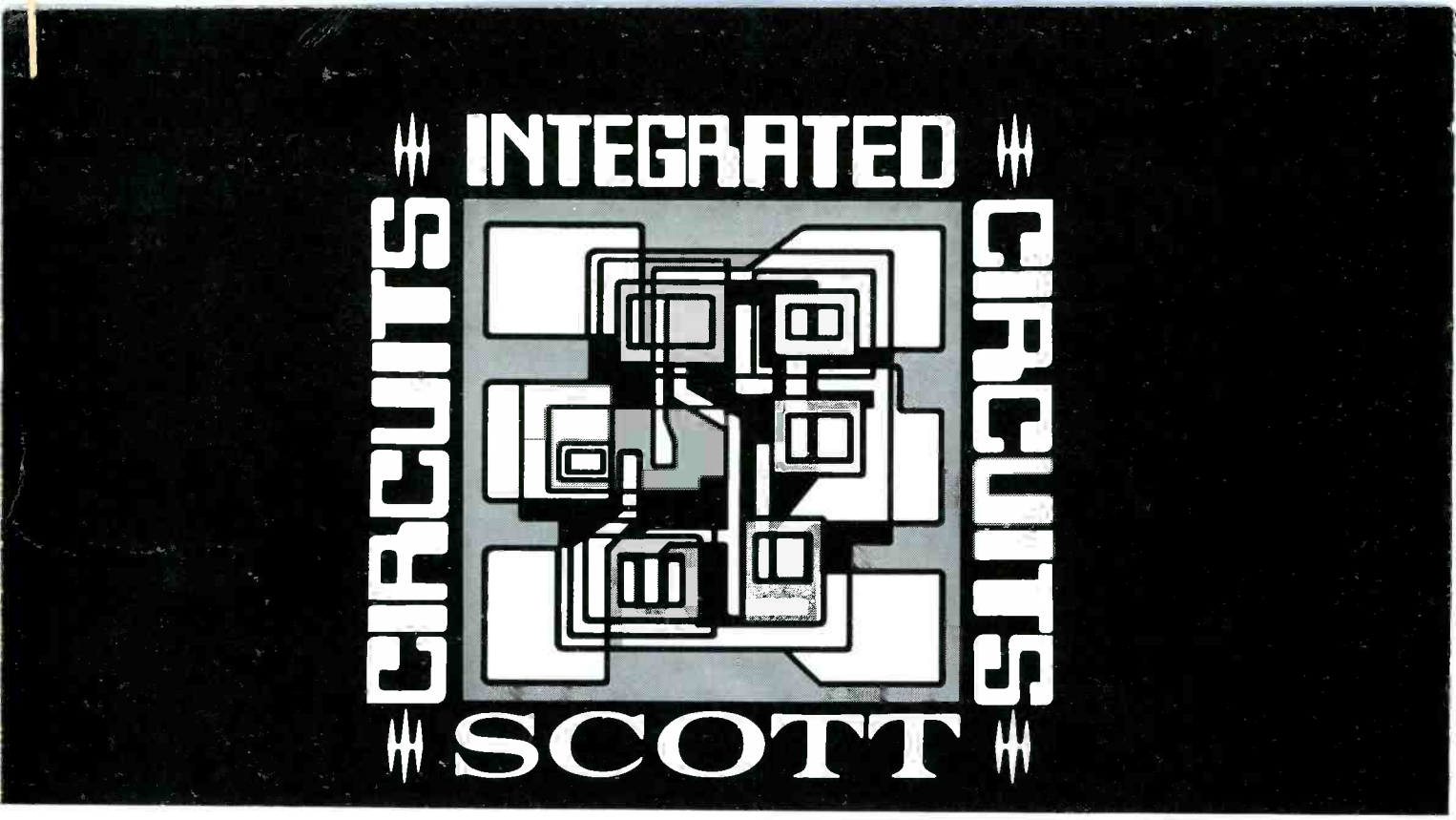
AUDIO

FEBRUARY 1967

. . . the authoritative magazine about high fidelity



Announcing an important Scott innovation in high fidelity . . .

Scott Integrated Circuits...now in 3 Scott receivers

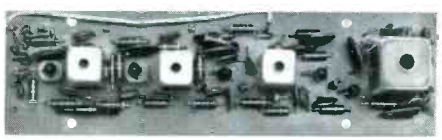
Hear stations you've never been able to hear before... brought to life with amazing clarity!

Integrated Circuits... the computer-born miracle.

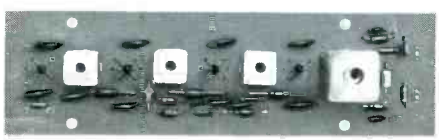
Originally developed as a space-saving device in giant computers, the integrated circuit ("IC") is a complete circuit in miniature . . . often barely larger than a grain of sand. The various elements of the circuit... transistors, resistors, and wiring... are permanently carved into a microscopic layer of silicon. There are no lose wires or parts that can change, age, fall out, or wear out. In fact, Scott Integrated Circuits can last literally thousands of years.

More performance in less space.

Used in the vital FM tuner IF strip, Scott Integrated Circuits actually incorporate more circuitry in less space. The new Scott IF strip now contains 20 transistors, as compared to four in the previous model. Scott's previous IF strip, without IC's, gave superb capture ratio and selectivity figures of 2.5 dB and 45 dB, respectively. Scott's new Integrated Circuit IF strip is conservatively rated at 1.8 dB capture ratio and 46 dB selectivity. Independent test reports, however, show the new Scott Integrated Circuits to be consistently capable of an incredible 0.8 dB capture ratio!



old IF strip



IC IF strip

What Scott IC's mean to you.

Now you can hear more stations with less noise and interference. Weak, distant stations that you never have been able to receive before will suddenly appear with amazing clarity. Outside interference from electric razors, auto ignitions, etc., will be drastically reduced. And, you can count on enjoying this amazing performance for many, many years . . . thanks to the absolute reliability of Scott Integrated Circuits.

When will Scott IC components be available?

Scott Integrated Circuit receivers are at your Scott dealer's showroom right now. Scott Integrated Circuits are incorporated into the design of the 388 120-Watt AM/FM stereo receiver, the 348 120-Watt FM stereo receiver, and the 344B 85-Watt FM stereo receiver. Your Scott dealer will be glad to demonstrate to you the amazing capabilities of these new receivers.

Scott . . . where innovation is a tradition

SCOTT®

H. H. Scott, Inc., Dept. 35-02, 111 Powdermill Road, Maynard, Mass. Export: Scott International, Maynard, Mass.

FREE Fact-filled, fully illustrated booklet on Scott Integrated Circuits . . . simply circle Reader Service No. 100.

Another innovation from Scott, manufacturers of superb components, compacts, kits, speakers, and consoles.

AUDIO

February, 1967 Vol. 51, No. 2

Successor to RADIO, Est. 1917

AUDIO Articles

AUDIO Reviews

AUDIO Profiles

AUDIO in General

AUDIO (title registered U. S. Pat. Off.) is published monthly by North American Publishing Co., I. J. Borowsky, President; Frank Nemeyer, C. G McProud, and Arthur Sitner, Vice Presidents. Executive and Editorial Offices, 134 North 13th St., Philadelphia, Pa. 19107. Subscription rates—U.S. Possesions, Canada, and Mexico, $5.00 for one year; $9.00 for two years; all other countries, $6.00 per year. Printed in U.S.A. at Philadelphia, Pa.

Second class postage paid at Philadelphia, Pa., and additional mailing offices.

REGIONAL SALES OFFICES: Sanford L. Cahn, Art Sitner, Robert Cooper 663 Fifth Ave., New York, N. Y. 10022; (212) 753-8824. Richard Reed, 205 W. Wacker Drive, Chicago, Ill. 60606; (312) 332-3910. Leonard Gold, 1900 Euclid Ave., Cleveland, Ohio 44125 (216) 621-4992. Jay Martin, 9350 Wilshire Blvd., Beverly Hills, Calif. (213) 273-1495.

REPRESENTATIVE: Warren Birkenhead, Inc., No. 25, 2-chome, Shiba Hamamatsu-cho, Minato-ku, Tokyo, Japan.

AUDIO, Editorial and Publishing Offices, 134 N. 13th St., Phila., Pa. 19107
Postmaster: Send Form 3579 to the above address.

Coming

Articles

"Tracking Capability of Phono Pickups," J. G. Woodward. Just what is involved in tracking a disc?

"Skating Force — Mountain or Molehill," R. S. Oakley. The author describes the pros and cons of skating force compensation.

"Get to Know the Deciber—Better" in which George H. R. O'Donnell simplifies the calculations involving the ubiquitous dB.

Profiles

Wharfedale W-20 Speakers
Dyna PAS-3 preamplifier and Stereo 120 amplifier
Pioneer Turntable System

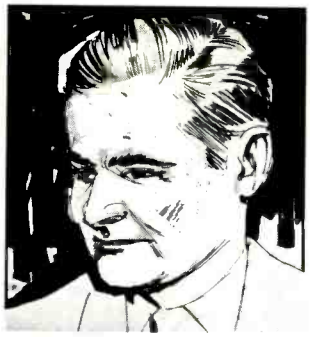
On the Newstands, at your favorite audio dealer's or in your own mailbox.

About the Cover

The intimate relationship between the worlds of music and recording are exemplified in this night club scene. For the full story see page 42.

AUDIO CLINIC

Joseph Giovanelli



If you have a problem or question on audio, write to Mr. Joseph Giovanelli at AUDIO, 134 North Thirteenth Street, Philadelphia, Pa. 19107. All letters are answered.

Recording Lathe Considerations

Q. Why is it not practical or possible to build a recording lathe with a pivoted arm carrying the cutting head, similar to a tonearm? It seems simpler to agree on a standard off-set and pivot point for the cutting device and manufacture turntables and tonearms to this standard than to worry about minimizing tracking error in reproduction.

If there is some great technical obstacle which makes this solution invalid, can you tell me what it is? J. N. Perrett, Jr., New Orleans, Louisiana.

A. For simplicity, let us consider that the record being cut is monophonic. Under normal conditions the cutting stylus moves along a radius, dead in line with the center hole of the disc. The turntable is rotating, of course, and, although the motion is circular, we can state that motion of the stylus under modulation is at right angles to the turntable motion. Let us now assume that the cutter was rotated 90 degrees so that the stylus motion under conditions of modulation would be forward and backward. This is in the direction of table rotation, is it not? Can we play such grooves back? Will there be modulation impressed on the grooves? The answer to the first question is *yes*, and to the remaining two questions, *no*. The reason for this is that nothing has been done to the groove; they have not been made to move from side to side. We have made the stylus move along the path of the spiral cut, but any tendency toward impressing modulation will be erased as the disc turns a small fraction of an inch.

Let us see if this point can be made still clearer. Suppose the cutter is moving toward the center of the disc from right to left. The stylus is moving forward and back during program material. Let us consider one cycle of modulation and see what happens. Suppose the cutter moves the stylus forward one mil. In other words, the stylus has moved in the direction that the table is moving. Even if the table were not moving, the stylus will complete the half cycle and come to its original starting position, move backward, and return to rest again. This condition will be worsened if the turntable was moving. As the table moves forward, the stylus moves backward. All signal will be erased.

Even if modulation was produced on the disc, this modulation will be moving in the direction of stylus travel. How can this result in an alteration of playback stylus position in accordance with the modulation? Clearly, it cannot.

Presumably, you are now asking what I am getting at, and how this even relates to your question. Look at it this way: I gave you two instances of recording head arrangements, one the conventional, and the other which is ridiculous. What you propose is that the cutter rotate like a tonearm. If this rotation is permitted to continue far enough, you can see that both of my cutter arrangements will occur, with intermediate positions within which modulation will begin to appear more and more until the cutter is in the standard position which we are accustomed to seeing.

First of all, then, we can see that if the cutter is forced to rotate like a cartridge and tonearm, some modulation will be lost. The amount of this loss will depend upon the amount of rotation. The loss of signal produced by this arrangement will not be cancelled by the tracking error of the playback assembly. All that will happen is that even more signal loss will take place.

There is still another problem. If you have ever used a lathe for metal work, you know that the cutting tool must be positioned correctly or it cannot cut the metal being worked. The greater the misalignment between the tool and the moving work, the less efficient the cutting process will be. Finally we will arrive at a point where the tool will not cut at all but will tear the work. Further, the tool probably will be ruined. A recording stylus is a cutting tool ground to small dimensions, but still basically a lathe tool. If this tool is allowed to be used at any angle other than the correct cutting angle, a rough cut will result, the playback will contain increased surface noise, and the groove depth will be decreased.

Even if you are not familiar with the operation of a metal-working lathe, consider what will happen if you are using an ordinary wood chisel and turned it in a manner other than the correct one. Do you think you can chisel a shape as accurately as you could by holding the tool correctly? Or course, you cannot hope to obtain any kind of results.

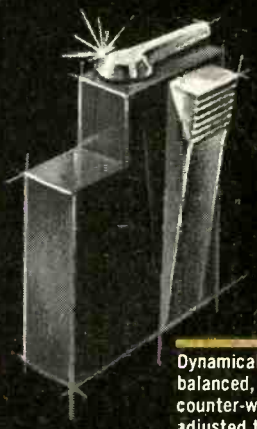
Mark of the leader...

GARRARD'S LAB 80 MK II

The ultimate expression of over 50 years of Garrard leadership, this much-imitated but unequaled automatic transcription turntable contains many developments invented, perfected and brilliantly refined by the Garrard Laboratories, and now considered essential for the finest record reproduction.

Heavy, cast 12" anti-magnetic turntable is dynamically balanced with copper weights on underside.

Hydraulic cueing and pause control eliminates damage to records or stylus through manual handling.

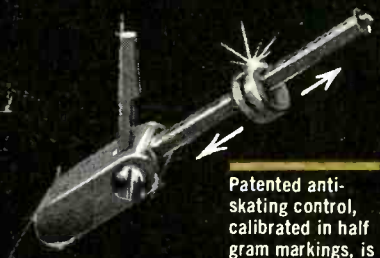


Dynamically balanced, counter-weight-adjusted tone arm of Afrormosia wood and aluminum for light weight, low resonance.

Low mass cutaway shell compatible with the most advanced, lightest tracking cartridges.

Anti-static, dust-repellent turntable mat has safety rings at 12", 10" and 7" positions to protect stylus should automatic switch be activated without record on turntable.

Two interchangeable spindles: short spindle facilitates manual play; long, center-drop spindle handles eight records fully automatically.



Patented anti-skating control, calibrated in half gram markings, is adjusted with springless, sliding weight.

Built-in stylus pressure gauge, calibrated in quarter gram intervals, has click-stops for precise, audible/visible settings.

Just two years ago, the stereo high fidelity world was introduced to the Lab 80, the first Automatic Transcription Turntable. It was instantly acclaimed because of the significant developments it contained. These imparted professional performance capabilities never before anticipated in automatic record playing units. Now, the Garrard Laboratories have refined and surpassed the original model with the Lab 80 Mark II, still priced at only $99.50, less base and cartridge. It is one of five new Garrard Automatic Turntables each of them the leader in its class.

For complimentary Comparator Guide, write Garrard, Dept. AB-1, Westbury, N.Y. 11590.

Check No. 103 on Reader Service Card.

It is very expensive to make a recording lathe in such a way that it can move smoothly across a radius; it is easier to pivot the entire assembly as you have suggested. In fact, inexpensive recorders are based on that very idea. Such cutters are built to keep error to a minimum, but discs cut under these conditions are not uniform as to cut or signal-to-noise ratio. Distortion increases. The idea behind the manufacture of these instruments is not to obtain better playback quality, but to make their price attractive to hobbyists.

My first cutter featured such a cutting system. Rather good discs could be cut on that machine, but they cannot compare to my present cuts, made on a lathe which allows the cutter to move in a straight line along a radius.

Although I have indicated that your idea is not feasible, I still must say that it represents good thinking. I believe that I would have reasoned along these same lines in my early days of cutting discs.

Noisy Preamplifier?

Q. Just today, I began to notice a loud sound in my speakers whenever I tapped my preamplifier lightly or even the shelf it is on. It also happens when I turn the selector knob, the bass or treble controls, etc. In other words, anything that jars the preamplifier the slightest produces a loud break-up in my speakers which sounds like what I would get when I would tap my finger against a microphone.

My first impression was that something was loose. My superficial examination, however, could discover nothing obvious. The six tubes extending through the back appear to be seated well. Tapping each one of them did not seem to pin point the problem. I checked each plug; they are all in place. Jiggling each one of them produced the noise, which did not identify a particular plug—but only that I was vibrating the chassis in general. Volume has no effect either. The noise is quite loud even with the volume at minimum. It takes place regardless of where the selector switch is set.

Is there something I might check out on this myself or is this a problem best handled by a service station? Samuel J. Neiditch, Highland, California.

A. Because I am not familiar with your background, I am not in a position to say whether or not you can repair the condition described in your letter. However, I can make some suggestions as to how you might go about locating the general area of the trouble.

Perhaps unknowingly, you have already done some trouble-shooting which has produced worthwhile information. You have learned, for example, that the difficulty is not the phonograph preamplifier stage of your equipment. Further, you have discovered that it is not occurring in any stage ahead of the volume control. Now you can concentrate on the problem of localizing the trouble in the remaining preamplifier stages.

D-19E/200 is a cardioid microphone for high quality recording and sound reproduction, and provided with bass roll-off switch for exceptionally clear speech intelligibility and excellent output for above average "reach." It features effective front-to-back discrimination and a non-metallic diaphragm—preventing popping and harshness on close-ups.

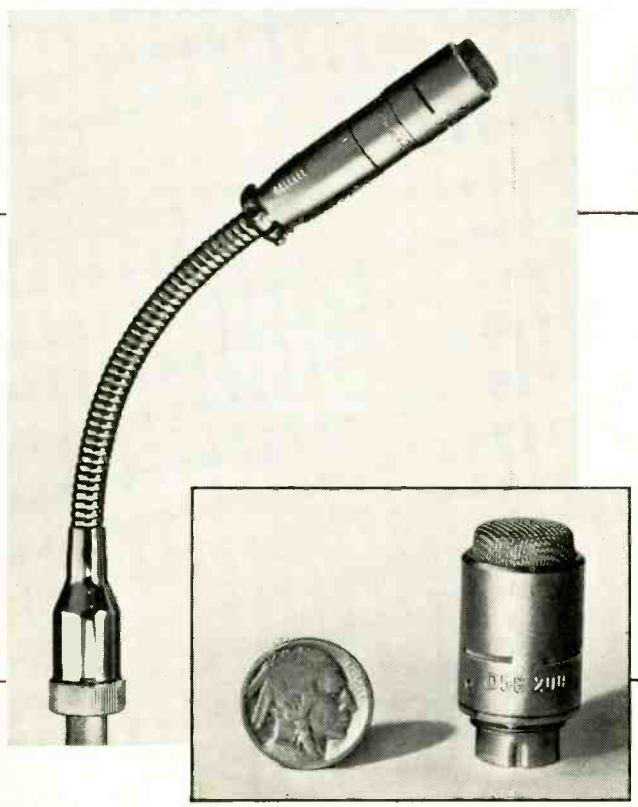
TECHNICAL DATA

Frequency range	40-16,000 cps.
Frequency response	± 3 db
Sensitivity	— 53 db
Impedance	200 ± 20%
Dimensions	7¼" long by 1⅞₆" diameter
Weight	7 ounces

Here are two economical microphones for a variety of recording, broadcast and public address applications. An accessory W-24 Windscreen is available for the D-19E/200; also fits the D-24E microphone.

Truly noise canceling, the D-58E microphone is the ideal choice for sportscasts, industrial uses or any similar noisy environment.

Send today for data sheets and prices.



D-58E is a noise-cancelling microphone limited to the speech range and offers crisp, clear speech reproduction, for maximum intelligibility. It effectively discriminates against any sound originating beyond 5" from the microphone.

TECHNICAL DATA

Frequency range	70-12,000 cps.
Sensitivity	— 58 db
Impedance	200 or 60 ohm ± 15%
Dimensions	1⅝" long by 1⅞₆" diameter
Weight	1.1 ounces
Goose neck	8" or 20" length (optional)

MADE IN AUSTRIA BY **AKG** GMBH.

Norelco® **PROFESSIONAL SOUND PRODUCTS**

NORTH AMERICAN PHILIPS COMPANY, INC.
Professional Products Division, 100 East 42nd St., New York, N.Y. 10017

4-66

Check No. 61 on Reader Service Card.

Starting from the volume-control stage, remove each tube. See at what point the tapping disappears. You will finally arrive at a tube, which, when it is removed from the socket, will result in no noise being heard when the preamplifier chassis is tapped. The actual trouble will be found in the stage associated with the tube you last removed from the socket. First of all, check the tube. Probably the surest way to check a tube under these conditions is to replace it with one which you know to be in good condition. If the tube proves to have been good, check the electrolytic capacitors to see that none of the ground or 'hot" terminals have become loose. Check all solder connections in that stage, including those in the decoupling circuitry, which you might normally associate with the power supply. My guess would have to be that something has been poorly soldered or that you have a defective component, probably an electrolytic capacitor.

If the trouble continues even though all tubes have been removed from their sockets, you will know that the trouble is in your power amplifier or in the cables associated with the preamplifier and the power amplifier. If the trouble appears to be in the last stage or so, it is also possible that it is a result of cable connections rather than internal in the preamplifier.

Sometimes the filament wiring is such that it is inadvisable to remove tubes from their sockets as described here. By doing so, you may cause an excessive rise of filament voltage applied to the other tubes, resulting in damage. Further, other tubes may have been connected in series with the one you took out, and these tubes will be extinguished, leading possibly to a false conclusion as to the troubled stage.

In these instances, it is best to short the grids to ground successively. This has the further advantage of localizing the trouble to a particular stage rather than to a particular tube. Most tubes encompass two stages.

