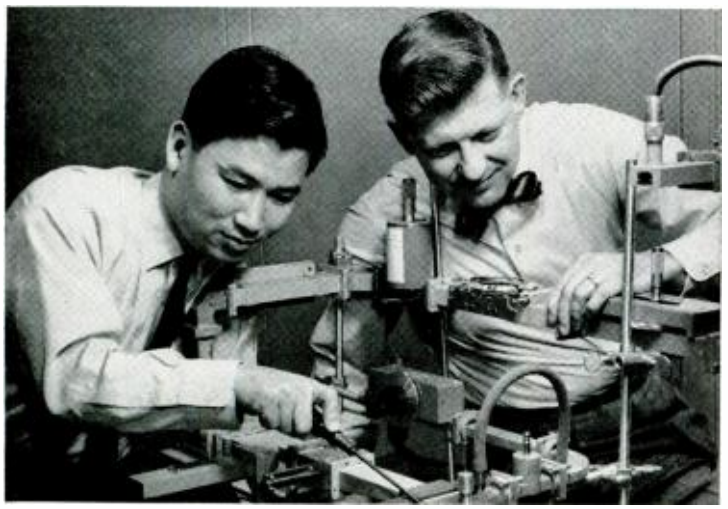
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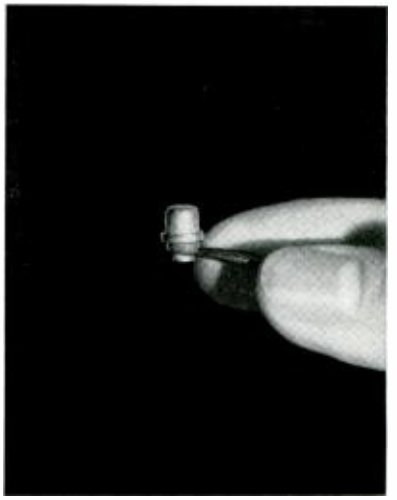
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THE IDEA THAT GREW FOR 100 YEARS



At Bell Laboratories, M. Uenohara (left) adjusts his reactance amplifier, assisted by A. E. Bakanowski, who helped develop first suitable diode. Extremely low "noise" is achieved when certain diodes are cooled in liquid nitrogen.

First practical diode for amplifier, shown here held by tweezers, was jointly developed by A. E. Bakanowski and A. Uhlir.



How basic scientific ideas develop in the light of expanding knowledge is strikingly illustrated by the development of Bell Laboratories' new "parametric" or "reactance" amplifier.

Over 100 years ago, scientists experimenting with vibrating strings observed that vibrations could be amplified by giving them a push at strategic moments, using properly synchronized tuning forks. This is done in much the same way a child on a swing "pumps" in new energy by shifting his center of gravity in step with his motion.

At the turn of the century, scientists theorized that *electrical* vibrations, too, could be amplified by synchronously varying the *reactance* of an inductor or capacitor. Later amplifiers were made to work on this principle but none at microwave frequencies.

Then came the middle 50's. Bell Telephone Laboratories scientists, by applying their new transistor technology, developed semiconductor diodes of greatly improved capabilities. They determined theoretically *how* the electrical capacitance of these new diodes could be utilized to amplify at *microwave* frequencies. They created a new microwave amplifier with far less "noise" than conventional amplifiers.

The new reactance amplifier has a busy future in the battle with "noise." At present, it is being developed for applications in tropospheric transmission and radar. But it has many other possible applications, as well. It can be used, for instance, in the reception of signals reflected from satellites. It is still another example of the continuing efforts to improve your Bell System communications.

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New Design Chart for Bass-Reflex Enclosures

R. D. HERLOCKER*

After a thorough study of bass-reflex enclosures and the effects of aspect ratio of the port, the author provides a design chart that takes into account all of the pertinent factors.

THE BASS-REFLEX is probably the most popular type of speaker enclosure that is available today. This is particularly true with those audio fans who build their own. There are several good reasons for this popularity: a properly designed and constructed bass-reflex enclosure will give a smoothly extended low end to a moderately priced speaker; the design is quite flexible, and can usually be modified as may be necessary to fit the available space; it is as economical of materials as any type of enclosure; and last, but certainly by no means least from the standpoint of the person who is building one, it can be built without cutting and fitting a lot of tricky corners, such as are needed with most horn designs.

The bass-reflex is a time-tested enclosure, which, however, seems to have been down-graded in the minds of many people, since the big publicity during the past few years has been for horn-type enclosures, some of which were actually horns by courtesy only. Since the reflex is basically a much simpler design than the horn, it is the writer's belief that, dollar for dollar, at least in the lower and middle price ranges, more performance can be obtained from a bass-reflex and a properly matched speaker than from a horn system of equivalent cost. How far down the bass response goes is, in either case, pretty much a function of the speaker used. While admittedly the electro-acoustic efficiency of the bass-reflex system is lower than that of a good horn, it is still more than adequate for normal home use.

New information on the effects of some of the variables involved in the design of a bass-reflex enclosure has been developed by the author. This information has been incorporated into a new design chart, the use of which will simplify the design calculations for such enclosures.

Some of the comparative disfavor felt toward the bass-reflex is undoubtedly due to the "boom-bass" resulting from gross mis-matching of the enclosure to its speaker. It is well known that, to obtain the best results from a bass-reflex enclosure with a typical speaker, its resonant frequency should match that of the speaker. (An exception to this rule is the case of the very highly compliant speaker, whose resonance will fall in the 15- to 25-cps range, and which is intended for use in an "acoustic stiffness" type of enclosure, which may or may not be ported). Matching, however, is not too critical, within 5 per cent being considered quite satisfactory, because of the low "Q" of the finished enclosure. Then, too, the resonant frequency of a speaker can easily change that much with prolonged use, thus making more precise matching useless.

Matching may be done in more than one way. The crudest, and least satisfactory, is to cut the port somewhat larger than you expect to need; then, while listening to music containing tones in the desired low-frequency range (such as a good theater pipe organ record), block off increasingly larger areas of the port, until your ear tells you that the response is balanced. The block is now fastened to the inside of the port in this position. A somewhat more refined, but still tedious, method is to run impedance curves for the frequency range below 100 cps, first on the speaker alone, and then with the speaker mounted in the enclosure, adjusting the port size until the ratio of the resonant frequency of the speaker alone to that of the lower peak of the speaker in the enclosure equals the ratio of the upper peak frequency to that of the speaker alone.

If, while the enclosure is still in the planning stage, it can be matched to the speaker, even approximately, much of this cut-and-try can be eliminated. Use of the design chart will accomplish this end, which is especially important if a ducted port is to be used, such as in several designs by Jensen[1] and others[2,3], since the duct dimensions cannot easily be changed once the enclosure is completed.

* 7918 Delmar Ave., Hammond, Ind.

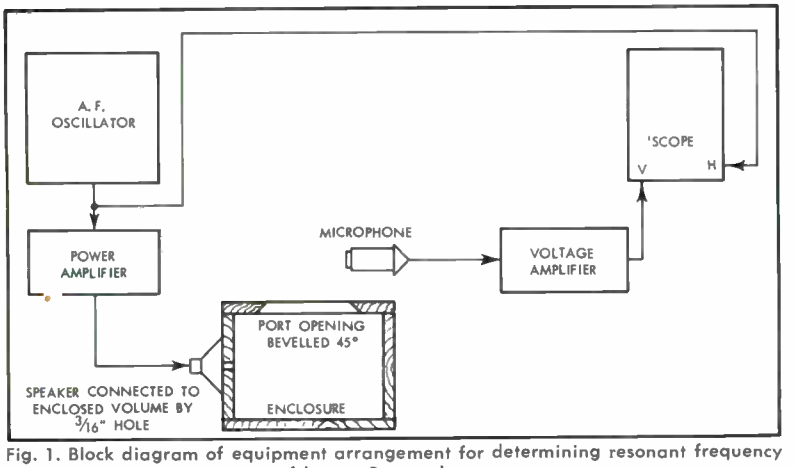


Fig. 1. Block diagram of equipment arrangement for determining resonant frequency of bass-reflex enclosures.

Design Equations

The basic design equation for the bass reflex enclosure is:

$$F^2 = \frac{2150^2 A}{V(L + A^{0.5})} \qquad (1)$$

where

F = resonant frequency, cps (taken as the speaker resonant frequency)

[1] D. J. Plach, & P. B. Williams, "The Bass Ultraflex enclosure." *Radio & Television News*, December, 1954.

[2] Monitor, "Pro-Plane Prismatic Speaker System," *Radio-Electronics*, February, 1956.

[3] F. Langford-Smith, *Radiotron Designer's Handbook*, 4th ed., Radio Corp. of America, 1953 (page 847).

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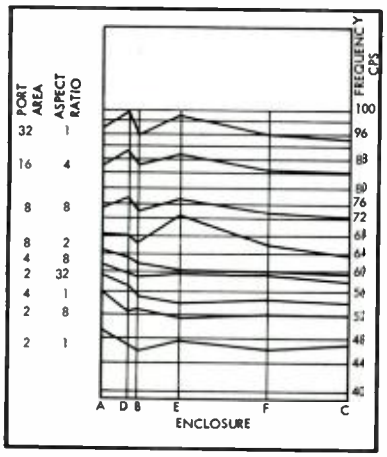


Fig. 2. Comparison of resonant frequencies of various shapes of enclosures.

A = port area, square inches
V = enclosed volume, cubic inches
L = duct length, inches (if no duct is used, L is the thickness of the enclosure wall).

It has been known for quite a while that the shape of the enclosure and of the port may affect the validity of this question. However, it has been generally assumed that enclosure shape has no signifieant effect, as long as the longest enclosed dimension is not over three times the shortest, to avoid an "organ pipe" type of resonance. Similarly, the effect of port shape was of little importance until recently, when slotted ports began to be widely used. Voigt[4] indicated that a definite relationship exists, though he did not fully develop it. On the other hand, Moir[5] elaims that the shape of the port has no noticeable effect on the resonant frequency of an enclosure.

A set of experiments was designed by the author to determine the effect, if any, of changes in enclosure and port shapes on the resonant frequencies of bass-reflex enclosures.

Six enclosures were constructed, each of which contained 3036 cubic inches of air, within 0.5 per cent, but of varying dimensional ratios, as listed in Table I. All joints were carefully sealed, and an eight inch square port was cut into one side of each box. The edges of each port were beveled to 45 deg. to minimize the ducting effect of wall thickness. An "L" shaped piece of plywood, with its edges similarly beveled, was used to change the size and shape of the port as desired. By maintaining these restrictions, it was possible to eliminate volume and duct length from the variables, and to concentrate attention to the port itself, and to enclosure shape.

Resonant frequencies were determined for each of the six enclosures for a variety of port sizes and shapes. The test procedure was that given by Moir.[6] A hole, approximately 3/16 inches in diameter, was drilled in one wall of the enclosure, and a small TV-type speaker fastened tightly over the hole. The speaker was fed from an audio oscillator through a small power amplifier. While Moir states (and this writer has confirmed) that resonance can be quite accurately detected by ear, for these tests a microphone was placed adjacent to the port, within three to four inches, and its output fed through a voltage amplifier to the vertical plates of an oscilloscope, where the microphone output was compared to the direct output of the oscillator, which was simultaneously fed to the scope's horizontal plates. The equipment arrangement for these tests is shown in *Fig.* 1. The frequency of maximum pickup from the microphone was taken as the resonant frequency of the enclosure. Incidentally, the phase angle of the sound from the port changes very rapidly in he immediate vicinity of resonance, as can readily be seen on the oscilloscope screen.

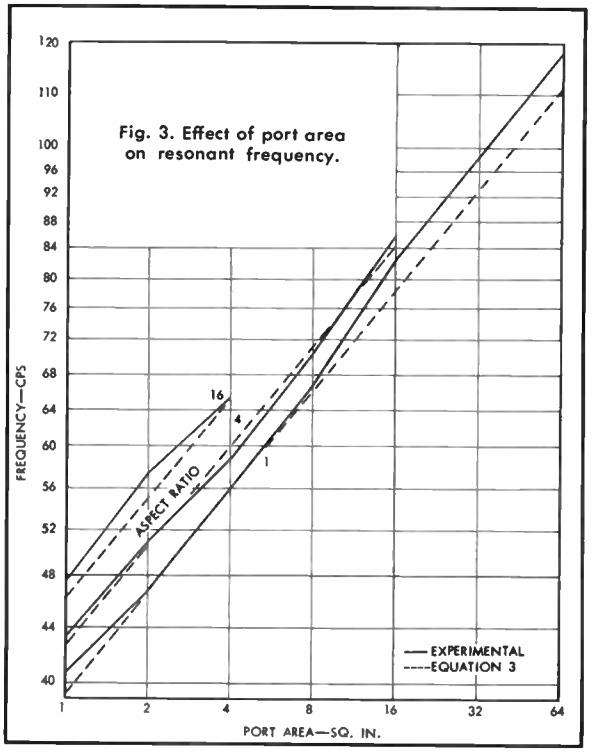
There was no interference from the natural resonance of the speaker, as it was completely damped out by the small amount of air trapped between the speaker and the enclosure wall. Neither was there any noticeable interference from direct radiation from the speaker. Most measurements were made in the low-frequency range where the speaker's direct radiation efficieney is very low, and the use of a directional microphone helped.

A comparison of resonances of the six enclosures tested is given in *Fig.* 2. (See Table I for identification of the enclosures). They are compared here at a variety of port areas ranging from 2 to 32 square inches, and aspect ratios (port length divided by width) from 1 to 32. Enclosure "A" is a cube, and enclosure "C," (at the right of *Fig.* 2), with its 1:1:3 internal dimension ratio, represents the greatest departure from the cube of any of those tested. In general,

[4] P. G. A. H. Voigt, "All about the reflex enclosure" *Radio-Electronics,* April, 1959.

[5] James Moir, "Ported loudspeaker cabinets" AUDIO, October, 1956.

[6] James Moir, *"High Quality Sound Reproduction"* MacMillan: 1958, (page 446).



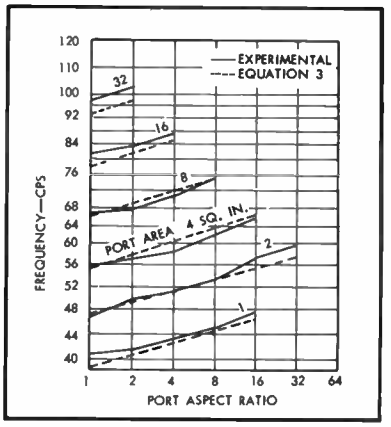


Fig. 4. Effect of aspect ratio on resonant frequency.

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the enclosures whose shapes are furthest from the cube have slightly lower resonances than those whose shapes approach the cube. However, the difference is very slight, and is also rather erratic, so that, on the basis of these tests, it is believed best to ignore this factor in design, at least within the limit of the three-to-one maximum ratio of longest to shortest sides.

In *Fig.* 3 is shown the relationship between port size and resonant frequency. For this figure, and also for *Fig.* 4, frequency values for the six enclosures have been averaged, in the interest of clarity. This procedure is believed valid, in view of the lack of significant variation among them.

Since the enclosures were designed to eliminate (or at least minimize) the ducting effect of the wall thickness, we may set $L = 0$ in Eq. (*1*), and we have

$$F^2 = \frac{2150^2 A^{0.5}}{V} \qquad (2)$$

which is the dashed line in *Fig.* 3, corresponding to a port aspect ratio of 1 (square port). The solid line represents the test results.

The other two pairs of lines in this figure give similar test and calculated results for port aspect ratios of 4 and 16. The agreement between calculated and experimental data is quite good, verifying the validity of Eq. (*2*) for these test conditions, including the simplifying assumption of zero port thickness.

Change of Port Shape

The effect of changing the shape of the port is shown in *Fig.* 4. Each solid line in this figure represents the resonant frequencies obtained from a given port area by changing its shape. All ports involved here were rectangular, with aspect ratios varying from 1 to as high as 32. In all cases, there is a regular increase in resonant frequency as the aspect ratio is raised. This increase is proportional to the 0.06 power of the aspect ratio of the port, for a rectangular port. Adding this factor to Eq. (*2*), we have

$$F^2 = \frac{2150^2 A^{0.5} R^{0.12}}{V} \qquad (3)$$

The 0.12 power of R (the aspect ratio) is used instead of 0.06 because the frequency term is squared.

The dashed lines of *Fig.* 4 are calculated from Eq. (*3*). The smaller ports give results in excellent agreement with this equation, but the largest ones (particularly 32 sq. in.) show a slight discrepancy. At present there is no explanation for this. However, it is within the 5 per cent working limit mentioned earlier.

There are circumstances where the discrepancies cannot be ignored, though. Such circumstances include the use of complex shaped ports, such as L-shaped, or multiple ports. Table II shows some test results from the use of L-shaped and twin rectangular slots as ports with enclosure B (see Table I). In all cases, the resonant frequency is raised well above that of an equivalent rectangular port, even taking the most favorable value of R for comparison. In those few cases where complex porting would be felt to be necessary or desirable, one must re-

(*Continued on page 60*)

TABLE I
ENCLOSURES TESTED

Enclosure	Enclosed Volume, Cubic Inches	Dimension Ratio
A	3050	1:1:1
B	3051	1:1:1.5
C	3022	1:1:3
D	3044	1:1.5:1.5
E	3048	1:2:2
F	3032	1:3:3

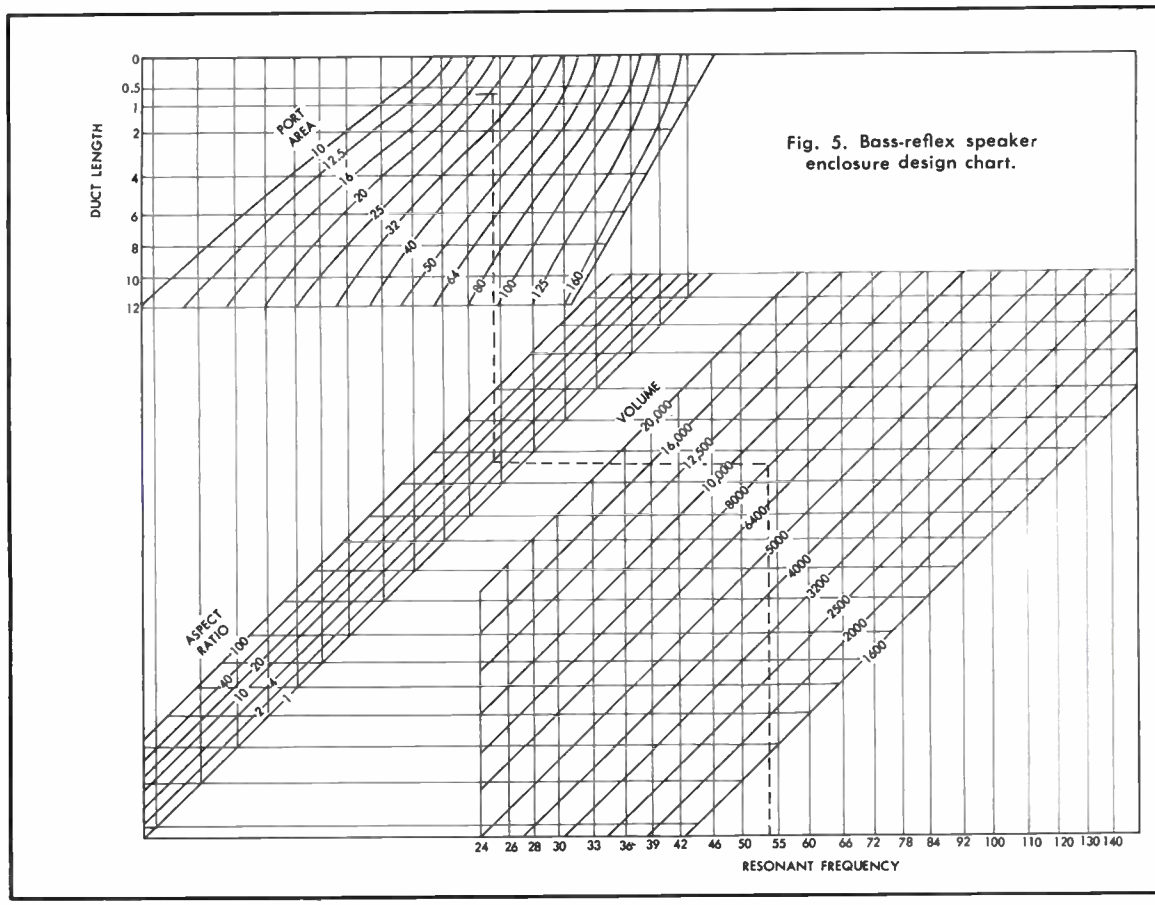


Fig. 5. Bass-reflex speaker enclosure design chart.

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Notes on the Cathodyne Phase-Splitter

ALBERT PREISMAN*

Performance of the split-load circuit has often been questioned by designers and constructors. The author shows why most of the doubts are unfounded.

THE SPLIT-PHASE CIRCUIT of *Fig.* 1 is quite commonly used to drive a push-pull output stage, and has several interesting features. It is stated in various texts that the impedance seen looking into the plate circuit is different from that looking into the cathode circuit, yet for *equal* loads, the output voltages and frequency response are identical. It would appear that the cathode circuit, having the lower apparent source impedance, would have the better high-frequency response when both outputs are shunted by equal (and inevitable) circuit capacitances. In fact, some people think that this type of circuit is inherently unbalanced at the higher frequencies, whereas in actuality it is just as well balanced at the high frequencies as it is at the low frequencies, provided the two output load impedances are at all times equal.

The impedance looking into plate terminal A_p, (exclusive of Z_L), is

$$Z_{OP} = r_p + (1+\mu)Z_K \qquad (1)$$

where r_p is the plate resistance of the tube and μ is its amplification factor. The impedance looking into cathode terminal A_K, (exclusive of Z_K) is

$$Z_{OK} = \frac{r_p + Z_L}{1+\mu} \qquad (2)$$

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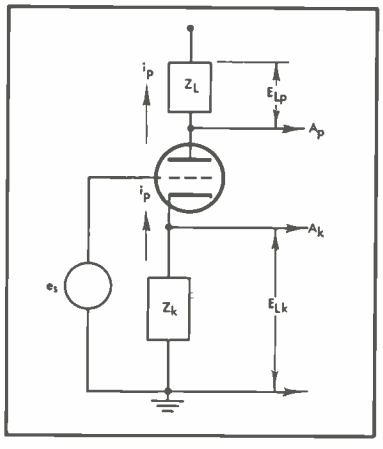


Fig. 1. Basic phase-splitter circuit.

It is evident that Z_{OK}, for reasonable values of Z_L, is much less than r_p, and Z_{OP} is greater than r_p by the amount of $(1+\mu)Z_K$. In spite of this, the regulation of both portions of the circuit are the same, so long as $Z_K = Z_L$. For example, if Z_K and Z_L each are represented by a resistance paralleled by a capacitance, their high-frequency responses are the same, (as stated above), in spite of the fact that one is driven by a high-impedance source and the other by a low-impedance source.

The apparent paradox can be explained if we formulate the gain expression for either terminal A_p or A_K. Let the applied grid signal voltage be e_s, and let it develop output voltages E_{LK} across Z_K and E_{LP} across Z_L, where at first we do not assume $Z_K = Z_L$. The net voltage between the grid and cathode is e_g, where

$$e_g = e_s - E_{LK} \qquad (3)$$

The equivalent voltage in the plate circuit is μe_g, and it causes a current i_p to to flow through Z_K, r_p of the tube, and Z_L. Hence, by a simple application of Ohm's law, we have

$$i_p = \mu e_g / [r_p + Z_K + Z_L] \qquad (4)$$

Current i_p, in flowing through Z_K, sets up the voltage

$$E_{LK} = i_p Z_K \qquad (5)$$

and in flowing through Z_L, sets up the voltage

$$E_{LP} = i_p Z_L \qquad (6)$$

If we substitute Eq. (5) in Eq. (3), and then Eq. (4) for the value of i_p, we obtain, after some algebraic manipulation:

$$e_g = e_s \left[\frac{r_p + Z_K + Z_L}{r_p + (1+\mu)Z_K + Z_L} \right] \qquad (7)$$

Eq. (7) can now be substituted in Eq. (4) to obtain:

$$i_p = \mu e_s / [r_p + (1+\mu)Z_K + Z_L] \qquad (8)$$

which, when substituted in Eqs. (5) and (6), yields finally

$$E_{LK} = \mu e_s Z_K / [r_p + (1+\mu)Z_K + Z_L] \qquad (9)$$

and

$$E_{LP} = \mu e_s Z_L / [r_p + (1+\mu)Z_K + Z_L] \qquad (10)$$

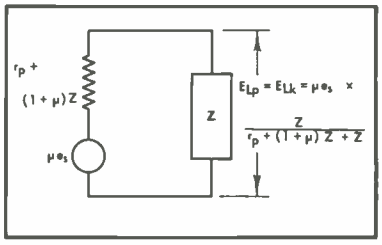


Fig. 2. Equivalent circuit for plate or cathode output.

If we now impose the phase-splitter condition that $Z_K = Z_L = Z$, we obtain:

$$E_{LK} = E_{LP} = \mu e_s Z / [r_p + (1+\mu)Z + Z] \qquad (11)$$

Equivalent Circuit

Equation (11) can be represented by the equivalent circuit shown in *Fig.* 2. The output voltage across Z is the fraction of the apparent generated voltage μe_s that Z is of the total circuit impedance. The latter consists of an apparent source impedance $[r_p + (1+\mu)Z]$ that is greater than r_p by the amount $(1+\mu)Z$. Note, then, that from this viewpoint, we have the *same* apparent generated voltage μe_s acting for *either* output, and the same apparent source impedance $[r_p + (1+\mu)Z]$, rather than unequal source impedance as given by Eqs. (1) and (2).

We seem to be in greater mess than ever. However, let us go back to Eq. (9) and divide numerator and denominator of the right side by $(\mu+1)$. We obtain:

$$E_{LK} = \frac{\mu}{\mu+1} e_s \left[\frac{Z_K}{\left(\frac{r_p + Z_L}{\mu - 1} \right) + Z_K} \right] \qquad (12)$$

The equivalent circuit is shown in *Fig.* 3. It holds whether Z_K is equal to Z_L, as in the case of the phase-splitter, or Z_K is not equal to Z_L. Note that the apparent source impedance appears here *lower* than r_p (for reasonable value of Z_L) owing to the factor $(\mu+1)$ appearing in the denominator. But the apparent generated voltage is now also lower; it is also reduced by the factor $(\mu+1)$.

In the special case where $Z_K = Z_L$, the circuit of *Fig.* 3 becomes exactly equivalent to that of *Fig.* 2, so that we can say in this case that the internal source im-

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pedance for the plate output terminal A_p of *Fig.* 1 is also as low provided we also accept a lower apparent generated voltage. Or, we can say that the apparent source impedance for this terminal is higher, namely $[r_p + (1+\mu)Z]$, provided we also specify the higher apparent generated voltage. When $Z_L = Z_K$, the individual impedances lose their separate identities, as do also Eqs. (*9*) and (*10*), whereupon we can regard either output terminal as having a higher or lower source impedance, provided we also adjust the apparent generated voltages to correspondingly higher or lower values. It is only when we permit Z_K and Z_L to be unequal that we must use Eqs. (*8*) and (*9*) separately rather than use Eq. (*11*) for both output voltages.

We see, therefore, that the paradox is resolved if we take into account not only the change in source impedance but also the change in source-generated voltage. One can compensate for the other, but only in the case where $Z_L = Z_K$. Otherwise, a variation in either impedance causes the opposite effect upon the output voltage of the other terminal.

Practical Case

For example, suppose Z_L, the plate-load resistor, is increased but Z_K, the cathode resistor, is maintained constant. From Eq. (*9*) we see that E_{LK} decreases because only the denominator of the right expression increases. At the same time, Eq. (*10*) shows that E_{LP} increases because the numerator of its right expression increases faster than the denominator. The opposite effects are of course obtained if Z_L decreases.

On the other hand, if Z_K increases, E_{LP} decreases and E_{LK} increases by the same line of argument; and vice versa for a decrease in Z_K. We can summarize the effects by stating that a variation in either impedance causes a similar effect on its output voltage and an opposite effect on the output voltage of the other terminal; for equality of impedance, the two output voltages are equal.

The action described above concerning the difference in source impedance and the compensating difference in generated voltage can be more specifically explained in terms of what may be called a little network theorem. In (A) of *Fig.* 4 we see the basic circuit. The generated voltage is E_G; the source impedance is

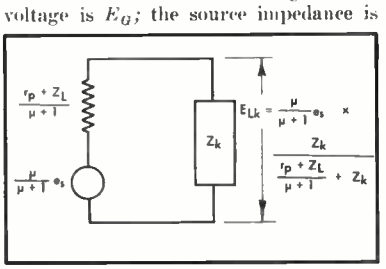


Fig. 3. Equivalent circuit for cathode output.

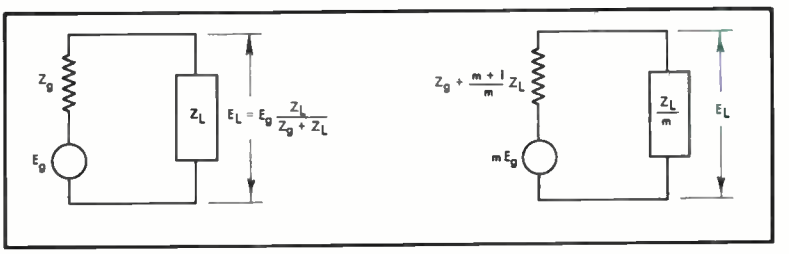


Fig. 4. Basic circuit and an equivalent circuit.

Z_G; and the load impedance is Z_L. The output voltage is

$$E_L = E_G \frac{Z_L}{Z_G + Z_L} \qquad (13)$$

just as in the case of Eqs. (*9*) and (*10*).

If we multiply E_G by some factor m, divide Z_L by the same factor m, increase Z_G an amount $\left(\frac{m-1}{m}\right) Z_L$, and substitute these altered values in Eq. (*13*), we obtain the same value E_L as before. Actually, the circuit impedance is unchanged; $Z_G + \left(\frac{m-1}{m}\right) Z_L + \frac{Z_L}{m}$ equals $Z_G + Z_L$, so that a physical interpretation of this alteration is that in (A) of *Fig.* 4 we have tapped down on Z_L at a point $1/m$th its impedance and take off the voltage E_L at this tap. The rest of Z_L is then lumped with Z_G to represent an increased source or generator impedance. However, at the tap the voltage would be $1/m$th its previous value; to compensate we make our generated voltage m times as great and thereby obtain the same value of E_L as before.

In the case of the phase-splitter circuit, $Z_K = Z_L = Z$, and in this case a term involving Z that is associated with the apparent source resistance can be shifted so as to become part of the load resistance or vice versa without changing the algebraic form of the gain expression. Under these conditions, we can shift terms so as to make them appear as part of the source resistance or as part of the load resistance, providing we compensate the apparent generated voltage correspondingly. The result is the same; the two output voltages are the same whether we regard the internal impedances of the two output terminals as equal or unequal. It is only when Z_K is not equal to Z_L that such shifting of terms is inadmissible, and it is then that the voltage regulations of the two terminals are different.

Before concluding this article, the writer cannot help but mention a result he obtained many years ago.[1] In using a vacuum-tube stage to feed a coaxial cable of, say, 75 ohms characteristic impedance, one can feed it from the plate circuit by first paralleling the r_p of the tube by a suitable low plate-load resistor so as to make the apparent source impedance 75 ohms to match the cable, or one can feed it from the cathode circuit by first paralleling the lower apparent source resistance of $r_p/(1+\mu)$ with a suitably higher load resistance to get the same apparent source resistance of 75 ohms.

The interesting thing is that when the characteristic impedance of the cable is matched from either point, the gain of the stage is the same. The advantages of feeding the cable from the cathode (cathode-follower stage) are that the benefits of inverse feedback are obtained (although amplitude distortion is not so serious a factor in a video amplifier), and more importantly from a practical viewpoint, the cable sheath can be placed at ground potential.

In the case of the phase-splitter circuit just analyzed, we can conclude that so long as the two load impedances are maintained equal at all frequencies of interest, no concern need be felt about the differences in apparent source impedance. The writer employed this type of phase-splitter back in the days when cathode-ray oscilloscopes had a bandwidth of 3 mc at most, and could maintain a flat response with such a circuit out to 8 mc.[2] The only difficulty encountered was that the screen signal current flowed through the cathode resistor but not through the plate load resistor, so that the latter had to be increased in value to obtain equal voltage outputs, but that is another story.