Cable Losses

Q. For the past six months I have been making my own patch cables. They have all worked satisfactorily using high-impedance sources. Recently, I had occasion to compare my patch cords with the store-bought variety. It seems that I am getting greater losses in general and per distances than the store-bought types present. I am using regular shielded coaxial cable which is stamped 75 ohms. I was always under the impression that shielded cable is all alike. This is apparently false.

Please give me the characteristics or specifications of lower-loss audio cable. LT (jg) George J. Korinek, FPO, San Francisco, California

A. The most significant problem when high-impedance lines are used is the loss of high frequency response as a result of the capacitance between

LE MANS IS CHILD'S PLAY COMPARED TO "FOUR CONCERTOS FOR HARPSICHORDS AND ORCHESTRA"

The Shure V-15 Type II phono cartridge must be *much* more trackable than a Lotus Ford. This seemingly silly simile has significance, however, when one fully appreciates the importance of *trackability* in providing crisp, clear, distortion-free sound from *all* of your recordings. The ascents and descents, jarring side swipes, abrupt turns of a Grand Prix course are widely known. (Other analogies we might have used are the slalom, the steeplechase, the bobsled). Not yet as well known has been the curious fact that the grooves reproducing high level recordings of orchestral bells, harpsichords, glockenspiels, drums, pianos—through which the cartridge must wend its melodic way—are even more tortuous, more punishing. Thus, the much talked about "compliance" and "mass" of past evaluations are now merely parameters of design—whereas "trackability" is the true measure of performance.

For *your* entry into the era of high trackability, for an experience in listening you will find most astonishing, ask your Shure dealer to demonstrate the Shure V-15 Type II Super-Track* at $67.50, the Grand Prix elite among cartridges. It maintains contact between the stylus and record groove at tracking forces from ¾ to 1½ grams, throughout and beyond the audible spectrum at the highest velocities encountered in quality recordings. Shure Brothers, Inc., 222 Hartrey Avenue, Evanston, Illinois 60204

*T.M.

Check No. 62 on Reader Service Card.

the center conductor of the cable and its shield. Most of the time, and for most of the runs encountered in home installations, these losses are unimportant because the circuits at the 'sending' end of the line are cathode-follower or emitter-follower circuits, and the capacitive reactance will be higher than the impedance of the cathode follower. This will be true even at the highest audio frequencies.

If you plan to run a line which will extend over 100 feet or more, you should consider the use of line transformers. There again, the capacitive losses will be of little consequence.

If the impedance of the line is very low, as is true when loudspeakers are involved, capacitive losses again are of little or no importance even over great distances. However, the ohmic resistance of the wire making up the cable will play a big part. There will be a voltage division action between the amplifier, the cable and the speaker at the other end of the line. If a run is to be of considerable length, you must use either a large wire gauge or use line-to-voice coil transformers at each end of the line so that the impedance will be high enough so that the losses in the line will not be significant.

If you are using a crystal microphone, the capacitive losses will play a great part in the overall picture. The microphone is capacitive in nature. It will, therefore, be a capacitive voltage division action between the capacitance in the mike and that of the cable. Further, long, high-impedance cable runs such as this are susceptible to hum pickup.

Phonograph cable leads are subject to loss of high-frequency response if their length is too great. Their capacitance is added to the internal capacitance of the cartridge. If this capacitance is sufficiently large, it will resonate with the inductance in the cartridge at some audio frequency and there will be a peak produced, and above this peak there will be a fall-off of highs. The load resistor placed across the cartridge is not meant as an impedance-matching device as many people believe. It is intended to lower the Q of such a resonant circuit, leading to a reduction of the size of the peak.

Your cable problem, therefore, resolves itself into locating lower capacity line than you are presently using. 75 ohm coaxial cable has a considerable amount of capacitance per foot. I am quite sure that a good grade of mike cable will contain less capacitance than you are now using. Æ

This ad is supposed to give you a reason for listening to the Fisher 700-T solid state receiver.

We decided to give you several:

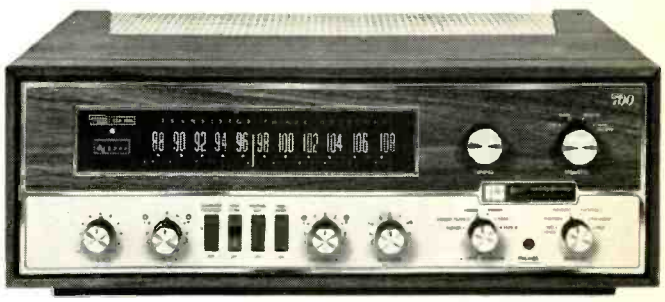
Amplifier section:

Music power (IHF)	
4 ohms	120 watts
8 ohms	90 watts
Harmonic distortion (1 kHz)	
At rated output	0.8%
3 db below rated output	0.3%
IM distortion (60:7000/4:1)	
At rated output	0.8%
3 db below rated output	0.3%
Frequency response 10-70,000 Hz	+0, −1 db
Hum and noise	
Volume control (min.)	−80 db
Phono input (6 mV ref.)	−55 db
Aux. input (400 mV ref.)	−65 db
Input sensitivities (at 1 kHz, for rated power at 4 ohms)	
Phono (low)	3.5 mV
Phono (high)	10 mV
Tape Head	2.5 mV
Auxiliary (low)	200 mV
(high)	400 mV

Tuner section:

Usable sensitivity (IHF)	1.8μV
Harmonic distortion (100% mod. and 400 Hz)	0.4%
Stereo separation (400 Hz)	40 db
Signal-to-noise ratio (100% mod.)	70 db
Selectivity (alternate channel)	50 db
Capture ratio (at 1 mV)	2.0 db
Spurious response rejection (100 M Hz)	90 db

PRICE, $499.50 (CABINET $24.95). FOR MORE INFORMATION, PLUS A FREE COPY OF THE FISHER HANDBOOK, WRITE FISHER RADIO CORPORATION, 11-22 45th ROAD, LONG ISLAND CITY, N. Y. 11101.



The Fisher

No ad man can do it justice.

FISHER RADIO CORPORATION, INC., 11-35 45TH ROAD, LONG ISLAND CITY, N. Y. 11101. OVERSEAS AND CANADIAN RESIDENTS PLEASE WRITE TO FISHER RADIO INTERNATIONAL, INC., LONG ISLAND CITY, N. Y. 11101

Check No. 97 on Reader Service Card.

LETTERS

Stereo Indicator

SIR:

If my memory serves me properly, quite a long time ago you had a schematic for a stereo light. This was actuated by a relay circuit in a stereo tuner when a stereo broadcast was on the air.

Please tell me how I may obtain either a copy of the article or a copy of the issue in which it appeared.

SIDNEY LANDAU,
2137 West Huntington Ave.,
Anaheim, Calif. 92801

(Not us, we think. Only article on a stereo indicator that we can locate was in Popular Electronics *in September 1963. You might inquire from them, at 1 Park Avenue, New York, N. Y. 10016).*

Ribbon Microphone Modification

SIR:

We are trying to track down an article which appeared in AUDIO about a year ago concerning a firm here in the Boston Area which did some work on an RCA ribbon microphone in that they were able to step up the output by installing a transformer, and other modifications.

At the time, the article in question was found to be very interesting, but we laid it aside in some manner and it became lost. We would like to get another copy of the issue, or a reprint of the article.

RICHARD MILES,
131 Farrington St.
Wollaston 70, Mass.

(We can do better on this one, although we do not have any copies of the issue in question. The article was entitled, "A 'New' Ribbon Microphone," and was by Charles P. Fisher. It appeared in the August, 1965, issue. If it is important, we could furnish photocopies of the article. ED.)

PROFESSIONAL PLAYMATES

The new Sony Solid State 350 adds professional performance to home entertainment systems

Selecting the brilliant new Sony Solid State 350 to fulfill the stereo tape recording and playback functions of your professional component music system will also enduringly compliment your impeccable taste and passion for music at its finest. With an instant connection to your other stereo components, the versatile two-speed Sony 350 places at your pleasure a full array of professional features, including: 3 heads for tape and source monitoring. Vertical or horizontal operation. Belt-free, true capstan drive. Stereo recording amplifiers and playback pre-amps. Dual V U meters. Automatic sentinel switch. Frequency response 50-15,000 cps ± 2db. S.N. ratio plus 50db. Flutter and wow under 0.15%. Richly handsome gold and black decor with luxurious walnut grained low profile base. This remarkable instrument is yours at the equally remarkable price of less than $199.50. Should you want to add portability to all this, there's the Model 350C, mounted in handsome dark gray and satin-chrome carrying case, at less than $219.50. *For information write Dept. 17, Superscope, Inc., Sun Valley, Calif.*

SONY **SUPERSCOPE** *The Tapeway to Stereo* ®

Portable Model 350C

Check No. 71 on Reader Service Card.

Fundamental AUDIO

MARTIN LEYNARD

Loudness and the Decibel

We hear frequencies logarithmically, as we discussed last month. Our perception of frequency differences is based on the proportional, rather than the absolute differences between them.

For example, we hear the 440-Hertz difference between A (440 Hertz) and A′ (880 Hz.) as an octave, because the higher frequency is exactly twice the lower. But if we jump an additional 440 Hz., from 880 to 1320 Hz., we hear the difference as only a fifth (A′ to E′); farther up the scale, the same 440-Hz. difference can be a single whole tone, the difference between A‴ (3520 Hz.) and B‴ (3960).

Our perception of sound intensities is similar. We hear a sound as "twice as loud" when its actual intensity increases ten-fold. ("Intensity," of course, refers to the absolute sound level, while "loudness" is our perception of it.) An average house, with a sound pressure level of perhaps 0.02 dynes per square centimeter, sounds only half as noisy to us as a noisy office (0.2 dynes/cm^2), and a noisy factory, or subway train (2.0 dynes/cm^2) sounds twice as loud as that.

The Decibel

Sound intensity (in air) is usually expressed by the pressure of the sound wave, in "dynes/cm^2" or "microbars." Loudness is usually expressed in decibels. And since audio is more concerned with what we think we hear than what we're really hearing (the object is to *hear* the Philharmonic in your living room; not to have them there), we'll be using the decibel quite frequently from here on in, sound pressure measurements almost never.

The decibel takes its name, a trifle indirectly, from Alexander Graham Bell, whose main interests in life were understanding and improving human hearing (his wife, incidentally, was deaf), and whose invention of the telephone might be called, in a way, a by-product of these interests. When early experimenters found a ten-fold increase in sound intensity equal to a doubling of loudness, they called this difference "one bel."

The bel is too large a unit to work with comfortably, so the "decibel"—1/10 bel—was established as the standard measure of relative sound levels. The decibel ("dB," for short) is indispensable for two reasons: Being a logarithmic unit, it greatly condenses numbers we must work with; we may call the range from the threshold of hearing to the threshold of pain "0.002 to 200 dynes/cm^2" or refer to it as a relative energy range of 1,000,000,000,000 to 1—or we can call it 120 dB and be done with it. And because our hearing is also logarithmic, it corresponds to our perception of sound. One decibel is also, by a handy coincidence, just about the minimum difference in sound level that human ears can perceive.

Unlike the microbar, which is an absolute measurement, the decibel is a relative unit, meaningful only when related to some absolute level. Thus, "a level of 7 microbars "refers to a specific sound level, and "an increase of 6 dB" describes a proportional change in sound level, but "a level of 6 dB" is, without some implicit or explicit reference level, meaningless. But in contexts where levels are frequently given in decibels referred to some standard sound intensity, the reference level tends to become implicit. You may usually assume, for example that in any discussion of acoustics or hearing—including future FUNDAMENTAL AUDIO columns,—sound levels given in dB are being implicitly referred to the threshold of hearing, .0002 microbar.

When we say that a decibel is a tenth of a bel, we must keep in mind these units' logarithmic character. Although the difference between 1 microbar of sound pressure and 10 microbars is 10 decibels—one bel—we must not assume that 2 microbars is 1 dB louder than 1 microbar, 3 microbars are 2 dB louder and so on. Nothing of the sort! Actually, every time we double the sound level, we raise it 3 dB. For example, 2 microbars are 3 dB louder than 1, 4 microbars are 6 dB louder than 1, and 8 microbars are 9 dB louder than 1 (and 6 dB louder than 2).

Thus, the difference in output capabilities of a 50-watt amplifier and a 25-watt amplifier is only 3 dB louder, (3.0105 dB to be exact) not "twice as loud," as some think (and you'd probably listen to either at a 1- to 5-watt level most of the time anyway).

All of the above statements on how we hear are true only for certain conditions of listening. Our perception of sound will vary according to the type of sound, its frequency, its level, our own age and sex, the noises we hear at the

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same time as the sound, and so on. One of the most important of these variations is the change in loudness perception with changes in frequency and intensity.

Now the Phon Begins

As you can see from the table in *Fig.* 1, the ear's sensitivity covers a sound intensity range of one thousand billion to one. But experimenters have determined that the ear's sensitivity falls off as frequencies get lower (and, to a lesser extent, as they rise) and that this effect is more pronounced at low sound levels than at high ones.

Figure 2 shows these changes in hearing, as reported by experimenters in the U.S.A. (Fletcher and Munson, *Fig.* 2a) and England (Churcher and King, *Fig.* 2b). While the curves differ in detail, they tell much the same story. Each line on the graph represents the sound pressure level (vertical scale) necessary to produce the perception of a given loudness at any frequency (horizontal scale). The bottom lines of both graphs represent the minimum audible sound, while the top line of *Fig.* 2a tells how loud a sound will cause pain at any frequency.

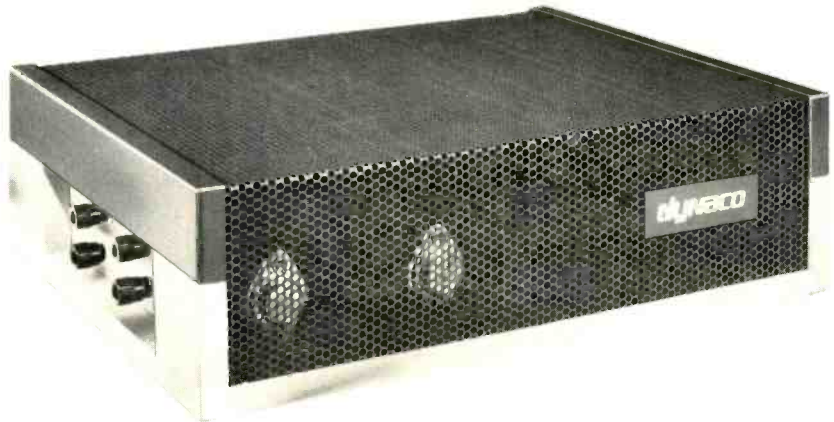
"Zero" on the sound-level scale in each case is 0.0002 microbar of sound pressure, the figure usually quoted as the threshold of hearing. But note that this is truly the threshold only in the vicinity of 1000 cycles—at 30 cycles, for example, the minimum audible sound is 60 dB higher (about 0.2 microbars). There is some evidence, in fact, that this curve could be continued down to frequencies usually considered inaudible, and that a 2-Hertz note can be heard —but only at a level 135 dB higher than that at which a 1,000-Hertz note becomes audible (yet at 1,000 Hz., 120 dB is the pain threshold)!

What's more, at very low levels, even our statement that "a level change of 10 dB corresponds roughly to a doubling of loudness" becomes untrue: at low levels a 10 dB level change is perceived as a tripling of loudness, and at the

FIGURE 1. Relative Levels of Typical Sounds.

Noise	dB	Relative energy	Sound pressure dynes/cm²	Typical examples
	120	1,000,000,000,000	200	Threshold of pain
Deafening	110	100,000,000,000		Thunder Gunfire Pneumatic drill Steam whistle Large machine shop
	100	10,000,000,000	20	
Very loud	90	1,000,000,000		Subway Busy street Noisy factory Inside aeroplane Loud public address system
	80	100,000,000	2	
Loud	70	10,000,000		Noisy office Suburban train Typewriters Radio set—full volume Average factory
	60	1,000,000	0·2	
Moderate	50	100,000		Large shop Average office Quiet motor car Quiet office Average house
	40	10,000	0·02	
Faint	30	1,000		Public library Country road Quiet conversation Rustle of paper Whisper
	20	100	0·002	
Very faint	10	10		Quiet church Still night in the country Sound-proof room Threshold of hearing
	0	1	0·0002	

WORTH WAITING FOR!



DYNACO STEREO 120

The Dynaco Stereo 120—the most anxiously awaited high fidelity product in years—is now at many dealers. After more than 3 years of intensive development, this great new transistorized amplifier offers the same high level of quality, dependability and economy which have become synonymous with the Dynaco name.

The Stereo 120 delivers 60 watts per channel continuous power with performance specifications and with a purity of sound rivalled only by Dynaco vacuum tube amplifiers which have had a 10 year reputation for excellence. Its frequency response, distortion, power response, transient response, overload characteristics and phase characteristics are all outstanding. Its sound quality is impeccable, with not a trace of the unnatural brightness of "transistor sound." Many new Stereo 120 owners feel it surpasses all other amplifiers, tube or transistor.

Complete specifications are available on request from Dynaco, but some of the Stereo 120's special attributes are:

- A fully regulated, rock-solid power supply—capable of delivering unchanging supply voltages under all power demands and line fluctuations, yet its protective circuitry acts faster than a fuse in case of accidental abuse.
- Electronic instantaneous protection against overload, open or short circuits (even at full power) on each amplifier.
- In addition to assuring extremely low distortion at high power levels, patented Dynaco circuitry virtually eliminates the usual transistor distortion at very low power levels.
- Modular construction for surer, faster kit assembly and service when required, using prefabricated circuit-tested etched circuit boards.
- Common output ground permits the use of most headphone junction boxes, multiple speaker installations, and optional 3 speaker stereo systems.
- All silicon transistors and computer-grade electrolytic capacitors for permanent loudspeaker protection and superior reliability.
- No adjustments—ever!

The Dynaco Stereo 120 is ideally matched to the Dynaco PAS-3X perfectionist's preamplifier. The **combined** distortion of this pair over the audio frequency range at most useable power levels can be expected to stay below 0.1%—yes, one-tenth of one percent! We do not feel that further commentary on this combination is required.

The demand for the Dynaco Stereo 120 is very great. Please be patient if your dealer cannot fill your order immediately. The factory assembled amplifier is $199.95; the kit version now being released is $159.95 and requires about 5 hours to build.

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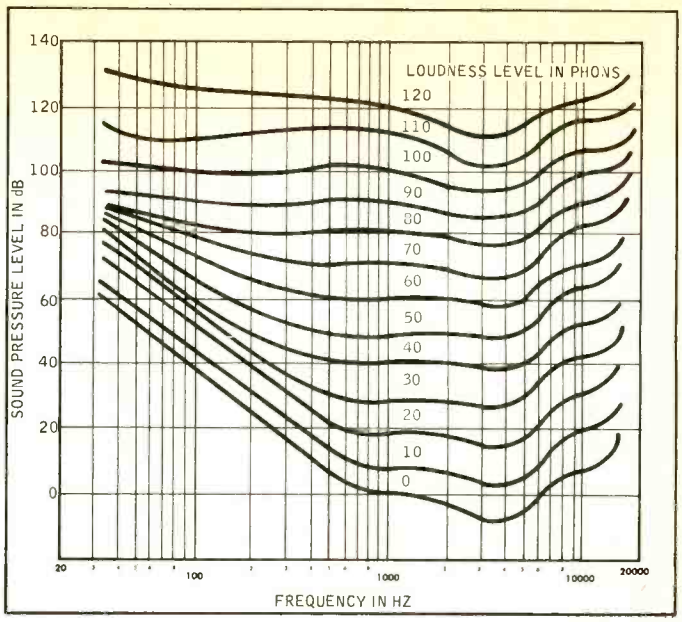

Fig. 2a. The Fletcher-Munson hearing curve.

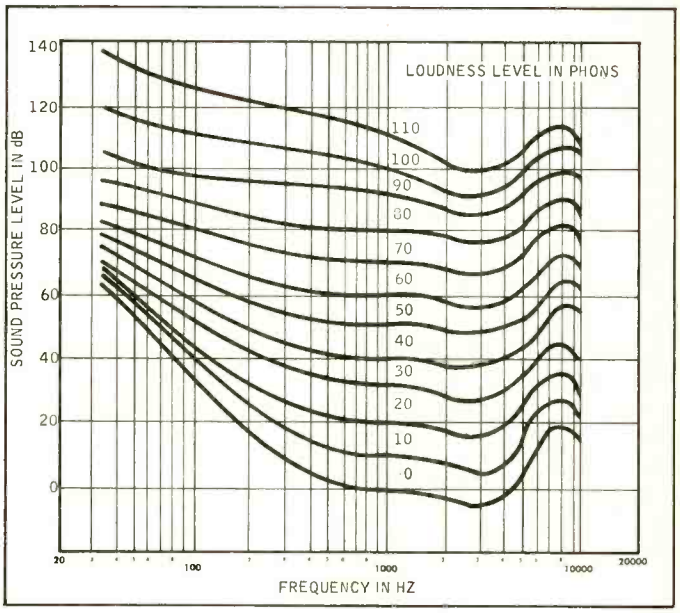

Fig. 2b. The Churcher-King hearing curve.

very lowest levels it is heard as a change in loudness by a factor of nearly 20.

So it would seem that the decibel is an imperfect measure of loudness, though still a most convenient measure of sound intensity relationships and (assuming an explicit or implicit reference level) of sound intensities as well.

Now each of the curves in *Fig.* 2 is an "equal loudness" curve; that is, any two points on any curve will sound equally loud. Based on these curves, we get a new unit, of *loudness*, not intensity, called the *phon*. A sound's loudness in phons is equal to the loudness, in dB relative to the hearing threshold, of a 1,000 Hz. pure sine-wave tone.