The only important disadvantage of the phase-splitter is that its maximum output voltage from either load resistor is only half that from a single-ended stage of the same total load impedance, so that some difficulty might be obtained in attempting to drive some power-tube grids. Ordinarily, however, the maximum output voltage is sufficient to drive the grids of even the larger power tubes used in high-fidelity audio amplifiers.

Some readers may wonder why the two terms involving Z in the denominator of Eq. (*11*) were not combined. They were left separate to show the same form as that of Eq. (*13*), namely, $Z_L/(Z_G + Z_L)$. Ordinarily, we would write Eq. (*11*) as

$$E_{LK} = E_{LP} = \mu e_s Z/[r_p + (2+\mu)Z] \qquad (14)$$

which is the form you will find in the handbooks and other texts. Æ

[1] A. Preisman, "Some notes on video amplifier design," *RCA Rev.*, April, 1938.

[2] See "A wide-range video amplifier for a cathode ray oscilloscope," A. Preisman, *RCA Rev.*, April, 1939.

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Those Crazy Mixed-up Currents

ALMUS PRUITT*

In a jocular vein, the author presents a valid clarification of the two concepts—current flow and electron flow—which we utilize in analyzing electrical and electronic circuits.

WHAT WOULD YOU MAKE of a statement to the effect that electrons must flow past a point at the rate of 6.24 million million million per second in order to constitute 1 ampere of current flowing in the opposite direction? (Statements similar to this appear in current textbooks.) No, it's not the astronomical number 6.24×10^{18} to which I call attention. (Numbers like that are like the national debt, anyhow—too big for comprehension.) What bothers me is the phrase, *in the opposite direction*. The textbooks tell us that current is electric charge in motion; electrons carry charge; ergo it appears to me that the above statement means we have current flowing in two opposite directions at once. But electrons are the only charge carriers mentioned; therefore, to my simple mind it appears the only direction of current should be that in which the electrons flow.

Many electronic textbooks nowadays, while acknowledging that negative charges, such as those carried by electrons, actually do travel from the negative to the positive terminals of a load, (A) in *Fig.* 1, nevertheless bow to convention with remarks about *current* being considered as flowing in the direction which positive charges would take, i.e., from positive to negative in the load, as in (B) of *Fig.* 1. In this they commit two grave errors, in my opinion: one, they are apt to give the impression that current and electron flow are two distinct things, whereas they are the same; and, two, they require positive charge carriers, i.e., positive ions, to travel through any kind of load, whereas this is impossible if the load is a solid. A positive ion is an atom which has lost one or more of its electrons. In a solid the position of an atom is fixed, aside from minor vibratory or displacement movements; therefore positive ions cannot flow in solids. As for liquids and gases, even there positive ions do not ordinarily constitute the predominant charge carriers, i.e., there are as many, or more, negative carriers as positive.

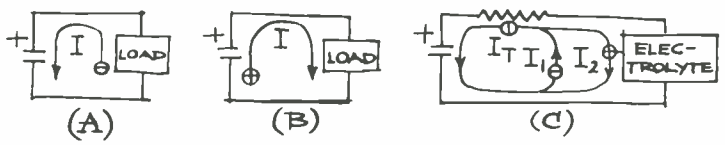
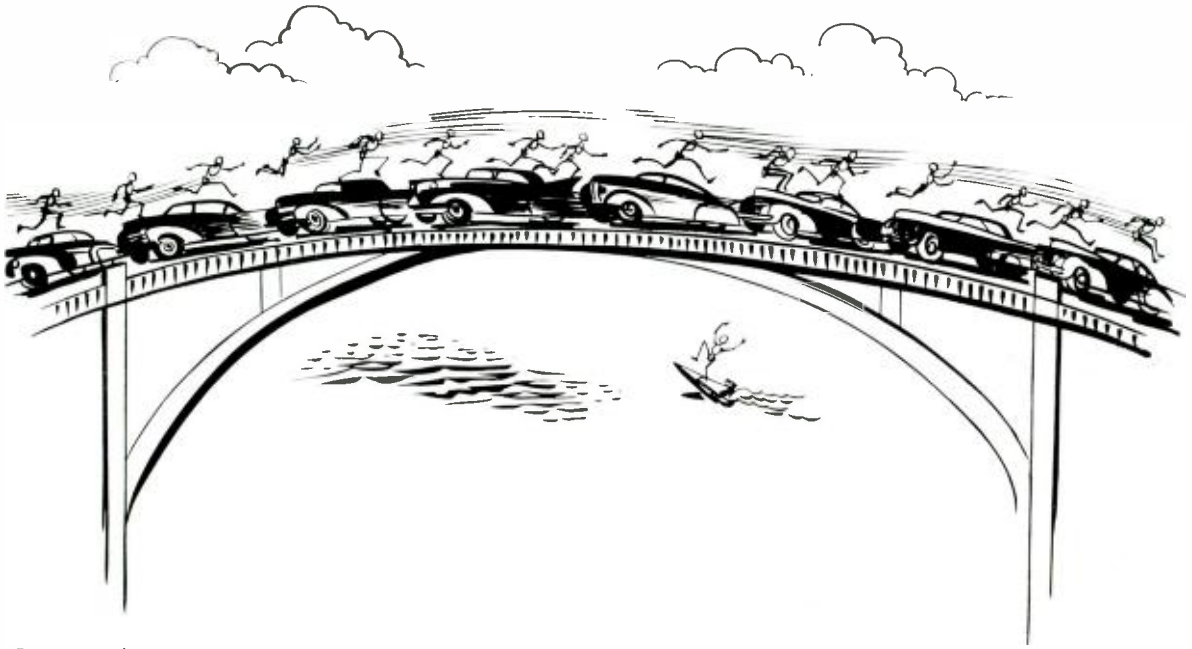


Fig. 1. (A) Electron flow. The charge carriers are electrons or negative ions, as shown by the ⊖ sign. (B) Conventional current flow. The charge carriers are (hypothetically) positive ions, as shown by the ⊕ sign. (C) Here both types of current flow in the electrolyte, but only electrons can flow in the resistor.

Free Grid, writing in *Wireless World*, March, 1954, expressed the contretemps



One anomaly arising from the current vs. electron concept—how does current (represented by the runners) travel from left to right on a stream of electrons (automabiles) which is travelling from right to left?

* *119 N. Central, Medford, Ore.*

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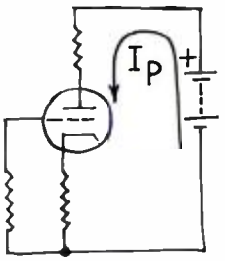


Fig. 2. D.c. circuit of a vacuum-tube amplifier stage, showing conventional current flow as adopted by many textbooks. Questions: How can positive charge carriers flow through metallic conductors from the + terminal of the battery to the plate of the tube and from the cathode to the – terminal of the battery? Granting such flow possible, what happens inside the tube, where it is known that practically all current flows from cathode to anode in the form of electrons?

delightfully in the following excerpt from his "Alice in Solidconductorland":

> "But nobody is blind now," protested Alice. "Of course not, child," said the Duchess chidingly, "but out of respect for my great-grandfather's memory we still like to pretend he was right even though it gets us into all sorts of difficulties, so when soldiers are moving from *B* to *A* we always pretend that troops are moving from *A* to *B* even though troops don't really move; at any rate not in Solidconductorland in which we live."

(For soldiers read electrons. For troops read positive ions.)

Benjamin Franklin seems to have started the confusion some two hundred years ago when he advanced his "single-fluid" theory of electricity, in which he proposed that a vitreously electrified body be regarded as positively electrified and a resinously electrified body as negatively electrified. He proposed to assign the algebraic signs + and – to the two kinds of electrification. Although Franklin stated that the decision as to which body was positive and which negative was tentative (actually it couldn't be more than a mere guess at that time), the world ignored such uncertainty. (Uncertainty was regarded as a sign of weakness then, and still is, by nearly all but scientists.)

What Franklin was driving at, although he didn't know how to put it so simply then, is that if a glass rod is rubbed with silk, say, the glass will acquire excess charge (Franklin's fluid) at the expense of the silk. Only it turned out that the excess charge is on the silk, not the glass. We know now that some of the electrons of the surface atoms of the glass are captured (rubbed off, as it were) by the silk.

Even though Franklin made a poor guess, he deserves credit for being on the right track. He perceived that what one substance lost the other gained—a big step forward then. He had a 50-50 chance of being right about the excess charge; it was his and our misfortune that he called "heads" and it came up "tails."

Franklin's theory soon gained wide acceptance, along with the view that any discharge must be from positive to negative, which seemed logical at the time, given the assumption of excess charge at the positive electrode and deficit charge at the negative electrode. It remained for the development of vacuum tube theory, back in the early part of the present century, to raise the first strong doubts; but by that time the positive charge direction of current flow was so strongly entrenched among textbooks, and authorities found it so painful to uproot, that it took a new generation, disgusted with trying to follow a current from the positive plate to the negative cathode of a vacuum tube, to rebel against the nonsense.

Fate of this Convention

Today it appears to me that the convention is well on the way to oblivion, in spite of its retention (often with an apology) in many textbooks, and in spite of views such as L. B. Arguimbeau's, who states in his *"Vacuum Tube Circuits"* (Wiley, 1948): "United States Navy training courses made a commendable effort to do away with the convention, but the result was not a happy one."

Even if there have been unhappy results (mostly as a result of trying to mix the teachings of the older and the

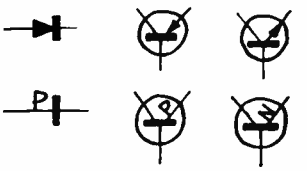


Fig. 4. Standard semiconductor symbols, upper row, may be changed as in the lower row, in order to avoid anomalies.

up-to-date textbooks), one might argue in rebuttal that the results of adhering to convention are apt to be far unhappier. See *Fig.* 2. Furthermore, unhappy or not, the Navy seems to be sticking by its guns with regard to scuttling the convention. I have a copy of *"Physics for Electronics Technicians,"* Navy Training Courses, NavPers 10095, published 1951, which strongly supports electron flow direction, stating, p. 252: "It has been the experience of the Navy that training is simplified when electron flow is used whenever currents are studied." Furthermore, John F. Rider Publisher has recently brought out a series of textbooks based on U.S. Navy training programs which consistently follow the direction of electron flow. Dr. White, of the University of California and the Continental Classroom TV series on physics, does likewise, as does RCA's *"Transistor Fundamentals and Applications,"* published 1958. The Encyclopedia Brittanica in its article on Electricity gives some cogent arguments against what it calls the "false convention."

But even if the convention is on the way out, it appears we are stuck, perhaps for ages to come, with some of its unfortunate consequences.

For example, when the time came to establish the polarity of electron charge, it had to be negative, because Franklin had called the charge on the glass rod positive. So it came to pass that we have a positive charge resulting from a *lack* of something, to wit, one or more electrons. It would appear much better usage to term the excess charge positive and the deficit charge negative. Thus the charge of an electron would be called positive.

Alas, it's too late now. It's like the standard typewriter keyboard. It's very easy to design a much better one, but with millions of the standard models in use, it simply isn't feasible to make the change. Even a child, it seems, would not put often-used letters, such as *a, e, r, s,* and *t,* under the left hand, with letter *a* under the left little finger, and seldom-used letters, such as *j, k, p,* and *y,* under the right hand, with letter *j,* of all letters, given the place of honor under the right index finger, central row. This suggests that the original designer may have been a left-handed, arthritic hunt-and-pecker with missing index fingers.

(*Continued on page 67*)

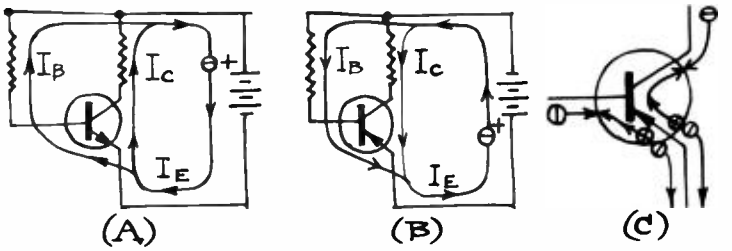


Fig. 3. (A) Electron flow in the d.c. circuit of an n-p-n transistor. Note the opposing arrowheads beside the emitter. (B) Electron flow in the d.c. circuit of a p-n-p transistor; again note the opposing arrowheads beside the emitter. (C) Electron flow outside a p-n-p transistor; hole flow inside. See text.

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New Microphone Has Unique Directivity

HAROLD S. MAWBY*

Theory, construction, and applications of a new type of microphone which combines the unfamiliar "line" design with the well known pressure-gradient principle to provide a high degree of directivity in a unit of practical size.

IN THE RECENT PAST, public address sound specialists and home recordists have had a wide and varied choice of microphones available to satisfy their needs. Besides the variations in frequency response characteristics and the variations in appearance, they also have had a choice of directional characteristics to assist them in solving basic sound problems. When acoustics are favorable, a nondirectional microphone has been the typical choice. When acoustical problems presented themselves, the choice of a directional microphone was indicated. This choice may have been dictated by a desire to reduce reverberation, feedback, or unwanted signals (noise).

One limitation, however, has been that there were but two types of directional microphones easily available. (For the purposes of this discussion, we will ignore such esoteric types as parabolic, machinegun, and so on, which are not generally used or available.) The two pickup patterns available were the bidirectional and the cardioid types. In addition, some microphones were classified as "semidirectional" having a pattern which at higher frequencies approaches but does not achieve the cardioid polar pattern.

Unfortunately, some sound problems cannot be solved by use of these two types of microphones. The bidirectional microphones attenuate "noise" at the sides but not at the back. The cardioid microphones attenuate sound arriving at the back but sound arriving at the side is reduced only 6 db. Where noise problems are severe, or acoustics or feedback problems are bad, it is desirable to attenuate sound arriving at *both* the sides and the back of the microphone. This basic problem stimulated the design of the new Electro-Voice Model 644 Sound Spot microphone.

The design objectives for this microphone were most stringent. Primary was a need for a microphone with increased directivity. Since the 644 was to be used at greater distances than normally encountered, additional sensitivity was also required. Since the microphone was intended for public address and semi-professional recording, it had to be extremely rugged, moderate in size and weight, and relatively insensitive to wind. These objectives had to be achieved without degradation of on-axis frequency response range or uniformity. Finally these goals had to be met in a microphone whose cost was not prohibitive.

In order to explain how these design objectives have been met with the Sound Spot microphone, it is necessary to review methods of determining directivity as well as the types of presentation of performance normally encountered. In addition, we will explain the function of the "slotted-tube" or "line" method of achieving the unique directivity.



The Electro-Voice Model 644 "Sound Spot" microphone, a combination of line and pressure-gradient units.

Polar Patterns

The common method of expressing directivity of a microphone is to utilize a polar pattern. This chart shows the sensitivity (in db) of the microphone at any angle in a plane, relative to the sensitivity on axis. This polar pattern will be uniform for any plane normal to the major axis of the microphone if the microphone is physically symmetrical. Asymmetrical microphones will exhibit various polar patterns depending on the plane chosen. Conventionally the pattern shown is of the plane through the microphone's major axis when the microphone is upright and pointed at the sound source.

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A symmetrical nondirectional microphone will respond over the greater part of its frequency range equally at any angle to the axis of the microphone and has a three-dimensional polar-response pattern similar to (B) in *Fig.* 1. The polar pattern for this microphone usually is shown in one plane as in (A). This plane pattern is the shaded slice shown in the three-dimensional polar pattern. It shows the response in one plane of the microphone at any angle from the 0-deg. reference, which is the front of the microphone.

Common cardioid and bidirectional microphones would have two-dimensional and three-dimensional polar patterns as shown in *Figs.* 2 and 3.

In normal use, if a nondirectional microphone were used in the actual sound reinforcement situation such as shown in *Fig.* 4, there would be no appreciable sound reflection from the surroundings which would cause excessive reverberation. The sound will be dispersed into the audience and the trees with no appreciable reflecting surfaces in the vicinity. Sound traveling directly from the speaker system will, of course cause some degree of feedback, depending on the required gain of the system.

If, on the other hand, the nondirectional microphone were used in a room such as shown in *Fig.* 5, there would be considerable reflection of sound energy from the hard walls—much as an echo would be heard in such a room. Most of this reflected energy reaches the microphone from the rear and sides and is again amplified.

Depending on the gain of the system, the reflected energy adds various degrees of "color" to the reproduced sound. If this reflected energy reduces intelligibility or produces feedback oscillation, a directional microphone that attenuates sound pickup from the sides and rear is needed. In both the outdoor and indoor system independent sound sources (noise) from the rear and sides must also be considered. Audience noise can be a serious problem in the enclosed room.

The poorer the room acoustics, the more effective the directional microphone must be in rejecting reproduced sound, reflected sound energy, and unwanted sound or noise sources.

Directional Efficiency

The directional efficiency, or the "directivity index" should be considered to provide another method of comparing directional microphones. The ratio of energy response of a directional microphone as compared to a nondirectional microphone, all directions being equally probable, is termed the directional efficiency.[1]

[1] H. F. Olson, *"Elements of Acoustical Engineering."* New York: D. Van Nostrand and Company, Inc., 1957, p. 331.

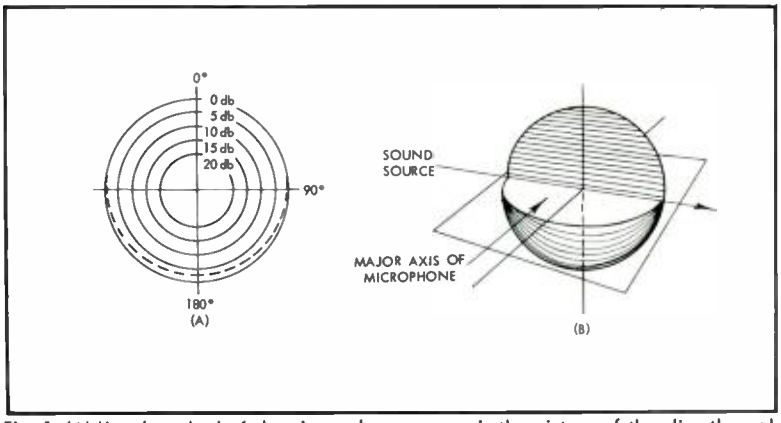


Fig. 1. (A) Usual method of showing polar response is the picture of the slice through the sphere (B), which is a three-dimensional representation of the sound pick-up of a nondirectional microphone.

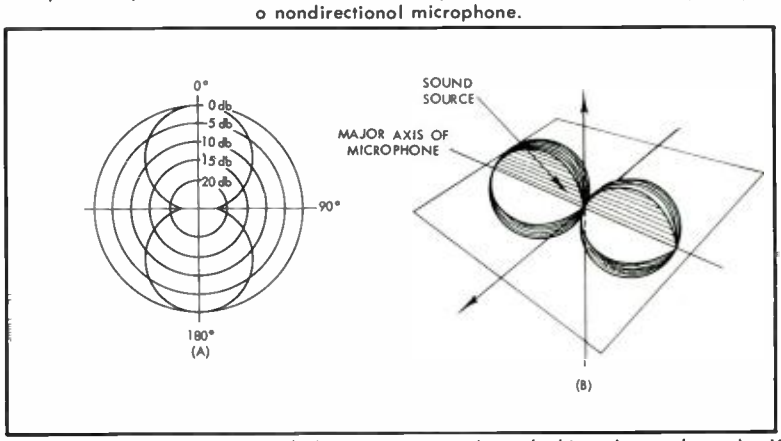


Fig. 2. (A) Polar pattern of a bidirectional microphone looking down along the Y axis of (B), which is the equivalent three-dimensional representation of the sound pick-up.

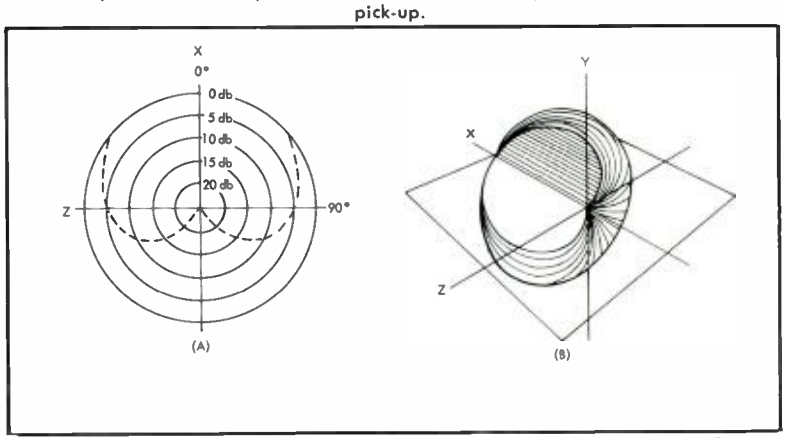


Fig. 3. (A) Polar pattern, and (B) three-dimensional picture of the sound pick-up of a cardioid microphone.

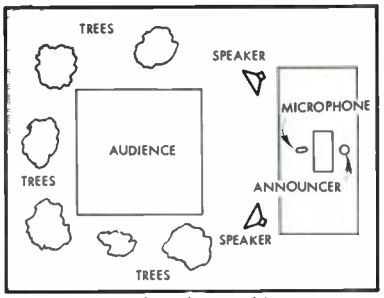


Fig. 4. Typical public address system outdoors.

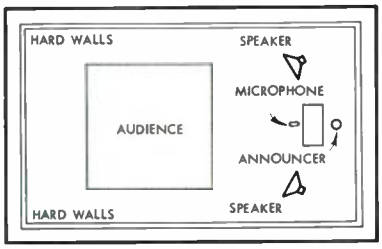


Fig. 5. Public address system in an indoor location.

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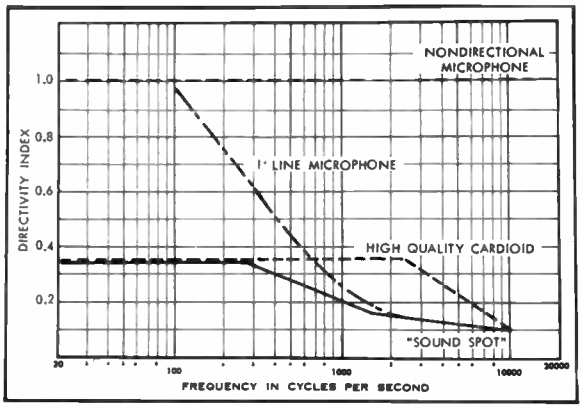


Fig. 6. Directivity index vs. frequency curves.

Mathematically this can be expressed as:

$$\text{Directional efficiency} = \frac{1}{4\pi}\int_0^{4\pi} f^2(Q)\,du_Q$$

where:

$f(Q)$ = ratio of the voltage output for incidence at the angle Q to that for $Q = 0°$, and

du_Q = element of solid angle at the angle Q.

Look again at the three dimensional polar response patterns in *Figs.* 1, 2 and 3. Imagine sound coming from all directions to each of these microphones and you can better visualize by comparing the relative volumes of the figures, the total energy output for each of the various directional patterns.

The directivity index for the polar pattern shapes shown in *Figs.* 1, 2 and 3 are:

Nondirectional	1.00
Bidirectional	0.33
Cardioid	0.33

Keep in mind the *lower* the directivity index the *more* random sound energy is rejected.

Working Distance

When you hear someone say, "This microphone can be worked at twice the distance!" what he is saying is that a particular directional microphone can be used at twice the distance at which a reference microphone can be used successfully. The basic reference is usually a nondirectional microphone.

This makes sense. Each microphone has a certain directivity index which is defined as its discrimination against random and sound sources. If the reverberation and unwanted noise off the major axis and behind the microphone is attenuated to a great degree due to the characteristics of the microphone, then the gain of the amplifier can be increased. Thus, the desired sound sources in front of the microphone do not have to be as high in sound output, or conversely, the sound source would not have to be as close to the microphone in order to have the same level in audio output at the speakers.

The accepted acoustical signal-to-noise ratio for a directional microphone is higher than for a nondirectional microphone under typical conditions. This is where the signal arrives on the major axis while the noise is of random direction.

There are always special cases, but a general method of figuring the working distance for a directional microphone is as follows:

$$W_{d_D} = \frac{1}{\sqrt{\text{Directivity index}}} \times W_{d_O}$$

where

W_{d_D} = working distance for a directional microphone, and

W_{d_O} = working distance for a nondirectional microphone

The directivity index used must be so chosen that it represents the microphone over the frequency range to be used.

Thus a cardioid can be worked:

$$W_{d_C} = \frac{1}{\sqrt{.33}} \times W_{d_O} = 1.7 \times W_{d_O}$$

= 1.7 times the distance a nondirectional microphone could be used.

The Sound Spot directivity index compared to other high quality cardioid directional microphones is shown in *Fig.* 6. Based on a random sound field the lower directivity index of the Sound Spot microphone allows it to be worked at a greater distance than other high quality unidirectional microphones.

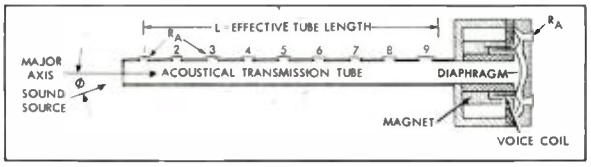


Fig. 7. Diagram of simple line microphone.

Polar Pattern and Directivity Index

Even though a microphone has a low directivity index there will be situations in which placement of the microphone may not allow one to take full advantage of the directivity due to the polar response of the microphone.

For example, take the particular frequency at which the polar pattern of a microphone is bidirectional as shown at (A) in *Fig.* 2. This results in a directivity index of 0.33, which was previously defined for sound arriving from all directions. In the case of reflections or noise directed to the back of the microphone, the sound pickup is as good at the back as at the front. If the unwanted sound arrives at the rear of the microphone, the acoustical signal-to-noise ratio would be low. In some cases the microphone could be reoriented 90 deg. so that the unwanted noise source is at the sides of the microphone. In comparison, a cardioid microphone which also has a directivity index of 0.33, but a polar pattern as at (A) in *Fig.* 3, will pick up a minimum of the energy coming toward the rear of the microphone.

It is not uncommon for the polar pattern of a microphone to change over the frequency range. A microphone is usually designed to give as uniform a polar pattern as possible over most of its useful frequency range. As can be seen from *Fig.* 6, however, greater directivity is usually achieved as frequency rises. In addition, some microphones may exhibit a bidirectional pattern in one frequency range and a cardioid pattern in another frequency range.

Thus, a knowledge of the shape of the polar pattern at various frequencies along with the directivity index is quite useful for solving difficult sound pickup problems.

"Sound Spot" Construction and Operation

The Sound Spot is a combination line microphone and pressure gradient microphone. Each principle will be discussed separately and then the resultant combination will be shown.

A "line" microphone depends upon wave interference for its directivity and thus must have dimensions comparable to one wavelength at the frequencies concerned. The first-order pressure-gradient microphone which is also used here depends on the difference in pressure between two points and, as will be shown later, involves dimensions shorter than the wavelength of the frequencies considered.

These two basic principles are used in making a highly directional microphone,

(*Continued on page 49*)

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pioneer

FOR RECEPTION OF ALL RADIO BROADCASTS...



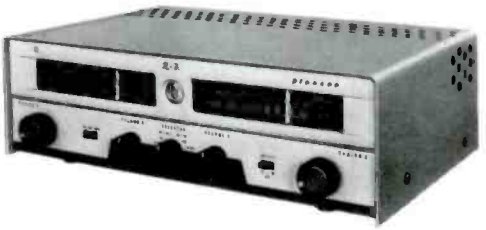
STEREO TUNER AFT-12

Ever since its debut on the market, PIONEER's model AFT-II stereo tuner, a tuner capable of reception of AM-FM stereophonic broadcasts, has enjoyed immense popularity among stereo enthusiasts. Now for those who wish to go a step further in stereophonic sound, PIONEER has developed the model AFT-12 tuner, a tuner capable of reception of stereophonic broadcasts using two AM channels, in addition to AM-FM stereophonic broadcasts.

The AFT-12 is comprised of two independent tuner circuits, one an AM-Broadcast/AM-shortwave circuit and the other an AM-Broadcast/FM circuit. Therefore, by operating both of these circuits together, it is possible to receive stereophonic broadcasts being transmitted using either two AM channels, or an AM channel and an FM channel.

The tuner capacitors are equipped with heavy flywheels to ensure smooth tuning, while with the use of a new type 'magic eye' tuning indicator (a 6G-E12 type tube), tuning has been greatly simplified.

Assemble a stereophonic sound system now—using a PIONEER AFT-12 tuner unit in conjunction with a PIONEER SM-R150 or SM-C800 stereophonic amplifier.



SPECIFICATIONS
Tubes: 10 tubes plus 4 germanium diodes
Tuners:
Channel 1; AM medium wave and AM shortwave
Channel 2; AM medium wave and FM
Power Supply: AC 117 & 100 volts, 50-60 cycles
Dimensions: 15 7/8(W) x 9 5/8(H) x 4 1/2(D) inch
Weight: 15.4 lbs.



ENORMOUS OUTPUT AT LOW DISTORTION !!
STEREO AMPLIFIER **SM-C800**
Power Output: 90 (45W x 2) watts (peak)
Inputs: TAPE, PHONO (MAGNETIC & CRYSTAL), RADIO, MIC., AUX.



A VERSATILE AMPLIFIER THAT CAN BE USED IN THREE DIFFERENT WAYS STEREO AMPLIFIER **SM-R150**
Power Output: 15 (7.5W x 2) watts
Inputs: PHOTO (MAGNETIC & CRYSTAL), TAPE, AUX.

5 Otowacho 6-chome, Bunkyoku, Tokyo, Japan **FUKUIN ELECTRIC, TOKYO, JAPAN**

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The Tape Guide

Maintaining Frequency Response in Recorders

If you are not satisfied with the frequency response you are getting from your tape recorder, this article may tell you why and it may also tell you what you can do to correct it.

HERMAN BURSTEIN*

IN TWO PARTS—PART II

The high-frequency bias current fed to the record head, if applied in sufficient quantity, causes the head to behave in the manner of an erase head. This is shown in *Fig.* 9, which represents the variation in output of a record-playback head operated at 7.5 ips at 1000 and at 10,000 cps as bias current is varied in magnitude. At first the recorded level goes up with an increase in bias, but eventually the level goes down as bias is increased further. By comparing the curves for 1000 and 10,000 cps, it may be seen that the level goes down faster at higher frequencies.

The effect of bias current upon frequency response can be observed more directly in *Fig.* 10, which shows the unequalized response of a record-playback head at two values of bias current.

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

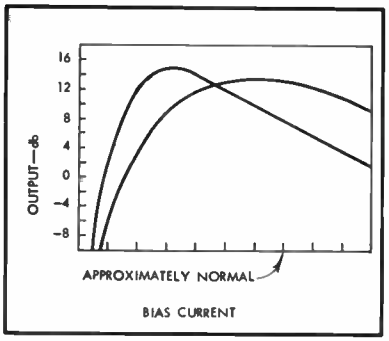


Fig. 9. Variation of output with bias current at 10,000 and 1000 cps for a record-playback head operating at 7.5 ips.

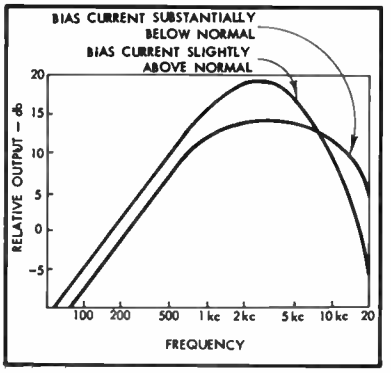


Fig. 10. Unequalized response of a record-playback head at 7.5 ips for two different values of bias current.

At the larger bias current, the drop in treble response is considerably greater.

The reason that the higher frequencies are more susceptible to an increase in bias current is that such frequencies, when recorded on the tape, do not penetrate the tape as deeply as do the lower frequencies. Therefore the upper frequencies are more easily erased by the alternating magnetic field due to the bias current in the record head.

One of the simplest measures that can be taken to improve high-frequency response is to decrease bias current or, from a different point of view, to prevent bias current from exceeding the value specified by the manufacturer of the tape machine or of the record head. In fact, in the attempt to maintain full-range response at 3.75 ips, appreciably smaller amounts of bias current are often used than at 7.5 ips.

The better tape machines often contain a control (variable resistor or variable capacitor) that permits one to adjust readily the amount of bias current fed to the record head. In other machines, however, it is necessary to change the value of a component—resistor or capacitor—in the circuit supplying the bias. In either case, measuring bias current and adjusting it is a procedure requiring technical competence and suitable instruments. While the layman is ordinarily not equipped to do this, it is well for him to be aware that deficient treble may be simply due to excessive bias rather than to something which is much more expensive to remedy, such as a playback head with a gap that is too wide. It can happen that one goes to the effort and expense of replacing a

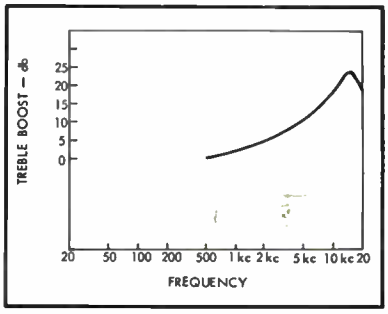
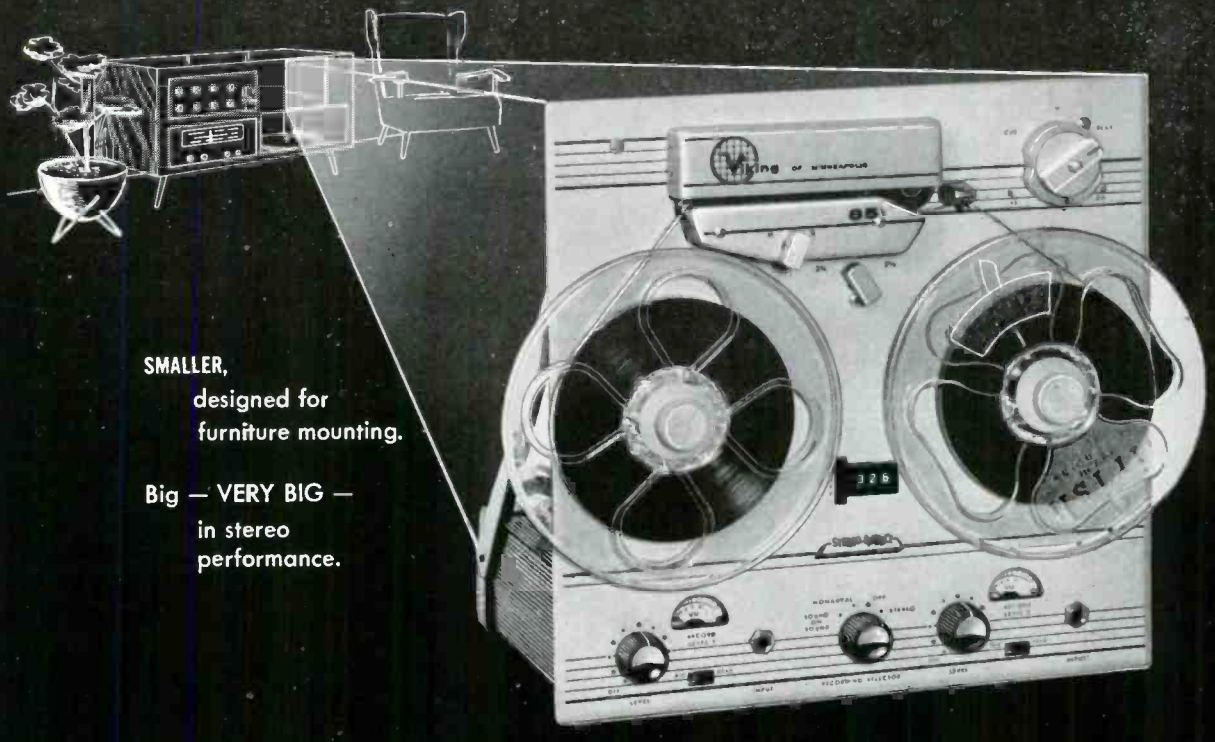


Fig. 11. Typical treble boost employed in recording on a tape machine at 7.5 ips with NAB playback equalization.

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In the Stereo-Compact, Viking offers for the first time, all the performance capabilities of the famous 85 deck, plus integrated stereo recording amplifiers. Amplifiers are the equivalent of the new RA72 Record Amplifiers, with VU-meter level indicators and "hot-spot" erase and record bias peaking adjustments. Front of panel selector provides for selection of stereo, monaural, or sound-on-sound (cross channel) recording modes.

The Stereo-Compact provides amplifiers for recording only. Utilizes the music system stereo preamplifier for playback and monitoring during recording.

Available in quarter-track recording model with exclusive wide-gap record head and short-gap play heads. (Ask for the Viking Stereo-Compact RMQ.)

Available with half-track erase and record heads and short-gap quarter-track play heads. (Ask for the Stereo-Compact ESQ.)

Both models employ high performance *laminated heads* and feature head shift for use with either half-track or quarter-track tapes.

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playback head, only to find that the fault lay in too much bias.

One must guard against excessive reduction of bias in order to achieve the desired treble response. The penalty for too little bias is excessive distortion. And the increase in distortion is quite sharp as one reduces bias. It can easily happen that in the effort to extend treble response by a relatively moderate amount, say from 12,000 to 15,000 eps, one decreases bias to an extent which results in a severe increase in distortion. More about this in the next article.

One can partly or completely avoid an increase in distortion by reducing the recording level, but then one has less recorded signal on the tape, and this means a reduced signal-to-noise ratio in playback. In sum, the effort to extend frequency response by decreasing bias involves an increase in distortion or a reduction in signal-to-noise ratio or a combination of the two. On the other hand, it is quite possible that for accidental reasons bias current is above the level consistent with reasonably low distortion and a satisfactory signal to noise ratio. In such cases, particularly at speeds of 7.5 ips and less, it is important that bias be reduced to its proper value.

Record Equalization

In recording there are two kinds of magnetic losses which become increasingly severe as frequency rises. One of these has already been described—the loss due to bias current in the record head. The other, known as demagnetization loss, refers to the fact that as frequency goes up the equivalent bar magnets recorded on the tape grow shorter, with the consequence that the opposite poles of each magnet are closer and therefore tend to cancel each other to a greater extent.

Altogether, the recording losses require a great deal of treble boost in order to make it possible to achieve response out of 12,000 eps or beyond. *Figure* 11 indicates how much treble boost is necessary by showing the typical treble equalization for a machine operating at 7.5 ips and designed to yield a relatively flat response when playback equalization conforms to the NAB (formerly NARTB) curve. With such a large amount of boost required, it may be realized that anything which prevents correct operation of the treble boost circuit—a faulty resistor, capacitor, inductor, or other component—can deal a severe blow to treble response.

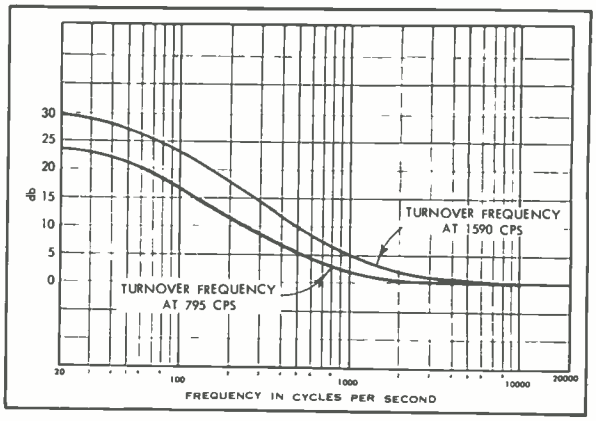


Fig. 13. Playback curves that have been used at 3.75 ips.

In some tape machines, especially the ones of semi-professional and professional quality, the amount of record treble boost can be controlled, within limits. Accordingly, as one adjusts bias current or as one changes to a different kind of tape with different high-frequency characteristics, one can make a compensating change in treble boost. In most home machines, however, there is no such adjustment. Unless precision components have been employed in the treble boost circuit, it may be necessary to replace a component in order to achieve treble response as flat as possible. It sometimes happens that there is a peak in treble response—usually in the region of about 6000 to 10,000 eps—which may be great enough to warrant removal through a change in the equalization circuit. Conversely, treble response may be deficient due to a component that is too far from design value. All in all, variable treble equalization in recording is a desirable feature in a machine to be operated by the audiofan who is meticulous about flat frequency response.

As tape speed is changed, the required amount of treble boost and the frequency (turnover) at which boost commences also change. In many tape machines, treble boost is automatically changed as speed is changed. In others, however, particularly those with external tape amplifiers, the equalization change must be made manually. It is quite easy for the recordist to forget to make this change when shifting speeds. If he has been recording at 7.5 ips and then goes to 3.75 ips without changing equalization, the result is deficient treble in the signal recorded on the tape. If he goes from 3.75 ips to 7.5 ips without changing equalization, then excessive treble is the result.

Some tape machines contain no provision for changing record equalization when shifting from one speed to another. Accordingly, inadequate frequency response is achieved at one speed or the other, unless a compromise equalization is used, which produces less than the best results at both speeds.

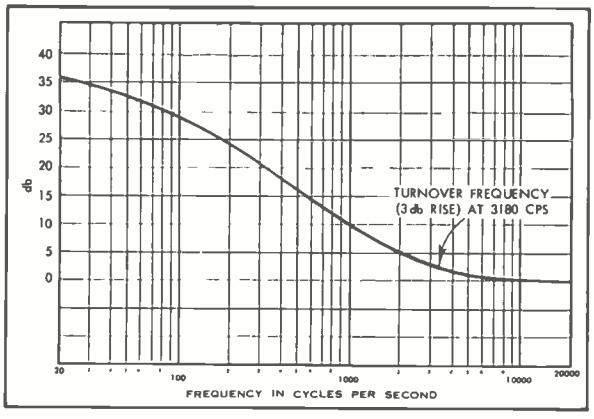


Fig. 12. NAB (formerly NARTB) playback equalization.

Playback Equalization

Figure 12 shows the NAB equalization that is standard for playback at 15 ips and virtually, though unofficially, standard for 7.5 ips as well. *Figure* 13 shows the two playback equalization curves that have been most commonly employed at 3.75 ips, although some tape machines have used the NAB curve at this speed. At the time of writing it appeared that curve (A) in *Fig.* 13 would become standard for 3.75 ips, although there is no assurance about this. In view of the uncertainties about playback equalization at 3.75 ips, the following discussion will be conducted in terms of the 7.5 ips speed, for which there seems to be little dispute, if any, about playback equalization.

When playing most 7.5-ips commercial recorded tapes, relatively flat response will be obtained if the tape machine provides NAB equalization. But to this day a substantial number of home machines provide different equali-

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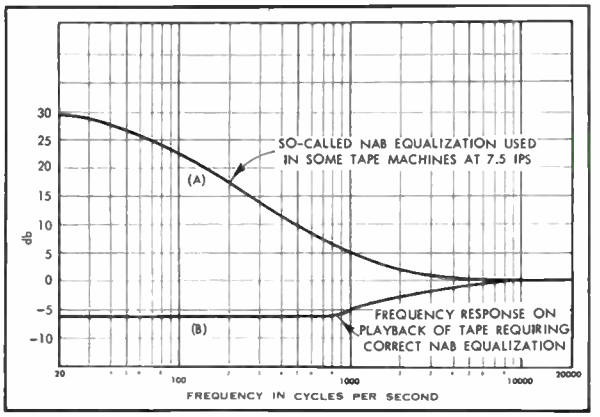


Fig. 14. Effect of improper playback equalization upon frequency response.

zation, typically that if curve (A) in *Fig.* 14, which the manufacturers often call NAB equalization even though it is not. If playback equalization is that of curve (A), the result will be too much treble and not enough bass, as shown by curve (B). This frequency imbalance can be more or less compensated through bass boost and treble cut elsewhere in the audio system.

A certain number of home machines employ so-called half-and-half equalization, as in *Fig.* 15, whereby half the required bass boost is supplied in recording and the other half in playback; similarly, treble boost is equally divided between recording and playback. When playing a commercial recorded tape, there will again be a thinness in the bass region, probably to a greater extent than with machines using the playback curve of *Fig.* 14. Moreover, there will be excessive treble, because half-and-half equalization provides treble boost in playback, whereas such boost (except to compensate playback head deficiencies) is not called for under NAB equalization.

All in all, the individual who wishes to play commercial recorded tapes is well-advised to ascertain that the machine he owns or plans to purchase provides accurate NAB equalization. As previously indicated, a number of tape machines or tape amplifiers that advertise NAB equalization fall short of the mark. Some say simply nothing on the subject. If one already has a machine that deviates appreciably from the NAB curve, it is quite simple for a qualified technician to make the necessary circuit change, often requiring replacement of only one component. However, in doing so, one upsets the record-playback frequency response of the machine in question, meaning that the record equalization must also be altered to achieve flat response when playing recordings made on the machine. Since the record equalization curve is a more complex affair than the playback one, it may be time-consuming and expensive to have record equalization adjusted accurately. What one can do instead is to have a switch installed, permitting one to use either the machine's original playback equalization or NAB equalization.

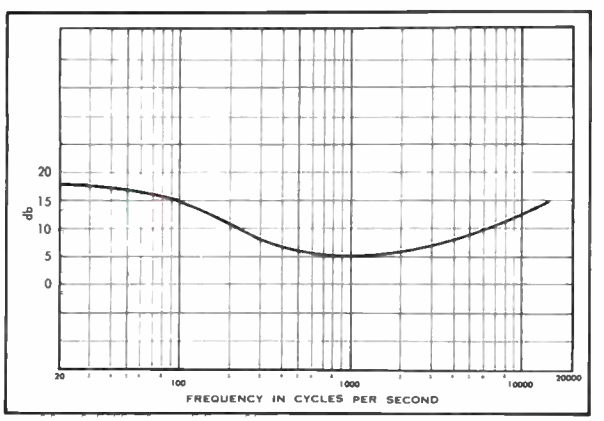


Fig. 15. Example of "half-and-half" equalization employed in some tape recorders for both record and playback.

As with record equalization, the tape machine may or may not provide for automatic change in playback equalization when changing from one speed to another. The comments in the preceding section on this problem apply here as well. However, the problem is less serious in playback. If a tape is played with the wrong equalization, one can correct the error; a new start can be made if desired. But if a tape has been recorded with wrong equalization, circumstances often do not permit the error to be retrieved, as when taping a program off the air.

In a number of tape machines and tape amplifiers, the treble drop above 1000 cps is less than shown in *Figs.* 12 and 13. The reason is to compensate for the falling response of the playback head in the upper range due to gap width. Modern heads, however, with extremely fine gaps on the order of .0001 in., generally do not require such compensation. By and large, the best procedure is to obtain a tape machine or tape amplifier with correct playback equalization and then compensate such deficiencies as may occur by means of the tone controls in the audio system.

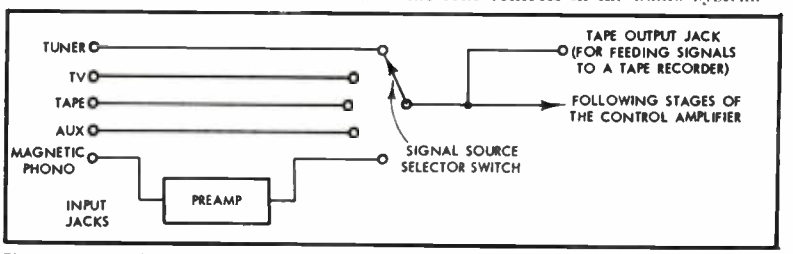


Fig. 16 Method employed in some control amplifiers for feeding incoming signals directly to a tape recorder.

Cables

High-frequency losses can be due to the cables between the tape machine and the rest of the audio system. Let us first consider the cable that carries the signal from the rest of the audio system to the tape machine for recording purposes.

In a number of control amplifiers or integrated amplifiers, the incoming signal is fed directly to the tape recorder, as illustrated in *Fig.* 16. If the signal source has a low impedance—for example, when a tuner has a cathode-follower output—a substantial run of cable between the control amplifier or integrated amplifier and the tape recorder will have no consequential effects upon treble response. On the other hand, if the signal source has a high impedance, then under the arrangement of *Fig.* 16 high-frequency response can be seriously affected by more than two or three feet of cable between the amplifier and the tape recorder.

To prevent the capacitance of the cable between the amplifier and the tape recorder's input jack from having a deleterious effect upon frequency response, some amplifiers feed the tape

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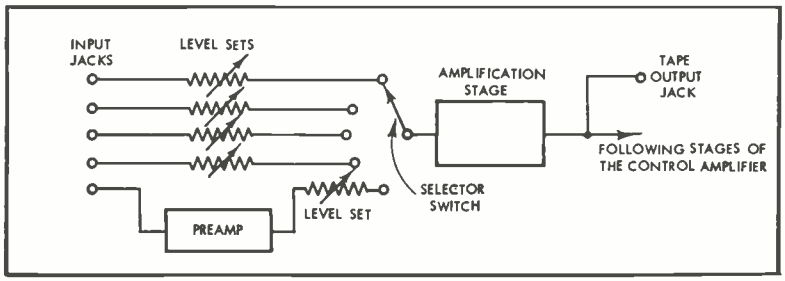


Fig. 17. A second method used in some control amplifiers to feed a tape recorder.

recorder from a cathode follower (or other low-impedance circuit), as in *Fig.* 17. Under these conditions a long cable has no appreciable effect.

The audiofan should ascertain whether the signal presented to the tape recorder comes from a low-impedance source—supplied by either the signal source (tuner, TV, etc.) or the amplifier—or whether it comes from a high-impedance source. In the latter case, he should make special effort to keep the cable to the recorder as short as possible, no more than three feet, and he should use low-capacitance cable.

The same kind of problem exists with respect to the cable leading from the output of the tape machine to the input of the control amplifier or integrated amplifier. Some tape machines have a low-impedance output, so that cable length, within reason, does not matter. But a number of home machines have high-impedance outputs, and here it is necessary to be careful about cable length.

The most serious problem, perhaps, occurs when a cable is run directly from the *tape head* to the control amplifier or integrated amplifier, there to undergo preamplification and equalization. This is the case when the audiofan is interested only in playing tapes, not in recording them, and therefore purchases a tape transport without electronics. In this situation, more than a foot or two of cable can significantly affect treble response.

Kind of Tape Used

Treble response tends to vary somewhat with the brand of tape used and with the kind of tape within the brand. Depending upon the formulation of the magnetic coating on the tape and the thickness of the coating, treble response may vary a few db at the upper end of the audio range.

The thinner tapes tend to have an advantage over standard tapes with respect to treble response. At the middle and low frequencies, the amplitude of the recorded signal increases somewhat with coating thickness. But the higher frequencies, which are recorded closer to the surface of the tape, are less affected by thickness of the coating. Therefore when the tape has a thin coating, as in the case of long-play and double-play tapes, response at low and middle frequencies is reduced in comparison with standard tape. In other words, high-frequency response, relatively speaking, is increased.

The thinner tapes tend to be more limp and therefore conform more easily to the contour of the playback head, assuring close contact between the tape and the head and thereby maximizing treble response. At 15,000 cps at the 3.75 ips speed, differences of as much as 5 db in response have been noted as the result of using thin tapes.

It has been pointed out that an increase in bias current results in a reduction in treble response. However, the extent to which treble response is affected by a slight increase in bias tends to vary somewhat among tapes. In other words, some tapes are less critical than others in terms of setting bias current to the correct operating value.

Location of the Tape Output Jack

In many or most monophonic control amplifiers, the tape-output jack is located ahead of the tone controls so that the setting of the latter has no effect upon the frequency balance of the tape recording. In other ampliers, however, particularly stereophonic ones, the tape-output jack is located *after* the tone contols, and frequency balance of the tape recordings depends upon how one sets the bass and treble controls (and possibly upon the setting of treble and bass filters as well). Quite possibly, excessive or deficient bass or treble in a recorded tape can be traced to the fact that recording did not take place with the tone controls in flat position. Moreover, the error tends to be compounded in playback. To illustrate, assume one normally turns up the bass control to a substantial degree to compensate for speaker and/or room acoustics. Consequently, a good deal of bass boost gets onto the tape. But if the bass control is left untouched in playback, then the repetition of bass boost can become objectionable.

On the other hand, location of the tone controls (and filters) ahead of the tape-output jack has a decided advantage. It permits one to restore frequency balance prior to recording program material on tape. Thus a substantial number of phonograph records have excessive treble in order to impart a false illusion of high fidelity, so-called. By turning down the treble when recording, one comes closer to a tape with natural balance. In addition, reduction of excessive treble tends to reduce distortion in recording. To take another illustration, AM reception is usually deficient in the high frequencies. Accordingly, one can boost the treble to achieve or approach natural frequency balance when recording a tape.

On the whole, location of the tape-output jack after the tone controls seem to be the more advantageous position. But this is an advantage only so long as the operator remembers to adjust these controls from the viewpoint of recording a tape rather than from the viewpoint of what sounds good at the moment over the loudspeaker. To make this point clear, assume that one wishes to record a tape while listening at low level to an FM program. Pleasant listening may require a substantial amount of bass boost to compensate for the apparent loss of bass at low volume. At the same time, it may be undesirable to have bass boost appear in the signal recorded on the tape.

Microphone and Room Characteristics

When recording through a micro-

(*Continued on page 61*)

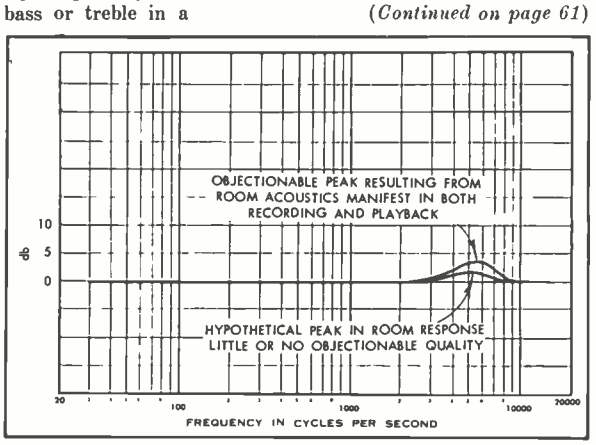


Fig. 18. Effect of a peak in room acoustics upon record - playback response.

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GO STEREO

with 100 watts peak power

ALTEC 353A STEREO

AMPLIFIER—PREAMPLIFIER



Check the specs—compare it for sensible price!

Start into stereo at the 100-watt peak. The Altec 353A is popular for a reason—it delivers the best specs at a realistic price. 100 watts peak, 50 watts rms continuous, 25 watts nominal per channel, stereo or mono. 2 or 3 channel stereo, dual mike inputs, 14 stereo or mono outputs, 6 stereo or mono inputs. Simplified controls handle 13 separate conditions. Response: 20-20,000 cps at 25 watts, ±0.5 db; 10-30,000 cps at 1 watt. Feedback type equalization brings distortion to 1% THD at 25 watts 100 cps, each channel. Low noise level, and too many desirable specs to mention here. With cabinet, just **$225.00.**



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MONO AMP-PREAMP

No peer in its price class. 20-watt output, 20-22,000 cps frequency range, 7 inputs, 3-position scratch filter and rumble filter, 4 volume controls, separate power switch, adapts to stereo, features eyeletted printed circuitry. Less cabinet, **$111.00.**

345A
STEREO POWER AMPLIFIER



Packs two 100 watt peak channels in one package, 60 watt rms continuous, stereo or mono. Flexible controls for 9 separate stereo or mono conditions. Resoonse: ±1.0 db 10-100,000 cps. **$270.00.**



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with wide slide-rule dial, automatic lock-on frequency control. 3 IF stages for clear station separation, between-station silencing, stereo multiplex adaptor, FCC radiation certification, low metal cabinet with platinum pink or gold panel. With cabinet, just **$120.** 307A FM TUNER duplicates 308A except for slide-rule dial. Less cabinet, only **$99.00.**



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features shielded 6 gang condenser, chassis-mounted for perfect grounding; stable, long-lived dry rectifier. Exceeds FCC radiation requirements. AM section features 3 IF stages, providing maximum band-width with very sharp skirt attenuation. FM section features Foster-Seeley (Armstrong) detector, "Cascode" low-noise mixer stage, 2 limiter stages. Less cabinet, **$199.50.**

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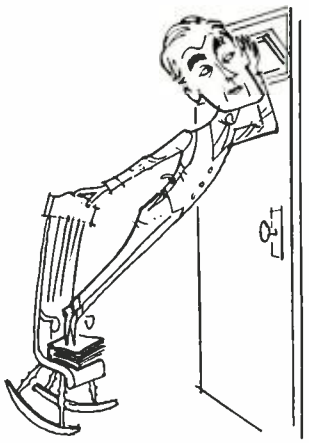
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TUNER: FM; 1. Low noise triode RF stage. 2. Triode converter. 3. 2 high gain IF stages plus 1 limiter. 4. Precision tuning indicator. 5. Temperature compensated oscillator for drift-free operation. 6. Sensitivity—2 uv for 20 db of quieting on 300 ohm antenna. 7. Range—88 to 108 mc. 8. Meets FCC radiation requirements. **AM;** 1. Tuned RF stage. 2. High gain, double tuned IF stage. 3. Rotatable ferrite loopstick antenna. 4. External antenna connection. 5. Precision tuning indicator. 6. AM Phase Switch. 7. Sensitivity—3 uv for 1 volt DC at detector. 8. Range—535 to 1680 kc. **PREAMPLIFIER:** 1. **11 Front Panel Controls**—Master Volume/Power, Automatic Shutoff, Loudness, Stereo Balance, Dual TroLoK Tone Controls (Bass Channel A, Bass Channel B, Treble Channel A, Treble Channel B), eight position Input Selector, FM Tuning, AM Tuning. 2. Inputs—2 pair of non-shorting inputs for permanent simultaneous connection of Multiplex adapter, tape recorder or TV sound—1 pair of low level inputs for turntable or changer. 3. Outputs: 4—Channel A Tape, Channel B Tape, Multiplex 1 and Multiplex 2. 4. Impedances—tape output: for signals introduced at phono input jacks, output impedance is 400 ohms at 20 kc enabling use of long cables with capacities up to 7,000 mmfd. When using high level input Multiplex or Tape: the tape output impedance is determined by the impedance of the signal source. Input Impedance: Magnetic phono—47,000 ohms. Multiplex—100,000 ohms. Tape recorder—100,000 ohms. 5. Treble Boost: 10 db at 20 kc. Treble Cut 17 db at 20 kc. 6. Bass Boost: 15 db at 20 cycles. Bass Cut: 24 db at 20 cycles. **AMPLIFIER SECTION:** 1. **Exclusive Pilot Feature**—Simpli-Matic Test Panel allows you to test for output tube balance using your speaker system as the balance indicator . . . no external meters required. 2. Power output: 30 watts total. 15 watts per channel. DC Balance Controls for minimum low frequency distortion. 3. Frequency response: 20-20,000 cycles, ± 1 db. 4. Hum and Noise: completely inaudible (80 db below full output). 5. Harmonic distortion: 1% @ full power. 6. Power requirement: 170 watts, 105-120 volts, 60 cycles AC. 7. Sensitivity: phono—3 millivolts. Multiplex—110 millivolts. Tape recorder—110 millivolts. 8. Speaker Impedance: Channels A and B—4, 8 or 16 ohms. 9. Simultaneous Stereo and Mono operation with Pilot Stereo Plus output. Can also be used for 3 speaker "Curtain of Sound" Stereo . . . No additional amplifier required. 10. 16 tubes, 1 tuning indicator, 4 silicon diode power rectifiers, 3 Germanium diodes. 11. 5½" high X 14⅝" wide X 11¾" deep. 12. 25 pounds.

Could Have Built The "602"!

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AUDIO ETC.

(*from page 12*)

at least within the area in which I mostly deal. That is my receipt of review material on records.

In the long haul, this index has been astonishingly faithful to trends that are now, in the past, well enough known to all of us. It has nicely reflected the growth of LP and it forecast the death of the classical 45 with deadly accuracy. (I did get them, for awhile.) It, too, cannot really be falsified, for even though one company may, for a while, deliberately flood the reviewers (and the market) with quantities of a given new product, other companies may hold off, thereby pointing to the true situation ever so graphically.

Look, then, at tape with this Reviewers' Index in mind. I'm not sure when I first received an actual commercial "pre-recorded" tape (monophonic) for review, but there were a few of them back, I guess, in 1955 and a modestly growing handful in 1956. Livingstons, RCA Victor, Webcor (now Concertape), several others; this was clearly a small but growing business with, equally significantly, a number of big labels staying out. Then when stereo tape appeared, a boomlet started.

First, as my review records clearly indicate, the stereo tape boomlet was sustained almost entirely by RCA Victor. I got box after box of gorgeous 2-track stereo tapes for review, unsolicited. The prices printed on them were outrageously high and I couldn't believe that people really were buying them—a Tchaikowsky Symphony for a mere $19, say. Nevertheless, the tapes kept coming, and gradually other major outfits started mailing tapes too. When Columbia chimed in, reluctantly to be sure, my indicator said that the stereo boom was getting off the ground even at the prevailingly high prices. Mercury, Westminster, Vox, virtually all the important companies in my area, came along with review tapes, and the picture was really clear.

Yes, virtually all these tapes duplicated a mono disc of the same performance. But the stereo alternative was something special and concrete, adding emphasis to tape's own inherent superiority. And so we reviewers got a good sampling of them in addition to the same music on discs. For awhile.

But—when the stereo disc appeared, the tape review copies stopped overnight! Never, according to my review index, did a boom die more suddenly and absolutely. Finis.

I still treasure several sad RCA Victor press mailings to reviewers, a line of type in the middle of a blank white page, stating that for the month of X there would be no new stereo tapes. Finally even these stopped coming. For the record, RCA kept its library nominally available and, for the record, also managed to issue about one "new" tape every three months. Stereo tape was still officially alive, but you'd never know it.

Two years ago come this June, the RCA cartridge bowed. One year ago this June, it bowed again. How about review copies of RCA-type cartridge stereo tapes?

Well, the straws in the wind have been very, very positive. I have not *ever* been sent *any* RCA-type cartridge for review! Not one. Yes, last summer I personally asked for and was sent a batch of seven or eight RCA Victor cartridges, to try on the RCA player. I had no complaint to make about them and, indeed, found them remarkably good, in direct comparison to their corresponding LP stereo versions, on disc. I took the trouble to make several AB comparisons (though I can't do that sort of thing very often in the hurly-burly of thousands of record releases per year) and I found that on the whole the RCA cartridge rated a bit above the RCA LP of the same stereo recording, notably in what seemed to be a wider dynamic range. So far so good.

The only trouble is that there have been no cartridge review copies since. None from RCA. None from anybody else. Significant?

I agree that, on specific occasions, with specific companies, there can well be minor misunderstandings. You'll remember that in stereo disc's first months I ran into exactly that, with RCA itself—I got only a handful of stereo discs from the company, merely due to an assumption by RCA that I would ask for stereo if I wanted it and an assumption by me that I would get stereo automatically. But, you see, that in itself was symptomatic of the situation at that time, soon after stereo disc had got under way.

Since then, of course, I have received thousands of stereo discs and—significantly again—I get them mostly automatically, without asking. But no stereo tape cartridges.

I don't even know (not being a record shopper) whether you folks can go out to your local record store and shop for RCA-type tape stereo cartridges. But I don't need to know. I have my own barometer for success, and I doubt if it can be disputed very far, one way or the other. Not for long, anyhow.

A year ago, for instance, London Records sent out enormous numbers of stereo discs for review—sixty or so in a single month. RCA, too, had a brave display of large numbers of stereo tape cartridges on view at last year's Hi-Fi shows, as you'll remember. But London is *still* sending out huge numbers of stereo discs for review—preposterously large numbers. It may be a big promotion stunt, but it clearly, by this time, must have general validity, taken along with the lesser but still large numbers of review items in stereo disc sent out by everybody else.

How does 4-track reel-to-reel tape at 7½ ips, stock up in this deadly scale I have devised? How about review copies?

Well, to this moment I have received only a handful of 4-track tapes, no more.

I am aware that several large companies have been releasing them and I am sure that the 4-track reel-to-reel system is on the road to a modest success, sparked by United Stereo Tapes. I know, too, that a great many of the 4-trackers are out of my area, in mood music, jazz, and show tunes.

The indications are perfectly clear, I would suggest. Disc is still far ahead. Tape is still, alas in a state of man-made confusion. And all of tape's horses and all of tape's men (notably the hard-working members of MRIA, the new Magnetic Recording Industry Association) have not yet been able to hoist tape off the commercial ground, in any form. So far, anyhow.

Please, do not take this as a criticism of tape itself nor even of the ardent developers and promoters who have worked for so long towards its hoped-for big success. It is natural and understandable that those who are working in tape should do their best to promote it, to make the most of its present successes and its future potentialities. That is part of the job—for without optimism nobody will get anywhere at all. They are quite right—potentially. Tape still has vast potential.