To give an example, an 80-dB, 50-Hz. sine-wave tone and a 70 dB tone at about 8,000 Hz. both sound as loud as a 1,000 Hz. tone at 60 dB above 0.0002 microbar. All three tones are therefore defined as having a loudness level of 60 phons (phons and dB are the same for 1,000 Hz. sine waves), and the curve in *Fig.* 2b that runs through these three points is called the 60-phon curve.

As you may gather from the stress placed on sine waves in the preceding paragraph, our perception of loudness is different for different wave-forms, too. But since the phon measures our perception of loudness, it can be applied as easily to square waves, triangular waves, or complex musical waveforms as to pure sine wave tones.

You may have noticed that the level controls of some audio amplifiers are labeled "volume" while others are labeled "loudness." Loudness controls introduce some bass boost at low settings, to compensate for the loss in low-frequency hearing that we've just been discussing; volume controls merely change level without introducing bass compensation. The pros, cons, and rationale of loudness controls will be the subject of a future chapter. Our next topics, however, will be waveforms, timbre and distortion. Æ

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AUDIO ETC.

Edward Tatnall Canby

Saturation Logging

The new antenna that I put up on my old rooftop mast, as described last month, was deliberately chosen by me because it incorporated a new design principle which had me intrigued—the so-called *log-periodic* configuration, developed under government auspices, if I am right, which has been adapted to home TV antenna systems and now, finally, to the broadcast FM band. It sounded to me like the answer to my far-fringe stereo problems. The design is supposed to provide (note my caution!) unprecedented sensitivity over a wide range of frequencies, as wide as you want. That's something.

Well, I'd like to say outright that log-periodic is *the* answer to my prayers, and maybe yours too. I can say that it most certainly is *an* answer! I am more than delighted with what I have on hand, and I seem to discover even more signal strengths, new usable stations, new clarity and separation, every day, and a really astonishingly complete satisfaction (thanks also to the Scott 312 tuner operating out of the antenna) in respect to the crucial far-fringe stereo reception. But I've only tried one antenna.

It is the JFD LPL-FM10 (will somebody please tell them to stop the alphabet soup?), senior FM model in a line of FM antennas, both FM and TV, which incorporate the log-periodic principle. As the name murkily implies, it is a ten-element job. (The line also includes 4, 6 and 8-element antennas, for varying degrees of fringidity, so to speak.) Moreover, this one is a full-wave affair, speaking laterally. That is, its sidewise arms are twice as long as the corresponding members on the usual half-wave antennas found everywhere today, which range from the home-made indoor folded dipole all the way up to the most complex pro models. Full-wave is a fine idea, except that it's BIG. Has to be, to match the FM frequencies.

Ten elements, full-wave! That isn't the theoretical maximum size, I'm sure, though it's plenty big. The TV versions, covering all the bands, and those which also include FM radio, have many more elements than 10; but thanks to the higher TV frequencies involved, the arms are mostly much shorter. So your multi-element TV antenna will fit on your rooftop without spreading sidewise onto your neighbor's roof.

Flagpole

I suppose you *could* treat yourself to a super-multiple element FM antenna, say a couple dozen arms, if you owned three houses in a row, and lots of back yard space. The middle house would hold up the antenna and it would have to be steel reinforced, of course. I mean the house. For a rotator, I figure, you'd buy up an old traction motor, the kind they used to run trolley cars. Massive, solid and slugging. For a mast you'd want—of course—a ship's mast. A big ship. Or maybe a second hand municipal flagpole, vertical-type, the kind that you find in city parks, surrounded by fountains and plazas. 'Bout a foot thick at the base.

Just mount it on top of your traction motor, suitably geared, and fasten the whole thing to ground via a solid steel and concrete pillar from the roof down into your basement. (On second thought, you'd better build the pillar first, then put up the house around it.) Next, hire a couple of cranes and raise up your antenna to the top of the flagpole. Wow! You're off in a cloud of stereo.

(I have a more modest alternative. Buy yourself one of those huge Dutch windmills, the largest, and have it shipped over here, complete with the big, sweeping sails. Then upend the whole thing onto your roof with the sails up, mount the antenna on them and hitch up your traction motor. You're in business.)

But to return to reality, you really can't afford to bother about super-antennas, because the 10-element full-wave job is plenty big enough already. My long-time favorite FM/Q antenna, which the JFD replaces, was a six-element, half-wave model and pretty fancy, at that, when it first went up on my roof. (Now, there's also a 12-element FM/Q, as well as others.) As mentioned last month, that smaller FM/Q was superb for distant-fringe *mono* FM and it should still be plenty adequate for the thousands of square miles of middle-fringe stereo surrounding our big cities, all over the place. That's where most of us live. But if your problem is tougher, like mine, then you must pay for better reception in terms of bigger size. No way that I know of to avoid it. That's what comes with stereo progress!

No Comparison

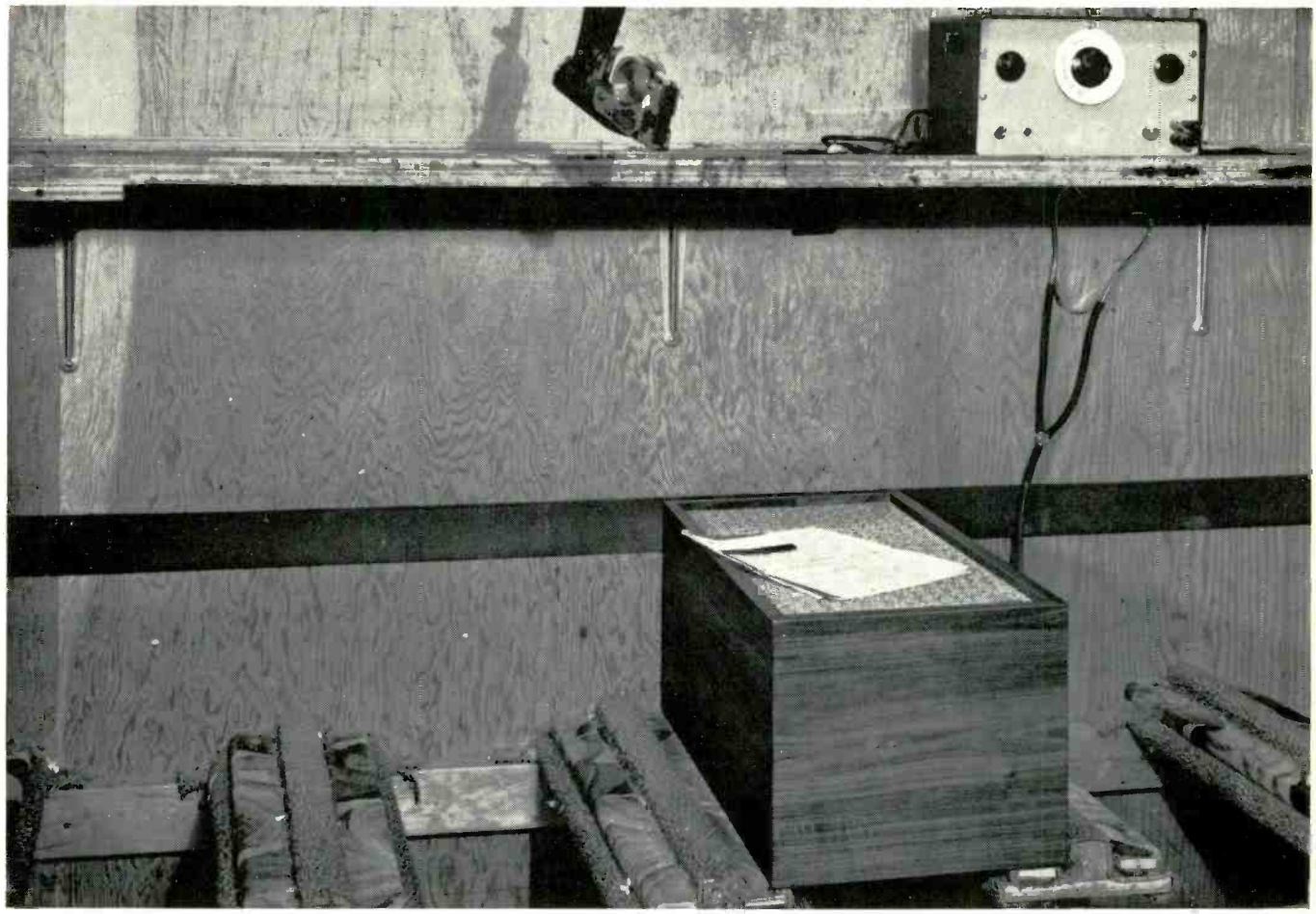
When I first unpacked the JFDLPL-FM10—I mean the JFD . . . LPL . . . FM . . . 10—out of a neatly streamlined fold-up shipping carton and laid it down on my front lawn (this was in warm weather last fall), my heart sank. It looked bigger than the house. It was incredible. Enormous! The lawn wasn't big enough to hold it. I had hysterical thoughts about the tail wagging the dog and then, instantly, more practical ones concerning the inevitable Big Wind that hits my exposed mountainous area. I could see the thing soaring off into the nearby forest like some sort of hoisting helicopter, toting my roof along with it underneath. In fact, my assistant was worried enough to replace all the old guy wires with new aluminum stuff, just to be sure that the roof would go along in one piece if things did blow away.

I shouldn't have worried. Nope, the JPLQZZPTHMPTYX is hardly a work of art as it sits on my roof novadays. But, like a tiny barn weather vane that seems huge when you have it down on the ground for repairs, the ten-element antenna shrank remarkably when we got it up where it belonged. Now, I hardly even notice it. And when the Big Wind came, the thing just rocked a bit fore and aft, and stayed put.

And so to business. I cannot specifically say that this ten-element unit with the log-periodic system incorporated is *the* answer to your stereo dreams simply because, rooftop conditions being what they are, I was not able to make a direct A-B comparison with somebody else's ten-element array, or equivalent.

Please—my house! I'm not going up there on the roof and *ask* for trouble with two of these monsters! But there's a better reason. See AUDIO for October, p. 33, where Walter Wohleking shows a picture of two antennas on a roof getting in each other's hair. He notes that this sort of antenna proximity "deteriorates pattern and impedance of e antenna" and I can back him up s fically. At first, I thought I'd try

AR INC.'s dirty laundry— the repair room



This AR-2a was bought in 1962. Three years later it developed a buzz and was returned to us under the terms of our five-year guarantee.

We fixed it, sent it through regular production test channels, and returned it to its owner in East Hartford. We also sent him a check for $3.95 to reimburse him for his expenses in shipping the speaker to us.

The entire transaction didn't cost him anything—we had even sent him a new shipping carton in which to return his speaker. It did put him to a lot of trouble, and we're sorry about that. But we don't think that the return rate of AR-2a's and AR-2a^{x}'s (less than nine-tenths of one per cent over the five-year life of the guarantee) can be reduced much. It is already lower than the figures projected by many carton manufacturers **for shipping damage alone**. AR speakers are packed in heavy, over-designed cartons, and before being packed are subjected to testing and quality control procedures that border on the fanatical.

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new antenna and the old together—while the wind was calm—on the same old mast, and I did. It didn't work. All I got was a weird set of sensitivity lobes that certainly did not represent either the FM/Q or the JFD. Just as he said. And so, down came the old model and up went the new one, solo. I can only speak, therefore, for what the one antenna has done for me since then. That's plenty.

The JFD people claim that the log-periodic configuration gives "up to 41 percent more signal voltage than today's best 10-element FM yagi," a statement that I can't possibly substantiate, you see. But I rather suspect that it does. The thing is amazingly effective. It has solved maybe 98 percent of my far-fringe distance problems for me, stereo and mono both. That's something I never would have thought possible.

What IS the log-periodic array? Uhuh—I gotta be careful. I'm the dumb amateur, remember. You'll find plenty of good accounts in proper engineering language. I'll only say that the antenna, with its side arms and reflectors, looks outwardly much like the familiar sort; but the arms are longer and graduated in size (obviously in a logarithmic relationship) as you move from back to front. And they are hooked up in an ingenious fashion, alternating from side to side, each transmission line connected to a right, then a left, then a right arm and so on.

There is an excellent account of this type of antenna, if I may quote an esteemed colleague magazine, in the February 1966 issue of *Electronics World,* though it concerns TV applications primarily. There, you may find specific info on the mathematical relationships involved in this ingenious species of array. I caught on easily enough; but I am much too wise to start paraphrasing in this department. All that need be said here is that a single dipole, as we all know, is ideally tuned for a single resonant frequency and not only does its "radiation" (i.e., its sensitivity—doesn't matter whether the signal is coming or going) change with signal frequency but also its impedance. So, short of dozens of dipoles to bring in every channel, we can ordinarily do no better than compromise for wider, smoother sensitivity; and that is where the fun comes in for the antenna designers.

Via the log-periodic dipole array, which was developed in 1959 (it says) by D. E. Isbell at the Antenna Laboratory of the U. of Illinois, a collection of mated dipoles somehow manages to act like one theoretical super-dipole with a high and uniform sensitivity over a very wide frequency range—theoretically, as wide as you wish, given enough elements. (Am I right? I think so.) Since this is precisely what we all want, the log-periodic just *has* to be good. That is, if it works out in practice. It seems to.

Karlson

I must say that I am strongly reminded of an old speaker problem that is oddly related, that of smoothing out speaker-cabinet resonance in the bass. Remember the big arguments we used to have, the assorted tunings, the blended peaks, cone resonances, cabinet resonances, reflex circuits, etcetc.? But do you remember in particular one tricky wide-band bass enclosure that always has struck me as amazingly simple and ingenious—the Karlson? Instead of a hole, behind, it loaded the speaker in front with a spreading slot, a mathematically curved V, for an infinity of resonances in the range of the bass tones, smoothly blended over the necessary bandwidth. Strange, how much like the log-periodic solution that Karlson arrangement turns out to be.

Saturation Tuning

Now—for results. Not comparative but absolute.

I've already noted some 61 fully limited mono stations, actually identified as of last month's column. Since then, of course, I've stumbled onto still more, or have waited them out, none too patiently, until the darned things could get around to identifying themselves. I've stayed up late (ugh), until 2:30 or 3 a.m., just to pick up a few chance extras in the holes that open up around midnight. (But the distant ones go off the air too.) And so my total is now around 70-plus. And there are dozens more, I suspect, if I could just get them to tell me their make, model and location.

In fact, it is a novel experience, quite new to me, to reach what amounts to almost complete *saturation* in terms of the spectrum of stations. During most of my listening time, now, except for a few hissy blank areas down among the educational stations (below 92 mc and to the bottom at 88.1) there is *not a single empty space on the dial.* The tuner passes smoothly from one fully-limited signal to another, straight from one end of the non-educational segment to the other, and not a hiss the whole way. Sometimes a few "holes" at the very top. Never in the middle, where the main power stations are located. Talk about inter-channel muting! I don't have any interchannel to mute.

Now one of the supreme advantages of FM, over the old familiar AM spectrum, is that when two signals meet, the weaker one bows out, the stronger one taking over completely. I suppose this depends partly on the tuner circuit, but the principle holds for all FM reception, as opposed to comparable AM. My tuner-antenna combination, then, is doing a very characteristic job here. You see, I find, as I should indeed, that I get very few really distant stations. Instead, I simply get *more* stations, within a rather specific circle of distance, roughly 100 miles out. That is because, in my Northeastern location, the vast number of FM outlets within that 100-mile contour, especially in the greater New York area, simply fill up all the available space. The more distant outlets, on the same frequencies or between, never have a chance to appear. They are the weaker signals. They are totally suppressed.

Thus, given a proper "hole," I can get any Philadelphia station, well over 200 miles away as I figure it, with entire mono limiting and even with passible stereo quality—a moderate hiss, not too objectionable. But there is seldom a crack for Philadelphia to get through, past New York! Somebody nearer and stronger is always monopolizing the channel. And Philadelphia is directionally too close to New York for my rotator to help.

To my West there are endless mountains, wild country and a few really distant stations out in Pennsylvania and Western New York State. Often they are drowned by the weak side-pickup of much nearer and stronger outlets to the South. To the East, mountain trouble keeps the distant stations away—but I get Hartford, 50 miles out. (See below.) Northwest, there's a pack of powerful stations in the Albany-Troy-Schenectady region, but beyond them only a thousand miles of wilderness, up into Canada. No signals.

So—no spectacular distance-getting. Not here in the crowded East, anyhow. And no skip waves.

That's the whole idea. And I'm all for it, much as I'd like to pick up, say, San Antonio, or Charleston, S.C., and boast to you. Do that on AM. Not FM.

The Government Was Right

In fact, I now see anew how abundantly *right* the government has been in its careful allocation of the many FM channels. No doubt about it, the present system works wonderfully well, in spite of the many changes that have occurred in FM since the present band was set up after the war. With enormously more sensitive tuners, more potent signals and, today, more powerful antennas, the arrangement of stations is still an excellent one and is not likely to suffer a bit, as I see it, from further changes in equipment.

Just take a look at the aforementioned Sams book, the North American Radio-TV Guide, and see how the stations on each channel are distributed all over the country at calculated distances from each

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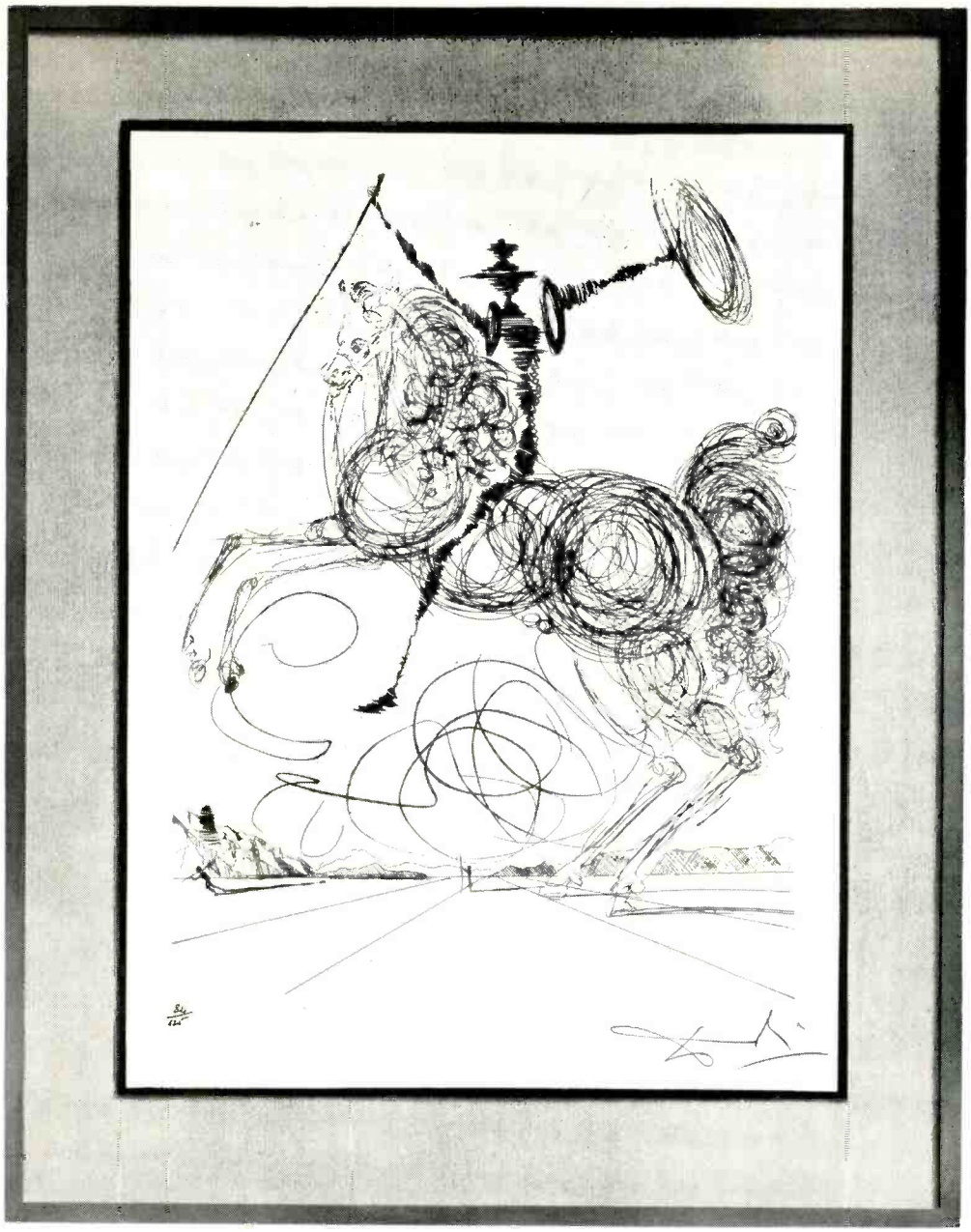

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other, and how, moreover, those in each big city seem generally to be staggered, every other channel. That works, too.

A tuner like my big Scott 312 (as mentioned last month, it is the test machine for these articles) is precisely adjusted to this situation. In the crowded mid-spectrum, the every-other-channel arrangement brings in each station over a spread that completely overlaps the intervening channel; there is not a trace of interference. But in those cases where strong stations do exist on adjacent channels *but in different directions*, the JFD antenna separates them neatly and the tuner brings in each one, cheek by jowl, again with no interference whatsoever.

A specific example. One of my chief listening stations in New York is WQXR, at 96.3 mHz. Right next to it is another important one for me, WTIC in Hartford, Conn. at 96.5, the adjacent channel. At 96.7 there is a strong local, WSTC in Stamford, Conn., just a few degrees off from New York and close enough to me to be plenty potent. (50 miles, about.)

Now when the JFD is aimed at New York City, SSW, I get the first and third of these, which the government has wisely spaced apart via one intervening channel, just as though they were adjacent. WQXR at 96.3 gives way directly to WSTC at 96.7 with no trace of overlap or interference. The station in between, WTIC at 96.5, simply does not exist, though it is a potent signal, only some 50 miles away. That's because it's to the East; the others are South-Southwest.

But swing the JFD antenna around to East and WTIC comes in with top signal strength on the meter, and the other two stations vanish! WTIC is now much stronger than either of them, and so its signal blanks out the two channels on either side. Excellent.

The system works even better than that. Take two good, potent stations on the *same* channel. Again, the government has them geographically well separated, so that the chances are good that if you are 'way out in the fringe they will fall into different directional locations for your antenna. (If you are in close, you get one station only. Period.) I'll give you an example here, too.

In New York city there is a noncommercial outfit named WBAI, a branch of the Pacifica group on the West Coast. A zany station, yes, nutty at times, but always interesting. People die for WBAI hereabouts in Connecticut—but they die in vain, so to speak. They can't get it. Boy, do *I* get it, though, at 100 miles! Like a local.

Now WBAI, listener-sponsored and all that, is located at 99.5 mHz. SSW 100 miles.

It happens that there's another station on the same 99.5, off to my Northwest at about the same distance. It's far away from WBAI; but I'm right between. WGFM, 99.5 in Schenectady (General Electric, the FM outlet for WGY) is NW 100 mi. And boy, do I get that one, too! Full strength.

But not simultaneously. Each one is as clear as a bell, completely minus interference. All I do is tune the Scott to 99.5 and rotate the antenna. The sharp line that separates these two strong stations must be heard to be believed. No fading, no flutter—they are too strong for that. Instead, a hair's breadth motion of the antenna and one is gone, the other is there. It can't be more than an inch or two, up on the roof. I find it impossible to stop the rotator on the exact point of turnover.

Not only that. There are signs of a third station on 99.5, faintly, somewhere else on another segment of turn, though I haven't identified it. Could be off-tuned on another channel, next door. You have to work quite awhile to untangle such mysteries.

But the fact is that this particular combination of tuner and antenna, the Scott 312 and the JFD etcetcetc., is perfectly capable of bringing in at least three strong stations on a single channel, selectively and without interference, if the directions and signal strengths happen to be rightly dispersed. Not too likely in practice; but on many points of your dial you will easily separate two stations if you are in a typical fringe area.

You will see in the North American Guide that each FM channel is assigned to from ten to as many as thirty or so stations, spread out all over the country. If you log your own area, you discover that you are neatly confined to a calculated *one* station per channel in almost all cases, seldom more than two, even allowing for time off the air, and for directional differences. That is exactly the intention. And the beauty of it is that the situation does *not* change with a more powerful antenna. You simply fill in more channels, at more uniformly high signal levels; everything within an area of a hundred to 150 miles (assuming a clear location) becomes "local." Not a trace of that terrible hash of mixed signals and static that used to enliven the old AM days! Old Major Armstrong knew what he was doing when he invented FM. So did the government when it set up the present arrangement.

Just a Thumb Print

Really distant stations on FM, then, are virtually impossible to get except maybe in the most sparcely populated areas of the country, out in the deserts and plains. A 250-mile reach seems a lot, as you tune it in with full limiting and perfect in-the-room reception. But look at the U.S.A. and see what a tiny segment of the whole you cover! Just a thumb print on a full page of map. That's exactly as it should be. A bigger antenna—even my super-windmill job or the flagpole model—will make not a particle of difference; you'll just get more stations, stronger, and 99 percent of them will be within that thumb print that has you at its center. You can forget about the vast stretches of territory that make up all the rest of our great nation.

Quite a set-up, this FM!

Stereo

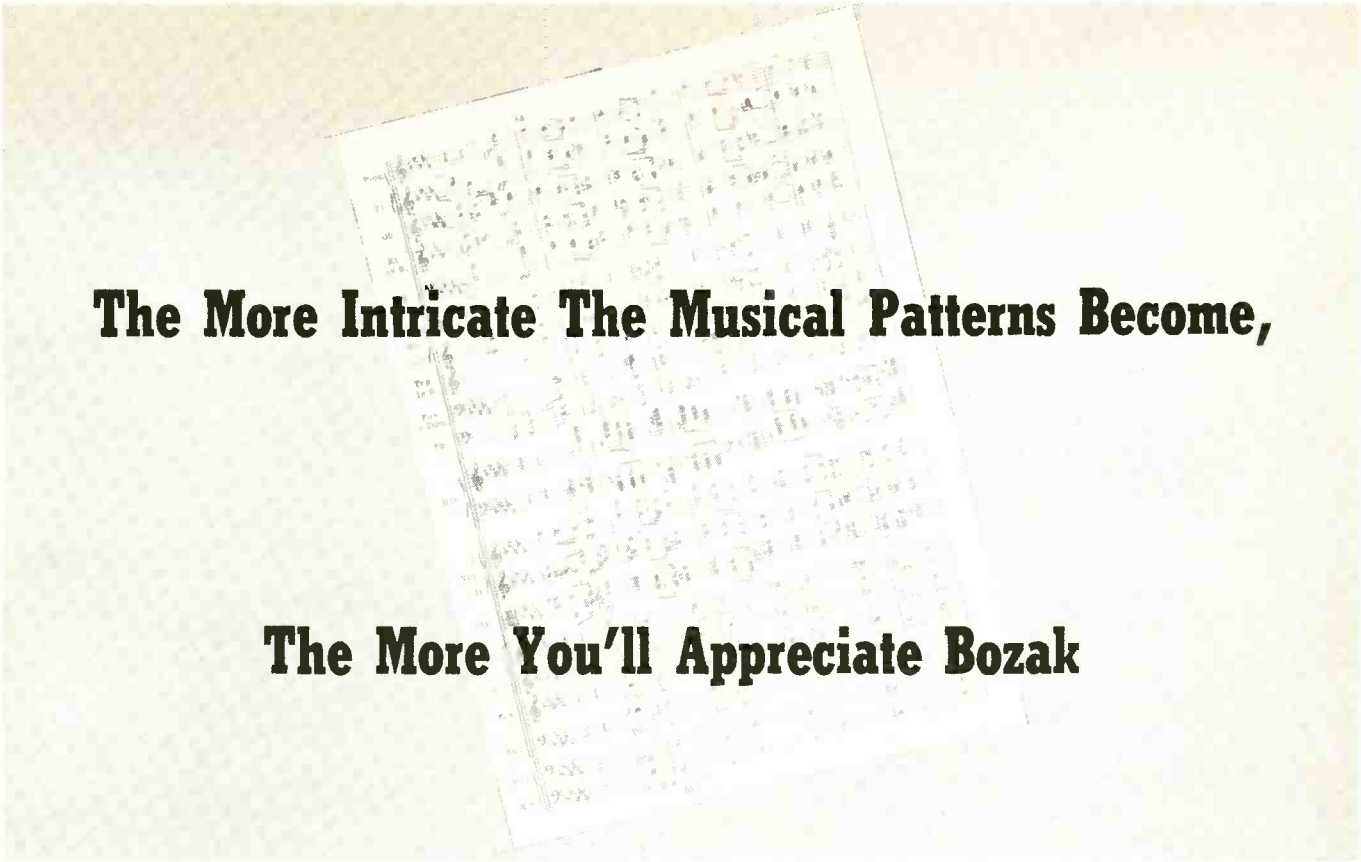
And what about stereo? I've said no more because I've said it already. Stereo, with its much weaker effective signal, is locked into the same picture, in proportion. Along with my 70-odd mono signals I've picked up a couple of dozen stereo emanations in my thumb-print area and virtually all of them are now listenable, minus background hiss. That's because there is signal strength to spare.

You see, the same saturation principle applies to stereo. Once your bandwidth is filled up with strong "local" stations, up to 150 miles, there is no way for the weaker stations to get through. You don't hear them. Blanked out. And so you seldom hear really weak stereo, either. Like Philadelphia from my location. When it gets through on stereo, occasionally, it's hissy. But mostly it doesn't get through at all. Might as well not exist.

Though the Northeast is maybe the most crowded FM region, there are surely similar situations out in the fringe areas of the middle West and on the West Coast, where with one of these new FM antennas you will get the same sort of channel saturation, and hence the same strong stereo straight across the dial. Very pleasant, you'll agree! That's what I was after. I've got it. And so the infamous FFFFF problem is licked, at least for me.

* * *

P.S. If I had more space I'd tell you about the curious reception patterns I turned up with the JFD on my rotator, the oddly useful spiky lobes here and there, and, not less important, the trick ways I found to identify recalcitrant stations that refuse to name themselves. I could even measure distance by the reception characteristic, spotting a weak nearby local from a distant signal in no time flat. Maybe later for all this. Æ



The More Intricate The Musical Patterns Become,

The More You'll Appreciate Bozak

A Bozak speaker can reproduce a trumpet solo with the utmost clarity. Any number of other speakers can do as well.

But, when it comes to reproducing a major symphony played by a major orchestra, Bozak stands alone in its faithfulness of reproduction to the original performance.

Here's Why

Bozak speakers are engineered for the music lover. Each component speaker reproduces its portion of the audio spectrum in such a way as to deliver not only the frequency, but the spirit of music; it is this that sets Bozak apart from all other speakers. Bass speakers deliver foundation tones which give a sense of feel and of ease to music; midrange speakers provide clarity and detail, instrument by instrument, and treble speakers have the warm, sweet natural notes, not artificial strident tones.

That's why we urge you to listen to all types of music when comparing loudspeakers. If the speaker you choose isn't capable of reproducing all types of music with maximum realism, you'll soon tire of it.

Musical Test Track

Just as you wouldn't judge an automabile's performance on the basis of smooth, level roads, we don't think you should judge your loudspeakers on that basis, either.

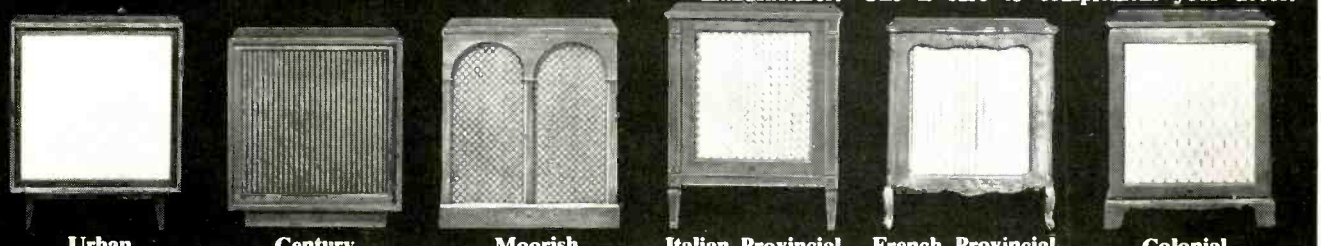
We'll gladly suggest a couple of recordings which contain most of the obstacles to realistic reproduction — a sort of musical "test track".

Bozak

DARIEN, CONNECTICUT

They Please The Eye — As Well As The Ear

Bozak speakers are available in the broadest range of authentic furniture styles available from any quality speaker manufacturer. One is sure to complement your decor.



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EDITOR'S REVIEW

NEWS OF THE 1967 SHOWS

OF IMMEDIATE INTEREST, of course, is the Washington High Fidelity Music Show which will open at the Park Sheraton in Washington, D.C., on Friday, February 10 and continue through Sunday, February 12. The Washington and Philadelphia shows, run under the direction of Teresa Rogers, have always been good ones, and we look forward to seeing many of our regular readers again.

It has already been announced that there will be no Spring show in Los Angeles this year, and none at all in San Francisco. This was in accordance with the wishes of the membership of the IHF, as expressed at a general meeting held during the New York Show. However, the Ambassador Hotel bungalows will be the scene of the only California Show in 1967, and that will be from October 25th through the 29th. As the Ambassador cottages represent probably the best site of all the cities where hi-fi shows have been held in the U.S., we are most pleased with this development. And, of course, the Fall dates are more acceptable to the manufacturers and their representatives and dealers, most of whom have deplored the March or April dates. Some of us in the East preferred the even earlier February dates of several years ago, since it gave us an opportunity to get away from the snow during our worst month. But it is undeniably better for the exhibitor, and after all, what is good for the industry must be good for us. So we'll be in L.A. in October.

As to the county's largest hi-fi show—New York—September 20 will see its opening in a new location. The Statler-Hilton Hotel, directly opposite the Pennsylvania Station on Seventh Avenue in Manhattan, and known for many years as the Pennsylvania Hotel, has revamped its second and third floors to accommodate shows of various types, and the IHF New York Show moves there for a five-day stay. In many respects, the solid walls of a hotel—and particularly one built the way they were built in the "good old days"—will make a much better setting for our industry's type of exhibit. When the rooms are separated only by dry-wall partitions of perhaps a half-inch thickness, it may be true that the spectators can not *see* what goes on in the next one, but they certainly can *hear,* and it is next to impossible to evaluate the performance of the equipment being demonstrated when the one in the adjacent exhibit room is only 10 dB down from the one we are trying to assess.

As an exhibitor, we have always accepted the inevitable and made the best of the facilities, and since our own exhibit has never depended on the sound we create in our room, we really couldn't care less from a selfish viewpoint. And while the Trade Show Building offered a haven when the previous location became untenable because of difficulties in handling the crowds, and while the mechanics of staging a show there were as comfortable as one could want, there was still that background of your neighbor's exhibit. We'll miss Tex Carlton, who ran the Trade Show Building during our many shows there, and will undoubtedly continue to hold forth in the same place, but we expect the new location to be a definite improvement. Time will tell. In any case, remember the dates—though we'll remind you from time to time anyhow—September 20th through the 24th.

A REAL STEP FORWARD

Of far more importance than the shows—as far as the entire industry is concerned—is the teaming up of the IHF with the National Design Centers in New York and Chicago to effect a co-operation between them in the presentation of a permanent "Sound Ideas" exhibit. The National Design Center, under the direction of Norman Ginsberg, its president, will create nine separate decorator rooms, each with a different period of design, but with a central theme of decorating with sound. The basic idea is to demonstrate the use of components to provide flexibility in the decor of livable rooms.

Since these exhibits are essentially permanent, they will be seen during the next twelve months by perhaps half a million people who browse through the centers to get ideas as to how they can improve their own homes. New ideas in decorating materials are constantly on display in the two centers, and while the visitor to one of them might not follow any given design slavishly, he is certain to get at least one idea every time he walks through them.

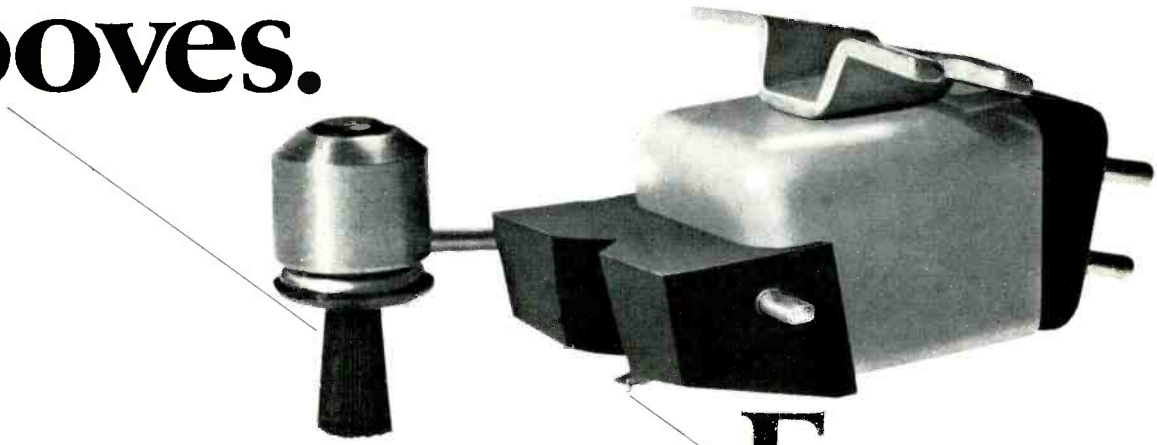
We believe this relationship between the Design Centers will do more for the component concept than hi-fi shows ever could.

DECEMBER'S SHOWINGS

Two events occurring during December are worthy of mention—Sony showed an AM radio that was almost exactly the same size as one-third of a pack of king-size cigarettes. In this miniscule device is an integrated circuit which contains nine transistors and all their necessary related capacitors and resistors.

And a week earlier, Columbia Records hosted a delightful tour of their new headquarters in New York. The facilities there are as complete as their requirements could possibly dictate—and if they are not adequate, we'd guess that there'd be some changes made until they were. Quite a place.

For cleaner grooves.



For cleaner tracing.

New Pickering V-15/3 cartridge with Dynamic Coupling for minimum tracing distortion and maximum tracking ability, plus Dustamatic™ feature for dust-free grooves.

As stereo cartridges approach perfection, dust in the grooves becomes intolerable.

The Pickering V-15/3 Micro-Magnetic™ cartridge has a new moving system that reduces tracing distortion close to the theoretical minimum, thanks to Dynamic Coupling of the stylus to the groove. But what good is perfect contact between the stylus tip and those high-velocity turns if dust particles get in the way?

That is why the Dustamatic brush assembly is an essential part of Pickering's total performance cartridge. It cleans the groove automatically before the stylus gets there.

The new moving system also provides a further refinement of Pickering's famous natural sound by extending peak-free response well beyond the audible range, and the patented V-Guard Floating Stylus continues to assure the ultimate in record protection.

There are four "application engineered" Pickering V-15/3 Dustamatic models with Dynamic Coupling, to match every possible installation from conventional record changers to ultrasophisticated low-mass transcription arms. Prices from $29.95 to $44.95.

For free literature complete with all details, write to Pickering & Co., Plainview, L. I., New York.

For those who can hear the difference. Pickering

Check No. 70 on Reader Service Card.

Compare these new Sherwood S-8800 features and specs! ALL-SILICON reliability. Noise-threshold-gated automatic FM Stereo/mono switching, FM stereo light, zero-center tuning meter, FM interchannel hush adjustment, Front-panel mono/stereo switch and stereo headphone jack, Rocker-action switches for tape monitor, noise filter, main and remote speakers disconnect. Music power 140 watts (4 ohms) @ 0.6% harm distortion. IM distortion 0.1% @ 10 watts or less. Power bandwidth 12-35,000 cps. Phono sens. 1.8 mv. Hum and noise (phono) —70 db. FM sens. (IHF) 1.6 μv for 30 db quieting. FM signal-to-noise: 70 db. Capture ratio: 2.2 db. Drift ±.01%. 42 Silicon transistors plus 14 Silicon diodes and rectifiers. Size: 16½ x 4½ x 14 in. deep.

"WE HAVE COME TO EXPECT HIGH PERFORMANCE FROM SHERWOOD and...

the S-8800 did not let us down. The tuner section, with its high sensitivity and very low distortion, is among the best in the business—clean and responsive. FM Stereo comes in loud and clear and, as the curves plotted at CBS Labs show, with very ample separation. The usual increase in distortion, when switching from mono to stereo in receivers, was in this set just about negligible. We would say that Sherwood has come up here with another typically 'hot' front end that makes FM listening a sheer joy.

"As for the amplifier . . . comparing the results with the specifications, it is apparent that the S-8800 does provide the power it claims, and this—for a popularly priced combination set—is considerable. A glance at the IM curves, for instance, shows how much power the S-8800 will furnish before it runs into any serious distortion problem at all three impedences. . . . For rated power bandwidth distortion of 1%, the curve ran below and above the normal 20 to 20 kHz band; and the 1-watt frequency response was virtually a straight line in this area, being down by 2.5db at 40 kHz—fine figures for a receiver . . .

"Those heavy percussion and crisp castanets will come through with just about all the *con brio* the performers have put into them."

*As appeared in HIGH FIDELITY Magazine Equipment Reports by CBS Labs. November 1966 issue

S-8800 140-watt FM ALL-SILICON Receiver
$359.50 for custom mounting
$368.50 in walnut leatherette case
$387.50 in hand-rubbed walnut cabinet

Sherwood

Sherwood Electronic Laboratories, Inc., 4300 North California Avenue, Chicago, Illinois 60618. Write Dept. 2A

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Professional Tone Controls

In Three Parts - Part 1

So you want to become an audio engineer. Here, in three parts, are some of the important considerations which must be included in any planning of a professional installation. In fact, the principles presented may well be thought of as the groundwork of any professional-system philosophy.

ARTHUR C. DAVIS and DON DAVIS

THE PROFESSIONAL AUDIO ENGINEER has long used fixed-gain/passive-control components in recording, broadcasting, and reinforcement system design.

Increasingly, the audio experimenter and high-quality-audio buff is becoming aware of the differences between home high fidelity components and those used by the professional engineer.

Three major differences are obvious when professional audio systems are compared with the very best home hi-fi systems. Professional systems utilize:

1. Fixed gain amplifiers.
2. Passive control devices.
3. Low impedance transmission circuits.

Not so immediately apparent are the factors of greater precision, longer service life, and greater versatility of service inherent in the professional components.

There are two types of controls possible in audio systems:

1. Active circuits.
2. Passive circuits.

Active Circuits

Active circuits are those that exert the required control by means of varying changes in the feedback circuit of an amplifier. Usually such controls are basically some form of frequency-discriminating network in the feedback loop of a negative-feedback amplifier which shapes the gain-frequency characteristics of the total amplifier.

Passive Circuits

This article is a short general discussion of the passive controls used in professional audio systems and shows how the advanced high fidelity buff can graduate to a fixed-gain, passive-gain, passive-control, professional sound system.