But until the vexing matter of the tape magazine, or cartridge, or whatever-you-may-call-it is settled, positively or negatively, tape is going to go right on floundering. If C-----ia does not introduce its newer, smaller, slower, narrower tape device, then reel-to-reel 4-track has a good chance for a continued, if somewhat limited, success as a useful adjunct to the colossus, disc. If the new and revolutionary system does appear, the situation could be turned inside out and upside down all over again with possibilities for just about anything.

As for RCA's own cartridge, it was a noble attempt (or anyhow a vigorous attempt) in what still seems to me a basically valid area and a right direction.

If it is dead, its death was not entirely in vain and by no means without useful consequences in the larger future of tape. It did try to meet the biggest difficulty that exists with home tape, that tape *moved by hand* is inherently limited in market potential and can never by any chance reach the enormously varied and responsive market that belongs now to the disc. That is the clincher in tape and until somebody meets the problem head-on, tape is going to stay in a secondary position.

Lovely Month of June

If somebody does make a big try, I'd predict the lovely month of June as an excellent time in which to keep eyes and ears open for radical developments—always assuming they haven't occurred earlier.

June is the time to get married. The weather's fine and summer is just ahead. It's also the time to launch major commercial developments. Nice weather for press conferences and there are three long months afterward in which to get production and distribution under way and rolling. Is *that* important!

Finish up your development all winter long, behind the scenes. (Announce it to the trade, or "leak" it here and there, if desirable.) Set the birthpangs for June and throw your big press parties, for newspapers and mags. Sweat hard all summer and launch the big advertising push in September—then hope like fury to get out the goods in time for Xmas. That's the standard launching time-sequence, wishful-thought-about by most promoters, anyhow. And for the public, the big moment is always that June announcement.

The LP record was announced in June, 1948. (A few were actually sold by Christmas time, as I remember.) The stereo disc was launched in June, 1958. The RCA tape cartridge first appeared that same June and then was launched all over again in June, 1959.

(2) FOR BETTER OR WORSE

If you ever took a course in philosophy, you may recollect a fancy term that, at a certain youthful age, strikes many students as a wonderfully silly yet rather fascinating idea—the Egocentric Predicament. I took my bit of official philosophy many years ago, but I always remember that term and I still enjoy the implication. It is that if you get literal-minded and fol-

(*Continued on page 64*)

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U.S. PATENT 2,775,309

There are hundreds of United States Patents on loudspeakers. Most of them relate to minor improvements; a few have changed the face of the speaker industry.

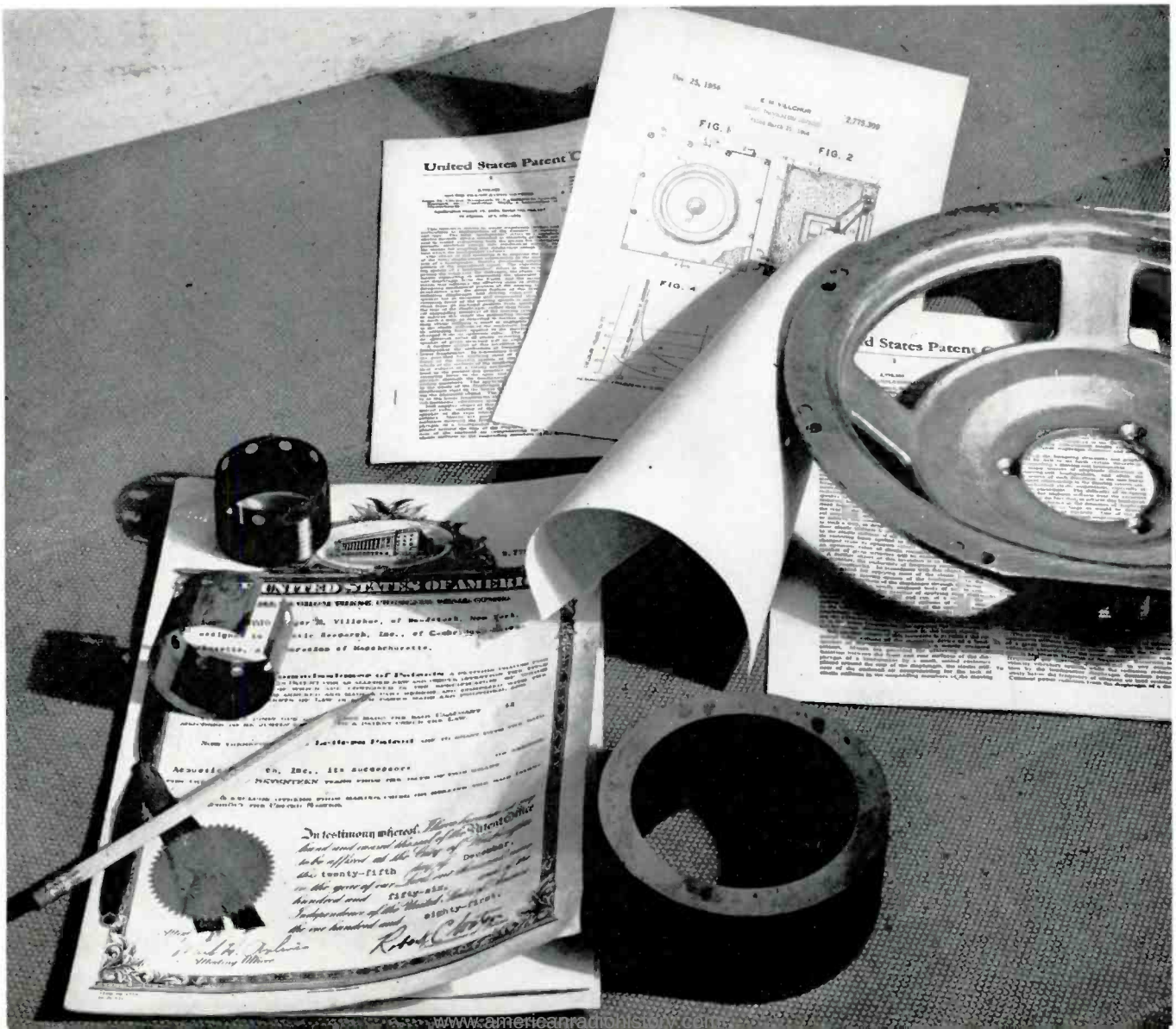
AR's patent on the acoustic suspension speaker system has had far-reaching effects. A very large number of speakers has been produced under the patent by AR and its licensees, and speaker design in general has been given a new direction. In our opinion this patent has proved to be the most significant issued in the speaker field since 1932, when Thuras was awarded a patent on the bass-reflex enclosure.

The basic idea of the acoustic suspension system is that the speaker works against an elastic pillow of air sealed into the cabinet instead of against mechanical springs of its own. This design makes possible vastly improved bass reproduction (particularly from the point of view of lowered distortion), and simultaneously dictates small cabinet size.

The acoustic suspension principle is now used in four AR models—the AR-1, AR-2, AR-2a, and AR-3, priced from $89 to $225. We invite you to listen to these speakers at your dealer's, or, if you live near New York City, at the AR Music Room in Grand Central Terminal.

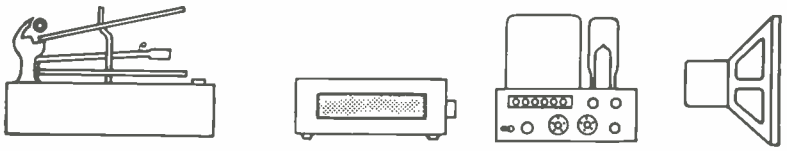
Literature on AR speakers is available for the asking.

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EQUIPMENT PROFILE



SHERWOOD MODEL S-4400 STEREO PREAMP/36-WATT AMPLIFIER

One of the problems in converting to stereo—and there are many who have not yet done so but are still considering how they may do it sensibly and economically—is what to do with already existing hi-fi equipment. Anyone who has already had any experience with stereo agrees that the use of two separate monophonic preamplifiers and two separate power amplifiers—while it may work perfectly when everything is in proper adjustment—is not the ideal solution. After a few hours of trying to achieve a suitable balance of sound outputs without a digital computer to indicate how the settings should be made is likely to conclude that this is far from the correct operating procedure. Even with a stereo adapter or coupling unit, operation is still somewhat complicated.

Similarly, anyone who has any experience with stereo reproduction realizes that regardless of whether the two power amplifiers are absolutely identical and the speakers as alike as two peas in a pod, the control *must* be vested in a single unit. But, says the potential stereofan, what do I do with my present power amplifier? The answer is, of course, to use it, along with your present loudspeaker. Simply get another speaker which you can connect directly to the Sherwood S-4400, and connect the second-channel output of the S-4400 to your present amplifier and speaker, connect up the source equipment and you have stereo.

One of the more logical approaches, in our opinion, to conversion is to change a present mono preamp to a stereo unit, whatever the power amplifier situation may be. This involves, of course, the disposal of an existing preamp unit. But the headaches encountered in trying to keep two separate preamps balanced—with the need for using two hands to change volume, for example—certainly rule against a separate control for each channel. In order to achieve a fair amount of convenience in operation with a similarly fair compromise with economics, the logical approach is in a hybrid type of amplifier such as the Sherwood S-4400.

This unit combines a more or less conventional stereo preamp with a 36-watt monophonic power amplifier at somewhat lower cost than an equivalent stereo preamp plus a power amplifier, both of which are sure to be needed, in one form or another. The power amplifier is fed from the channel 1 preamp, while the existing amplifier is connected to the channel 2 output. In effect, therefore, one winds up with a complete stereo amplifier.

The S-4400 consists of two preamp sections in the usual stereo arrangement—ganged controls, similar circuitry, and so on—and the single power amplifier. Each section consists of a preamplifier comprising the two halves of two 12AX7's separated by a passive equalization networks. This is followed by two additional 12AX7 halves as Baxandall-type tone-control amplifiers and half of a 12DW7 as the preamp output stage. Channel 1 feeds directly into the output amplifier, which consists of a 7199 triode-pentode amplifier and phase splitter followed by an output stage consisting of four 7189/6BQ5/EL84's in a push-pull parallel output stage. The two control sections are not identical in arrangement, but they are in performance.

Among the interesting features of this amplifier are the provision for adjusting phono input level, low-frequency response (rumble filter), high-frequency response (scratch filter), loudspeaker phase, presence, loudness/volume, and for the usual tone controls. The phono/tape-head preamp stages operate with d.c. on their heaters, and adequate filtering keeps the hum and noise to a satisfactorily low level.

The external appearance of the unit is pictured in *Fig.* 1. The upper three buttons at the left control scratch, rumble, and presence filters, while the lower one is the phono level potentiometer which adjusts for different pickup outputs. The left side switch is the tape monitor control and the right switch is the loudness/volume selector. The knobs, from left to right, are the selector switch, balance control—the knob being moved in or out to reverse loudspeaker phase—bass and treble tone controls, volume/loudness control, and function switch. At the far right are two pairs of indicator lights— each pair consisting of an amber and a green section. The upper pair indicate the source—channel 1 or channel 2—feeding the left loudspeaker, while the lower pair indicate the source feeding the right loudspeaker. These indicators are controlled by the function switch.

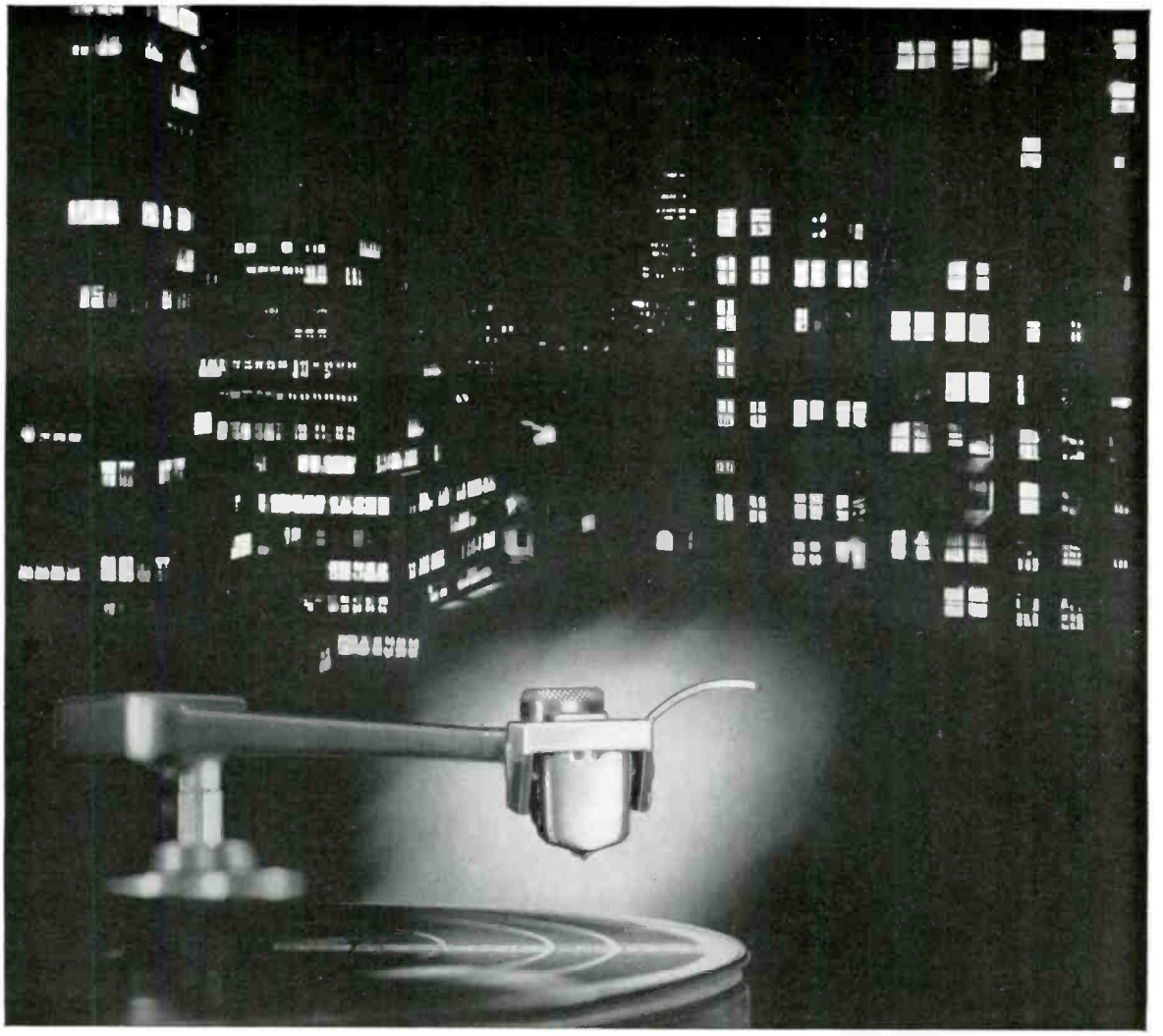
The bass and treble controls are friction-coupled for the two channels; normally they both turn simultaneously, yet they may be moved separately for individual control of the channels. On the rear apron are two convenience outlets—one "hot" and the other switched—the power fuse, input and output phono jacks, and the output tube balance control. On the top of the chassis is a switch which connects the cathode return of the output stages to one side of a heater winding for balancing the d.c. bias to the tubes. With both pairs of tubes returning to ground through an a.c. winding, a minimum of hum will be heard in the loudspeakers when the biases are adjusted so the gain of the two sides of the push-pull amplifier are adjusted to the same gain, which is the optimum operating condition.

Another useful and attractive feature is the provision for converting the tape-head input position to an additional phono input simply by cutting four well indicated jumpers under the chassis. This operation changes the equalization of the tape-head position to that required for RIAA phono. Another pair of jumpers is provided across series capacitors in the main phono inputs. With magnetic pickups the jumpers are left in place—for ceramic or crystal pick-



Fig. 1. Sherwood Model S-4400 stereo preamp with a single 36-watt power amplifier.

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General Electric VR-22 Stereo Cartridge—Superior in the four vital areas

Stop to think for a moment of all the jobs required of a stereo cartridge: It must track, with utmost precision, in not one but two directions. It must separate the two stereo channels inscribed in a single record groove. It must perform smoothly in mid-range and at both ends of the audible frequency spectrum. And it must do all these things without producing noticeable hum or noise. Only a fantastically sensitive and precise instrument like the General Electric VR-22 can do all these jobs successfully.

General Electric's VR-22 is superior in the four vital areas of stereo cartridge performance: (1) **Compliance**—It tracks precisely, without the least trace of stiffness. (2) **Channel separation**—Up to 28 db for maximum stereo effect. (3) **Response**—Smooth and flat for superior sound from 20 to 20,000 cycles (VR-22-5), 20 to 17,000 cycles (VR-22-7). (4) **Freedom from hum**—The VR-22 is triple-shielded against stray currents.



VR-22-5 with .5 mil diamond stylus for professional quality tone arms, **$27.95***. VR-22-7 with .7 mil diamond stylus for professional arms and record changers, **$24.95***. Both are excellent for monophonic records, too. TM-2G Tone Arm—designed for use with General Electric stereo cartridges as an integrated pickup system, **$29.95***.

General Electric Co., Audio Products Section, Auburn, N. Y.

*Manufacturer's suggested resale prices.

GENERAL ELECTRIC

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ups the jumpers are cut to provide the correct equalization and pickup termination. Still another feature is the provision of a strap on the output terminal strip which may be removed to introduce a small amount of current feedback which reduces the damping factor from the normal value of 10 to the value of 2 for those speaker installations which perform better with reduced damping. For ease in selecting input and output phono jacks, they are color coded to indicate typical circuit level and application.



Fig. 2. PACO stereo preamplifier/dual 20-watt power amplifier combination assembled from a kit.

Performance

Maximum sensitivity was measured at 1.75 mv at the phono jack with the phono level control at maximum, and at 0.17 volts at the high-level inputs, both for the rated 36-watt output. Intermodulation distortion was measured at less than 0.2 per cent up to 10 watts, 1 per cent at 25 watts, and 2 per cent at 39 watts. Harmonic distortion was measured at 0.5 per cent at 36 watts, and under IHFM measurement standards the Music Power Output (for short duration) measured 1 per cent distortion at 51 watts.

The rumble filter provides a 12-db-per-octave rolloff beginning at around 100 cps and down 3 db at 80 cps, while the scratch filter provides a fairly sharp cutoff beginning at 5200 cps and sloping downward at 12 db per octave. The presence filter—which is handy for filling in with certain types of loudspeakers which appear to be deficient in the middle-frequency range—introduces a 6 db boost at approximately 3000 cps, the slope being quite gradual and beginning at 500 cps and returning to flat at around 16,000 cps.

Even though this unit is extremely compact, measuring only 4 in. high, 14 in. wide, and 10 in. deep, it packs quite a wallop. Listening quality is pleasant, and worked with another amplifier of equal quality for the second channel is perfectly capable of providing satisfactory performance together with thoroughly adequate control for a stereo system. **D-24**

PACO 40-WATT STEREO PREAMP-AMPLIFIER KIT

In many respects, the audiofan can obtain the greatest value for the money by assembling kits for the equipment he wants—not because the factory-built equipment is not good value, but simply because the many hours of labor required for the assembly can be furnished by the kit buyer rather than being paid for in money. Therefore, if the audiofan can put together a kit satisfactorily, he is in the position of working for the manufacturer for whatever number of hours is required to assemble the kit, and he is remunerated—in the form of a saving in cost—for his labor. The PACO SA-40 was assembled by our assistant editor in—she says—27 hours, and aside from a couple of overlooked solder joints, it worked right off.

This unit consists of two identical channels employing a total of three 12AX7's, two 7199's, and four 7189's. It provides two inputs for phono, one each for tape head and microphone, and three for high level sources such as tuners or tape amplifiers. There are right and left outputs for tape recorder, a separate output for the left-channel preamp for feeding an external power amplifier, and switching facilities for feeding the right-channel preamp section into both output amplifiers when used with an additional power amplifier. Switching is provided to change equalization from 7½ to 3¾ ips for tape and from RIAA to European curves for records, for introducing a loudness contour to the volume controls, and for selecting either or both of two separate stereo speaker systems from the front panel. The input selector switch chooses the desired source and corrects equalization for each; the mode switch provides two positions for balancing the channels—each being separately fed from the left channel input—a monophonic position which connects the two input channels together, stereo, stereo reverse, and two separate mono inputs from either of the input channels. Separate tone controls are provided for the two channels, and the usual balance and loudness (or volume) controls are provided. The unit is 5⅛ in. high, 15⅜ in. wide, and 11¼ in. deep, and weighs 25 pounds.

With 318 separate steps in the assembly, it is quite obvious that there is a lot of work in assembling this unit. The instructions and diagrams are clear, and only in a few instances did our operative suggest that there might be some minor changes in the order in which certain of the operations should be performed for greater simplicity in the construction. However, when the job was done, it was quite professional in appearance, which is as good a sign as any that the instructions are adequate.

Performance

Proof of the construction appeared in the measurements, which fulfilled the specifications exceptionally well. Frequency response for all equalization positions fell within ±2 db, measured at an output of 1 watt. Rated power output is 20 watts per channel, and measured intermodulation distortion was below 1 per cent up to 20 watts, reaching 2 per cent at 23 watts. The use of silicon rectifiers in the plate supply makes possible a music power output of 26 watts at 1 per cent harmonic distortion.

For the rated output of 20 watts per channel, the input signal at the phono jack was measured at 4.8 millivolts, and on the high-level inputs at 0.69 volts. The rumble filter provided a 6-db-per-octave rolloff below 60 cps, and the tone control ranges measured at −16, +17 db at 50 cps (referred to 1000 cps) and −18, +16 db at 10,000 cps.

Hum and noise figures range from −82 db on the high-level inputs, to −69 db on phono and −66 db on tape, all figures being weighted in accordance with IHFM Standards.

The tape output level for feeding a recorder measured 1.9 volts with the indicated input signals for 20-watt output per channel, and are not affected by volume or tone controls. The damping factor is indicated in the specifications as 22, which is borne out by the measurement of an output impedance of 0.7 ohm on the 16-ohm tap.

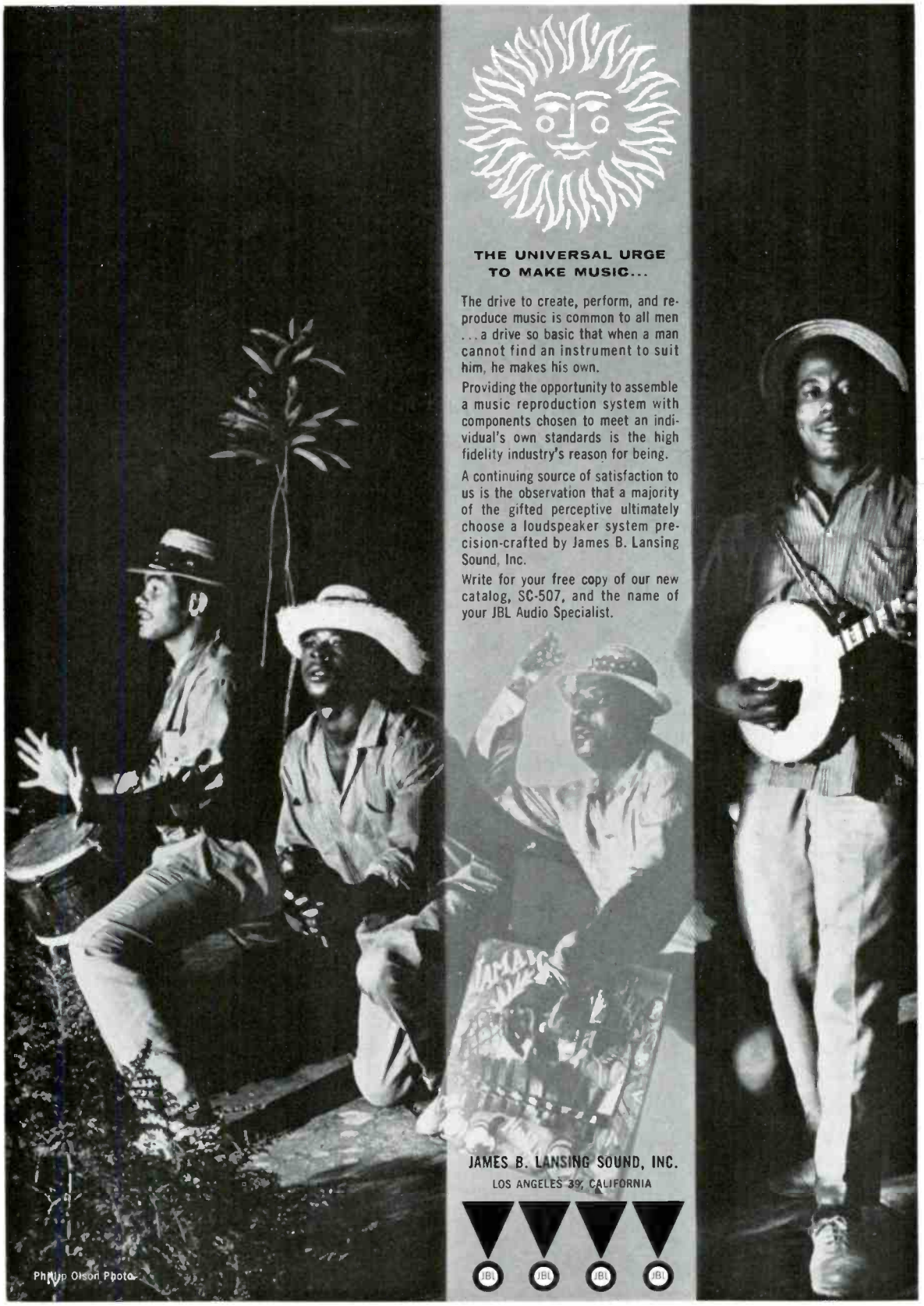
The panel is finished in a satin gold color, and is slanted backward slightly for ease of viewing; the external case is finished in satin gold and black. For optimum ventilation the case stands off the supporting surface by about ¾ in., allowing free circulation of air under the unit and through the holes in the bottom.

After several hours of operation, the amplifier is warm, but does not overheat, and the case does not become too hot to be touched with comfort. It would appear that if the audiofan has the time to assemble this amplifier he will end up with a unit which will give him excellent performance at a reasonable price. The switching provided for speaker selection is in itself very desirable for many installations, and its general flexibility of control should appeal to most users. **D-25**

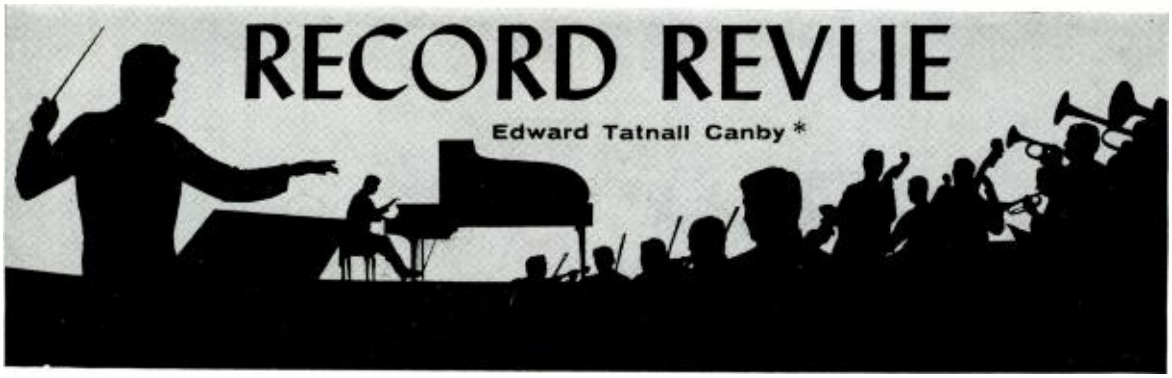


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RECORD REVUE

Edward Tatnall Canby *

PAIRS

Stravinsky: The Rite of Spring
(a) London Symphony, Goossens
Everest SDBR 3047 stereo
(b) Philharmonia Orch., Markevitch
Angel S35549 stereo

Not surprising, considering the orchestras, that these two have a congenial similarity of style—both are excellent musically, fierce but not ugly except as the music demands it, both played with remarkable verve and accuracy by the two groups of British musicians. Markevitch, out of France and born Russian, is closest to the music; but the generally unfierce Mr. Goossens does an astonishingly similar job of well-controlled musical hysteria. Both of these are musically far ahead of such hard-as-nails versions as the Dorati-Mercury hi-fi spectacular of awhile back.

Angel's Rite is at a grand distance—too distant for best impact. I'd say, Everest's is somewhat closer though still with a big overall liveness, and Everest's is at a slightly higher level (or sounds so); the inner details are somewhat sharper and more clear. All in all, I'd hate to have to choose but for fi I'd pick Everest by a hair, for music, Angel, by another hair.

Grieg: Piano Concerto Op. 16. Franck: Vars. Symphoniques. Litolff: Scherzo. Clifford Curzon; London Philharmonic, Boult.
London CS 6157 stereo

Grieg: Piano Concerto, Op. 16. Schumann: Piano Concerto, Op. 54. Solomon; Philharmonia Orch., Menges.
Capitol SG 7191 stereo

British competition again—indeed, from the two biggest, Decca and E.M.I. The London recording is the most massive in sound and will appeal most immediately to hi-fi lovers. But to my mind, the Solomon-Philharmonia Grieg is musically far superior and plenty good enough in the hi fi, as well. London's Curzon & Co. go in for the big dramatics that, in this day, tend to make the Grieg music merely seem more dated than it is—a false emphasis, again and again, too unctuous, without enough musical conviction to shape the unction into proper expression. Same goes for the Franck in the reverse—a lovely piece that is too perfumed here, and yet somehow heavy-handed too. I didn't like it.

Solomon's Grieg (and the Philharmonia's) is lighter, more even, more straightforward and much more believable as music. I am sure that all who listen to the music *as music*—not mere hi-fi—will enjoy this disc. And the always-difficult Schumann concerto on the reverse benefits from the same sort of treatment. It comes off wonderfully well.

Handel: The Water Music
(a) Philomusica of London, Thurston Dart.
L'Oiseau-Lyre SOL 60010 stereo
(b) Amsterdam Concertgeboew, Van Beinum.
Epic BC 1016 stereo

Handel: Water Music, Royal Fireworks Music (suites) Vienna State Opera Orch., Prohaska, Appia. Vanguard SRV 115SD stereo

There was a time when "The Water Music" meant, purely and simply, the familiar suite originally concocted by Sir Hamilton Harty, all six movements of it (or other copyright-free imitation thereof). But the real Water Music was smaller in number of instruments, much larger in terms of length; sources differ but the respectable average is around twenty movements altogether. The "extra" music has been getting around lately. Two out of these three recordings have it.

The only one of these that attempts to give approximately the original scoring, unarranged (even this is somewhat problematical) is the Oiseau-Lyre stereo with the excellent Mr. Dart, who has done a splendidly musical job with many restored antiques. He divvies the Water Music into three sections (suites) in F, G, and D, conjectures that maybe the middle section was played indoors for the king while he supped on land and the last and most brilliant part on the river going home—fast, for it is short. (But the existing accounts say the whole music was played "three times over".) Anyhow, it's a good division and the really small orchestra, with Handel's own horns, trumpets, oboes for color and an occasional accompanying harpsichord, sounds refreshingly lovely to my ears. It is done up in a big, comfortably live recording—an unbeatable sonic combination.

The Amsterdam orchestra plays the complete Water Music—most of the whole—in an arrangement for large orchestra not unlike the familiar Harty one. But here the directors, recording and musical, play a trick that is increasingly popular today, having your small-orchestra cake and eating it too. That is, they contrive to give a small-orchestra sound to their big orchestra. You hear the harpsichord accompaniment; many instruments seem close and intimate, like Baroque chamber music, and yet the orchestra as a whole is large and symphonic. Interesting and perhaps necessary if you are to use a big "name" orchestra, and it makes for a satisfactory in-between version of the Water Music in long form.

Vanguard's two short suites, Water and Fire, are for out-and-out big orchestra, in arrangements roughly like the familiar ones we usually hear—Harty and Beecham. Yet even here a small-group effect is approached, in still another way, via close-up groupings of soloists, concerto-grosso style, In the Fire suite, thus, there apparently is a string quartet that alternates with the whole string orchestra. (It's just as loud, but is recorded close-up.) Though with different conductors, these two suites both tend towards a fast delivery and no leisure for schmaltzy effects.