Passive controls are those that exert the desired change without power being added in the process. Passive devices take the form of:

1. *Attenuators.* Normally a resistive network that attenuates equally at all frequencies within the bandpass of interest while maintaining constant terminal impedances.

2. *Equalizers.* Devices that attenuate or restore inserted attenuation at selected frequencies.

3. *Filters.* Filters and special effects devices under this category are high- and low-pass filters and notch filters. These devices are characterized by zero insertion loss at all frequencies other than their operating frequencies.

Passive Equalizers and Filters

Passive equalizers and filters can be of the RC, LC, or RLC type. They can be constant "K," "M" derived, Butterworth, or Chebishev design. The circuits employed can be:

1. Series 2. Shunt	Both of these circuits are characterized by input and output impedances that change with frequency.
3. Full series 4. Full shunt	These circuits maintain a constant input impedance but the output impedance varies with frequency.
5. "T" 6. Bridged "T" 7. Lattice type	These three circuits are identified by constant input and output impedances.

Equalizers and filters can further be of the balanced or unbalanced circuit configuration. Because of the 2-to-1 cost consideration and the very short length transmission paths inside a professional audio console, most equalizers and filters are of the unbalanced type. Any transmission circuits that enter or leave the console, however, are balanced and isolated from the unbalanced console circuitry by the use of high-quality repeat coils (isolation transformers).

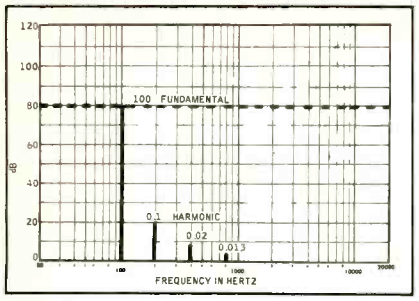


Fig. 1. True distortion of a circuit with the frequency response of Fig. 2.

Circuits Used Commercially

The devices discussed in this article are all of the four-terminal constant-K, unbalanced-circuit, passive, bridged-T type. The preferred impedance is 600 ohms, though 150 ohms as well as other values are encountered in the use of such devices.

Advantages of Passive Controls

The advantages of using such a passive control can be summarized as follows:

1. Very low design cost compared to a really stable active circuit.
2. Less complicated to build and to use.
3. More reliable over long time intervals. Greater repeatible accuracy.
4. More versatile. It can be used in system after system because it is an independent component.
5. Extremely low maintenance costs.
6. Minimum distortion that remains constant. No circuit changes in amplifiers will change the inherently low distortion figure of the controls. (Not measurable.)

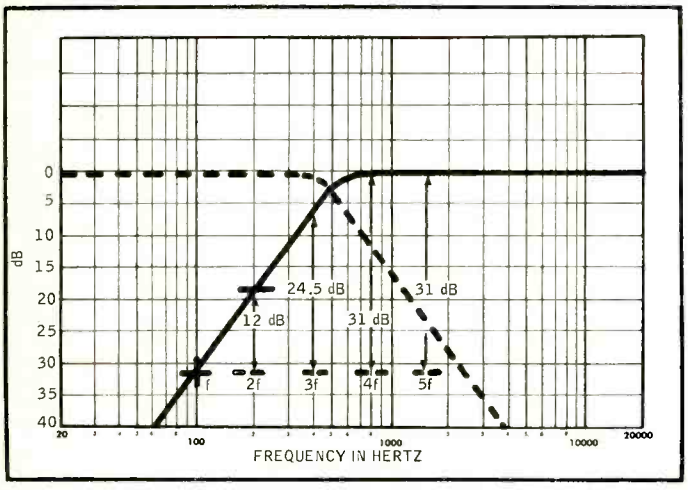


Fig. 2. Effect of frequency response on measured distortion figures.

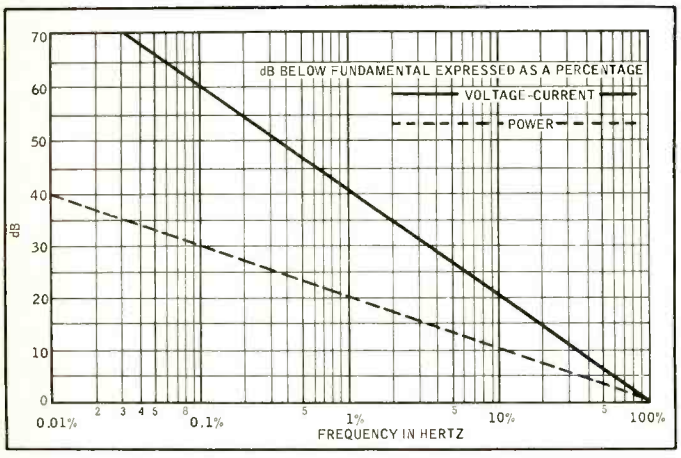


Fig. 3. Chart showing percentage derived from measurement of distortion as the number of dB below the fundamental.

Precautions to Observe

It is possible in the design of active circuits to "magnify" the "Q" of an inductance used, thereby allowing smaller sized components to be employed. When passive devices are used, particularly at low frequencies, size and weight of the components required will not lend themselves to miniaturization. Due to the high "Q" coils employed in passive equalizers care should be exercised when they are employed near appreciably high flux fields.

Distortion Measurements Pose Special Problem

Finally, it should be recognized that any frequency-response curve with a changing amplitude characteristic makes distortion measurements difficult. A typical example is the measurement of distortion in a crossover-network where the technician begins at a frequency that is on the slope of the network's response. Let's say that the real distortion characteristic looks like the chart shown in *Fig.* 1. *Figure* 2 discloses the slope of a 12-dB-per-octave crossover network. If 100 Hz is chosen as the measuring frequency, then it can be seen that the second harmonic will be increased 12 dB due to the slope. From *Fig.* 3 it is obvious that a harmonic 60 dB below the fundamental represents 0.1 per cent distortion, but, due to the slope of the network, the 2nd harmonic is now 60 dB minus 12 dB below the fundamental or 48 dB below the fundamental which equals 0.4 per cent distortion. The 3rd harmonic was 74 dB below the fundamental or 0.02 per cent distortion. Now, because of the slope of the network's frequency response it is now 74 dB minus 24.5 dB below the fundamental, or 49.5 dB below the fundamental, and this equals a distortion indication of 0.32 per cent.

Measuring Distortion in Equalized Circuits

This same discrepancy can occur in the use of high frequency equalization. *Figure* 4 illustrates the distortion characteristics of a system at a "flat" setting, while *Fig.* 5 shows the apparent increase in distortion caused

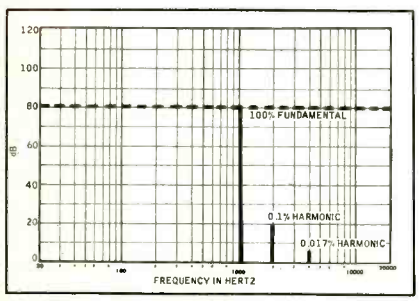


Fig. 4. Distribution of harmonics in a flat-response system.

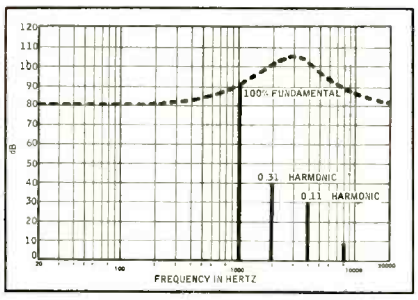


Fig. 5. Distribution of harmonics in a system with a "boosted" response.

by a high frequency boost of 12 dB at 3000 Hz. (Notice that the 100 per cent indication for the fundamental is also raised by the equalization process.) So far as the ear is concerned such boost sounds like a real increase in distortion and this effect puts a practical limit on high-frequency boost of about 12 dB.

Low-frequency boost can have the inverse effect by dropping the higher harmonics still lower in relation to the fundamental .(This may well be the reason low-quality package hi fi's are usually adjusted "bass" heavy by their users.)

Calculation of Correction Factor

To obtain an accurate harmonic distortion figure from a system with a rising high-frequency amplitude characteristic, take the measured distortion expressed in dB below the fundamental and add the dB increase due to the slope of the system. This total, converted to percentage, will equal the true distortion of the system. (dB measured distortion + dB scope increase = dB below fundamental.)

Other Considerations

Attention must be paid to the insertion loss of the device (equalizer) and the maximum and minimum levels required for satisfactory operation. In passive equalizers there are two choices that can be made regarding insertion loss. Because it is a passive device the only way to obtain "boost" is to attenuate all but the desired "boost" frequency. When this is done the "boost" frequency is higher, relatively, than the non-"boosted" frequencies. However, if we merely depressed the frequencies to be attenuated in order to "boost" the selected frequency, we would have a loss in level at all frequencies attenuated that would vary with each equalizer setting.

One way to achieve constant gain in the equalizer is to use an inverse loss attenuator in conjunction with the equalizer. The attenuator inserts loss at the "flat" setting and gradually removes it to the same degree that the majority of the bandpass is depressed to obtain equalization.

Preferred Method

In the equalizers to be discussed in this article a full bandpass insertion loss is chosen, usually 14 to 16 dB, and equalization restores the required amount of this loss to obtain selective boost at chosen frequencies. By this means the only level change encountered in the program material is that occasioned by "boosting" a selected frequency. The resulting increased level at that frequency is the sought-after effect. The unequalized portion of the bandpass remains at a constant level.

Dynamic Range Determined

Passive equalizers and filters of the unbalanced, bridged-T, constant-K type illustrated in this article should be operated between the levels of —70 and +20 dBm. *Figure* 6 reveals the dynamic range, noise, and gain characteristics of a high-quality, fixed- gain, plug-in-type professional audio system amplifier. This same amplifier shown in *Fig.* 7 can be used as a preamplifier, booster, program, and even line amplifier by merely changing the "strapping" at its *external* socket connection. This allows a single type plug-in unit to be used interchangably anywhere in the system and this minimizes the number of units required for maintenance back-up. Fixed-gain amplifiers of this type can be designed for optimum negative feedback and stability. *Figure* 6 shows that the maximum output for the unit (at less than 1 per cent THD 20 to 20,000 Hz) is +27 dBm. Since it has a *fixed voltage gain* of 45 dB terminated and 51 dB unterminated, the maximum allowable input signal must not exceed —18 dB and —24 dB respectively.

With these figures in mind it can be seen that the maximum input signal into an equalizer placed just ahead of such an amplifier must not exceed —16 dB. (—16 dB)—(14 dB insertion loss) + (12 dB max. equalization) = —18 dB output at some selected frequency. If for one of a number of reasons the output from the equalizer exceeds this figure the use of a fixed loss pad can correct the level.

Fixed Parameters

Again referring to *Fig.* 6 the fixed parameters are seen to be maximum output level, maximum input signal level and the equivalent-input-noise figure (E.I.N.), and consequently, the maximum signal-to-noise ratio. The dynamic range and the minimum signal-to-noise ratio are parameters that are played against each other depending on the requirements at hand. In general the minimum signal-to-noise ratio need not exceed 10 dB with 25 to 30 exceptionally quiet. The maximum dynamic range available in a

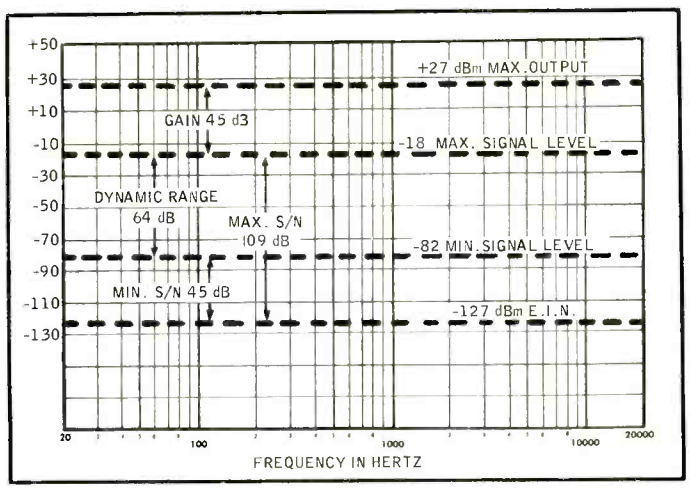


Fig. 6. Relation of dynamic - range, noise, and gain characteristics of a high - quality fixed-gain professional amplifier.

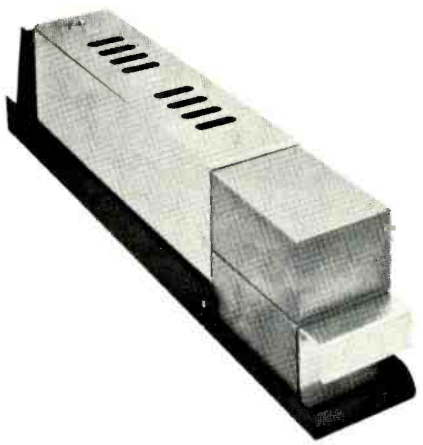


Fig. 7. Amplifier of the type giving the characteristics of Fig. 6.

very quiet studio is shown in *Fig.* 8. The noise level shown is Noise Criterion Curve NC-20, and the maximum level shown is the maximum sound power level (SPL) in dB at 4 feet that can be expected from the best monitor speaker available. Since the figure shown, 93 dB, is the maximum dynamic range, it is also the maximum signal-to-noise ratio. Because the ear can barely hear sound below NC-20 any sound system with a maximum signal-to-noise ratio of better than 90 dB is going to have a noise level below that found in even the quietest acoustical environments.

The component that usually determines the noise threshold of the electronic part of the system is the power amplifier. *Figure* 9 gives the gain, maximum signal level, and maximum signal-to-noise ratios for the 20-watt professional monitor amplifier shown in Fig. 10.

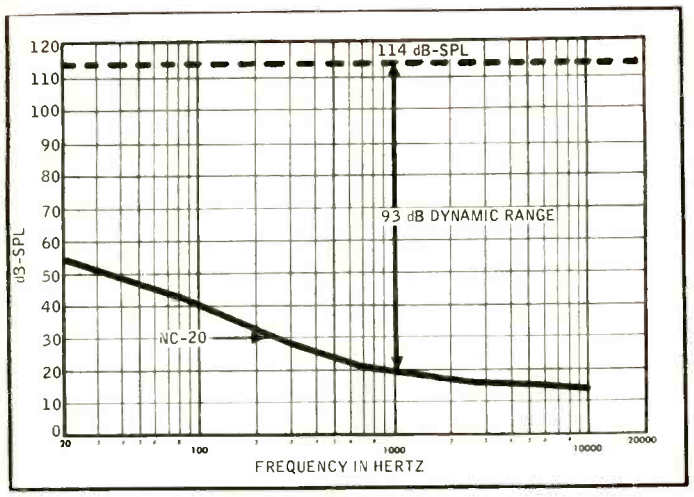
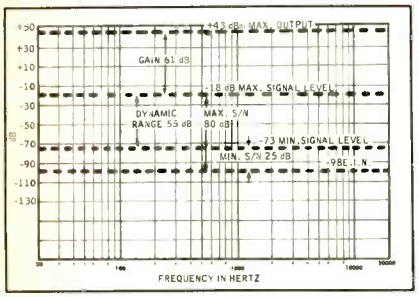


Fig. 8. Maximum dynamic range available in a quiet studio. The noise level shown in the Noise Criterion Curve NC-20.



Fg. 9. Characteristics of a typical 20-watt professional-type monitor amplifier Altec 9471A, shown in Fig. 10.

Fig. 10. The Altec 947-A 20 - watt monitor amplifier.

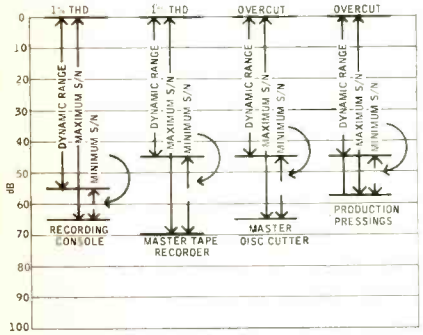


Fig. 11. Characteristics specified by a major recording company for various elements of their recording channels.

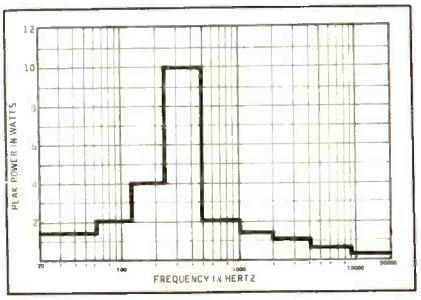


Fig. 12. Peak power per octave in a typical orchestral composition.

Practical Limits to Dynamic Range

Figure 11 shows the dynamic range, and maximum and minimum signal-to-noise ratios required by a major recording company for their recording consoles, master tape recorders, master disc lathe, and finally, their production pressings. In the final analysis, the real determination of realistic dynamic range requirements and signal-to-noise specifications is the limits set by the source material. Even the finest professional tape recorder has a maximum signal-to-noise ratio that is 10 dB less than that achieved in the 20-watt amplifier shown in *Fig.* 10.

Another limitation of dynamic range in a listening system is the occasional use of a small "bookshelf" type speaker system with a mass loaded cone to help lower cone resonance in a too-small enclosure. Such loudspeakers exhibit a minimum level below which the inertia of the cone and the resistance of the suspension are not overcome by the signal. Once the input signal reaches a level of sufficient magnitude to overcome the friction and inertia, the loudspeaker suddenly "comes on." The transition from low-level output to no output is not continuous but is characterized by the loudspeaker "shutting off" below a critical level. The solution, of course, is replacement by a more efficient type of loudspeaker utilizing a lighter moving system.

Energy Distribution of "Live" Source

One final consideration of dynamic range and equalization is that of the distribution of energy in typical source material. *Figure* 12 exhibits the peak power expressed in watts *vs.* frequency of a typical orchestral composition. It can easily be seen that consideration of equalization in the region of 125 Hz to 500 Hz requires careful consideration of maximum allowable input signal to the amplifier that follows such equalization. (For best results each program source should be individually studied to determine frequency distribution of energy.) Æ

(Continued next month)

PHOTOGRAPHED AT CAPITOL RECORDS BY FRANZ EDSON

Good records start with Stanton.

A professional needs to know for sure. When he listens to a test pressing, he needs a cartridge that will reproduce exactly what has been cut into the grooves. No more, no less. Otherwise he would never be able to control the final product. The record you buy in the store.

That's why the professionals keep using Stanton. It tells them the whole truth, and nothing but.

In the photograph above, studio engineers are shown listening to a test pressing. This is a critical stage in record making. The stereo playback system they are listening through is fronted by a Stanton 581 EL Calibration Standard. (The turntable also happens to be a Stanton. Other fine turntables will work, too.) They're getting the whole message. You'll get it, too, in an upcoming release.

Each Stanton Micro FLUX-VALVE® Calibration Standard is custom made. That means that each will perform exactly as the original laboratory prototype. We laboriously adjust them until they do. It also means that you will get the same accuracy that the professionals get. Guaranteed.

Stanton Calibration Standards are hard to make. And the price reflects it. $49.50. But that really isn't much to pay for uncompromising accuracy.

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sound&sight

HAROLD D. WEILER

Video tape recording will become education's fourth "R"—along with reading and arithmetic, predicted Leo M. Storey, Jr.—marketing manager of General Electric's Closed Circuit Television Business section. This prediction was made at the recent introduction of GE's new low-cost video recording system for the educational market. Storey added, that he expects VTR systems to quickly become an integral part of modern educational and training programs.

General Electric's decision to market a VTR system specifically designed for the educational and training fields was based on the vast unfilled needs of these customers. Storey explained, "These markets cannot always afford, nor do they always require expensive complex equipment. Research and analysis of their special requirements led to the development of our new system which offers optimum performance at a reasonable price."

The uses for video tape recorders in the classroom, on athletic fields, and at any educational level from kindergarten through college are unlimited. Instantaneous sight and sound recording, which can be replayed immediately without the costly processing or the time lapse required with chemical film provides an effective and inexpensive method for assuring comprehension of educational and extra-curricular assignments.

Storey added that the cost of one hour of tape is approximately one-half the cost of film. On economics, he added that to produce a 30 minute training film the cost ranges between $40,000 and $80,000, and requires the services of a highly skilled professional. "Anyone who can aim a camera can operate our new VTR system."

The instant replay technique permits students to review difficult areas of learning at their own pace and convenience. Students who find it increasingly hard to grasp lessons and keep up with the class can now review those areas until they are fully understood.

Teachers may now tape lessons which can be replayed for students who miss a class because of illness. Special lessons or lectures by experts, in a particular branch of learning may be stored for future use or be circulated among other schools and classes on a recurring exchange basis. TV network documentaries of historical or general interest, which are usually broadcast at inconvenient viewing times, for educational purposes, may now be stored for delayed and more convenient replay during school hours.

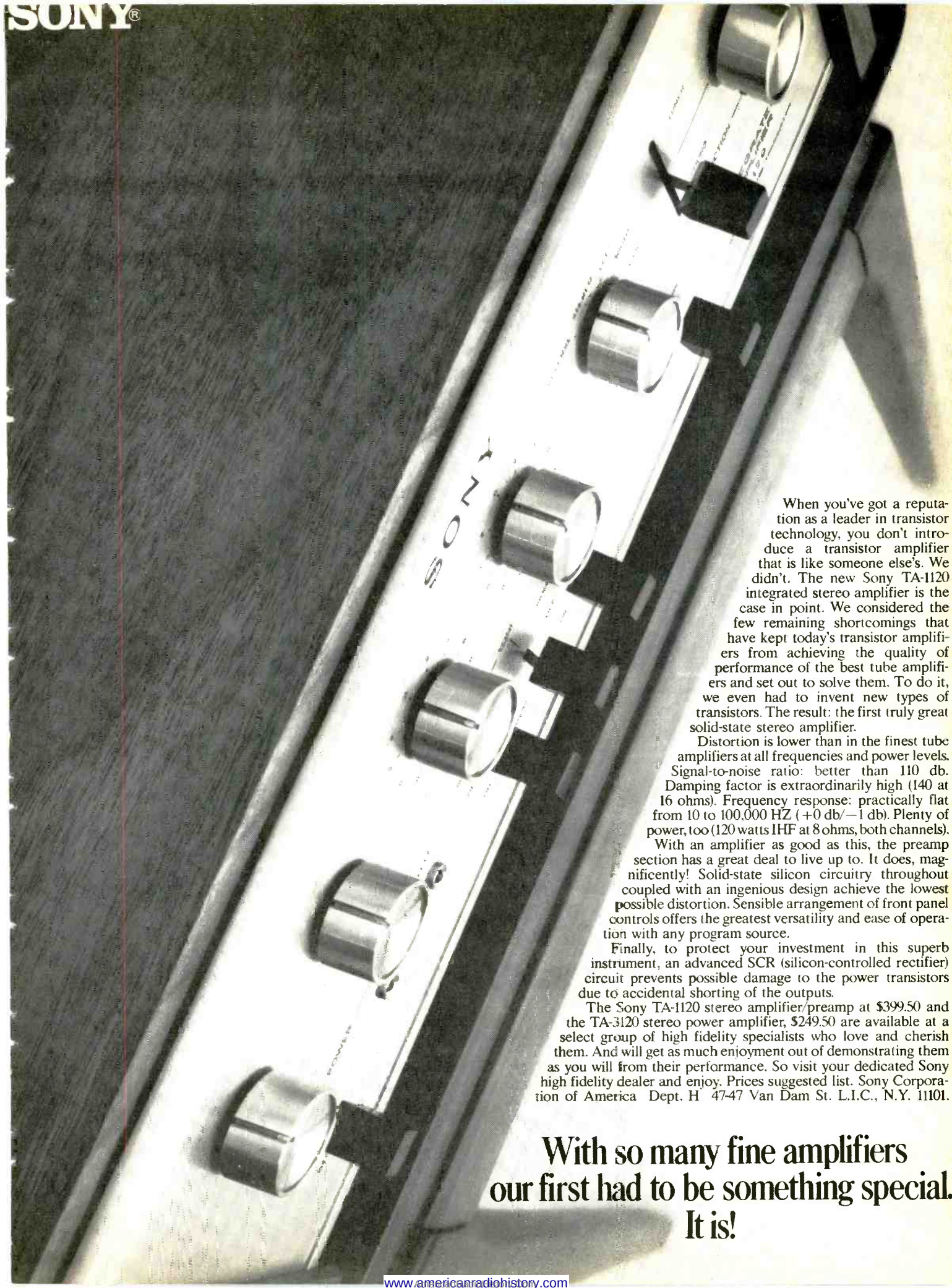
In the gymnasium or on the athletic field, video tape recording can be employed as a valuable coaching aid to visually demonstrate new techniques and correct flaws. Football plays, for example may be recorded and played back immediately to point out mistakes in passing, blocking and running and improve both the team as a whole and individual performances. Athletic instructors can now use video recording as an electronic aid to help improve batting styles, golf swings, and swimming strokes.

Video recording can easily be applied to speech and music training, drama, driver education and science labs. In the laboratory the combination of the video camera-recorder and modified optical equipment such as a microscope similar to those normally employed, provides the most powerful teaching aid in the history of the life sciences. The GE system can serve as an electronic enlarger which permits every student in the class to observe every minute detail of any demonstration or experiment simultaneously. All students can enjoy the same image quality, eliminating the necessity for individual instruments and viewing. The observation of the greatly magnified specimens is completely controlled by the instructor, assuring that all students are viewing the intended subject at the proper time. Because of the video recorder more elaborate demonstrations can be provided, since these recordings may be used many times.

The new GE system housed in a walnut grained Textolite® console, only 36 in. wide by 34½ in. high and 18¾ in. deep is literally a miniature television recording studio. The top of the console is divided into two sections which house the video tape recorder and a monitor receiver. Each section has an

Fig. 1. General Electric's new video tape recorder mobile console encloses the system's three major components — a video tape recorder, a monitor and a closed-circuit TV camera, plus a complete set of accessories such as a tripod, microphone with lavalier and stand, ½ hour of recording tape and connecting cable.

SONY®



When you've got a reputation as a leader in transistor technology, you don't introduce a transistor amplifier that is like someone else's. We didn't. The new Sony TA-1120 integrated stereo amplifier is the case in point. We considered the few remaining shortcomings that have kept today's transistor amplifiers from achieving the quality of performance of the best tube amplifiers and set out to solve them. To do it, we even had to invent new types of transistors. The result: the first truly great solid-state stereo amplifier.

Distortion is lower than in the finest tube amplifiers at all frequencies and power levels. Signal-to-noise ratio: better than 110 db. Damping factor is extraordinarily high (140 at 16 ohms). Frequency response: practically flat from 10 to 100,000 HZ (+0 db/−1 db). Plenty of power, too (120 watts IHF at 8 ohms, both channels).

With an amplifier as good as this, the preamp section has a great deal to live up to. It does, magnificently! Solid-state silicon circuitry throughout coupled with an ingenious design achieve the lowest possible distortion. Sensible arrangement of front panel controls offers the greatest versatility and ease of operation with any program source.

Finally, to protect your investment in this superb instrument, an advanced SCR (silicon-controlled rectifier) circuit prevents possible damage to the power transistors due to accidental shorting of the outputs.

The Sony TA-1120 stereo amplifier/preamp at $399.50 and the TA-3120 stereo power amplifier, $249.50 are available at a select group of high fidelity specialists who love and cherish them. And will get as much enjoyment out of demonstrating them as you will from their performance. So visit your dedicated Sony high fidelity dealer and enjoy. Prices suggested list. Sony Corporation of America Dept. H 47-47 Van Dam St. L.I.C., N.Y. 11101.

With so many fine amplifiers our first had to be something special. It is!

Fig. 3. The new General Electric type TE-23 CCTV camera is solid-state, and equipped with a crystal oscillator to provide optimum picture stability. Camera resolution is approximately 500 lines when displayed on a standard video monitor. Only two controls—an on/off switch and focus knob—provide simplicity and ease of operation.

individual lid with an adjustable support to hold it in upright position or permit it to be folded behind the console. Both sections are equipped with key locks as is the full length compartmented accessory storage drawer below to eliminate unauthorized operation. The console is mounted on cast aluminum legs equipped with shock-absorbing casters for easy manuverability.

The solid-state video recorder employed, was designed to provide the ultimate in simplicity of operation. The tape is threaded into the recorder and it is turned on. When the record button is pushed the recording begins. Even untrained personnel can create excellent recordings since the recorder is equipped with an easy-to-read recording-level indicator. Both video and audio levels can be accurately set with the indicator showing the optimum level for each.

This video tape recorder employs a slant-track helical-scan tape drive which provides quality performance, dependability and economical operation. The slant-track helical-scan tape drive is very simply and cleverly accomplished by having the video recording heads rotate on a horizontal plane and guiding the recording tape around the scanning drum, past the rotating heads, at an angle. This angle is provided by the mechanical arrangement of the tape path. The tape supply reel is mounted approximately ½-in. higher than the takeup reel. Thus the tape passes around the scanning drum at a downward angle. With the video heads rotating on a horizontal plane and the tape passing this horizontal plane at a downward angle the track is recorded, on the tape, at an angle, as may be seen. The helical-scan method of recording permits the slanted video tracks to be placed very close together and in effect greatly increases the recording time which may be obtained with a given amount of tape, reducing the operating cost per minute. The economical tape speed of 7½ i.p.s. further reduces the operating cost, however the actual scanning speed of approximately 480 i.p.s. which is due to the combined speed of the rotating heads and the moving tape, in combination with the sophisticated electronic techniques, normally employed only in more expensive professional video recorders, provide a horizontal resolution in excess of 200 lines, more than adequate for the majority of educational applications.

The 12 in. monitor-receiver, expressly designed for this system, is mounted at the right side of the console. It may be operated in the storage position, tilted out of the console at a 30 degree angle, or fully raised to the upright position. While upright it may be swiveled 360 degrees to provide viewing from any point around the console. When a video camera is employed for recording, the monitor displays the images being recorded to permit accurate camera placement, framing of the subject, and precise recorder adjustment. When an off-the-air program is recorded the monitor displays the signals being fed into the recorder. When a video recording is played back the monitor displays the images previously recorded. The monitor may also be employed as a standard television receiver for both VHF and UHF reception. It includes provision for connection to any existing school antenna system. A BNC coaxial connector at the rear of the monitor permits auxiliary monitors to be employed for multiple display purposes.

The new GE TE 23 closed-circuit television camera, illustrated in *Fig.* 3, which is part of the system is also completely solid-state for reliable, trouble-free operation. This compact camera is fully automatic—anyone can operate it. An ultra-fast f.1.4 lens, usually only provided with high-quality professional equipment, and the automatic sensitivity control provide excellent images at extremely low light levels.

All of the camera's electronic components are contained on a single precision-etched Fiberglas circuit board. This board and the camera's vidicon tube are housed in a lightweight aluminum case. The camera, in the video mode of operation, provides a horizontal resolution of 500 lines, (300 lines at the corners.). In the RF mode of operation the resolution is 300 lines.

The complete video recording system, including microphone, lens, camera, tripod, a 7-in reel of recording tape, and a maintenance kit is priced under $2000.00. A similar unit in portable form is available at less than $1700.00. Æ

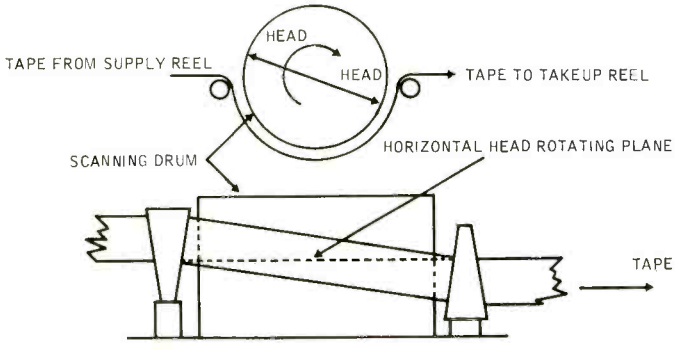


Fig. 2. The helican-scan method of video recording used in the GE VTR.

Ten reasons why Altec shouldn't sell its new condenser microphone systems for 198^{00}...

1. Your choice: AC or DC, Cardioid or Omnidirectional—Order the system you need now and expand by adding the appropriate extra mike or supply at any later time. Get any combination by simply switching microphones and/or power supplies. Model designations: M49—AC/cardioid; M50—DC/cardioid; M51—AC/omnidirectional; M52—DC/omnidirectional.

2. Frequency response from 20 to 20,000 Hz—This is with an essentially flat curve. Output level is—53 dBm re 10 dynes/cm², with balanced system output.

3. Extremely small diaphragm—Under 0.5" in diameter. HF dropoff for sound waves arriving at random, non-perpendicular angles of incidence will occur only at frequencies above 20,000 Hz. All Altec condenser microphones contain diaphragms small enough to insure that HF dropoff does not occur within the usable frequency range.

4. 100% solid-state circuitry—The 195A base utilizes an FET as an emitter follower and also contains a 3-pin XLR-12 connector. No RF or balanced-bridge critical adjustments are used. The FET drops the extremely high impedance of the microphone to an impedance suitable for connection to a shielded 2-conductor standard cable. Power is simplexed over this same cable. The separate power supply provides balanced outputs for standard 150/250-ohm microphone preamp inputs.

5. Small, light power supply—About the size of two back-to-back packs of cigarettes, both the DC and the AC supplies provide ruggedness for long-term heavy duty combined with small size and light weight for new ease in handling. Finish is hard chrome.

6. Long-life DC battery operation—Two mercury batteries provide 2500 operational hours, up to a year in normal use. A convenient meter on the supply shows battery condition. Battery drain is prevented when system is not in use by unplugging the 195A base or by operating a recessed switch on the supply housing.

7. Many accessories are standard—With each system a wind/pop screen; microphone holder; and a 25-foot, 2-wire, shielded cable are provided at no additional cost. Connectors and mounting hardware are attached.

8. High-temperature ambient permissible—The systems will operate in an ambient up to 55° maximum (131°F).

9. Exclusive Altec exchange policy—After expiration of the normal full year guarantee, Altec will accept an inoperative microphone in exchange for a comparable new unit at a fraction of original cost. This policy is unique in the industry.

10. Microphone is unusually small and light—This feature—microphone and base are 3½" L x ¾" Diam.; weight 2.2 oz.—designed as a means of eliminating the cumbersome size, bulky shape, and heavy weight of older style microphones.

* Extra High Sensitivity Models: Extremely high sensitivity (45 dBm re 10 dynes/cm²) with unusually high signal-to-noise ratio. Designed specifically for use where microphone must be placed at some distance from performers (such as suspended over stage, orchestra pit, or audience, or in footlights). Identical to M51 and M52 systems in other respects, the M251 is for AC operation; M252 for DC. Both are omnidirectional. Price per system: $216.

And one reason why it can.

How Altec can offer you these superb systems at only $198 per—Part of the reason is that they're entirely American-made at our Anaheim plant. No import duties or importer profits to pay. Another part is that we know how to build studio mikes. We should—we've been doing it for nearly 30 years! (For example, remember the 21B and M-11?)

Send your inquiry today for complete technical information. We'll include a recent article on the values of big vs. little condenser microphones written by Alex Badmaieff, our chief engineer of transducers. Also our colorful new 1967 Stereo Components Catalog, just in case you're interested.

ALTEC LANSING

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Check No. 75 on Reader Service Card.

Audio Measurements Course

Part 13

NORMAN H. CROWHURST

IN THIS INSTALLMENT we shall continue discussing what have been called "subjective measurements" in audio. I feel that the word "measurement" in this connection is somewhat of a misnomer. I prefer the word "test," but our psychologist friends will probably give me an argument, by asserting that the results of properly designed tests involving subjective judgment can be just as precise and repeatable as any objective test.

Probably my deep-seated objection arises from the question of what constitutes a "properly designed" test. The number of facts or elements involved is such that it is impossible to be sure that *only* the quantities nominally being compared are in fact the only ones influencing the ultimate result.

In the last installment, we introduced the question of frequency band, a factor that can be measured with objective meters, with suggestions as to how variations in the roll-off rate could alter the conclusions about what at first seemed such a simple comparison to make. How sharply frequencies beyond the band are removed changes the subjective impression in ways other than simple frequency loss, about which it is difficult to obtain meaningful distinctions from the subjects of the test.

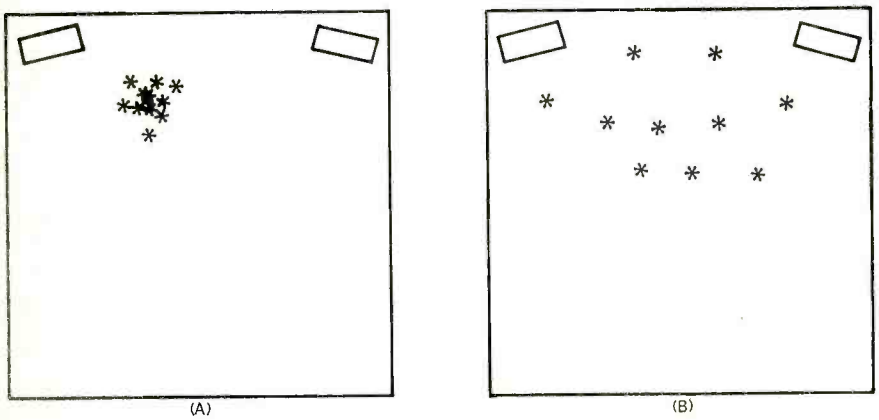

Fig. 13-1. Types of subjective result. In each case the marks indicate where 10 different subjects identified location of a particular instrument from its stereo reproduction. At (A) location is quite accurate: the subjects agree closely on the location. At (B) location is scattered, indicating that sense of location is not strong.

It is difficult for a trained listener to be certain why things sound different at times, so it is impossible to expect untrained listeners to give an opinion, unless tests can be devised that remove the conclusion from the realm of opinion, into simple 'yes' or 'no' responses.

Stereo Illusion

As I suggested in the last installment, similar frequency-range tests on two channels can relate the reality of the stereo illusion or the apparent separation to the frequency band present in each channel. Tests to determine this usually take the form of deliberately deteriorating either the frequency response of each channel, or the separation between channels and asking observers to indicate the apparent locations of different instruments in an ensemble of program material.

Such an approach is a psychologist's dream. On the accuracy with which subjects indicate the location and on the consistency with which they identify it, quite positive conclusions are possible. If the system gives a "tight" correlation of position (with the particular program material presented, which can vary too) then the observers will mark their charts quite consistently. If the correlation is not so good, then the charts will be more erratically marked (*Fig.* 13-1).

Such tests are repeatable, as the psychologists claim, provided everything in the test is repeated: same environment, same system, same pro-

gram material, but a different group of subjects, maybe. The tests will repeat in that tight, accurate clusters will consistently appear for some tests, with the locations consistently repeating, while for others they will be consistently scattered.

But change environment, system, or program material, and the results are apt to change. Some work has been done to correlate these three variables, but much more could usefully be done. From what has been done, environment and system have been found to be complementary. Large, horn type units do best in one environment, the small bookshelf units in another, a third will be served best by using reflection methods, either integral with the system or by speaker placement, while open-back units that radiate as dipoles, somewhat differently placed, may be best in some instances (*Fig.* 13-2).

Assuming that each system is optimally placed in environment to suit it, program material adds another variable. Some use spaced microphones to pick up the two channels, or synthesize the channels from a larger number of mikes, placed so as to be close in to individual instruments or performers, while other programs are recorded with a "stereophonic microphone," in which both microphone elements are mounted together, but have differently oriented directivity patterns (*Fig.* 13-3).

The first two methods will possess time differences, as well as intensity differences between channels, although the close-in mike method will have mainly intensity differences, for any program element picked up (e.g. musical instrument or vocalist). The first has a stereo reverberation effect controlled only by the studio environment. The second enables precisely controlled reverberation to be used. The last will have very small time differences and will rely mainly on intensity differential, based on different direction of sound arrival at the common microphone location.

When these two forms are played back, one may sound better over one system and the other over another. So we have quite a complicated possibility of combinations of the three variables to attempt to evaluate. To correlate these results, another variable must be carefully checked. Earlier discussions of stereo either stressed or poked fun at the need for listeners to occupy an "ideal position" in the room, equidistant from the two speakers, leading to the antisocial arrangement of seating in single file (*Fig.* 13-4).

Actually, the need for this somewhat ridiculous arrangement for optimum appreciation applies only to certain types of recorded material, reproduced over certain systems in certain environments. Admittedly, unless specific efforts are made to avoid the need for it, the majority of systems would require it. But the available ways to improve this situation are becoming more prevalent all the time.

If the recorded program is essentially "binaural"—that is, the individual channels contain what would be picked up by ears in a human head,

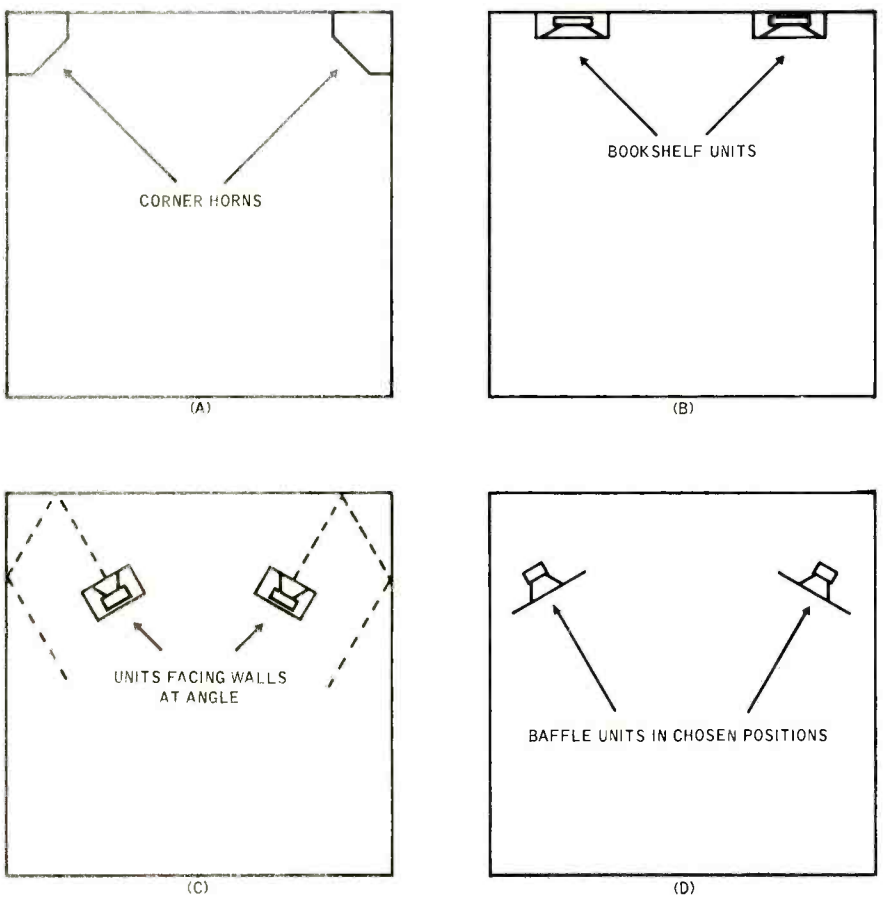

Fig. 13-2. Some different kinds of stereo loudspeaker systems (without indication of the type of room or furnishing for which each is best suited): (A) large corner horns; (B) bookshelf units; (C) one way of using wall reflection, particularly recommended by European manufacturers; (D) bipolar (baffle mounted) units.