Dvorak: Symphony #5 ("New World").
(a) Vienna State Opera Orch., Golschmann.
Vanguard SRV 114-SD stereo
(b) Columbia Symphony, Bruno Walter.
Columbia MS 6066 stereo

Vanguard's "New World" is the newer and cheaper (a low-price special demo)—but, for once, it seems to me the company has not used good judgment. At a higher price, the Columbia version is far superior, from beginning to end.

The trouble is, apparently, in the Vanguard conductor, Vladimir Golschmann—who recently left the somewhat insular Saint Louis orchestra after a quarter century there. Golschmann, as I quickly found out when I was in Saint Louis some years ago, is a conservative "natural" for Franco-Russian music of almost any sort, and sure death to German music and its relatives. I heard a Haydn symphony under his direction that left me horrified. Dvorak, alas, is in the negative zone of Golschmann's musical vision. This performance simply rings false to me in every line, missing the wonderful sense of the music most painfully—and this with a Viennese orchestra, too! He must really have put over his own ideas with a vengeance.

Bruno Walter may sound a wee bit old fashioned and soft-hearted, but to him Dvorak is second nature; his version is heart-warmingly "right." Not many conductors can hit it off with this symphony nowadays—it's usually over-dramatized, underdone on the vital lyric side, Dvorak's best. Try Walter—his recipe is good

Debussy: Images for Orchestra (Rondes de Printemps, Gigues, Iberia).
(a) New York Philharmonic, Bernstein.
Columbia MS 6097 stereo
(b) Boston Symphony, Munch.
RCA Victor LSC 2282 stereo

Released only a few months apart (Columbia's is the more recent), these make an interesting comparison. The three big works haven't often been heard all at once—"Iberia," in three movements on its own, is usually heard separately; the other two, a movement apiece, are mostly side-tracked. But the whole set fits perfectly on an LP—if not on a concert program. One more victory for recorded music!

The Bernstein version is more poignant, with greater emphasis on details of melody and color; the recording goes well with this—it is close-up, in the new Columbia manner, bringing out much interesting detail playing, accenting the beauty of the complex orchestrations (not all by Debussy: his friend Andr'e Caplet did most of the job). On the other hand, the RCA performance with Munch, an impeccable Frenchman himself, is all formal perfection, recorded at a greater distance and with the larger shapes and effects brought out, both musically and in the recording.

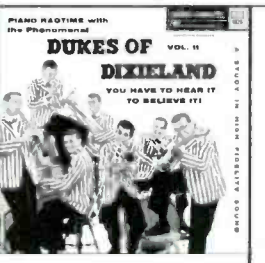
The Boston playing is superior in many ways, with better ensemble, more precision and more polish. The effect is superb; Boston outplays New York. But Bernstein's "heart" is an asset in terms of warmth.

Though none of the commentators seem to know it, "Gigues" is based on at least one familiar Scots tune, "Well May the Keel Row"—I used to sing it in grade school, The other jigs are presumably Scots too, by the sound of them, and we have thus a French-style Scots Rhapsody—as "Iberia" is a Spanish Rhapsody. "Rondes de Printemps," the remaining piece, is based on French folk

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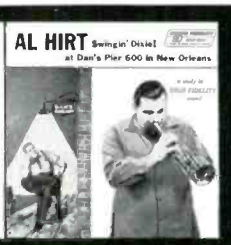
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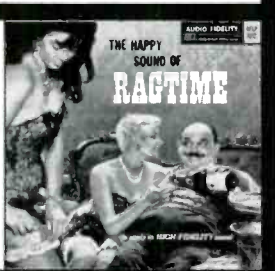
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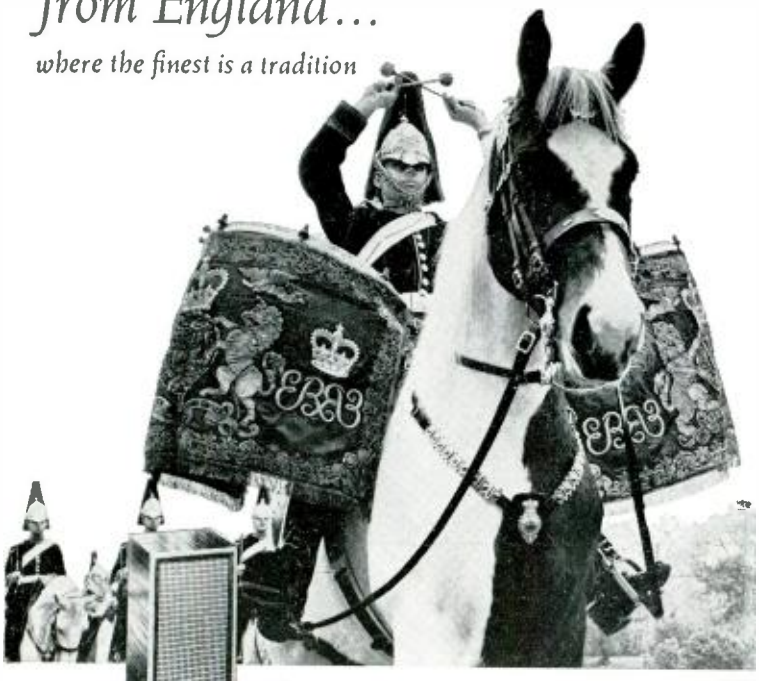
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tunes and is thus, clearly, a home-style evocation, to match the others. Odd that nobody ever seems to see this.

Ravel: Mother Goose Suite; Alborada del Gracioso; La Valse. Whittemore and Lowe, duo-pianists.

Capitol SP8513 stereo

Ravel: Ma Mere L'Oye; Alborada del Gracioso; Pavane pour une Infante Defunte; Rapsodie Espagnole. Cento Soli Orch. of Paris, Argenta.

Omega OML 1032 stereo

One of the astonishing things about much of Ravel's music is that it exists equally in two forms, for piano (or two pianos) and for orchestra—and in every such case, each version seems born and bred for its own medium alone, whether orchestra or piano. Most of us (except pianists) know the orchestral versions best; whichever form you know, the other is bound to amaze you. No other composer I can think of has hit this peculiar relationship between piano and orchestra.

The Whittemore and Lowe disc is a fascinating stereo, one piano on each side of your living room (and this is one record NOT to use a "third" or center channel upon!). They have a fine sense for Ravel and their teamwork is impeccable—"La Valse" is really extraordinarily in the seldom-heard two-piano version. Some of the music is one-piano, arranged for two, but the expansion is felicitous and in style.

Ataulfo Argenta made some spectacular stereos before he died; his best work was in French and Spanish music and this is a splendidly alive and intense Ravel recording, complementing the above in several of the works.

Chopin: Waltzes. (Complete).
(a) Alfred Cortot (1934).

Angel COLH 32

(b) Malcuzynski (1959).

Angel S35726 stereo

Angel purveys both of these recordings, made all of 25 years apart, and Angel has obligingly spaced the two sets out identically on the pair of discs—even the separation bands are the same. The company thus invites comparisons, between a top Chopin pianist of today and one of the great figures of the early part of the century, and I heartily recommend the same—I spent literally days on these two records, so interesting did I find them.

Malcuzynski is perhaps the ideal pianist for the Chopin waltzes today. His versions are poetic, imaginative, free in rhythm, never hard or ugly but full of power; the piano is huge and full, somewhat hard in its louder sounds but lovely most of the time in its reverberant stereo form. You will not find better Chopin today (nor better recording) than this.

Cortot, whose prime was in the early days of the century, is a greater pianist but a more eccentric one—or so he seems today. He is a fabulous showman, in the manner of his time; he takes breathtaking liberties with the music, as no one would dare to do now, but carries them off (even the wrong notes) with a drive and lightness that is the product of an interpretative genius, no less. (See last month).

Mozart: Serenades #11 and #12, K. 375, 388. Everest Woodwind Octet, Newell Jenkins.

Everest SDBR 3042 stereo

Mozart: Serenade #11, K. 275.
Beethoven: Octet in E Flat Op. 103 (1792?). Conservatory Professors Chamber Society of Prague.

Vanguard VSD 2043 stereo

These two recordings, overlapping in a Mozart Serenade, oddly span both the Iron Curtain and the Alps—for Newell Jenkins, who spent some ten years mainly in Italy,

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conducts Mozart in a brisk, elegant, transparent manner out of the Italy of the eighteenth century, his specialty, whereas the Professors at Prague play their Mozart and Beethoven in a fully Austro-German style, right in the Germanic tradition, Iron Curtain or no. (Mozart has been a top favorite in Prague since his own days in the city, where his operas had their greatest success.)

I like the Jenkins lightness and dispatch and Everest's recording too; but I suspect that the more juicy, slightly more romantic Prague Mozart will please more listeners—they really play wonderfully expressively, these Professors. And do I hear a Vanguard original, i.e., taken down by Vanguard itself in Prague? The big, warm liveness is the sort that Vanguard records so well in Vienna and elsewhere. Lovely. Everest has its Octet closer and drier, in line with the playing.

The Beethoven Octet is a surprise, a very pleasant early piece, expertly and expressively written in non-boisterous style. Æ

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O Winston Link stereo

Another Link steam railroad record—need more be said! This one is in stereo, too, which adds a certain something to the Link technique, imparting a fine spatial sense to the whistle duets between distant trains echoing through the mountains, dramatizing the long approach (to the left) of a laboring titan and its passage nearby (and off to the right), then on into the distance. There's a reasonable minimum, too, of what I call the U-turn effect—sound coming straight at you from speaker A, then straight away in speaker B after a quick 180-degree turn.

The big thing about Link, aside from super fi and beautiful photographs of the very sound you hear, is his excellent and original sense of imaginative drama. His aren't just any old engines and trains; they are particular trains, on particular days, at particular places, and the whole sequence is described in enthusiastic prose on the album cover, so that you can follow exactly what happens. Moreover, Link knows one unique trick—keep the sound running. His trains run consecutively for minutes and minutes, building marvelously dramatic tension as some huge, puffing monster approaches from the far, far distance until it passes, then moves on, on, on, back to silence.

There's always a trick effect in a Link record, natural and unrehearsed; in the last, it was "Silent Night" played on a peaceful small-town church carillon, drowned out by the roar of the Christmas eve express going through—in this new record the stunt is a distant cow, bellowing sadly in answer to the long wail of a steam whistle. Poignant touch, and pure Link-ese!

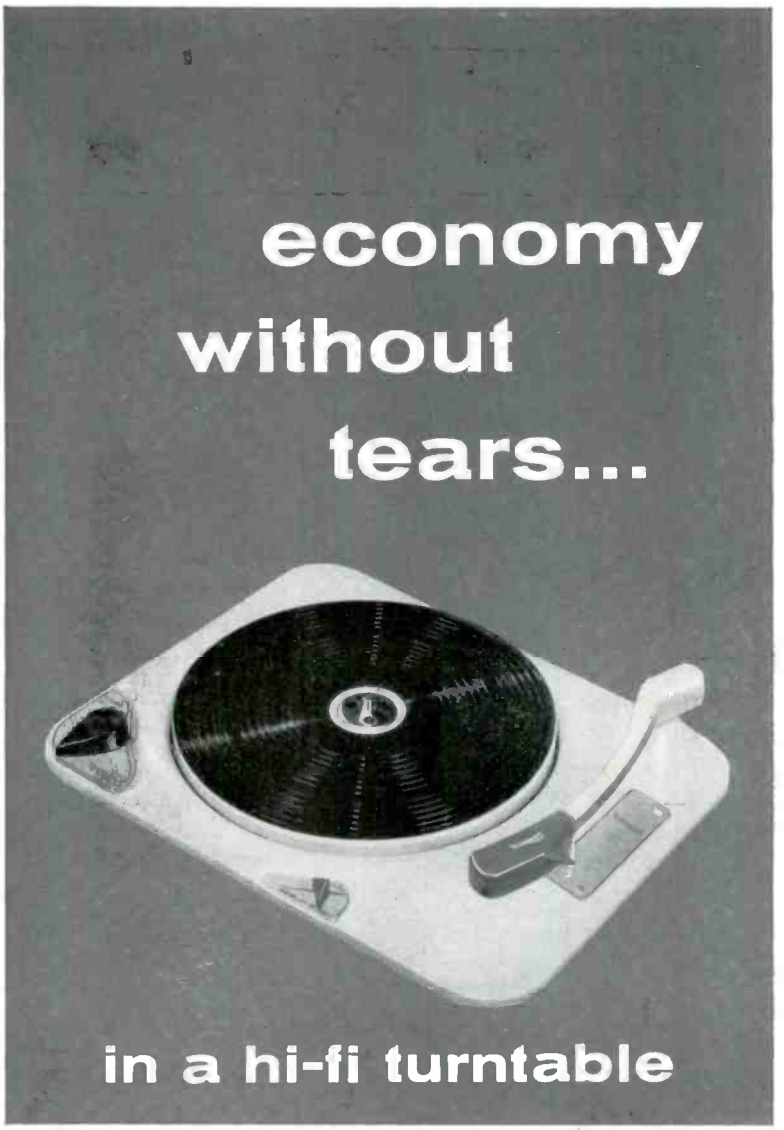
The wonderfully silent plastic surfaces on these records have much to do with the appealing effect of very distant trains, whistles, sounds of nature such as crickets, the low murmer of casual voices off in the background. Link builds in a huge dynamic range, thanks to the capability for extreme low-level sound and the complete absence of recorded hum and rumble.

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Noh is a continuously active tradition going back 600 years or so, carefully preserved in full-time schools of study, the newest of which dates from the seventeenth century. Noh, if I am right, is in part written down, via a kind of suggestion-notation, related to the early European neumes for our



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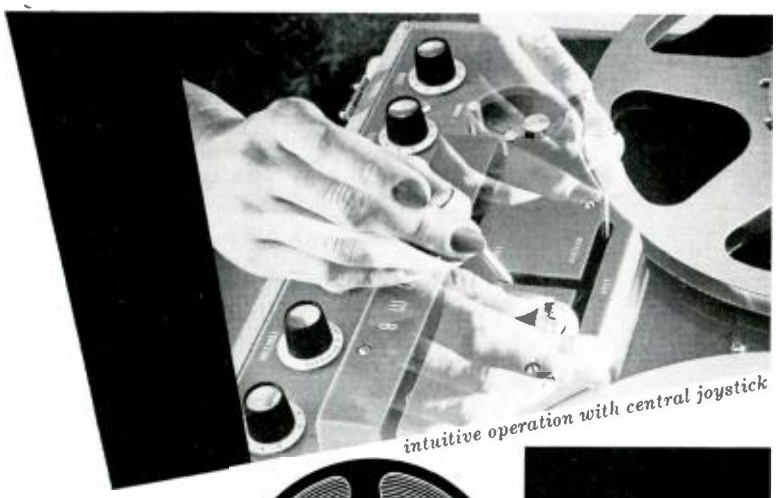
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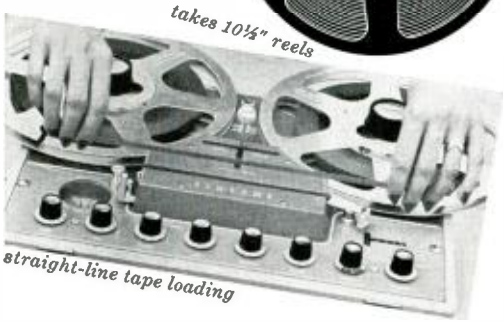
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music. But most of the tradition is passed on by long study, eye to eye and ear to ear. Every detail is precisely worked out, relatively unchangeably, the sort of formal art that the East has long held to be the essence of continuing culture.

So—what do we hear, under these inspiring auspices? Well, I'll have to be crude. Your first impression is likely to be that you are listening to a herd of dreadfully distressed cows, locked up in a barn unmilked. Lowings and wailing, hiccups, wheezes, groans galore. A shrill flute plays, not one note "in tune," sliding up and down in pitch in a seasick fashion. Somebody idly chops wood in the background—a set of percussion instruments. You become aware that some of the groans are evidently words; there is a chorus. Throughout the "action" other performers keep sounding as though suddenly kicked in the stomach, or stabbed in the vital organs—a kind of horribly eloquent grunt, straight out of the TV westerns (but there, the villain grunts once and falls dead.)

Dancing takes place (according to the accompanying booklet). Words are replaced by an endless series of strange, heaving exclamations, *ceyough, eceyough,* and, faster, *yo, yo yo.* I kept mumbling to myself, irreverently, *"and a bottle of rum."* A wild screetch of agony lets loose in the background. Notes say it is Boy Dancer remarking "The white Chrysanthem-dew." More cow-grunts from the chorus, saying (notes), "The dew of the flowers dripping day by day In how many thousand years Will it have grown into a pool?"

No disrespect intended, mind you. I'm only pointing out that what is clearly an inspiring and timeless artistic preoccupation for the Japanese in the know (Noh), is for us incredibly, entirely meaningless.

No, not even the vaguely pleasurable excitement that you'll surely arrive at, after awhile here, is to be called genuine appreciation. Remember the Siamese (?) who thought the best part of a Western symphony was the tuning-up sounds at the beginning?

2 Contemporary Composers. (Alec Wilder: Suite for Brass Quintet. Hammond: Quintet for Brass.) New York Brass Quintet. **Golden Crest CR 4017**

This is a sincere and well-meaning record from start to finish, but the music is remarkably unimportant and it's hard to figure who is supposed to be the intended listener, unless other brass players.

The trouble is that the music doesn't focus on anything much, except perhaps fancy brass playing (which it does very well); it's neither this nor that, has a bit of almost anything, says not very much in far too many musical words.

This is a typical phenomenon of our age of musical confusion and overspecialization, I'm sorry to say. *What is music for?*—that's the question now, and it has replaced the old one, what is music *about?* If you're after brass music for the edification and exercise of brass players, this is it, decidely—it is beautifully written, hard to play but effective in terms of brass technique; the players are good and they enjoy themselves, obviously. But why should *I* listen—why should *you?*

The Alec Wilder piece is the more musically interesting to me, because though Mr. Wilder doesn't ever quite seem to be able to find himself, outside of the commercial music medium, he does have a gift for simple melody and he does, somehow, radiate in all his music a personal sincerity that comes through in spite of the dismal cliches and hackneyed harmonies that he occasionally promotes. The Wilder is hardly "great" music (and who wants great music *all* the time—good music is more important, most of the time); but it is listenable and very simply enjoyable on a minor level.

The other piece is less good, for my ear, because it is more skillful, much slicker, longer, and practically soulless. I itched to turn it off, long before the end; it just irritates me, all this polished and smooth brass playing, signifying virtually nothing. Sorry—you can always try it to see whether you feel otherwise and, indeed, I suggest you do. Should be interesting.

(Continued on page 66)

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MICROPHONE

(*from page 28*)

yet keeping it moderate in size and weight.

The Line Microphone

A simple line microphone is shown in *Fig.* 7. A series of openings in a tube shown as #1, #2, #3, and so on are on the major axis of the microphone. There is an acoustical resistance, made of cloth, over each opening. This cloth is adjusted so that a given sound entering each opening in turn will produce an identical sound pressure at the diaphragm. At one end of the tube is a diaphragm, voice coil, and magnet as shown. Behind the diaphragm are openings covered with acoustical resistance r_a. The pickup tube is terminated at the diaphragm in an acoustical impedance which minimizes the acoustical energy being reflected back down the tube.

To understand the operation of a line microphone, imagine a wave front of sound pressure traveling along the major axis of the microphone. A change in pressure at the first opening causes a wave front to travel down the inside of the tube toward the generating element at the same velocity as the wave front on the outside. In like manner, when the wave front causes an increment of sound energy to pass through #2 opening it is in phase with the pressure front that has traveled from #1 opening inside the tube. This condition is identical at each opening.

Continuing down the tube the sound pressure at #9 opening is in phase with that on the inside of the tube. This gives a maxmum resultant pressure at the generating element when sound originates from the angle $\phi = 0$ deg.

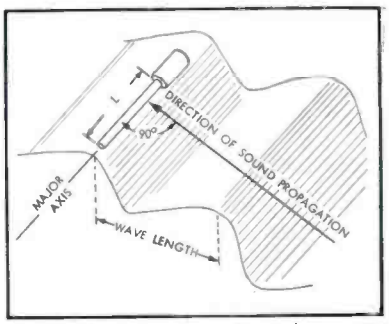
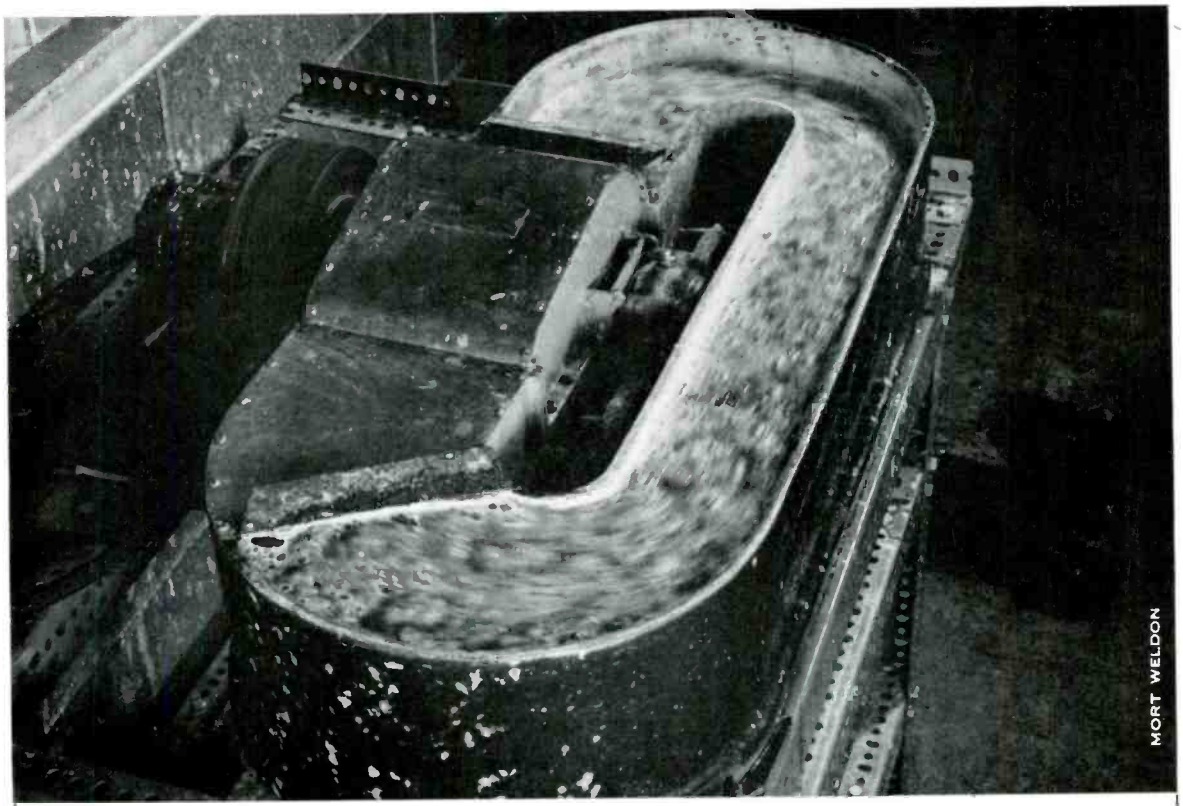


Fig. 8. Line microphone in a plane-wave sound field.



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Not so long ago the mahatmas of hi fi were solemnly preaching anent loudspeaker enclosures that "the bigger the box, the better the sound." Since the advent of stereo, this catch-phrase is no longer heard. The reason, obviously, is purely commercial. The monaural market was able to swallow one big box, but the stereo market couldn't swallow two.

Since necessity is the mother of invention, this situation created a galaxy of new geniuses. Though they had never thought of it before stereo, or even said it couldn't be done, there suddenly appeared a rash of small boxes, even "shelf-size," all with the most astonishing attributes. They were "even better" than their big brothers. Actually, they were nothing more than smaller versions of the same old bass-reflexes and folded-horns with their inevitable boom and distortion.

Some time before this stereo-forced miniaturization, an entirely new, definitive and compact loudspeaker enclosure was invented . . . an invention of such outstanding novelty and merit that fifteen claims . . . all that were asked . . . were allowed by the Patent Office. Equally valuable foreign patents were also granted. The principle was ingenious, logical and scientific, and should appeal at once to anyone who has perception enough to grasp the idea.

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Now, imagine sound energy traveling in a plane wave as shown in *Fig.* 8, approaching the microphone 90 deg. off the major axis. Also assume L (length of line or tube) $= \lambda$, the wavelength at the frequency we are observing.

At the same instant of time sound will enter all openings along the tube in phase, but each increment of sound pressure has to travel a different path length to reach the diaphragm. Sound entering #1 would be one wavelength behind that entering #9, and thus be in phase with that at #9 as shown in the vector diagram in *Fig.* 9. (One revolution clockwise represents a phase lag of 360 deg. or one wavelength.)

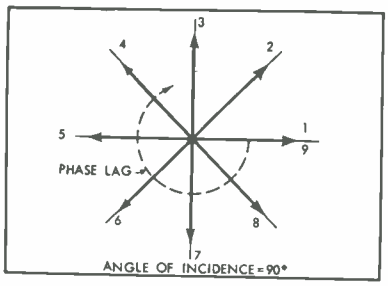


Fig. 9. Diagram of angle of incidence of 90 deg.

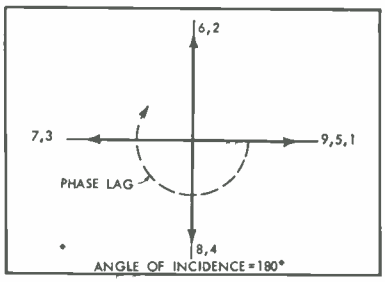


Fig. 10. Diagram of angle of incidence of 180 deg.

Consider #2 and #6 on the diagram. They cancel each other because they are separated by one-half wavelength. Comparing the phase of the sound entering hole #3 with #7 and #4 with #8, it can be seen all will cancel leaving a minimum pressure to affect the generating element.

Now consider the case of sound entering from the rear of the microphone using the same frequency as before where $\lambda = L$. Sound enters hole #9 and in addition travels on to hole #5, enters, and travels back down the inside of the tube to #9 making a total path length equal to a wavelength or a 360-deg lag, as marked on the diagram in *Fig.* 10.

A similar effect occurs at opening #3; sound travels $\frac{3}{4}\lambda$ from #9 to #3 on the outside of the tube and then $\frac{3}{4}\lambda$ back to #9 on the inside of the tube, giving a vector in position shown in *Fig.* 10.

If there were an infinite number of holes or a slot along the tube would give

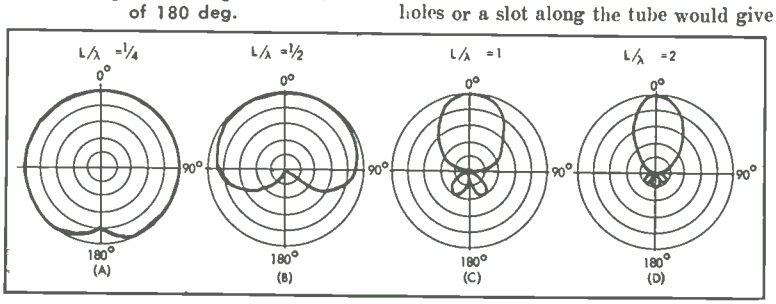


Fig. 11. Polar patterns for line microphones having various values of Lλ.

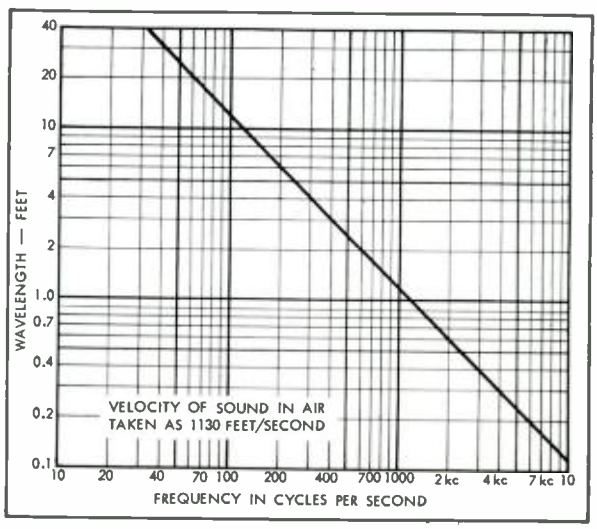


Fig. 12. Frequency vs. wavelength of sound in air.

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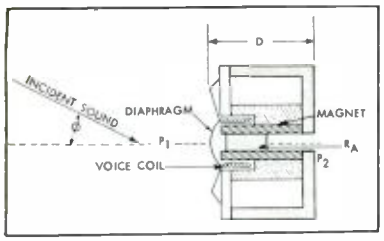


Fig. 13. Simple pressure-gradient microphone.

vectors on the diagram which would all cancel just as in the case for the angle of incidence of $\phi = 90$ deg.

An equation which expresses the ratio of the output of a line microphone, such as the one discussed, at an angle ϕ to the output for $\phi = 0$ as follows[2]:

$$R_\phi = \frac{\sin \frac{\pi}{\lambda}(L - L\cos\phi)}{\frac{\pi}{\lambda}(1 - L\cos\phi)}$$

where L = effective length of line microphone
ϕ = angle of incident sound
λ = wave length of sound at the observed frequency

The polar pattern of a line microphone for various values of line length L compared to wavelength λ of sound is shown in *Fig.* 11, and it is seen that for a fixed length of line or tube the pattern becomes sharper as the frequency increases.

From the chart of *Fig.* 12 the sound wavelength λ for a given frequency can be found using air as a medium of transmission.

Consider the line microphone one foot long—$L = 1$ foot. The polar pattern at 1130 cps would be as shown at (C) in *Fig.* 13 because $L/\lambda = 1$. At $\lambda = 4$ feet or 283 cps the microphone response would be nearly equal in all directions as shown at (A). The directivity in the 100-cps range is important for a directional microphone in order to reject possible reverberation pickup. Thus, this 1-ft. line microphone would be objectionable in the frequency range of 100–400 cps because of poor directivity.

The solution to this problem is simple. Extend the line of the microphone to a little more than 5½ feet and a pattern as at (B) in *Fig.* 11 would be obtained at 100 cps. Or, better yet, make the line 11 feet long and obtain a polar pattern as shown at (C) at 100 cps. This results in a very narrow acceptance angle at high frequencies in addition to cumbersome length and weight.

The Sound Spot keeps the microphone length reasonably short by using an effective line microphone of one foot in length and adding a pressure gradient microphone to give a cardioid polar pat-

[2] Ibid, p. 323.

(*Continued on page 71*)

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CHARLES A. ROBERTSON*

STEREOPHONIC

Louis Armstrong: Satchmo Ploys King Oliver

Audio Fidelity Stereo AFSD5930

Like everyone else who is celebrating a sixtieth birthday this year, the indefatigable Louis Armstrong has lived through his share of ups and downs. Although his measure of commercial success follows an upward curve as majestically as one of his trumpet climaxes, faithful collectors of his recorded output plot his course according to a number of artistic peaks. The first came at an early age, shortly after he packed his horn in a straw suitcase, left New Orleans in his twenty-second year and went to join King Oliver in Chicago. Together they made jazz history, projecting the exciting cornet breaks and exacting unison passages that serve to this day as models of New Orleans style.

It was a creative period during which the youthful Armstrong gained the impetus to develop as a soloist, strike out on his own and eventually attain his present eminence as jazz ambassador to the world. Oliver had a slight inkling of this future rise to fame when he remarked, "I never could nor will play the cornet Louis does, but as long as he's with me, he can't hurt me." It was a combination of bad luck and ill health that hurt Oliver, who died in 1938 while working as a poolroom attendant in Georgia. No wonder Armstrong is a health faddist whom nothing seems to hurt, not even the grinding treadmill of countless one-nighters. But once set, his repertoire is likely to remain unchanged until all possibilities of exploiting it are exhausted.

The high points in Armstrong's recorded career usually coincide with the times when he renews his material. By calling on the resources acquired as a youth, he consistently shows an ability to transform the tawdriest popular song. And the rarest treats are in store when he picks works that are as much a part of him as the air he breathes. Such were the results when George Avakian prevailed upon him to dedicate albums to W. C. Handy and Fats Waller. A similar occasion arose last fall, at Radio Recorders Studio in Hollywood, when the band was resting from the road and could enjoy assimilating the tunes of Oliver and his era. The leader was busy taping a television show with Bing Crosby, a performer who always brings out the best in Louis, as attested by the superb form shown on both the telecast and the dozen tunes here.