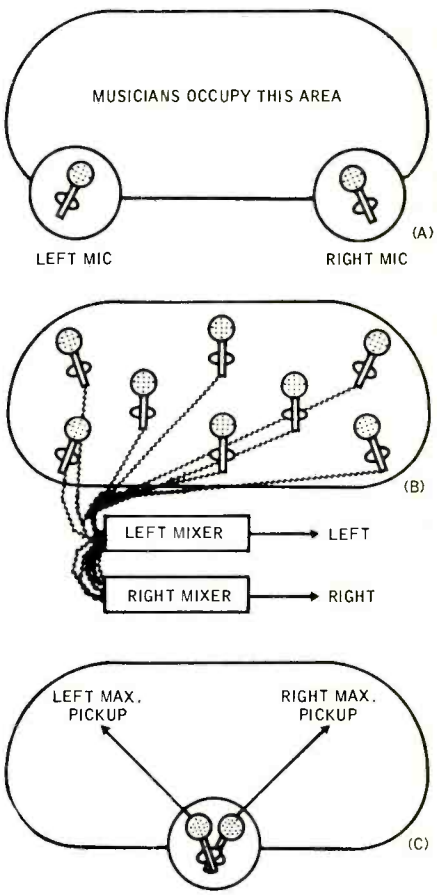

Fig. 13-3. Three basic ways in which program is "miked" for stereo recording or transmission: (A) two widely-spaced mikes, one for each channel; (B) close-in mikes for each instrument or performer, location being determined by electronic mixing (reverberation is also added with this type); (C) the "stereo mike"—two directional microphones mounted together with different directivity.

then the best way to listen is with binaural headphones (*Fig.* 13-5). A more comfortable way (but less effective in its illusion of realism) is to listen to the same type of program material at an ideal position—at equal distance from two loudspeakers to which the same two channels are fed.

But most modern stereophonic material is not recorded this way. Some is deliberately "piped" into quite separate left and right channels, so as to achieve a "ping-pong" effect. This makes wonderful demonstration material, to sell stereo by contrast with the old monaural, but it can become tiring as a regular listening "diet" and is not true reproduction of a musical program as normally performed.

The concept that led to use of an idealized listening position assumed a virtual point-source radiator: a pressure-type loudspeaker, with a closed-in back, so that sound from a single unit would always be pin-pointed at that unit. This method is still used, but many reproducers use different means of getting away from this concept as a basic form.

Some units "spread" the apparent source by the use of reflectors, either as part of the system (*Fig.* 13-6) or by facing the units of conventional structure toward the walls (*Fig.* 13-7). A more effective approach is to use open back units, that radiate a bipolar pattern, to radiate a composite wave, that generates sound wave particle movement in the vicinity of each listener's head, that will produce the correct illusion (*Fig.* 13-8).

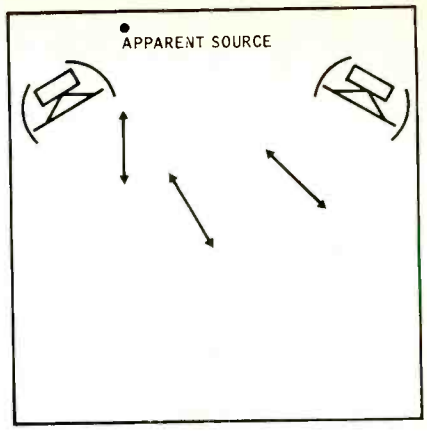

Fig. 13-8. Bipolar radiators, placed to suit the listening room, enable quite-accurate locations from almost anywhere in the room, and also lose the sense of identifying the speakers as the sound sources.

The last-mentioned approach may seem unnatural to listeners who expect to hear sound "come from the loudspeaker," because it has the curious effect of producing imaginary sources, not identified with the speaker locations.

When one listens to stereo radiated from conventional pressure (closed back) units, although (in a correct listening position, *Fig.* 13-4) one can realize an illusion of position for individual instruments, conscious concentration on the location of the speakers always enables the listener to identify clearly what he hears in terms of sound from each unit.

Units faced toward the wall or other reflecting surfaces have a similar effect, except that the apparent location of the unit is moved. This enables a system in a limited space to serve listeners in that space more effectively than the direct radiator by

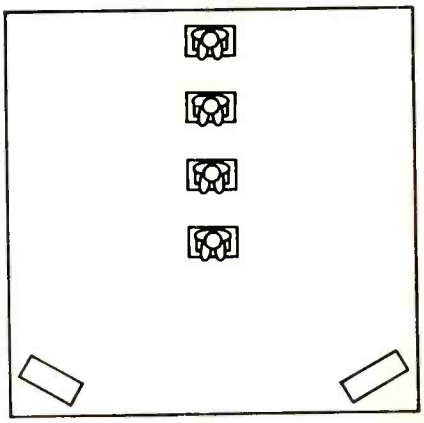

Fig. 13-4. The "classic" ideal seating arrangement for stereo—rather anti-social!

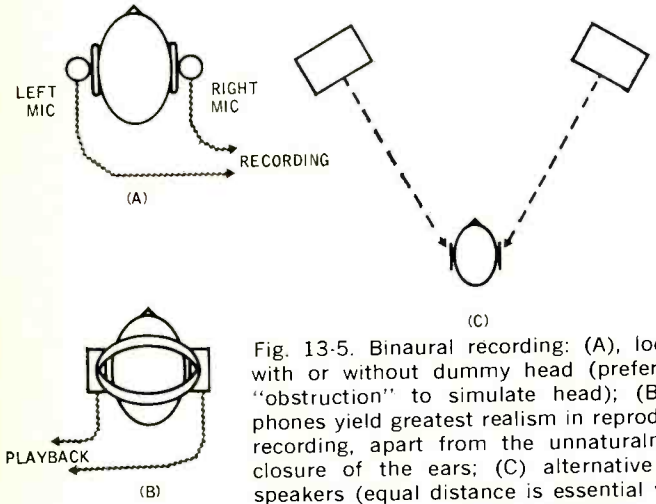

Fig. 13-5. Binaural recording: (A), location of mikes, with or without dummy head (preferably with some "obstruction" to simulate head); (B), stereo headphones yield greatest realism in reproduction from this recording, apart from the unnaturalness due to enclosure of the ears; (C) alternative listening, from speakers (equal distance is essential with this type of recorded material).

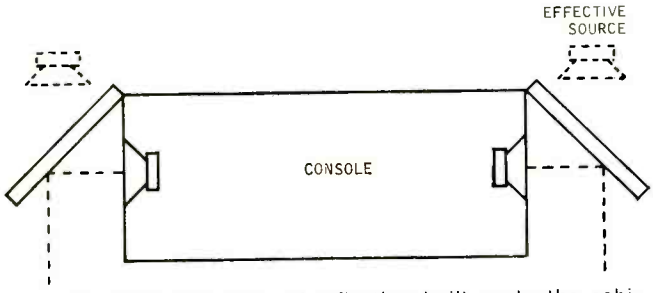

Fig. 13-6. One form of reflection built on to the cabinet design in the form of hinged doors.

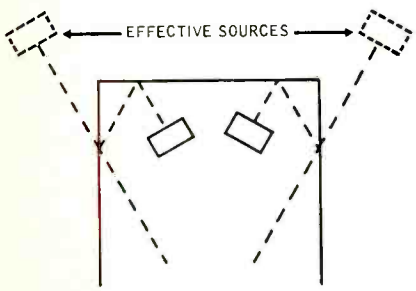

Fig. 13-7. A preferred form of speaker placement to project the effective stereo sources much further apart than the physical structure of the room allows.

For people who really listen, we offer the first receiver with $400 specifications that sells for $279

ADC 606

90 watt, solid-state, FM Stereo Receiver

SPECIFICATIONS

Amplifier Section

Power:
90 watts (IHF) @ 4 ohms
70 watts (IHF) @ 8 ohms

Total Harmonic Distortion:
@ rated output, .5%
3 db below rated output, .2%

IM Distortion:
@ rated output, .5%
3 db below rated output, .3%

Frequency Response:
10-60,000 Hz ±1 db

Hum and Noise:
With volume control minimum —78 db
Magnetic phono input, —65 db
Musical instrument input, —50 db
Auxiliary input, —75 db

Input Sensitivities:
Magnetic phono, 3 mv
Musical instrument, 50 mv
Tape, 100 mv
Auxiliary, 100 mv

Tuner Section

Usable FM Sensitivity IHF:
1.6 uv

Harmonic Distortion
(100% modulation): .5%

FM Stereo Separation:
35 db at 400 Hz
32 db at 1,000 Hz
20 db at 8,000 Hz

Signal-to-Noise Ratio
(100% modulation): 70 db

Spurious Response Rejection:
80 db

Capture Ratio:
3 db

FEATURES

First, true bookshelf depth: 17" wide, 5" high, 9" deep
Side panels eliminate need for separate cabinet
Large, readable, FM dial
Complete tape playback and monitoring facilities
Headphone jack
Musical instrument input
Automatic frequency control (switchable) for FM
Independent control for 2 sets of speakers
Each channel separately fused, plus main power fuse
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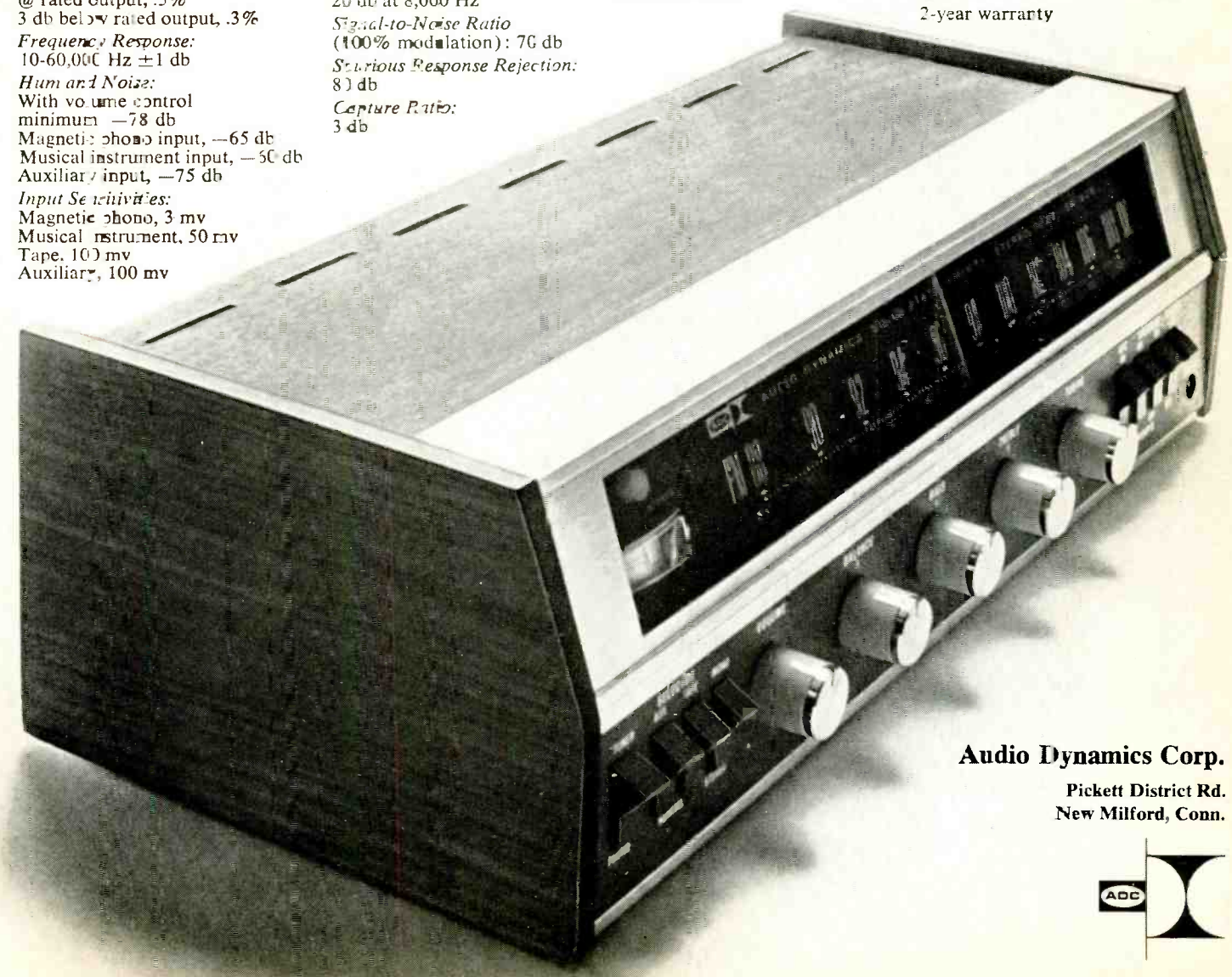

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making the actual listening room effectively a small part, located in the ideal listening position inside a much larger "image" room. But the method still suffers from the fact that it can be recognized as "two-channel" stereo.

When one listens to stereo radiated from bipolar units, this identification of two definite sources no longer obtains. If the listener attempts to concentrate on the speaker locations, he gets the impression that they are not working, that no sound comes from these locations, and that the sound must be coming from "somewhere else." When such a system does its job well, even listening at a position close to one of the units will not enable the listener to identify part of the sound as coming from that unit.

So, if you want to listen to a system, with the notion of always being conscious that the sound comes from the loudspeakers, systems using bipolar radiators may be a little frustrating, but it will usually be more realistic, once this purely artificial desire is dismissed.

So far as source location and separation are concerned, so good. Let's assume that all a complete documentation of these effects needs is time and effort and that suitable tests of sufficient number and diversity are developed and used to correlate a complete set of conclusions. But is separation and source location all stereo is good for?

Do most of us listen, while trying to enjoy stereo reproduction, to determine the precise location of every instrument? If we do so, are our eyes open or closed? If they are closed, then we also imagine the whole scene and can probably draw it, or fill in details on a sketch previously prepared by the psychologist for all subjects to use.

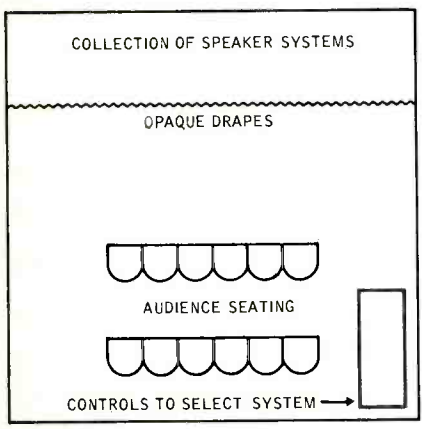

Fig. 13-9. A form of listening room to provide for "eyes open" comparison, that allows the imagination to visualize instrument placement.

If we have our eyes open, we may still use our imagination, if the whole reproduction area is concealed by opaque drapes, so we can imagine the orchestra, or what-have-you, is set out just the other side of the drapes we cannot see through. (*Fig.* 13-9).

But not all living rooms, or places for stereo listening, lend themselves to this kind of treatment and imagination and the fact that they don't does not destroy the advantage that good stereo reproduction can achieve for the average listener. The fact that the apparent location of the piano happens to be occupied by a flickering fire in an open grate, does not destroy enjoyment. What really makes the difference?

There we have a question where psychologists and engineers are equally at a loss. They may conduct a poll for personal opinions, but the subjective test, as such, begins to lose its conceptual meaning.

Stereo, if it is good, makes the program sound better. In what way? This is very difficult to pin down. One thing seems to emerge from all tests: it is related to the accuracy of separation, as well as freedom from distortion, including fullness of frequency response.

Comparison of Systems

So we leave the hypothetical subjective tests and move to some more concrete—as affects the pocket book: to find which is the best-sounding system, either for the money, or at any price? Various groups, independent testing agencies, sales salons, manufacturers, have set up comparison facilities in an elaborately prepared listening environment.

Virtually, this is the only way to make a quickly assessable comparison —what is commonly called an A-B test. It seems hardly practical to say, "Listen to this, and remember carefully exactly what it sounds like," and then take the subjects to another listening location and ask them to compare the performance of a different system in that location with the one they carry in their memories from the first. One just cannot carry so many aspects of audio performance, or the impression it creates, in one's head.

A very ambitious high-fidelity salon might conceivably set up a number of listening rooms, each with different shape and acoustical environment, or with adjustable environment features, so the prospect could first choose the listening room providing the environment most similar to that in which he plans to install his equipment. Then in the chosen listening room, he could listen to and compare a diversity of systems, over which any variety of program could be played to suit the buyer's taste.

This would be quite an expensive set-up, completely beyond the reach of any but the biggest high-fidelity merchandizing companies, who would have to carry most of the available product lines. To make comparison simpler for the potential buyer, the selling organization can sensibly narrow down the choice to suit each individual room, by providing in each kind of room, a selection of the systems that sound best in that room.

The only problem then is that some customers, not aware of the interdependence between systems and environment, may come in with a notion that such and such a system is "the best"—probably based on having heard it in a different kind of environment from that planned.

If only the systems suited to the room intended are available for listening, such a customer may want to hear the one thought best, to satisfy his own ears about the judgement. If the only way for him to hear it is to go to another room, where the environment does suit the system, his initial notion will be erroneously confirmed. The only way for him to realize that it is not similarly ideal for his chosen environment is to allow him to hear it in that environment.

Such a variety of listening-environment and complexity-of-system arrangements in each would be quite an expensive set-up, possible only for large-scale merchandizing operations. Most salons must content themselves with one listening room, organized to be as typical as possible of the average listening room that customers of the locality are likely to have and with being well enough informed to do the best possible job of providing reliable advice beyond the range available for actual demonstration.

Having thus covered most of the measurements connected with individual items of equipment and with systems as a whole, including some comments on subjective aspects, in which area there is still much more work to be done, we will turn, in the next installment, to some of the measurements that become necessary within certain components: those concerned either with finding out why a unit does not function as it should, or with finding ways and means of improving performance.

Much of this is concerned with correctly interpreting measurements made, which may not always mean what they apparently obviously indicate! Æ

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Jazz in Greenwich Village

LARRY ZIDE

Fig. 2. The second group.

The recording group on the cover is proof that the sort of equipment available to the hobbyist is more than able to meet the most stringent recording needs.

The cover artists are as follows: Bobby Hackett — cornet, Ray Mosca — drums, Bob Knutzen—trombone, David C. Sibley—bass, Dave McKenna—piano, and Pee Wee Russell—clarinet.

You will note that there is a triangular device in Bobby Hackett's horn. This is a special Koss transducer designed for this kind of instrument. It allows the lower-efficiency musical instrument to compete in sheer decibel output with electric guitars and other high-volume instruments. It means that a live artist can move about while a fixed microphone gets an ideal picture of the instrument; one that does not vary as the artist roams about the stage. (See p. 64.)

The place is Greenwich Village's Half-Note Club on the night of October 18th. Robert Bowman of Tandberg sits on the left, John Koss of the company that bears his name is on the right. They assembled this recording session with a unique project in mind.

Most conventional stereo recordings are made (in essence) with widely spaced channel pickups. This creates a dramatic earphone effect to be sure, but it was the effort of this session to produce a master tape that was recorded binaurally. (Do you remember that word?) Binaural recordings are made with the microphones placed apart in the same way as your ears are placed apart. The purpose of these sessions was to produce a binaural master that could be converted to disc.

Two recorders are used. Both are Tandbergs. One is the new 64X. It features an extra bias head on the reverse side of the tape and a solid-state bias oscillator circuit. Frequency response at the top speed of 7½ ips is ±2 dB over the range of 30-20,000 Hz. But this machine was used primarily at 3¾ where its response is ±2 dB, 30-15,000 Hz.

The machine used to record the 7½ ips master for future binaural discing is a Tandberg 62 half-track recorder. This is otherwise similar to the 64X though we understand it does not have the reverse-bias head.

Two microphones each were used. The 64X was fed from two Grampian DP 4H high-impedance units. These were spaced about 8-feet apart.

The binaural recording was made through a pair of Norelco/AKG D-24 units. These are low-impedance microphones so a pair of transformers was necessary to match them to the Tandberg. Both sets of microphones were actually placed about 8 feet out into the audience but are shown otherwise for the pictures.

The Acoustech V-A integrated amplifier was used in conjunction with a Koss Model 1220 monitoring headphone amplifier. The headphones are the Koss Model KO-727 and Model PRO-4A.

There were two separate recording sessions on that same day. The second group which didn't make our cover did make the tapes. The personnel here (*Fig. 2*) were Zoot Sims—sax, Steven Schaeffer—drums, David Frishberg—piano, and Major Holly Jr.—bass.

The home recordist can learn something significant from these sessions (which may be released as a binaural recording by the Koss-Rek-O-Kut company). The primary lesson is to use top-grade equipment in peak operating condition. Also, to monitor everything while recording—so that technical errors may be quickly corrected). Finally note the quality microphones. These transducers are your "window on the performance." You simply cannot get quality out of low-grade mikes.