No attempt is made to recreate original recordings, and if Armstrong says that Oliver might have played *My Old Kentucky Home,* who is there to question his authority? Besides the Creole Jazz Band would be incomplete without the Dodds brothers. Danny Barcelona provides dramatic drum breaks during the leader's vocal on *Big Butter and Egg Man,* and should not be ignored in the search for an heir to the throne of the late Sidney Catlett. If he ever takes the trouble to learn Baby Dodds' shimmy beat, his position among select company should be assured. He joins melodic inventiveness and the punch required behind the driving trumpet solos, as it is, tucking in any loose ends with a shimmering cymbal accent. Aided by bassist Mort Herbert, he brings a certain amount of rhythmic subtlety to a role which could easily become an exhibition of tricks.

Billy Kyle is the lone accompanist to Louis on *Frankie and Johnny,* playing a background redolent of honky-tonks at the turn of the century. On *Panama,* his piano refrain sparkles with the gaiety of a Mardi Gras parade. Beside him marches Trummy Young, whose gutty trombone adds to the heat of *Hot Time in the Old Town Tonight.* But the star of the supporting cast is Peanuts Hucko, a clarinetist who finally comes into his own with glorious ensemble work and a perfect underlining of vocals.

Armstrong devotees are well informed as to the changes wrought in his style during the transition from playing second horn to Oliver and a billing as the world's greatest jazz trumpeter. Because he recalls the style used for each tune in its pristine state, the most important period in his development is neatly summarized, beginning with *Drop That Sack.* This popular adaptation of an old work song is phrased in the raggy, archaic manner of the men who preceded Louis. Nowhere is the debt to Bunk Johnson, Kid Howard, and others among his teachers more touchingly acknowledged than in the brisk, staccato ensemble passages.

From this starting point, successive steps in his gradual break with the older way of playing can be detected on such tunes as *Chimes Blues, Dr. Jazz,* and *Jelly Roll Blues.* The fully fledged improvisor, who influenced so many musicians and changed the course of jazz, is heard on *St. James Infirmary,* and *I Ain't Got Nobody.* They represent Louis at the height of his powers and are charged with the electric excitement he turns on to transfix a theater crowd. With characteristic vocals sprinkled throughout, including a scat chorus or two, the mixture blends the new and traditional in a delightful survey of the crucial years in an astonishing career.

Louis never sounded better in the studio. Stereo arrays the front line in correct marching order and aligns the rhythm men in depth. It was somewhat unsettling to hear him finish a chorus fortissimo, on previous recordings, to be followed by the piano at the same level. The use of the "MS" microphone technique spaces everyone properly without interfering with the ensemble voice. Armstrong's debut on this label is auspicious and his second appearance, with the Dukes of Dixieland, is due shortly. Their first session together, which was announced as in the works, is being remade because of difficulties only a legal mind could fathom.

Ahmed Abdul-Malik: East Meets West

RCA Victor Stereo LSP2015

In a second program aimed at melding Oriental and American music, Ahmed Abdul-Malik enlists a greater amount of jazz talent in his cause with agreeable results. Johnny Griffin, tenor sax, and drummer Al Harewood are veterans of the first safari, having ventured across the desert sands to prepare a way for future caravans. Gathered at the oasis to greet them are Ahmed Yetman, a master of the 72-string kanoon, violinist Naim Karacand, and a pair of darabeka drummers. Besides alternating on bass viol and oud, Abdul-Malik acts as benevolent guide and host, directing the newcomers to proper places in the solo order and maintaining strict discipline lest a cutting contest ensue.

Lee Morgan, who is the first speaker for jazz, unleashes a fiery trumpet salute that might easily start a revolution in cooler climes. After a vocal peace offering chanted by Jarkarawan Nasseur, the festivities proceed smoothly, with Benny Golson and Jerome Richardson providing atmospheric touches, while trombonist Curtis Fuller contents himself by playing the blues. As for the fine bass sound, ask any engineer experienced with the leader's tone what a joy it is to record. Ray Hall and Bernard Keville strike a nice balance between the Western horns and the more delicate Eastern strings. As one who has effected a rapprochement between different cultures, perhaps Abdul-Malik can find a couple of balalaika players for Duke Ellington and Louis Armstrong. It might help them to breach the Iron Curtain and tour Russia. If not, the State Department should try to get the present group through.

Jon Hendricks: A Good Git-Together

World Pacific Stereo 1283

Called in San Francisco at Fugasi Hall, this meeting pretty well defies ordinary descriptive terms—to be believed, it must be heard. Congregated there under the ministering eye of Jon Hendricks are such devoted family units as the three Montgomery brothers, the Adderley pair, and Norwood Piondexter, the leader's own soul brother as previously acknowledged on the tune *Little Pony.* The opening ceremony consists of the number Hendricks sang with Lambert and Ross to bring on the acts at the last Montgomery Jazz Festival, *Everything Started in the House of the Lord,* providing a firm foundation for what turns out to be a combined vocal and instrumental jam session. Nearly everything that happens is completely spontaneous, despite passages prepared in advance by pianist Gildo Mahones, who also roughed out a preliminary sketch of *The Shouter.* Hendricks makes up the title tune on the spot, and recalls two of the hits he wrote for Louis Jordan. Next to actually being there in person, stereo is the only way to listen to the assemblage and the excitement it generates. Even producer Bill Perkins beats a tambourine during the group singing.

Sir Charles Thompson and The Swing Organ

Columbia Stereo CS8205

When there are too few big bands around to satisfy even sidemen, the number of frustrated band leaders is bound to be large. Sir Charles Thompson, a great admirer of the Basie band, would be perfectly content as its pianist, let alone lead. As both posts are already filled by the Count, he channels his impulses through the Hammond organ, sublimating them thoroughly by playing like the whole Basie band. Aiding in this admirable project are J. C. Heard on drums, Aaron Bell, bass, Perry France, tenor sax, and Rudy Rutherford, clarinet. Also a piano and spare organ, as Thompson utilizes three instruments without resort to multiple recording. If he practices any trickery, it is in making the whole thing seem deceptively easy. The people who manufacture electronic organs have a fine promotional opportunity for instruction follos, which might actually make it easy, if prepared by the likes of Jackie Davis, Shirley Scott, Jimmy Smith, and Sir Charles in particular.

April Love, I Get A Kick Out Of You, Lady In Red, and other standards are swung lightly, but seven original tunes are written to bring out the voice of a full band. The two horns blend well within the organ, and Thompson finds stops for the trombone sound of Dickie Wells or the shout of Jimmy Rushing on the blues. While tickling the piano with one hand, he nudges out organ chords that neither Hammond nor any other company can provide through automatic devices. They should encourage Sir Charles to reveal a few of his

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

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secrets. The stereo effects are brilliantly conceived, due to both the placement of instruments and their use in conjuring up Basie riffs and section work. Plenty of bass, too.

Jimmy Rushing: Rushing Lullabies
Columbia Stereo CS8196
Joe Williams: Everyday I Have The Blues
Roulette Stereo SR52033

Delving back into shared memories, these veteran blues singers chance to come up with totally different title lists. In fact, Rushing seems to have anticipated the rival effort by writing *One Evening*, a spirited finish to *Everyday*. Aside from *Did You Ever*, another blues fresh from his pen, the tunes have been in and out of his program for years. But some he has never recorded and all are stereo firsts. Little Jimmy directs the accompanying group himself, calling on soloists, and furnishing a shining example of how to swing. Most of the early problems of bringing a voice, an organ, and other instruments together in stereo are solved in this instance, with Sir Charles Thompson providing a firm organ foundation to support solos by Buddy Tate, tenor sax; Ray Bryant, piano; Skeeter Best, guitar; Gene Ramey, bass, and Jo Jones, drums.

Joe Williams engages in a remake of eleven favorites for stereo and his latest label affiliation. Thad Jones and Frank Foster have refurbished the arrangements, and Al Grey wields his trombone with fierce abandon throughout. His muted responses are growled in a manner which spurs the singer to new heights. Included are Big Bill Broonzy's *Just A Dream*, Pete Johnson's *Cherry Red*, and Rushings' *Good Morning Blues*. Count Basie leads his band from the piano on this one, but his spirit is present on both.

Duke Ellington: Festival Session
Columbia Stereo CS8200

Just before sailing on a European tour, Duke Ellington tied a full summer of festival activities into a neat package, including all the new works introduced during the season and a few from former years. Due to the advance preparation and shouted instructions from the leader, the session was wrapped up in the space of one morning. The annual bout between Paul Gonzalves and tenor sax is now given a full production, with the whole orchestra cheering the contenders on *Copout Extension*. The battle scene shifts to Sam Woodyard and Jimmy Johnson, who engage in a stereo drum duel refereed by the Duke.

After the smoke clears away, the band settles down to a study of tactics on *Idiom '59*, which begins with a soulful clarinet passage by Russell Procope and gathers momentum through three stages until everyone is in action. Clark Terry, Britt Woodman, Jimmy Hamilton and Gonzalves don space helmets on *Launching Pad*, piloting the rocket ship bearing the rest of the crew to Duke's own private planet. Terry returns for his trumpet part on *Perdido*, and Johnny Hodges recalls *Things Ain't What They Used To Be*. Among his travels, Ellington has evidently given some thought to stereo, fortifying the two drummers with bassists Jimmy Woode and Joe Benjamin, as well as sharpening the contrast between sections for excellent results all around.

Jacques Loussier: Play Bach
London Stereo PS188
Dave Brubeck: Time Out
Columbia Stereo CS8192

Ever since Bach was first swung by Alec Templeton in the Thirties, his music has intrigued jazz pianists, some studying him for form and others turning his familiar phrases into clichés. Just how much it has become a part of the language of modern jazz is detailed in a syllabus provided by Jacques Loussier, a young Frenchman who sums up the situation once and for all. After this, there can be no excuse for not recognizing Bach when some newly discovered genius borrows from him in the middle of an improvisation. With a rhythmic assist from bassist Pierre Michelot and Christian Garros on drums, Loussier probes eight of the mas-

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ter's piano pieces with dexterous fingers, letting the clichés fall where they may. They seem glad to be back home, while the trio sounds best on the *Toccata*, which so far has escaped being ransacked to any great extent. The piano is beautifully recorded, and the stereo picture compact.

Dave Brubeck likes to toy with musical forms from any geographical location as well as the classics. He picks up a fair quota of worn devices on the way, just as alto saxist Paul Desmond is apt to throw in a quote or two, even though they are soon discarded. On the present experiment with unusual time signatures, drummer Joe Morello allows neither time nor opportunity to indulge in such luxuries. The quartet is kept as busy as a cat on a hot tin roof, a simile which might be used to title one of seven originals. If the listener wants to be any less busy, he had better forget about rhythmic variation and regard the tunes as a Turkish-flavored blues, a couple of waltzes, and some up-tempo numbers. Caught in a crossfire from Morello and bassist Eugene Wright, Brubeck has no such easy out and fights his way clear by pianistic prowess alone. At least, he never stands still and stereo helps to keep up with him.

Art Farmer: The Aztec Suite
United Artists Stereo UAS5062
Stan Kenton: Viva Kenton!
Capitol Stereo SW1305

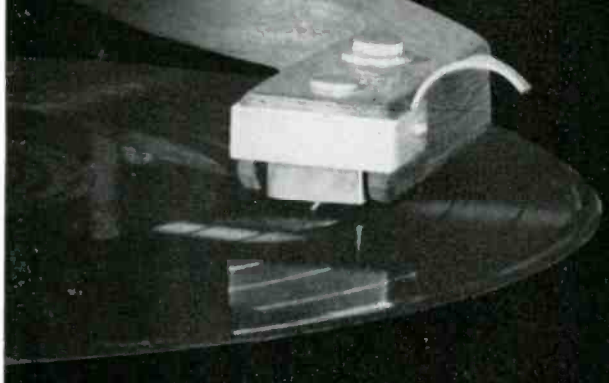
Chico O'Farrell arrived from Cuba in 1948 to study composition with Bernard Wagenaar, wrote arrangements for Goodman, Kenton, and Gillespie, and later organized a band of his own. Now studying in Mexico, he expects his First Symphony to be premiered in Havana this year. During the course of a short vacation, Art Farmer prevailed upon him to plan enough material to fill an LP. Once completed, it was turned over to Al Cohn, who conducts a studio orchestra of twenty-one pieces, including three Latin percussionists to assist drummer Charlie Persip. The Suite, an original work which fills one side, is episodic and ranges from the stately tread of a ceremonial procession to the wild abandon of an Aztec sacrificial orgy. Farmer's lyric trumpet style is particularly appropriate in the slower passages, which are all the more attractive for using rhythms not often heard from a battery of this type. On five arrangements which complete the set, the drummers whip up a frenzy not equalled since Gillespie disbanded. Included are Grenet's *Drume, Negrita, Heat Wave,* and *Wood'yn You.*

Stan Kenton, who is frequently deadly serious about a frivolous ballad, relaxes on a Latin dance set. He even encourages unison band vocals, permits humorous brays from the trombones, and places three extra percussionists about the stereo stage. Besides dressing Kenton standards for the tropics, Gene Roland contributes eight colorful originals, allotting lively solos to Rolf Ericson, Chuck Mariano, and John Bonnie. Kenton should take such outings more often.

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Art Pepper: Modern Jazz Classics
Contemporary Stereo S7568
Something New, Something Blue
Columbia Stereo CS8183

The work of five young composer-arrangers is demonstrated on these two albums, and lurking in the background is a sixth, Gil Evans, whose successful example seems to have fostered the planning of both. His practice of shaping a set of band numbers about one principal soloist is followed by Marty Paich, who builds on the framework of twelve established modern jazz standards to form an integrated whole. The fortunate choice of Art Pepper enables the project to maintain the desired flow of consistent improvisation and still avoid the hazard of sameness entailed by stretching it over the length of an LP. In addition to the alto sax, his primary instrument, Pepper alternates on tenor sax, plays clarinet on *Anthropology*, and helps out as a reed section leader. More important is a capacity for fitting his style to the music, regardless of its ideologic or geographic origins. Paich directs the supporting West Coast eleven, in which Mel Lewis, Jack Sheldon, and Russ Freeman star, and the stereo is as fully integrated as the performance.

Credit Evans again for showing that a contrasting mixture of old and new can make a pleasantly varied program. Four contemporaries, all based in New York, take turns conducting hand-picked studio octets in a blues original apiece, following each with a familiar blues in a new arrangement from their respective pens. Many listeners find this format more enlightening than a diet restricted to a composer's latest works, especially when the men involved are noted for avant-garde tendencies. On this occasion, the foursome is intent on having as much fun as during an afternoon spent on the golf links, and no better place could be found to meet its members. Manny Albam is paired with *Tin Roof Blues*, Teo Macero with *St. Louis Blues*, Teddy Charles with *Blues In The Night*, and Bill Russo with *Davenport Blues*. All are experts at scoring for rich, full sound, and in stereo the two groups used seem larger than eight men.

Bud Shank: Latin Contrasts
World Pacific Stereo 1281
Dave Pell: The Big Small Bands
Capitol Stereo ST1309

Bud Shank and Laurindo Almeida present an encore to their previous album together, "Holiday in Brazil," ranging further afield on this occasion in the search for thematic material. Of ten tunes, all arranged by Almeida, seven are originals which they brought back to develop through relaxed and unstudied improvisations. The light, airy melodies contain both a gentle lyric quality and bits of humor. Alternating on flute and alto sax, Shank matches the tone and volume of his instrument to Almeida's unamplified guitar, enabling their sound to meet and mesh in stereo. Chuch Flores, on drums, compensates for the lack of a Latin percussionist, and his rhythmic companion is Gary Peacock. As before,

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jazz and classical elements are joined in a curious mixture suitable for serious listening or a quiet mood.

Dave Pell employs a total of twenty-three musicians to recreate the sounds of a dozen historic small bands, none of which was as subdued as the quartet just considered. Because of the intent to duplicate the originals down to the exact intonation and expression of the soloists, each man on the list is essential to the project. No more than eleven are in action at once, but the liner assigns each specialist a number so that substitutions can be readily discerned. Cootie Williams, Bud Freeman, and the late Lester Young among others are not on the list, but their sound is on the record. Among the groups picked are those of John Kirby, Raymond Scott, Miles Davis, and Gerry Mulligan. With or without stereo, the sound is bound to be an improvement over the originals.

Andre Previn: King Size
Contemporary Stereo S7570

Every so often Andre Previn gathers up the members of his trio, leaves a busy Hollywood schedule of composing and arranging behind, and goes on tour to play in jazz clubs about the country. A brief survey of his career on the excellent liner notes reveals much about Previn and why he feels this activity is necessary to his development as a jazz pianist. He tells how his classical training was a detriment to his jazz work at one time "because I was too much concerned with flawless technique and with getting around the piano than I was with playing ideas." His thoughts on the problem of making jazz more than a hobby, albeit a lucrative one, and pursuing at the same time a profession that includes nearly thirty classical concerts a season, are engrossing reading. But for the answers, both Previn and the listener must turn to the contents of the album, recorded after the trio had enjoyed a period of renewal on the road.

Among a quartet of ballads are two blues of the sort that come only at the end of a long evening spent pleasing the customers and satisfying requests. They are full of the release musicians find in the blues and contain probing solos from Red Mitchell, on bass, backed up by drummer Frankie Capp. Previn keeps them going for about ten minutes apiece, while engineer Howard Holzer captures a fine after-hours sound.

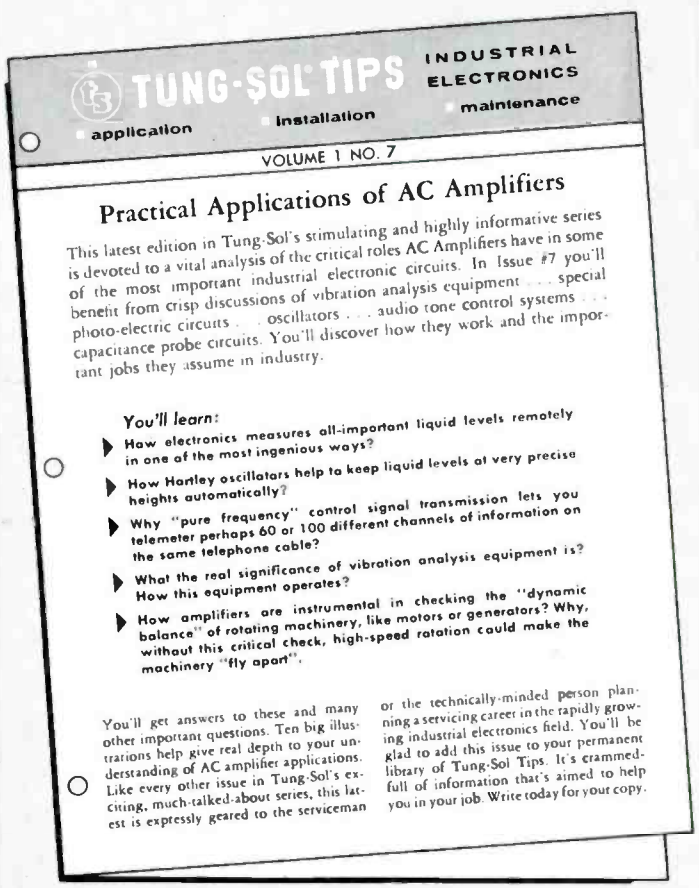
Larry Elgart: Saratoga
RCA Victor LSP2166

Lightning always strikes twice, according to the old adage, but not a cloud darkened the horizon when Larry Elgart accepted an assignment to extract a dance set from the Harold Arlen and Johnny Mercer musical. So perhaps it was a case of adding insult to injury that stranded the band, close to the show's locale, in a snowdrift at Junius Point, New York, during a blizzard shortly after the album was released. Anyhow, now that the production's fate is sealed, anything salvaged from the score will be due to Elgart and the efforts of his arrangers, John Murtaugh and Ernie Wilkins. Also the wordless vocal effects of Carol Sloane are an improvement on the original lyrics in *Have You Heard, Saratoga,* and *Goose Never Be A Peacock.* There is the always elegant Elgart sound, the tunes should mellow with age, and confirmed addicts of show albums will find it a more agreeable souvenir than the one prepared by the original Broadway cast.

Henry Mancini: The Mancini Touch
RCA Victor Stereo LSP2101

Viewers of the "Peter Gunn" series can take this opportunity to catch a glimpse of the composer of its jazz background music in a different setting. Having left the homely precincts of Mother's for the nonce, Henry Mancini is ensconced in a hotel ballroom exclusive enough to afford twenty string players on the premises. Also in the orchestra are four French horns, four trombones, two solo woodwinds and a rhythm section. Mancini employs the unusual instrumentation to dispense soft swing at danceable tempos, adapting to this treatment such suitable jazz standards as *Snowfall, Bijou, Trav'lin' Light,* and *Like*

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MONOPHONIC

Bob Wilber: The Music of Sidney Bechet
Classic Editions CJ5

A particularly warm and moving tribute is paid here to Sidney Bechet, the famed New Orleans veteran who died in France last year. Bob Wilber, a musician uniquely fitted to carry out the project, heads a superb septet and provides new arrangements of eleven of his late friend's compositions as a small token of his esteem. He devotes ample liner notes to the story of their long relationship which began with the purchase of a record while he was still a youth living in Scarsdale, New York, grew closer when he became a pupil of the master, and culminated in their playing soprano sax duets on the stand together. With these qualifications, Wilber might easily step into his mentor's shoes and duplicate his recorded solos. Such is not the intent at this session, happily, and he neglected to bring a soprano sax to the studio, playing instead clarinet, tenor sax, and bass clarinet.

A good share of Bechet's tunes were limited to his virtuoso displays. Because he liked to solo and played many instruments, RCA Victor picked him to make what was billed as the first commercial release of a multiple recording on which one person accounted for all the band parts. Other tunes were fragments used as a base for brilliant improvisations. *Georgia Cabin*, for instance, developed from a strain of *Lonesome Road*. They were so much Bechet's private property that not many other musicians performed them. Until Wilber took them in hand, most were fated for oblivion. While respecting the identity of each tune as well as the Bechet spirit, he succeeds in producing works that are suitable for many small groups playing today. No wonder the soprano sax is omitted.

The melodies cover a variety of moods and the players are eminently capable. Dick Cary, a substitute at the last minute for Buck Clayton, is on trumpet. Vic Dickinson on trombone, and guitarist Barry Galbraith moves up to become a voice in the front line. The rhythm section consists of pianist Dick Wellstood, bassist Leonard Gaskin, and drummer Bobby Donaldson. An offshoot of Music Minus One, the label is used to designate releases not containing the company's usual instrumental material. The same care is bestowed on the planning and preparation, however, and Dave Hancock is the engineer.

Workin' With The Miles Davis Quintet
Prestige PRLP7166

As the third album gleaned from the twenty-four titles recorded by the Miles Davis Quintet of 1956–7, in a historic two-part session, this production lives up to the standards set on the others and carries its own recommendation. Something for admirers of each of the group's several aspects is included, with the leader moving gingerly through soft, muted choruses on *It Never Entered My Mind*. Slightly more hardy is Brubeck's *In Your Own Sweet Way*, while his trumpet voice emerges in full potency on *Half Nelson*, and a new version of *Four*. What is reputed to be the first trio appearance in the studio by Red Garland occurs on *Ahmad's Blues*, now finally released after the pianist has five LP's to his credit. Needless to say, considerably more piano is played than the title's namesake usually offers, although Paul Chambers roves through a bowed bass solo.

Informal readings of the group's theme, complete with drum rolls from Philly Joe Jones, close out each side, and John Coltrane expands the material into a throbbing blues opus for tenor sax. The unison ending looks back to a New Orleans ensemble as it might play *Down By The Riverside*, and forward to the current gospel trend. The Quintet's timeless quality, which others are still trying to capture, makes the recording sound freshly minted.

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Shirley Scott: Shirley Plays The Duke
Prestige 7163

One supreme test of the jazz artist who lays claim to an original style is the music of Duke Ellington. All the composer's tunes are tailored to fit his band as a whole and the individual members in particular. Each of his recordings becomes a reference point by which future performances are judged. In meeting the challenge, Shirley Scott gives more attention to obtaining a full orchestral sound than before, adapting a number of Ellington's tonal colors to the organ. At the same time she develops the melodies at length in characteristic single line solos, and retains her own pizzicato effects and other identifying patterns. Her approach is bright and feminine on *In A Mellotone*, becomes brisk and masculine on *C Jam Blues*, and swings all the way. She engages a piano in brief conversations with the organ on several of the eight numbers, but the comments of bassist George Duvivier are more to the point. Arthur Edgehill is on drums. Altogether the organist's best effort, and a stereo version should be forthcoming.

The Mastersounds In Concert
World Pacific WP1269
The Wes Montgomery Trio
Riverside RLP12-310

During a tour of the college circuit last spring, The Mastersounds alighted at Pasadena Junior College long enough to be recorded for the first time before a "live" audience. Playing one of their typical concert programs, they specialize in jazz tunes of proven appeal and their delivery is of the sort to command attention. Like Brubeck and a few other modernists, they know how to hold the interest of a group of younger listeners and still not play down to it. Among the chief attractions are the lyric sounds Buddy Montgomery's mallets elicit from the vibes, the tasteful solos of pianist Richie Crabtree, and the closely integrated support of drummer Benny Barth and Monk Montgomery on electric bass.

The most profitable moments spent in a recording studio by The Mastersounds were undoubtedly those occasions when a third Montgomery sat in on guitar, raising a question as to why he was not made a permanent member. Well, it seems that brother Wes is kept close to the hometown of Indianapolis by a family that includes six children. There he holds two jobs, working regular hours at the Turf Bar, and playing after hours at the Missile Room. If his first LP falls short of the high expectation which awaited it, the blame may be attributed to the length of time taken to reach the after-hours spot. Those who are patient will be rewarded by Montgomery's own *Missile Blues*, and *Jingles*. Other guitarists and musicians rather than casual listeners are likely to be fascinated by his unusual chording on standards. Melvin Rhyne, on electric organ, and drummer Paul Parker complete the trio.

The Exciting Artistry of Will Holt
Elektra EKL181

Since disk jockeys and Bobby Darin managed to usurp *Mack The Knife*, many listeners have closed their ears to the Kurt Weill song. A few hardy souls may be enticed into letting Will Holt prove it need not be delivered in a monotonous bellow over a bumpy, repetitious beat. News of his performance may even spread from this source to persons sworn to turn elsewhere at the first gleam of shark's teeth, convincing them that the work can be enjoyed once more. Nestling among four other Weill songs, it glistens with the gemlike quality of the composer's original intent. Holt, singing in German and English, also brings a high polish to *Bilbao, Alabama Song, Kanonen*, and *Sailor's Tango*. Let's hope they never acquire the tarnish needed to make them popular on the air waves. Although known as an accomplished folk singer, Holt works skillfully in a number of metiers, programming *I Love Paris*, and *When The World Was Young*. Especially good are the seldom heard *Eagle And Me*, and *Broadway Is A Tame Street*. Carl Lynch is an imaginative accompanist on guitar. AE



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D-1

● **Impedance Meter.** The Vierling Model Z-800 direct-reading impedance meter permits the direct measurement of the absolute values of any apparent resistance in the range from 0.3 ohm to 1.0 megohm. It is readable to 3.0 megohms. The measuring frequency is 800 cps. Impedance readings may easily be transposed into capacitance and inductance values. It is furthermore possible to use the Z-800 as a 800-cps test oscillator with an internal



resistance which is at all times small when compared with the impedance value of the range chosen. Due to its high order of accuracy and the wide range it covers, this simple direct-reading instrument can replace many time-consuming and complicated bridge measurements. Furthermore, since it is quite small, and independent of outside power, its use is not restricted to the laboratory or work bench, but will find application in installation projects and other portable uses. Gotham Audio Corporation, 2 W. 46th St., New York 36, N.Y.

D-2

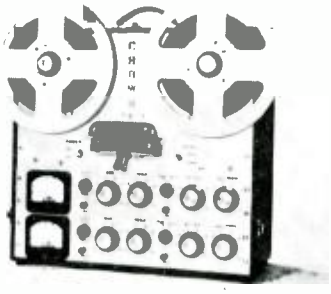
● **Audax Tweeter.** Most recent addition to the new line of Audax loudspeakers is a 3½-in. cone-type tweeter with frequency range of 3000 to 18,000 cps. Designated Type A-35T, the speaker employs a hard paper cone with a sealed basket which conforms closely to the cone contour. Having a sealed acoustic rear chamber, it operates as a direct radiator and requires no horn. Features include a 2.5-ounce slug magnet housed in an extra-heavy yoke, a 4-μf paper capacitor hermetically sealed in a metal container and



a perforated protective screen attached to the face. Power handling capacity is 25 watts. Manufactured by Audax, Inc., a division of the Rek-O-Kut Company, Corona, N.Y.

D-3

● **Crown Tape Recorder.** Engineered to professional specifications throughout, the Crown Model 714-C records and plays 4-track stereo, plays 2-track stereo, and records and plays monophonically. It is a deluxe unit which affords three operating speeds and accepts 10-in. reels. At 15 ips the frequency range of the 714-C is 50 to



28,000 cps ± 2.4 db; at 7½ ips it is 40 to 17,000 cps ± 2.0, and at 3¾ ips it is 30 to 9000 cps ± 2.0 db. Flutter and wow are .06, .09, and 0.18 per cent at the three speeds, respectively. The unit incorporates three motors and includes among its features an automatic stop. Four microphone inputs are provided. The 714-C is available for rack mounting or in a sturdy leatherette-finished case for portability. Manufactured by Crown International, Elkhart, Ind.

D-4

● **Matched Microphones.** Introduced for stereo recording, Sonotone paired "Ceramikes" are acoustically matched at the factory to a tolerance of 2.0 db. Plugged



into any quality stereo recorder, the CM-T10 set feeds the tape a substantially flat 50-to-13,000 cps signal at an output level of −62 db. The heart of every Ceramike is a rugged, rubber-encased ceramic transducer which is immune to extremes of both temperature and humidity. Controlled response is assured by an all-metal damping grid of a new design. The one-piece die-cast metal case is designed for easy hand use. For table and floor use there are matching stands. Sonotone Corporation, Elmsford, N.Y.

D-5

● **Damping Felt.** Known as audio felt, this is an ideal vibration-damping material for speaker-system enclosures, and for isolating amplifier chassis, changers and turntables from acoustic feedback. According to the Huff report (Audio, August, 1959), recently made to the Felt Association, felt is generally 50 per cent more effective than other materials in damping the entire frequency range from



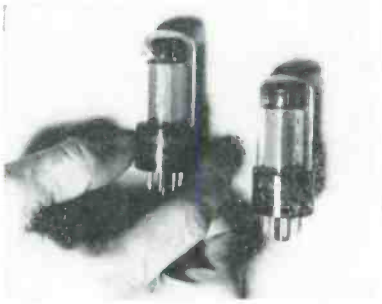
50 to 15,000 cps. Audio felt is manufactured by the American Felt Company, 350 Fifth Ave., New York 1, N.Y. It is ⅜ in. thick, is the company's Type F13, and is available direct to equipment manufacturers in bulk sheet or roll form. Through the Continental Felt Company, 22 W. 15th St., New York, N.Y., audio felt is available to the retail trade in 1-sq-yd. kit packages. The Huff report on enclosure damping materials may be obtained by writing the American Felt Company, 9 Glenville Road, Glenville, Conn.

D-6

● **Westinghouse Audio Tubes.** New Type 7591 beam-power pentodes available from Westinghouse electronic tube division are audio-frequency power-output tubes specifically for use in audio amplifiers capable of high power output and low distortion. In push-pull application they will deliver up to 45 watts with total harmonic distortion not exceeding 1.5 per cent. Operting conditions for this level of performance are: plate voltage, 450; screen voltage, 400; grid No. 1 voltage, −21; maximum-

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signal plate current, 72 ma per tube; maximum-signal screen current, 15.0 ma per tube; effective plate-to-plate load impedance, 6600 ohms. The 7591 operates at a rated screen dissipation of 3.3 watts,



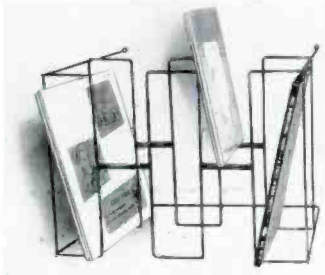
but screen dissipation of 6.0 watts is permissible during periods of maximum input of speech and music signals. For more information, write Electronic Tube Division, Westinghouse Electric Corporation, P.O. Box 284, Elmira, N.Y. **D-7**

● **Auto FM Tuner.** Developed to bring the advantages of noise-free FM reception to car drivers, the Model FM-100 tuner operates in any car equipped with 12-volt battery and negative ground. It makes use of the amplifier and speaker in the AM receiver. An accessory 30-in. FM antenna that bolts to the AM antenna is available, though the tuner may be operated with the AM aerial set at 30-ins. The tuner is compact, measuring but 2⅞ × 8¼ × 7¾ ins.,



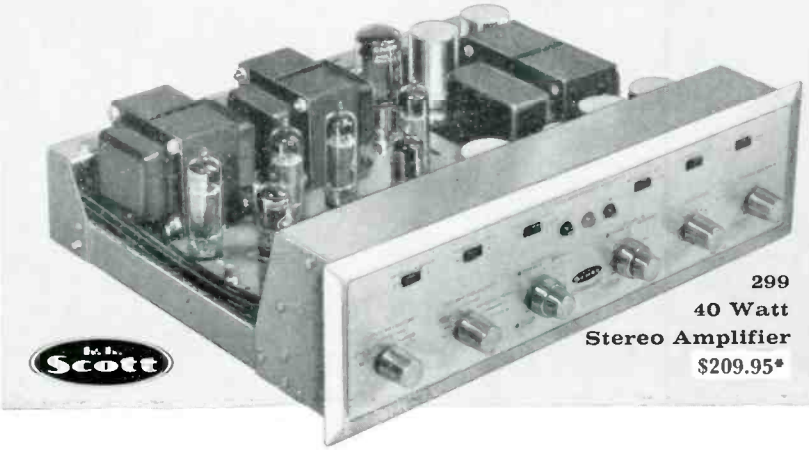
and features sensitivity of 1.5 microvolts for 20 db quieting. Audio frequency range is 20 to 20,000 cps. Circuitry includes a.f.c. with defeat control on front panel. The unit is attached under the dash in most cars by means of a metal bracket requiring only two screws. It is connected by two leads, one to the power supply (battery), the other to the AM radio. Manufactured by Eric Engineering Company, 1823 Colorado Ave., Santa Monica, Calif. **D-8**

● **Wall-Mounting Record Rack.** For music lovers who are short on floor space, and long on records, this new black wrought-iron wall rack may well be the answer to the record storage problem. The "Hang Around" has five compartments to permit sorting more than 100 long-playing record albums into various musical categories. Modular design permits hanging



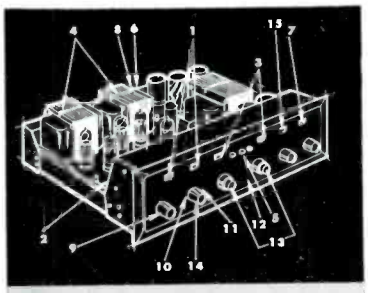
one rack above another, or side-by-side, as the record collection grows. Fully assembled, it may be fastened to any type wall, including wood paneling, plaster and brick. Made of sturdy steel-rod construction, it measures 13"h × 17"w × 10"d. Manufactured by Leslie Creations, Lafayette Hill, Pa. **D-9**

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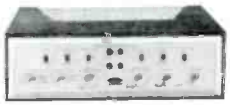
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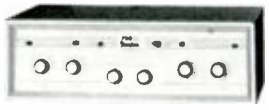
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DESIGN CHART FOR ENCLOSURES

(*from page 60*)

vert to trial and error to determine the enclosure's resonant frequency, since here the available mathematics does not tell enough of the story.

Referring back to Eqs. (*1*) and (*3*), they may be combined to give a general design equation:

$$F^2 = \frac{2150^2\, A\, R^{0.12}}{V(L + A^{0.5})} \qquad (4)$$

which takes into account variations in port aspect ratio (or shape), within the limitation that it is applicable only to single, simple ports. This equation, with its exponential factors, is somewhat difficult to use. Therefore, it has been put into chart form, *Fig.* 5, from which can be read off the several factors involved in the design.

Use of Chart

An example will make clear the method of using the chart: Supposing it is desired to match a speaker with 54-cps resonance to a reflex enclosure of 8000 cu. in. It is further desired to hold the port aspect at 4, and to use no duct other than the ¾-in. thickness of the enclosure wall. To solve this using *Fig.* 5, follow up from 52 cps to the 8000-cu. in. diagonal. Then to the left to meet the "4" aspect-ratio diagonal, and then up again to ¾-in. duct length. The port area required is read off as 24 sq. in., and its dimensions will be 2.45 by 9.8 in.

Since these enclosures were built strictly for experimental use, with no thought of using any of them for mounting a speaker for actual listening, no attempt was made to damp out any resonances, either by internal padding, or by bracing, though some of the panels were certainly large enough to need bracing. While not really pertinent to the present investigation, a quick check was made for the presence of resonances above the fundamental Helmholtz resonance. Enclosure "B" used was with a 64 sq. in. port. Resonances were detected at 347, 362, 390, 462, 730, 800, 810, 830, 900, and 980 cps, along with at least twenty others above 1000 cps. Several were pronounced enough to be quite objectionable, should they have been present in an enclosure intended for normal use. This is mentioned to emphasize what is well known, but apt to be forgotten at times, that adequate damping, both by padding and by solid construction, with bracing of large panels, can be just as important as the basic design of the enclosure. Æ

TABLE II

EFFECT OF COMPLEX AND MULTIPLE PORTS ON RESONANCE OF REFLEX ENCLOSURE B

Port Shape	Dimensions[1] Inches	Area Sq. In.	Aspect Ratio[2]	Resonant Frequency	
				Measured	Calculated (Eq. 3)
Symmetrical L	¼ x 15¾	3-15/16	63	78	62.1
"	½ x 15⅜	7-15/16	31	84	72.4
"	1 x 15⅛	15⅛	15	99.5	83.3
"	2 x 14	28	7	102	94.9
"	3 x 13	39	4-1/3	108	101.6
"	4 x 12	48	3	110	105.9
Parallel Twin Slots, 7½" c.l. spacing	½ x 8⅛ (each)	8⅛	32	86.5	72.9
" 7¼" spacing	¾ x 8⅛ (each)	12-3/16	21-2/3	88	79.8
" 6¾" spacing	1¼ x 8⅛ (each)	20-5/16	13	110	90.8

Notes

[1] Length of L-shaped slots is the total length of both legs.
[2] Aspect ratio for L slots is that for the equivalent rectangle having length of both legs of the L. For twin slots, is that of the rectangle formed by placing the two slots end to end.

LIGHT LISTENING

(*from page 14*)

Miss Meinert fills both channels with clever orchestral effects. Never at a loss for imaginative tonal ideas, this talented organist's experiments in stereo should perk up considerable interest in an instrument that can do far more than slam out a samba. Victor's dynamic range here is a very realistic one. In terms of usable frequency response, this disc is no pink-tea affair. It goes right down to the lowest working region of the latest stereo pickups.

Gianni Monese: Greetings from Italy
Stereovox STVX 426.170

There is nothing startling in this collection of Italian airs originally designed for easy floating over placid waters. In his second stereo recording for Vox, Monese is in a good position to satisfy the current demand for Italian pop material. A few recognizable fa-

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vorites such as *Santa Lucia* and *Chiribiribin* crop up as landmarks but the great percentage of the medley on each side of the disc will have a fresh sound for American ears. The backbone of the arrangements consists of easy going strings and woodwinds with the sound of mandolins and accordion used for color accents. The stereo miking is as close as they could arrange without abandoning the end players and the recording level has the intensity generally favored by Vox in their stereo releases.

MONOPHONIC

Steve and Eydie: We Got Us
ABC-Paramount 300

Some labels are set up to do an outstanding job in togetherness. ABC Paramount, with one of the better-known young married couples on its vocal roster, asked Dick Williams to provide special material for Mr. and Mrs. Steve Lawrence (she's the former Eydie Gorme, you know) in order to prove that two can sing almost as neatly as one. And they have a very pleasant record to show for their trouble. The kids (you always call them that until they're at least fifty) frolic their way through twelve duets that include the Charlap-Sweeney title tune, Frank Loesser's *No Two People* and *Baby It's Cold Outside*, Steve Allen's *This Could Be the Start of Something*, and Irving Berlin's *Cheek to Cheek*. Æ

TAPE GUIDE

(*from page 34*)

phone, one is, of course, greatly dependent upon the range and smoothness of the particular microphone used. In addition, room characteristics are an important factor in determining frequency balance. It is possible to blame a microphone for faulty response when it is as much the room that is to blame.

To illustrate, assume that room acoustics produce a treble peak at 5000 cps when using a microphone that, for the sake of illustration, is perfectly flat through the audio range. This peak is mild enough, let us say, so that it is not disturbing when listening to music taped from a tuner, phonograph, or TV set. But when recording from a microphone, the peak manifests itself twice: once in recording and again in playback. Then, as illustrated in *Fig.* 18, the peak may become sufficiently severe to become objectionable.

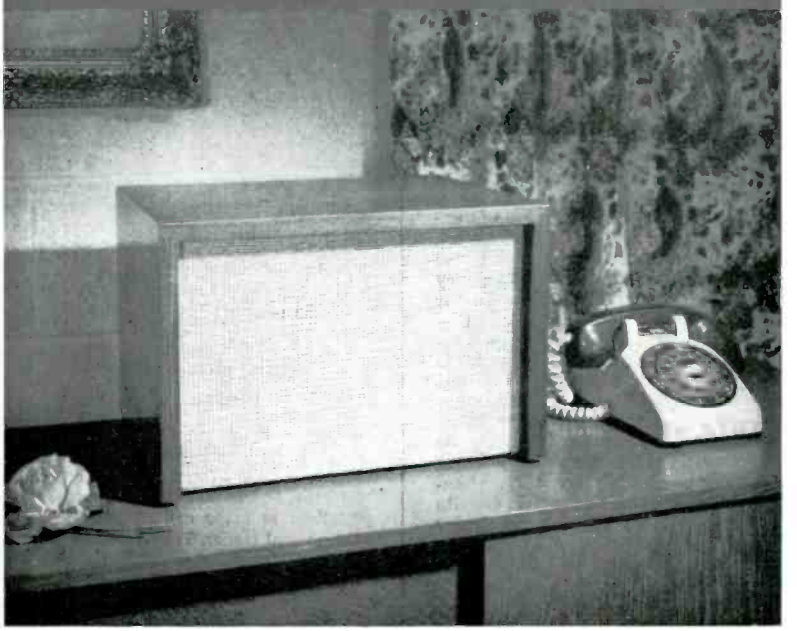
In similar fashion, if the room causes a fall-off in treble response because of its sound-absorbing characteristics, the drop may become objectionable only when it occurs both in recording and in playback.

If the microphone has an undesirable peak or droop in response, it is possible that room characteristics may either compensate or not make any difference one way or other. However, should both the microphone and the room tend to peak or droop in the same frequency area, then the results can sometimes become intolerable. In other words, some microphones may sound bad in certain rooms and not in others. Æ

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ABOUT MUSIC

The Composer Speaks for Himself

HAROLD LAWRENCE*

MEMOIRS HAVE PROBABLY been the most popular form of writing since man first inscribed hieroglyphics on papyrus rolls. Nowadays it has become almost *de rigueur* for prominent actors, statesmen, military heroes, scientists, religious leaders, and even convicted kidnappers to commit their personal experiences to print. Depending upon the subject's fame or notoriety, these accounts may combine elements of tragedy and self-justification, as in Anthony Eden's recently published *Full Circle* ("Destiny was merciless toward me . . ."), or they may confirm our best impressions or worse suspicions of such a movie idol as Errol Flynn in his swashbuckling, posthumously edited autobiography. In terms of literary value, memoirs are highly variable, being written by men and women whose achievements are usually in the realm of action rather than words. This often makes for dull reading, but not to publishers. It is no secret that the latter will print any writer who has played a relatively important role in world affairs or has otherwise made a name for himself. The name alone is a sufficient guarantee that the opus will receive front-page attention in the book review sections of the nation's leading newspapers. And with good reason. For the public is intensely curious about the personal background of historical events, especially when it gets its information from the proverbial horse's mouth. In the process, literary shortcomings are forgiven.

However, when the author happens to be a composer, the public tends to be far less indulgent. With rare exceptions, the literature of composers (memoirs, diaries, correspondence, and autobiographical essays) is specialized in scope and of little interest to the general reader. Take Jules Massenet's *Mes Souvenirs,* an account of the musical career of the composer of *Manon.* Neither witty nor profound, Massenet's recollections of his life in the French operatic world are amiable enough, but they represent slim pickings, even for the musicologist, since the author was niggardly with dates and other factual information.

The reverse is true of Darius Milhaud's *Notes Without Music.* There are facts in abundance here, as the French Provençal composer recites in dead pan fashion the principal happenings of his musical life: dates of composition, first performances, meetings with contemporary musicians, and important influences on his musical style. Milhaud's book, in short, reads like an expanded entry in Grove's *Dictionary.*

Of course, the informed reader will find something of value in the words of every great composer, especially when the latter explores his own music. Then he invites us to take an over-the-shoulder glimpse at his work desk as he points out some of the technical and esthetic factors that go into the creation of his musical works.

But composers' writings need not be of purely technical interest: Hector Berlioz, for instance, possessed a genuine flair for verbal as well as musical expression. In his *Memoirs,* we encounter a full-fledged representative of the Romantic age who traveled extensively, wielded pistols in a Parisian revolution, and constantly battled tenors, claques, Philistines, and academicians. Mozart's correspondence reveals fascinating insights into his music, his time, and his own personality. Beethoven's notebooks contain some of the most moving personal documents in musical history.

For obvious reasons, most composers have been reluctant to pronounce judgment on their own music. They may analyze a specific work or body of works, discuss its formal implications, and trace its genesis. But at one time or another, almost every composer leaves us a self-appraisal of sorts, ranging from a matter-of-fact statement to the most extravagant form of eulogy.

Mozart was not given to self-evaluation, but in a letter, he proudly quoted Archduke Maximilian's opinion of his music: "Such people only come into the world once in a hundred years."

Unlike Mozart, who happily accepted the fact of his own genius, Brahms felt obliged to present a humbler face to the musical world. He loved to dismay his friends by uttering the most pessimistic opinions on each new work he produced. In a letter to Simrock, his publisher, he wrote of his Second Symphony: "The new symphony is so melancholy that you will not be able to put up with it. Never before have I penned anything so sorrowful, so minor-y. The score must be published with a black border." Listening to a performance of one of his chamber works, he described his music as "cruelty to animals." And, once, summing up his output in general, Brahms wrote: "I know very well the place I shall one day have in history of music: the place that Cherubini once had and has today. That is my lot—my fate."

Satie, on the other hand, confounded the public with enigmatic statements such as the following: "Everyone will tell you that I am not a musician. This is quite right. From the beginning of my career I immediately ranked myself with the phonometographers. My work is pure phonometry. . . . You will see that they [my compositions] are inspired by no kind of musical idea. They are the result of scientific thought." And in the program notes of one of his concerts, Satie wrote: "The composer begs those who do not understand to assume an attitude of total submission and total inferiority."

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

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At the request of the Central Committee of the Communist Party, Prokofiev came forth with a description of his own music in 1948 which tells us more about the totalitarian state than the work of one of the greatest composers of our day: "There have been formalist elements in my music for the last fifteen or twenty years. The infection must have been caused by contact with certain Western currents."

What follows now is surely the most elaborate example of self-praise in the annals of musical history. It is part of an autobiography written by the 18th century Italian composer, Paisiello. Referring to himself in the third person, he sets down "some remarks on the nature of his talents, and on those qualities which characterized him. In a few words, they are fertility of invention, an extraordinary and happy facility for finding subjects full of both nature and originality, a talent unique in developing them by the resources of melody and embellishing them by interesting details, an arrangement always full of fancy and learning, a taste, grace, and freshness of melody, by which *he has far surpassed all other composers* (the italics are mine), and has been a model to all those who have labored after him. His composition, always very simple, and divested of all affectation of learning, is not only extremely correct, but exceedingly elegant, and his accompaniments always clear and at the same time always brilliant and full of effect. With regard to expression, although simplicity seems to be its principal and ruling character, it is not less true that he knows perfectly how to introduce variety, to seize on the different methods of producing effect, and to pass from the comic, from the simple and unaffected to the pathetic, to the majestic, and even to the terrible, without losing that grace and elegance, from which it appears impossible for him to depart. . . .

"He has received the homage of his age, and has assured to himself that of posterity."

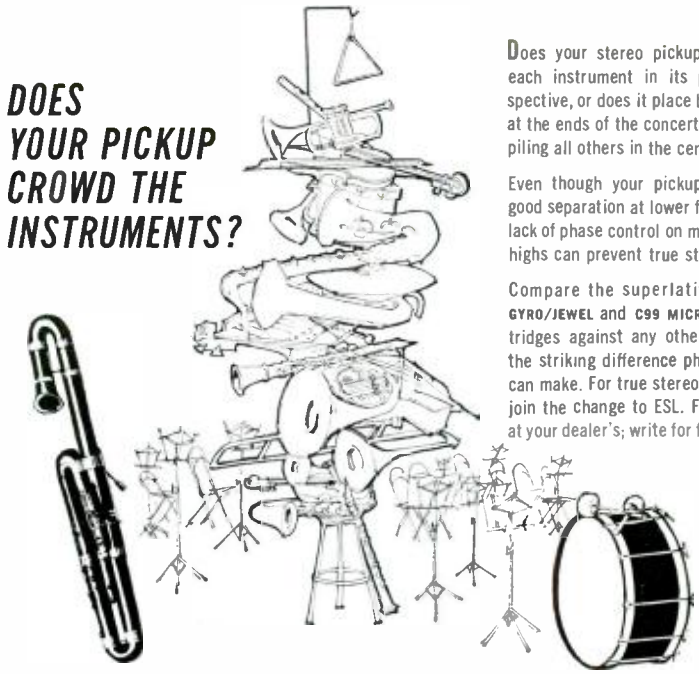
Perhaps a later Italian composer was thinking of Paisiello's orgy of self-acclaim when he wrote these words: "It is quite enough for the musical world to have put up with my notes for so long. . . . I will never condemn it to read my prose." Thus spake Giuseppe Verdi. **Æ**

NEW LITERATURE

(*Continued from page 8*)

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AUDIO ETC.

(*from page 38*)

low to a logical conclusion the idea that the universe is meaningful to *you* entirely in terms of what *you* see, feel, experience, you may suddenly come up with a dreadful thought; that maybe the universe *exists* only inside you. Reality, so far as you can tell, is in your mind. The whole universe. That is the egocentric predicament and it is, of course, a predicament, because it paints you into a philosophic corner and doesn't help you a bit to figure out how to go about practical living. Didn't help me, anyhow.

It may seem far-fetched to say that this thought has something to do with the launching of a new hi-fi product, which is my subject right now. There's a tenuous connection: I have my own favorite modern-style problem which I'm calling the predicament of the One-Way Comparison. You've heard me talk about it before (the Dangling Comparative) in various ways. This predicament, though, is a poser for many a manufacturer who gets caught in its nasty linguistic snare. Squirm as he will, he can't get loose—not in words, anyhow.

The predicament of the One-Way Comparison is common enough. It's the jam you get into when you are hot to make a comparison in *favor* of one product, but you can't say anything *against* another. An absurdity on the face of it, for how can one thing be better without something else thereby being worse? Yet that's the way we want to have it, and we just can't. Impossible.

You have, for example, a fine new model of your product to launch—any product—a model that is improved in numerous respects. You are proud of it and you're all set to trumpet its superiority. You are prepared to point out the exact ways in which you have made this model better than the one which went before it. You itch to brag—and who wouldn't. But you can't.

You can't say anything specific at all, because you can't afford to suggest that the other half of the comparison, the older model, is *inferior*. Heaven forbid! You just don't do that sort of thing, these days.

And so you resort, first, to a week-kneed sort of promotion. You're caught in a linguistic trap and the best you can do, under the circumstances, is to trumpet something vague and woolly about the new product being "better than ever." Who, or what, is "ever"? That won't sell your product.

But this is a far more serious matter than you might think in many cases, due to a highly practical and deadly joker, the old product itself. More often than not, of course, that product has been a good one and it is still selling. The dealers have it on hand still in quantity. You can't sell it down anybody's river by making damaging comparisons. Decidedly not.

Now mind you, I am not talking about some lemon of an old model, a sorry piece of junk and a gyp. I mean a perfectly good product that has, in the normal course of events, been honestly surpassed by a new model. It has to happen some time, to all of us. The world does move on. Your new product is definitely and gratifyingly good—it's "better." But the old one still has lots of value on its own and you are still selling it nicely.

So you are doubly in a fix. Not a word about better and worse. Even more, you can't so much as indicate (in so many words) the fact that your new model is *new*—for that might suggest that the earlier product was "old." Not *that*—heaven forbid; not yet, anyhow. Not until the existing stocks are safely (and quite legitimately) sold off.

So you shut up about all those fine new virtues about to be launched. How can you launch the new product and describe both of your models, without in any way implying that one is either older *or* inferior to the other? Boy, is that a fix to be in! Happens all the time, of course.

Well, there are ways to get out of this Doubly Comparative Predicament, and you'll see them everywhere. The thing to do is to give up on the language end entirely. You must forego any specific praise for the "new" model *as compared* to the "old"—which can't be of course be called old. You therefore issue your new product as a supplement, not a replacement. The old model continues the same (for the time being, anyhow), the standard, current mainstay of your line, as though nothing at all had happened. The new one is the extra, the superdeluxe job.

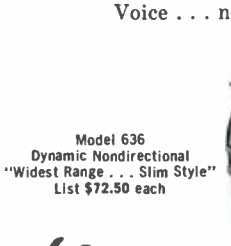
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Price Words

And, to put the whole thing on an entirely honest and legitimate footing—I mean it—you fix your prices so that *they* speak for you, where you can't in words.

Prices talk neatly. You don't even suggest, by so much as a whisper of small print, that the lesser model is a "good value at the price"—for that might hint at the unmentionable truth, the darned thing is actually inferior to . . . *what am I saying?* Do not let that thought enter a head, anybody's head. There is no such word as inferior, no such concept as less, worse, not as good. The new product, remember, is better than "ever," but not better than anything more specific, especially the worthy product which it will, no doubt, eventually replace.

And so, again and again, you'll discover a familiar hi-fi model joined by a new and supplementary deluxe product of the same sort and same brand, at a somewhat higher price. You take your choice according to price. And you bury your head in the small type trying to find out what the actual difference is and (needless to say) whether the de luxe model is better than the standard, and in what ways.

To tell the truth, you'll probably find out some of the facts. There's not a thing directly wrong about all of this, and no reason at all for witholding information of a favorable nature. It's just the *comparison*—any direct comparison—that is taboo. *You* can make it, but the promoter can't, no matter how much he may want to.

So, you see, the quality of the specific differences is clearly implied by the language of price. You imply that the older model is, indeed, a bit inferior, by the fact that it costs somewhat less, even though it may sell at exactly the same price it always did. Not even a reduction. (In fact, a reduction of the price might actually promote a falsehood, by suggesting that the earlier product was not good.) Your price figures must speak as carefully and as accurately as the actual words you can't use.

An honest statement via price, as per the hypothetical units I'm imagining here, would allow only for a very mild token reduction on the old model (still not called "old," remember) and a modestly higher price on the new, to imply clearly that this de luxe model is also practical, useful and worthwhile—which it is. Too high a price would imply that you were over-rating it, and your honesty would be questioned by the buyers just as definitely as though you had spoken out in actual words.

After awhile, maybe in a few months or six or even a year, the "old" model is quietly retired; stocks thin out, begin to get scarce, and then are no longer mentioned nor available. And, at that point, your new model has already undergone a modest price reduction or maybe several, so that it is down in the "standard" range of the company's line. Meanwhile, a new, improved, superior model has been developed which is really hot. The old one, once new, is now inferior . . . but it is still selling well and stocks are everywhere. The cycle begins again.

Pickering 380

The Pickering 380 stereo magnetic cartridge, which I've been using for some months now, is rapidly becoming one of my regular work-horses. I like it.

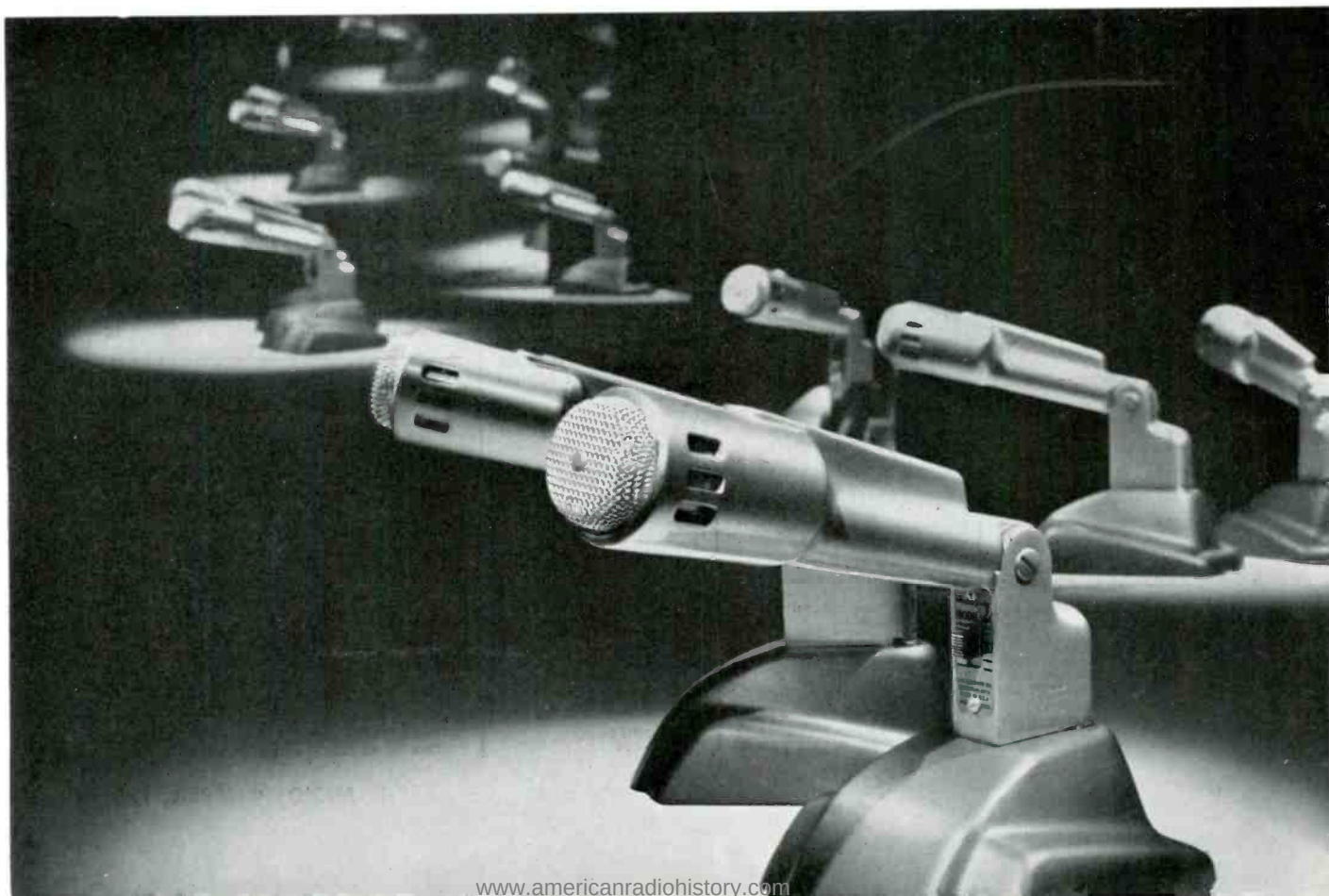
This sturdy pickup, which might be characterized at the moment as the deluxe Pickering offering, uses a plug-in stylus assembly in a V-shape, the "V-Guard," where other current Pickerings, the 371 series, use a similar T-shaped slide-in stylus, called the "T-Guard." The two stylus assemblies, both for stereo, are not interchangeable of course. Both cartridges are now being sold, the 380 at a slightly higher price than the 371.

I like the solid way that the V-Guard stylus slides into place and the excellent protection offered to the stylus tip itself. I approve of the alternative stylus compliances offered, slightly stiffer for changers and relatively rough usage, more compliant for professional hi-fi tone arms and careful users, a system which is also used in the 371 models employing the T-Guard system. I like, too, the trick whereby for safety you may slide the V-Guard stylus in upside down or on its side, rotated by 90 or 180 degrees, with the stylus aimed out of harm's way. Very good when you are carrying the unit or moving your player, or when you fear the inroads of childish hands.

But above all, I like the sound of this V-Guard Pickering. For my ear, it rates up with the very best stereo cartridges, and no more need be said (especially any sort of comparison).

The instant you set this cartridge up, you'll be aware of its smooth, easy, gentle sound, its happy way with any old record, with warped discs and hissy, noisy ones, with damaged grooves, worn grooves, bent grooves and what have you. It accommodates itself beautifully to all these common blemishes upon the fair art of recording, as well as to the sound of the very best discs.

I note one specialty of the 380 that I'm not entirely able to account for—I merely listen, I don't do measurements and tests. It seems to track successfully at about the lowest stylus force of any cartridge among those I've so far tried.



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I know quite well that other cartridges will, by test as well as claim, track at very low stylus forces. But there is something more subtle involved here. This Pickering, so to speak, *likes* to track light. It seems to behave at its very best when floating almost in free air, and it sticks to its grooves like a rock . . . well, like a lightweight train to its track. There isn't the slightest aberration in the sound until the stylus actually lifts out of the groove. Some cartridges have strange ways of swishing, whistling, producing odd swirling noises, when stylus force is very light and/or variable (as in many a slightly warped record); not this one. To me, this is a highly valuable feature and though I can't explain it too well, I'm happy to call attention to it.

Only one mildly less favorable observation to be casually noted, though this, too, is enmeshed in the intricacies of electrical and magnetic circuitry and isn't easy even for the advanced professionals to fathom 100 per cent. The 380 is encapsulated (a nasty word to pronounce, I find) in mu metal and is theoretically hum-proof. However, perhaps due to a relatively high impedance (†), in my system I found that with amplifier volume wide open, there is somehow slightly more audible hum in the air than in the same situation with several other comparable cartridges, in the same arm.

Slightly—and at wide-open position. Who plays records that way? Virtually nobody, even with a low-sensitivity 7-7 watt stereo amplifier! At normal playing volume there is a microscopically larger residual hum (to use a term that probably I shouldn't) in my imperfect system than with cartridges X, Y, and Z. My hum is my fault, and in part is due to necessary extra switches and the like that afford me versatility at the expense of ideal shielding—whether magnetic or electrostatic. So my system shows up things like this when it oughtn't to. But, of course, so do many other systems that oughtn't to, either.

In 99 out of 99½ cases, the Pickering 380 is sure to prove practically humless and if it doesn't, the fault is really yours, not Pickering's. Get your system in good order, chase away the ground loops, the unshielded switches and connections, the radiating transformers and phono motors (put them in better locations) and then you'll find this Pickering 380 one of the nicest cartridges on the market to work with.

I note with interest that in a 1960 hi-fi catalogue I now have beneath my eyes, one that was put together last summer, 1959, the Pickering line includes the model 371A (for manual arms) at about $27 and the 380A (same) at $35. That is the impeccably correct relationship, as described above. A newer catalogue, a flyer released early in this year, lists the 380A again at $35; the 371 is nowhere to be seen—but this is an abbreviated flyer and doesn't include all merchandise on sale, by any means. (The "C" models, with more rugged styli for changers, are somewhat less expensive.) I am sure you can still buy the 371, at its modestly lower pricing, in most hi-fi outlets.

* * * * * *

I note with equal interest a similar situation in regard to another worthy stereo pickup line. The 1960 catalogue that was assembled last summer lists *two* GE stereo cartridge lines.

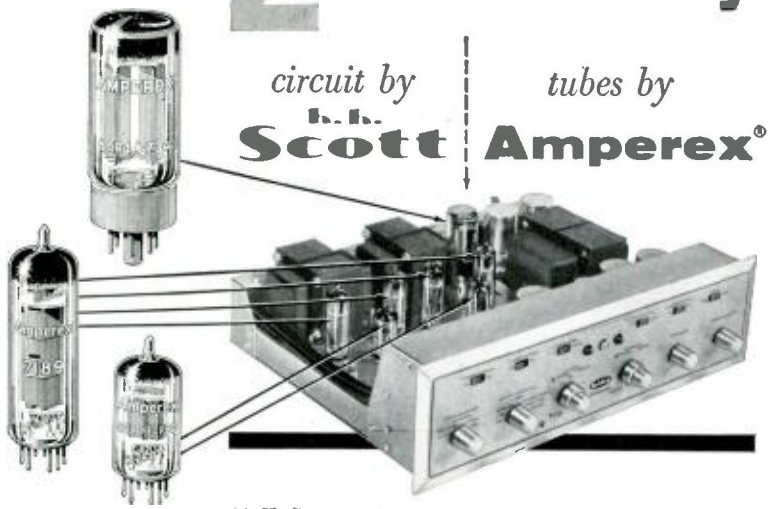
The "Golden Classic" GC-7 is about $24 (the manual-play version) and the VR-225 (same) about $28. The changer versions are $17 and $25, a greater difference due no doubt to the larger market involved.

But in their new hi-fi flyer, the "Classic" models aren't mentioned; the VR 227 is again $25. However—the cat will get out of the bag—I find in the same flyer on a different page, a special and colossal bargain—"save $15.48." The GE "Golden Classic" GC-7 stereo cartridge, Now Only $7.99—while they last. *"A Tremendous Hi-Fi Buy"* says the blurb and, of course, it is exactly that. I have one of these in one of my machines and have found it an excellent cartridge for, as they say, general use, and a lot less temperamental than some fancier models. It was good even at standard price.

But now there's something better—better than ever. It's the GE VR 22, which is, of course, the current standard model. Æ

2 for the money

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6CA4/EZ81: Indirectly heated, 150 mA
5AR4/GZ34: Indirectly heated, 250 mA

INDICATORS
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IM3/DM70: Subminiature "exclamation" pattern

SEMICONDUCTORS
2N1517: RF transistor, 70 mc
2N1516: RF transistor, 70 mc
2N1515: RF transistor, 70 mc
IN542: Matched pair discriminator diodes
IN87A: AM detector diode, subminiature

RECORD REVUE

(*from page 48*)

John Barrows and his French Horn. (Music by Alec Wilder.)
Golden Crest RE 7002

Alec Wilder is surely the most self-effacing musician in the business. I remember an album awhile back called "Frank Sinatra Conducts"—the entire contents were composed by Mr. Wilder. The same is true of this album, which contains two Horn Sonatas and a Horn Suite in two parts, plus a rhapsodical essay of praise on the back cover by the composer—praise for Mr. Barrows and his horn, of course. The music is for horn and piano and there is no indication as to who might be the pianist, the horn's fully-equal partner in the music. Could it be Mr. Wilder? What'll you bet?

This is, to use a corny phrase, fun music

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—but the phrase somehow suits it. That highly musical, very sincere quality of expression that is Wilder's when he lets go on his own hook is much in evidence here, and the writing both for horn and piano is expert and lightly effective. Needless to say, the Barrows horn is fabulous. (Needless to say for me, anyhow.)

Don't know when the two Horn Sonatas were composed but I'd guess they might be early works; the first is a sort of mildly Hindemithian piece with old Brahms peeping joyfully out of the harmonies; the second replaces Brahms with a more sophisticated and Ravel-type semi-dissonance. The Suite, half on each record side, plays gently on such titles as "Suitable for Dancing" and "Dons Quixotic", with a pleasant trace of mildly drawing-roomish jazz, liltingly done by both horn and piano.

Yes, this is Wilder at his best in spite of the usual indeterminacy of style and content. Nice listening, and it should have a more accurate title.

The Big News of 59. Walter Cronkite, narr. Columbia ML 5461

Newscast-style documentary recordings of current history, as well as of past events, are no longer novelties but their interest continues high. This one follows a pattern that has developed in a few years from the pioneering stage into an expected and even conventional format, sounding very much as the daily news roundup with its brief "for that, we take you to . . ." interludes, (so-and-so reporter reporting), plus the taped-in excerpts of famous voices, on-the-spot mobs and crowds, on-the-street interviews—all now familiar as dramatic means in the daily presentation of news around the world. There is even a recognizeable CBS style, as distinguished from the microscopically different styles of other networks. It is CBS we listen to here.

It seems to me that there is a double interest in a relatively permanent news account such as this, on an LP record. First, of course, is its immediate value as a summary and round-up of big events only a few months old and yet already strangely distant, out of our past memories in this fast-moving period. How odd to hear old Mr. K. again, blasting off at Los Angeles, and that smoothly idiomatic translator with his astonishingly good Americanese, using the new and highly effective semi-simultaneous translation system! What a shock to realize, here, that the death of Dulles was only last year, as was the escape of the Dalai Lama and Castro's revolution—January 1, 1959. This record takes us East with Ike, dabbles in the usual authoritative arguments about space lags, visits Europe for the usual bits of NATO (Ike, Adenauer in German, MacMillan in French); we also race to Russia and sit in on the famous Nixon-K. verbal duel over color TV—how long ago *that* seems already!—and we hear the tail end of Charles Van Doren's Confession.

Perhaps the oddest aspect of the disc is its coverage of the steel strike, which suddenly stops right at the climax. The record came out too soon to complete that bit of recent history, but the effect is as of an LP side that ends in the middle of a symphony, when you know . . . the rest by heart.

The other aspect of the double-interest here is in the future—for unlike a daily newscast, this LP is audible now and forever, given a continued flow of 117-volt a.c. This aspect fascinates me.

It is obvious to any social historian (amateur or otherwise) that the things which are taken utterly for granted in one time become the remarkable novelties of a different time, looking back. Ways of speech, dress, conventions of expression, the very tempo of a presentation, are things of utterly temporary status—yet we think of them as the very foundation of our present life, if we think of them at all. Reminds me of the home movies I took in 1936 and the stills I still have of family and friends in the late twenties. Those long waists and short skirts, the cloche hats! And, in 1936, the long, swishing skirts halfway down the calf! These are the very first things one notes in the old pictures; but did anyone think twice about them at the time?

So—what will this LP (and similar recordings) sound like ten, twenty, fifty years from now? What are the conventions that *we do not hear at all*, yet which will sound incredibly strange and odd to our future ears?

I don't know. But if you will buy one of these and put it away, you'll find out eventually. Almost worth waiting for, I'd say. AE

CRAZY MIXED-UP CURRENTS

(*from page 25*)

It is further unfortunate that the positive charge convention of current flow persisted at the time when semiconductor symbols were being formulated, hence all the wrong-way arrowheads, as in *Fig.* 3. Personally, I make the changes as in the lower row of *Fig.* 4 when I draw diagrams for myself. The P's and N's may be interpreted either as denoting the p-type or the n-type side of a p-n junction, or as denoting positive or negative polarity with respect to the opposite element of the junction. With transistors, either interpretation would generally be appropriate; a p-type emitter is normally positive to the base and an n-type emitter is normally negative to the base. Since the arrowhead denotes the emitter, it is this element which should be marked when the arrowhead is replaced with P or N. With diodes, we find some are p-n junction types, either germanium or silicon; some are lower current point contact types, either n-type germanium in contact with a tungsten or phosphor-bronze cat whisker or p-type silicon in contact with a tungsten cat whisker; some are semiconductor-metal junctions such as copper oxide in contact with copper, the oxide acting as a p-type semiconductor, or selenium in contact with Wood's metal, the selenium apparently acting as p-type. So, with diodes, the use of P to denote the element which should be positive to the other element for forward (easy) current flow may be thought of as also denoting the p-type semiconductor, since even the germanium point contact type has an effective p-type element at the junction of the cat whisker and the n-type germanium. But it would not be advisable to use N with diodes unless it were clearly understood that N referred only to polarity, since some diodes have no n-type element.

This seems an appropriate place to add a warning of a booby trap[1] in the

[1] S. D. Prensky, "Much fuss about plus." *Radio-Electronics*, April, 1956, p. 102.

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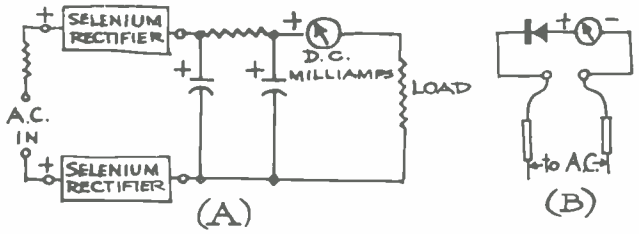


Fig. 5. (Left) (A) Here we have two selenium rectifiers, each with its left terminal stamped +, connected as shown. One rectifier is hooked up backwards and must be shorted out if the circuit is to function properly. (Note the polarities of the meter and the electrolytic capacitors.) Which rectifier should be shorted out? (B) Here the erroneous meter polarity shown is exactly as found on a similar diagram in a manual put out by our armed forces. See text.

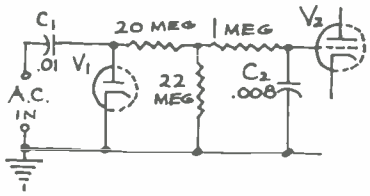


Fig. 6. (right) Can you trace currents and explain why the grid of V_2 goes negative when a.c. input is applied?

form of diode terminals marked with a + sign, or colored red. (This is probably the trap into which the manual referred to in the caption of (B) in *Fig.* 5 fell.)

If you conclude, not illogically, that this + terminal should be positive to the other terminal of the diode for forward current flow, you will connect the diode as you would an ammeter, (A) in *Fig.* 5, in the upper branch, with the + side toward the input terminal where the highest positive polarity should be found when the diode is conducting. But your logic will not be that of the manufacturers. Apparently they were thinking of the diode as a substitute for a battery, or a power source. Consequently the + here denotes the cathode, the element where a positive d.c. polarity is found when connected to the positive side of a filter and load, just as with the usual connection of the cathode of a vacuum tube rectifier. This makes a certain amount of sense, until you put the rectifier in the lower branch of (A) in *Fig.* 5, where it works quite happily in spite of the fact that, when the diode is conducting, the '+' terminal is the most negative point in the circuit.

If you deal much with such diodes (generally selenium types) my advice is to ignore the + or red mark, and think of cathode and anode, as in a vacuum tube diode. This should keep matters straight. Also, mark the anode P, as in *Fig.* 4, if you wish. The main thing is to understand electron flow. With diodes stamped with the conventional arrowhead and bar, the arrowhead denotes the anode, the bar the cathode.

If in doubt about a diode or a transistor, you can easily straighten things out by using an ohmmeter. (The R × 10 or R × 100 range is generally safest, as neither the current nor voltage applied will ordinarily exceed a safe level.) First determine the polarity of your ohmmeter. (Some VOM's reverse test lead polarity when switched to the ohmmeter function.) Then measure the resistance across the diode or base-emitter junction of the transistor. Reverse the test leads and measure again. One reading should be much lower than the other. The polarity which gave this lower reading is the one of forward conduction. The positive terminal for this lower reading is therefore the anode of the diode (mark it P) or the emitter of a p-n-p transistor (mark it P) or the base of an n-p-n transistor (mark the emitter N).

Returning to *Fig.* 1, it is noteworthy that at (C) the two currents shown flowing in the electrolyte, I_1 and I_2, are not of opposite sign, even though they flow

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in opposite directions. If one is considered positive, then so is the other. The reason is that both the charges and the directions are of opposite sign; therefore the current in both cases is of the same sign. This must be so, because the two currents add; each increases the total current, I_T. Also, if we take the current of (B) as positive, then the current of (A) is also positive, even though it flows in the opposite direction. A little math may help clarify this. The current, I, may be expressed as $I = \rho v A$, where ρ is the charge per unit volume of conductor, v is the average longitudinal, or drift, velocity of the charge carriers, and A is the cross sectional area of the conductor. We take v as positive when its drift direction is clockwise, as in (B). This is to agree with standard electric field theory, which deals with a hypothetical positive test charge. In all three diagrams of *Fig.* 1, the field is such that a positive charge within the conductor is urged clockwise around the circuit and a negative charge is urged counter-clockwise. Therefore when the charge is negative, as with electrons, or negative ions, v is negative; when the charge is positive, as with positive ions, v is positive. With the charge negative, $I = \rho v A$ gives I positive, because ρ and v are both negative. (The product of two negatives is positive.) With the charge positive, I is again positive, because ρ and v are both positive. A of course is always positive.

I fancy by now some would-be heckler is yearning to confound me with the concept of "hole" conduction in semiconductors. Are holes not positive charge carriers? he might ask. If so, is it not logical to use the conventional arrowhead on the emitter of p-n-p transistors? Holes are the majority carriers, except in the base. The emitter injects holes into the base which are swept into the collector and onward toward the collector terminal, which is negative to the emitter. Therefore the arrowhead points correctly toward negative polarity, the current being composed predominantly of positive charges.

But, I argue, what happens outside the transistor? It is hooked up by means of metallic conductors, usually copper wire. We know that only electrons, carrying negative charges, can flow in pure metal. What happens to our direction of current flow? Is it one way outside the transistor and the opposite inside?

Yes, answers the heckler, turning against me my own explanation of how two currents may flow in opposite directions and still be of the same sign, i.e., add. The current inside the transistor is composed predominantly of positive charges. The current outside is composed of negative charges. Therefore there is no anomaly. We simply have the condition of (C) in *Fig.* 3.

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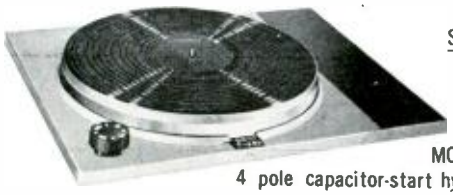
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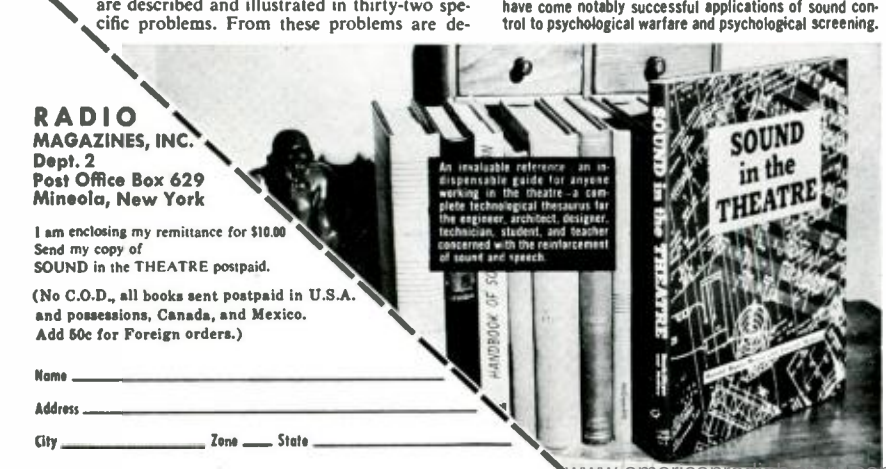
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by Harold Burris-Meyer and Vincent Mallory

Nothing like SOUND in the THEATRE has ever been published. It is the first book to set forth in authoritative detail what you can do with sound by electronic control, and how to do it whenever the source (singer, musician, speaker, etc.) and the audience are present together. The book develops the requirements for electronic sound control from the necessities of the performance, the characteristics of the audience (hearing and psychoacoustics), and the way sound is modified by environment, hall, and scenery. Sound sources are considered for their susceptibility of control and need for it, and the many techniques for applying electronic sound control are described and illustrated in thirty-two specific problems. From these problems are derived systems and equipment specifications. Complete procedures are given for: Planning, assembling, and testing sound control installations—Articulating sound control with other elements of production—Rehearsals and performances—Operation and maintenance of sound control equipment.

THE AUTHORS

During the past thirty years, the authors have developed the techniques of sound control in opera, open-air amphitheatres, theatres on Broadway, theatres on-the-road and off-Broadway, in concert halls and night clubs, in Hollywood and in the laboratory. Some of their techniques are used in broadcast and recording as well as in performances where an audience is present. From their laboratory have come notably successful applications of sound control to psychological warfare and psychological screening.



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To which I answer, the heckler has a point, given the reality of holes, even though it would be awkward to denote change of both direction and type of current every time we entered and left a transistor. But how about n-p-n transistors? Here the principal carriers are electrons, but we still find the arrowhead pointing the wrong way, as at (A) in *Fig.* 3. Then I deliver the crusher. As for holes, these are only a convenient fiction.[2] The actual conduction is via electrons.[3] William Shockley, writing in the *Proceedings of the I.R.E.*, Nov. 1952, p. 1297, warns that "confusion may arise if the model of the hole is taken too literally" and cites an example of such confusion.

Remarks like Shockley's lead me to suspect that the hole concept, useful as it is, is but another outgrowth of wrong thinking about current flow; that is, if Franklin had only gotten us off on the right foot, so that electron charges were designated positive and electrons were customarily accepted as the predominant charge carrier, we would have another, and less confusing, concept to replace that of the hole.

If you want to compare the merits of electron flow vs. conventional flow and at the same time test your understanding of currents in general, *Fig.* 6 offers a good opportunity. This represents the a.c. input circuit of a V.T.V.M., on the most sensitive range. As a suggestion, start with the half cycle when V_1 is conducting (upper a.c. input terminal positive to ground), trace currents, then consider what happens on the opposite half-cycle, bearing in mind that an inflow of electrons (carrying negative charge) to one plate of a capacitor is accompanied by an outflow of electrons from the opposite plate, so that the first plate has a surplus of electrons, resulting in a negative potential, and the second plate has a deficit of electrons, resulting in a positive potential, with respect to the other plate. For the a.c. input voltage to cause the d.c. meter (not shown) to register properly, the grid of V_2 must go negative to ground in proportion to the input amplitude. Therefore you should end up at V_2 grid with such a negative d.c. voltage, or more precisely, a filtered composite, mostly d.c., having minor components of the input.

The manual from which (B) of *Fig.* 5 is derived states that C_1 of a circuit similar to that of *Fig.* 6 "serves to block any d.c. voltage present in the circuit being measured." This seems to imply that if only a.c. were being measured, C_1 could be shorted out. Do you agree? Æ

[2] Dewitt and Rossoff: "*Transistor Electronics*," McGraw-Hill, 1957, p. 42.

[3] K. R. Spangenberg, "*Fundamentals of Electron Devices*," McGraw-Hill, 1957, pp. 7, 95.

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MICROPHONE

(*from page 51*)

tern in the lower frequencies where the line microphone becomes less directional.

Pressure Gradient Microphone

A pressure gradient microphone responds to a difference in sound pressure between the front and back of its diaphragm.

Consider a diaphragm and magnetic structure as shown in *Fig.* 13. Pressures P_1 and P_2 are of different magnitudes which cause the diaphragm to move toward the side of least pressure. This movement is transformed into an electrical signal by the voice coil moving in a magnetic field caused by the permanent magnet.

Sound approaching from the angle $\phi = 0$ would impinge upon the front of the diaphragm before impinging upon the back because of the phase lag due to the distance D from the front to the back of the microphone which is the space phase shift ψ_1. These pressures are shown in *Fig.* 14 at (A). The forces due to these pressures are represented at (B).

There is a 180-deg. phase shift to start with because the forces are on opposite sides of the diaphragm. The additional phase shift ψ_2 is caused by the acoustical

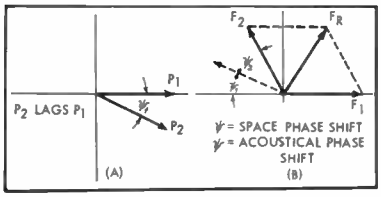


Fig. 14. Vector diagrams: (A) pressure and (B) force on a pressure-gradient microphone.

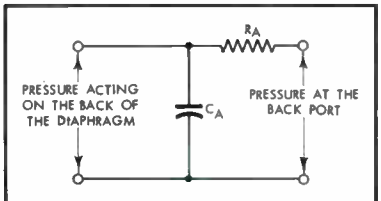


Fig. 15. Analogous electrical phase-shift circuit.

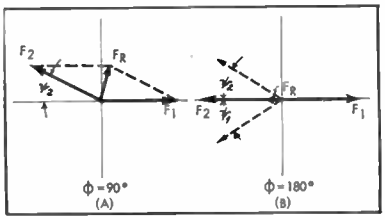


Fig. 16. Vector diagram of the forces on a pressure-gradient microphone when $\phi = 90$ deg. (A), and 180 deg. (B).



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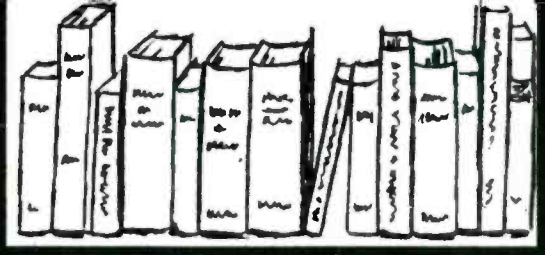
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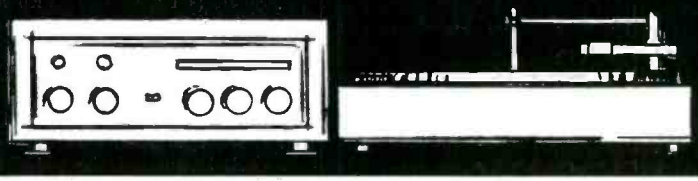
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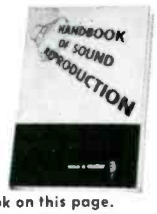




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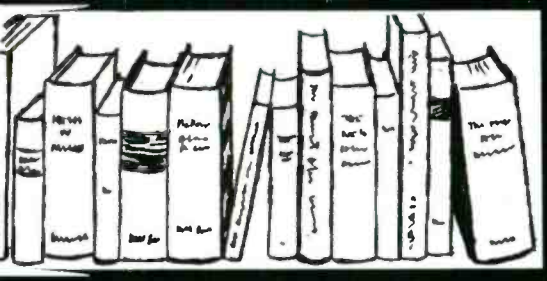
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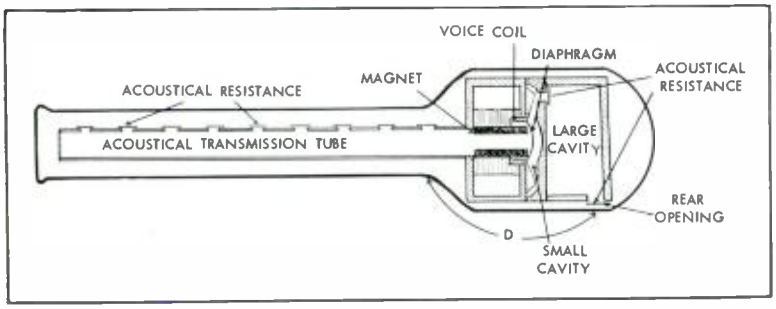


Fig. 17. Pressure-gradient and line microphone combined.

R_AC_A circuit. R_A is acoustical resistance such as felt or cloth. C_A is the cavity behind the diaphragm as shown in *Fig.* 13. The analogous electrical phase-shift circuit is shown in *Fig.* 15.

Assume R_A is adjusted to make $\Psi_1 = \Psi_2$ as shown on the vector diagram. The resultant force is F_r. Sound approaching from $\phi = 90$ *deg.* would reach the front and back of the microphone at the same time which means no space phase shift Ψ_1, but there is the acoustical phase shift Ψ_2. The resultant force is shown at (A) in *Fig.* 16 and is smaller in magnitude than the $\phi = 0$-*deg.* case. Sound coming from the rear gives a vector diagram as shown at (B). The resultant force to actuate the diaphragm is very small.

The polar pattern for this pressure gradient microphone is shown at (A) in *Fig.* 3, a cardiod pattern. The pressure gradient cardioid microphone can give a cardioid polar pattern below 100 cps without the value of D, the distance from the front of the microphone to the back, becoming very large.

When $\Psi_1 + \Psi_2 = 60$ *deg.*, the resultant vector F_r will equal in amplitude F_1 and F_2 assuming $F_1 = F_2$ because $P_1 = P_2$. When $F_r = F_1$ the output is the equivalent of a pressure microphone under the same conditions. As discussed earlier $\Psi_1 = \Psi_2$, or $60\ deg/2 = 30\ deg.$

The space phase shift from the front of the microphone to the back port is equal to the following:

$$\Psi_1 = \frac{2\pi f}{c} D = 30\ deg. = \frac{\pi}{6}$$

where f = frequency of operation in cycles/second
c = velocity of sound in air in feet/second
D = distance from the front to the back port of the microphone in feet

For this microphone to have an output equivalent to a pressure microphone at 100 cps:

$$D = \frac{c}{12f} = \frac{1130}{12 \times 100} = 11.3 \text{ inches}$$

The practical value of D for a pressure gradient microphone can be made shorter and still obtain similar results by underdamping the diaphragm resonance which is in the low-frequency range.

Since a line microphone alone would have to be 11.3 feet long to have a similar cardioid polar pattern at 100 cps, the line and pressure-gradient microphone are combined into one unit *using* one diaphragm and one magnetic structure, as shown in *Fig.* 17.

Acoustical filters decrease the effect of the pressure gradient microphone as the sound source approaches the frequency at which the line microphone gives a cardioid pattern. The line microphone section then controls the directional effect for all higher frequencies, the pattern becoming sharper as frequency increases.

The Sound Spot has a maximum length of 16 inches, a width of 2 5/16 inches, and weighs only 2 lbs. 9 oz. A parabolic reflector microphone with a similar pattern would probably be 4 feet in diameter and weigh much more. The diaphragm of the 644 is made of Acoustalloy and will last a lifetime. The microphone case is die cast zinc, chrome plated, making an attractive and rugged unit.

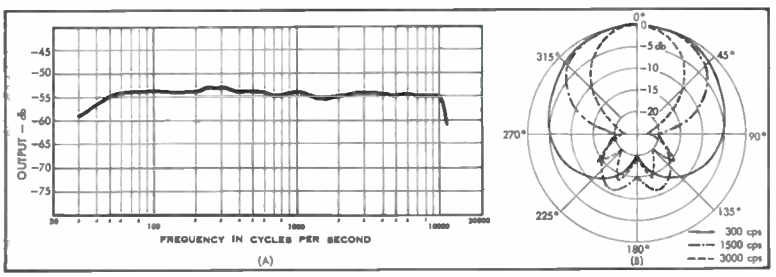


Fig. 18. Frequency response curves (A), and complete polar curves for the Sound Spot microphone.

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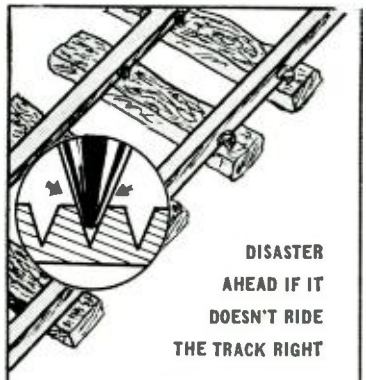
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Industry Notes...

REEVES BUYS PRESTO DISCS. Blank recording disc manufacturing facilities of the **Bogen-Presto Division** of Siegler Corporation have been purchased by **Reeves Soundcraft Corporation.** Reeves, which has manufactured discs in its Allentown, Pa., plant since the early 1940's, will in the future combine all manufacturing facilities in its new recording products plant in Danbury, Conn. Acquisition of the Bogen-Presto disc business will more than double Soundcraft's disc volume, according to Frank B. Rogers, Jr., Reeves executive vice-president.

Sony Corporation of Tokyo, Japan, has announced the termination, by mutual consent, of the arrangement whereby Sony transistor radios and related products have been distributed in the U. S. by Delmonico International. Distribution will now be taken over by the newly established Sony Corporation of America, with offices at 514 Broadway, New York 12, N. Y. New company is headed by Mr. Akio Morita, Executive Vice President of the parent organization in Tokyo, and will handle sales, repairs, and service of all Sony products. The arrangement with Superscope, Inc., Sun Valley, California, will remain unchanged with respect to the U. S. distribution of Sony stereophonic tape recorders, Sony microphones, and related products.

Industry People...

Theodore (Ted) Lindenberg, chief engineer for Pickering and Company, will join Astatic Corporation of Conneaut, O., on April 4 as director of engineering . . . **W. Walter Jablon,** a true veteran in the electronics industry, has been named president of the Mark Simpson Mfg. Co., Inc. He succeeds **Mrs. Miryam Simpson** who becomes chairman of the board. Mrs. Simpson, one of the founders of the company, will continue as general manager. Mr. Jablon will supervise sales . . . **Lawrence J. Epstein,** formerly of United Audio Products, Inc., is the new sales and merchandising manager for high fidelity and professional products manufactured by Bogen-Presto. He has served as a director of the Institute of High Fidelity Manufacturers for several years.

Walter O. Stanton, president of Pickering and Company, has been awarded a patent covering his inventions incorporated in the company's Fluxvalve cartridges . . . April 13 was a lucky day for **Harry Miller and Harold D. Weiler,** New York manufacturers' representatives. Both won blue ribbons for their canines in the annual Saw Mill River Kennel Club dog show held in White Plains, N. Y. . . . **George Elliot** and **Joseph Viviani** have been advanced to the positions of manager of distributor sales and manager of export sales, respectively, by Amperex Electronic Corporation.

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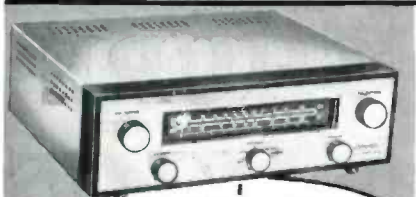


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KT-250A IN KIT FORM	LA-250A COMPLETELY WIRED
74.50	99.50

A completely new stereo high fidelity amplifier with a high quality of reproduction, versatility of operation, and distinctive styling.
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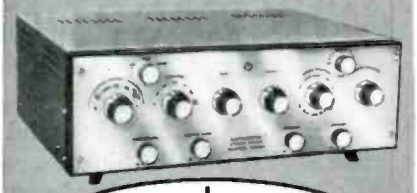


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Solves Every Stereo/Monaural Control Problem!

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• TAPE RECORDING PROBLEMS—AND HOW AUDIOTAPE HELPS YOU AVOID THEM



Listening to a recording with excessive harmonic distortion is like looking at a picture through a thin film of translucent material.



Reducing the distortion is like removing a curtain that was hanging between you and the sound source—all tones are clear and sharp.

Lifting the "film" of harmonic distortion

IF A TAPE RECORDING sounds "fuzzy"—as if the music were coming to you through an invisible curtain—harmonic distortion may well be your problem. This rather formidable term is simply the engineer's way of expressing the degree to which harmonics or "overtones" of a fundamental frequency are altered or distorted in recording or reproduction. Obviously, a good tape recording should have as little distortion as possible. Some of it may be introduced by the circuitry of your recorder, or be caused by recording at too high a level—but it can also be caused by the tape itself. A good check on where it's coming from is to record on a tape that is *known* to have *low distortion* and see if any difference is noted.

Audiotape is especially formulated and manufactured to provide the lowest possible distortion—so low that it is impossible for the human ear to detect. One reason for this distortion-free quality is that the minute oxide particles in Audiotape are *magnetically oriented*, so that they all point in the same direction. This means that all oxide particles are magnetized uniformly, and playback at maximum effectiveness.

No matter how you measure tape performance, you'll find that professional-quality Audiotape will *always* give you the cleanest, clearest sound which your recorder can produce. It is available in a size and type to meet every sound recording tape need. Ask your dealer for Audiotape—made *by* audio engineers *for* audio engineers—and backed by over 20 years of research and manufacturing experience in sound recording materials. It costs no more than ordinary recording tape—and its performance speaks for itself.



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How many times have you listened to your tiny youngster "talking" himself to sleep? Haven't you wished that you could preserve those cute mispronunciations forever? With a tape recorder you can make yourself an unrehearsed "sound diary" of your children (or nephews or nieces) as they grow up. We suggest you use a 5" reel of LR Audiotape (type 961) on durable 1-mil "Mylar." This will give 24 minutes of uninterrupted recording time. Or you can use type 261 (in the self-mailer package) for a shorter version.

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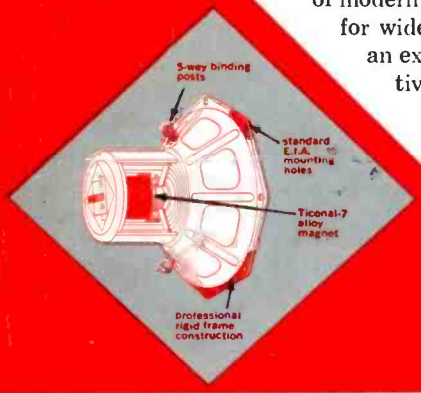
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