It is worthy of note that our informant tells us that the recordings made on either machine (one at 7½ and the other at 3¾) are indistinguishable as far as audible frequency response is concerned. That is the present state of the tape art —a far cry from what was standard just a few years ago. *AE*

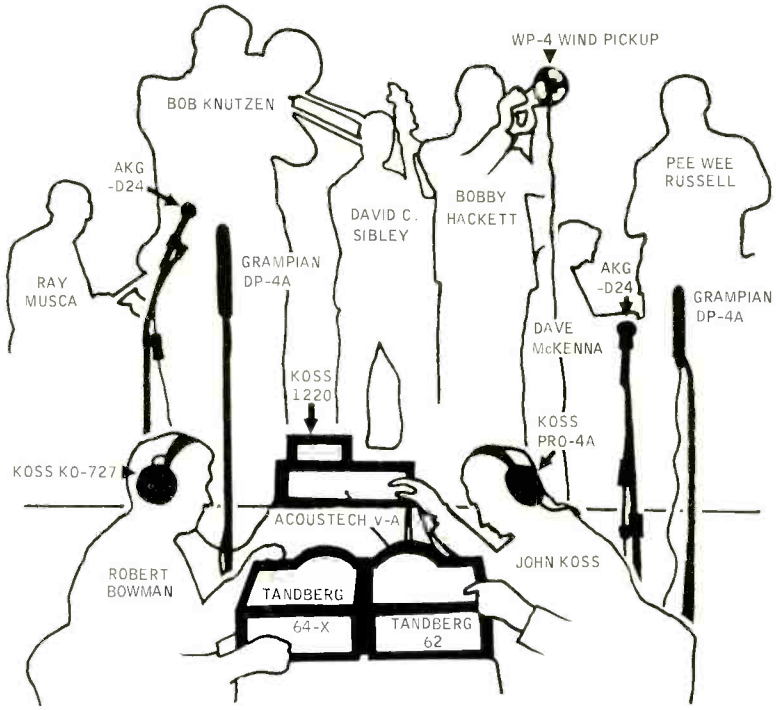

Fig. 1. The equipment and personnel on the cover.

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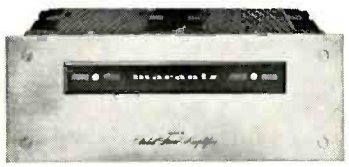

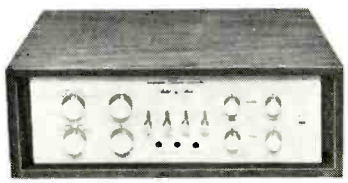

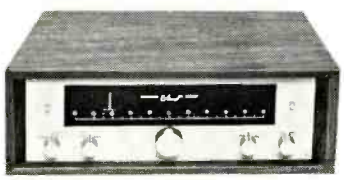

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AUDIO MUSIC AND RECORD REVIEW

Record Review • Edward Tatnall Canby
Light Listening • Chester Santon
Jazz & All That • Bertram Stanleigh

Record Review • Edward Tatnall Canby

Sofa Cushion Sound

R. Strauss: Alpine Symphony. Bavarian State Orch., Strauss (1941)
Seraphim 60006 mono

To filter or not to filter? That would seem to be the question here.

This is a famous war-time oldie 78, conducted in Germany by Strauss himself and (obviously) acquired later on by Angel-EMI in England. It is worthy material, all right, a document of the sort that Angel has been putting on its much more expensive COLH label, with those superb little gray booklets of fact and background tucked inside. At the low Seraphim price—no booklet. But there are good notes on the back, of course. And the sound, I'd guess, is precisely what it would have been in the high-price packaging. Alas.

Nobody, but nobody else (unless maybe RCA Victor) would dare put out this fine grade of felt-lined, drab-gray, sofa cushion non-hi-fi! It all comes through a sharp cut-off filter, if I'm guessing right, at maybe 3500 Hz, and there's a nasty hollow mid-range peak as a result. All dull bass, no highs whatsoever and a wet blanket effect from start to finish. Poor Strauss! The finest orchestral colorist of his generation. Buried in sonic pillows.

Did it *have* to be this way? Did the *original* sound like this? I can't believe it. I am sure that, somehow, a more imaginative re-creation might have been possible, even at the risk of a bit of outright distortion here and there (horrors! On *Angel?*) and maybe a lot of plain old hiss. Remember those shattering 78 inner-groove sounds, full-volume? We took them because of the better sound on the outer grooves. We still could, I think, if the situation were honestly explained to us. Well worth it. And who's afraid of a bit of hiss?

'Course, just maybe, the original discs sounded just like this, in which case not a thing could be done (unless perhaps a violent "presence peak" to add a bit of color contrast). I can't believe it—even in war time. After all, remember the Magnetophon.

Yes, the *Alpine Symphony* gets through all right, at least by inference. And it goes on and on and on. Its only glory, alas, is the superb orchestral color that ain't there. The music is pretty interminable, even with Strauss at the helm. Some document! E.T.C.

You Take the High Road . . .

Rubinstein, Brahms: Piano Concerto No. 1 in D Minor. Boston Symphony, Leinsdorf.
RCA Victor LSC 2917 stereo

Ah—*up* with high priced records and *down* with all cheap labels! That's the inevitable and healthy reaction to this superb, but necessarily high-priced item, with RCA's ever-improving mainstay pianist, Arthur Rubinstein. You can't have Rubinstein for peanuts. Not even for $2.50. He's worth double.

There's a long, passionate orchestral introduction to this concerto. When, at last Rubinstein's piano enters, you know instantly that he has been following every second of the music, that he's *with it*—a part of the whole. So many of the brilliant young prize winners sit there, figuratively, saying just wait until they hear ME. That's how they sound.

There's a famous long solo melody here, too, one of those massive Brahms piano themes that knock you for a loop when you first hear them. Rubinstein plays it with all his persuasiveness—but how wonderfully it fades down, suddenly, at the end, to meet the incoming orchestra at exactly the right *piano* volume. He's *with it* again.

Rubinstein does better than the Boston here, and better than Leinsdorf himself; but it doesn't matter. The concerto is far and away ahead of a hundred lesser versions with men of less profound experience than Rubinstein in his super-vital old age. E.T.C.

Brahms: Complete Piano Works, vol. 6: Schumann Variations Op. 9, Vars. on an Original Theme Op. 21/1, Vars. on a Hungarian Song Op. 21/2. Julius Katchen.
London CS 6477 stereo

Three big sets of early Brahms piano variations, out of his youthful period, and it will take a pretty solid understanding of the early Romantic idiom if you are to make sense out of them: for these are the mooniest, moodiest effusions of youthful ardor you're ever likely to hear! Brahms was very much "in" with his time, back then. And

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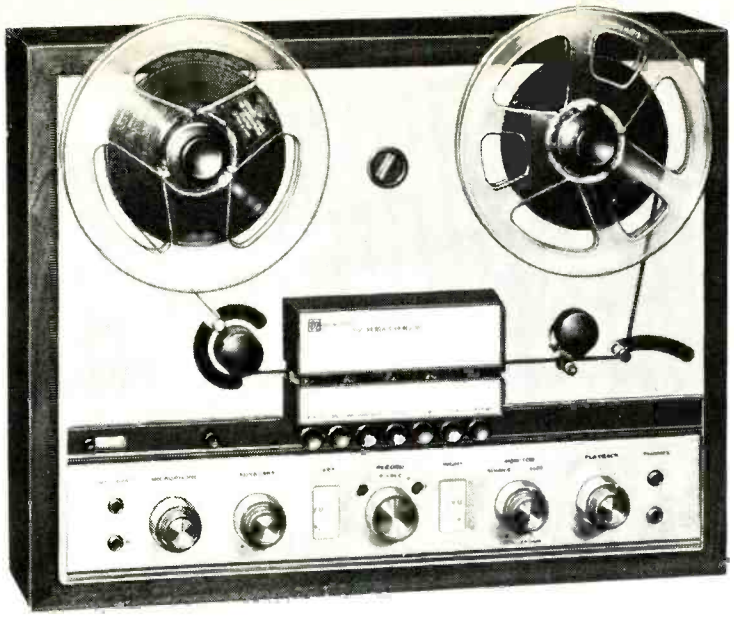

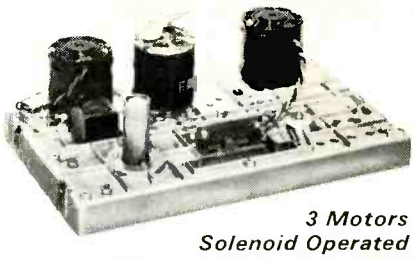

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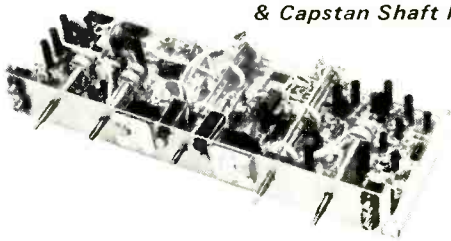

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what people wanted from youth was unabashed pathos, long hair and plenty of sweet anguishing and languishing.

Mr. Katchen doesn't entirely help these super-Romantic effusions by his own super-Romantic, or should I say, neo-Romantic treatment, all hesitations, ardor, *rubato* and pathos-deluxe. He is musical, decidedly, in this style. And probably right, too—for surely Brahms himself was even more soulful at the piano, in those days. But the constant slowings-down, the hesitations and the tearful agitation, while utterly musical, are also hard on the listener; for you can't easily keep track of the music itself. A more straightforward, even-paced playing would be much easier on the novice listener and perhaps more stylish for today, as well.

Of its neo-Romantic type, Mr. Katchen's playing is the very best. A second and third try and you'll get the sense plenty well, *rubato* or no. E.T.C.

Joseph Szigeti. Sonatas by Debussy, Honegger, Four Pieces Op. 7 by Webern. Roy Bogas, piano.

Mercury SR 90442 stereo

Szigeti was one of the world's great violinists back before the war. Then a sort of shaking palsy of the fiddle fingers slowed him down and reduced his usefulness to record companies. The painfully slow vibrato and seemingly shaky technique just was too much for most listeners, at close range.

But the old man didn't quit by any means. He is a great musician in his brain and experience, with a tremendous knowledge of the violin literature and its many styles. Mercury was wise to grab him.

In this typical Szigeti program the old slightly cold-in-the-head wiry tone is still evident, as is the weakness of control over pitch and vibrato—but in a minimum fashion. He has improved. And the engineers have put him well back, in the newer stereo style, surrounded by big liveness and a full piano tone. (Roy Bogas is excellent.) That brings out the best and suppresses the worst, decidedly. A happy solution and very musical.

And so the old violinist does some superb things here. The perfect styling of the Debussy sonata could not be bettered by anybody. The squeaky Webern tidbits are equally savvy. The more conventional Honegger and the folksy Ives are done with the right brashness and outwardness. A good record. E.T.C.

Handel: 15 Sonatas for Violin with Harpsichord. Henry Temianka; Malcolm Hamilton, hps.

Everest 3143/3 (3) stereo

Six whole sides' worth of Handel sonata music here, and a number of extra musical birds are killed with one stone since these works are also known variously as oboe, flute or recorder sonatas—depending on who's playing. (Handel was quite permissive; he listed all of these as alternative solo instruments.) In addition, Handel being an inveterate borrower of his own music, you'll hear other familiar music in these—from, say, the "Water Music" and one of the concerti with oboes. An all-around, general-purpose Handel concert, in spite of the unchanging pair of instruments.

Mr. Temianka, of the old school, plays very musically but in a now old-fashioned way, his tone sweet and melting, like Fritz Kreisler's, his ornaments mere blobs rather than the now-normal clean Baroque trills, his expression full of those gentle little sobs and sighs that used to be the pride of the virtuoso violinist! All this on a very restrained scale and audible mainly for the ear that is well up on Baroque music; the rest of the ears won't notice the difference—and so will find the playing a pleasure.

A forthright, well balanced harpsichord *continuo* from Malcolm Hamilton's harpsichord, a bit blocky in style. E.T.C.

Mahler: Symphony No. 7. N. Y. Philharmonic, Bernstein.

Columbia M2S 739 stereo

This enormous symphony, the least often heard of Mahler's nine (plus a tenth, left unfinished and recently completed and recorded) typically occupies four whole LP sides—and long ones, at that. The outer movements are perhaps the toughest, for they are full of that apocalyptic sense of cosmos-shaking importance which thrills some of us and leaves the rest wondering whether Mahler composing was somehow like Moses receiving the Commandments from the Lord. It is splendid music and yet, too, it is terribly egoistic.

The inner movements tend to the two inevitables in Mahler — songs and marches. Though they do go on and on, they are often lovely and/or impressively musical. I liked particularly the dramatic next-to-last movement (out of five), scored for relatively small "chamber" orchestra. It sounds out wonderfully well on records.

Yes, Bernstein has a way with this ultimate Romanticism. It *is* good—as the quoted critics say on the front cover. But the first and last (apocalyptic) movements are just a bit uneven, as though the Philharmonic hadn't yet quite got on top of their many complexities. E.T.C.

Albert Roussel: Symphonies No. 3, No. 4.

(a) Paris Conservatory Orch., Cluytens.

Angel 36327 stereo

(b) Lamoureux Orch., Munch.

Epic BC 1318 stereo

Did you ever! Two discs identical in content, with two notable French orchestras and a pair of very big French conductors—and the records were released in the very same month. Somebody's spies were asleep at the switch.

Roussel is one of those slickly professional big-orchestra composers (he died in 1937) whose music uses the large Romantic orchestra and its styling, but modified for the modern period by more dissonance, a harder sound and an augmented decibel potential. As we listen to these works, from 1930 and 1934, they seem excessively thick and dense in texture and surprisingly old-fashioned, for all their dissonance. Our ears prefer a more streamlined sound now, both in modern music and the revived older Baroque and the like. Frankly, Roussel gives my ears indigestion, though I do admire his professional touch.

Angel's recording comes over best. Conducted by one of the outstanding older French conductors, played by one of the best known of French orchestras, which can play French music superbly (that is, when it feels like playing well—which isn't always), this record has a mellow quality, a gentleness of approach, that puts Roussel in an optimum musical light. The recording, of Angel's somewhat distantly mellow conservative sort, fits the musical conception perfectly.

Epic's Lamoureux orchestra is conducted by the ex-conductor of the Boston Symphony, who is at his best in his own nation's music, especially of the more Romantic sort. But the well-remembered Munch hardness of approach, the driving, unmusical beat, too familiar in many a dull performance of the classics in Boston, is only too easily heard here. Where Cluytens leads his men through Roussel, Munch pushes and drives them. Oddly in line with this, the Epic sound is brighter, harder and closer than Angel's. It could be called a "hi-fi" sound, except that it seems to me a bit harsh in the balance (though not in terms of distortion) with overly brilliant highs and an absence of solid middle-orchestra sound. Mike pickup and acoustics, I'd guess. The recording is by Erato.

E.T.C.

Baroque Italian Concertos by Vivaldi, Geminiani, Locatelli, Albinoni. I Solisti Veneti, Scimone.

CBS 32 11 0004 stereo

Here's that odd bright-blue CBS label again and I'm still at a loss (since nobody tells me) as to why it is different from Columbia regular. Or Epic. They all sell at regular (high) prices.

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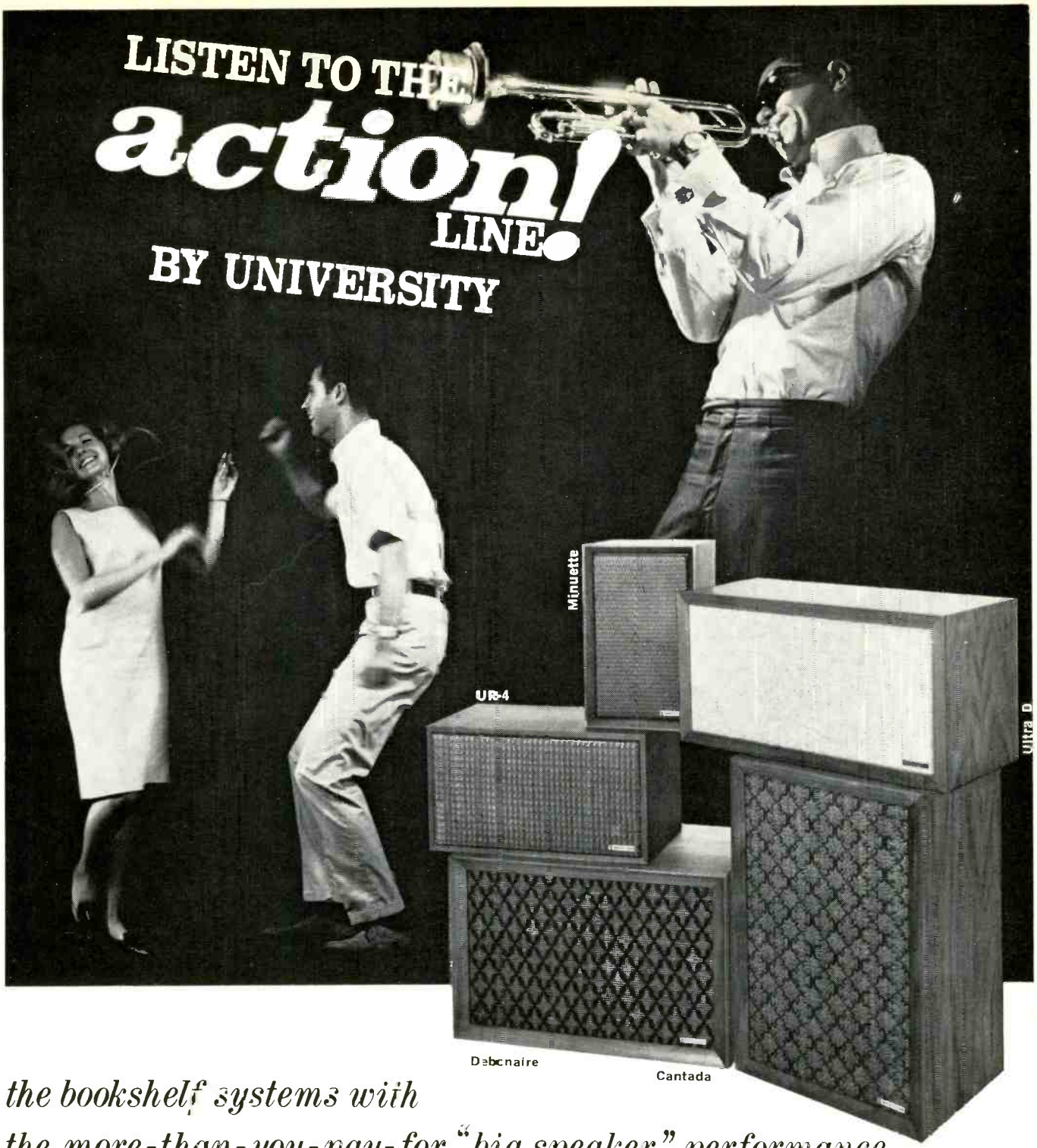
The Solisti Veneti are, of course, another of those new small virtuoso Italian groups that have followed the famed I Musici, reacting violently to the old methods, substituting overly small ensemble sound for overly large, playing chastely and fast, instead of opulently and slow. It's all very nice, but I don't find these players so very different from others of the sort on various labels.



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They're good. The music they have chosen varies from OK to very dull. Nothing to make such a big fuss about. You can't "revitalize" a Vivaldi concerto that just isn't one of his masterpieces, to put it mildly. Try side 2 if you want the best here—Geminiani and Albinoni. E.T.C.

. . . and I'll Take the Low Road

Stravinsky: Les Noces; Pribaoutki; Berceuses du chat; Four Russian Songs; Four Russian Peasant Songs. Soloists and Chorus of the Orch. du Theatre National de l'Opera, Boulez.

Nonesuch H-71133 stereo

Nonesuch has latched onto a couple of top-grade celebrity winners in this and its companion low-priced disc, *Le Sacre du Printemps*. Pierre Boulez is France's coming Toscanini, not to mention her big hope as an avant-garde composer and general musical practitioner. It's safe to say he'll soon be turning up on major celebrity labels—better grab him here while Nonesuch has him.

The major item (side 1), *Les Noces* is out of the early 'teens. Stravinsky's still-Russian wild period that began with *Le Sacre*, sophisticated yet violently primitive. This final version of *Les Noces* is scored for solo singers and four pianos —phew! If you like *Le Sacre* you'll like this, especially with the dynamic Boulez.

The other works are short, out of the same period, for assorted voices and odd instrumental combos. One is for mezzo soprano and three clarinets. Another uses a women's chorus and four horns.

An important Stravinsky record and a good show, any way you listen to it. E.T.C.

Ravel: Daphnis and Chloe Suite No. 1; Bolero; La Valse; Alborada del Grazioso. Czech Philharmonic, Baudo.

Crossroads 22 16 0040 stereo

Coming from such an unlikely place, out of old Bohemia, this Ravel is extraordinarily good. The playing is both enthusiastic and understanding, bringing out the essential Ravel as one would not think the Czechs could do. They have the right idea, exactly—that curious contradiction between urbanity and madness, fine-lined control and utter abandon, which is always near the surface in Ravel's music. Here are his major works of the sort; each one of them has the same succession of increasingly intense, farther-and-farther-out climaxes, first the splendid *Daphnis* music with its frenzied wordless chorus and wild rhythms; then the apotheosis of the waltz, *La Valse*, Johann Strauss carried to tortured, yet beautiful madness, ending in a horrendous grimace of terror; the famous *Bolero*, a stylized version of the same progression, a tour-de-force—and finally, an earlier work of the same genre, the *Alborada del Grazioso*, all Spanish rhythms again.

In each of these the Czech orchestra has grasped the sense of the music, the wildness, so perfectly controlled, the agonized ravings composed into music of incredible precision. The last few "paragraphs" of *La Valse* are superbly done; the sudden change of key at the end of the *Bolero* never sounded so startling, and the pounding chorus of *Daphnis and Chloe* reminds us how close is this music to Stravinsky's *Le Sacre du Printemps*—it came only a year before.

The Crossroads sound here is smoother and less edgy than that of the first batch of releases; indeed, far from being edgy, it is a bit on the dull side. A slight boost of the highs and plenty of volume bring out the best in the music. Epic evidently still has a problem in adapting the Czech Supraphon tapes to American standards. E.T.C.

The Fitzwilliam Virginal Book. Blanche Winogron, virginals.

Dover HCR ST 7015 stereo

This is a superb record! The Dover mail-order catalogue (180 Varick St., New York, N.Y. 10014) continues to amaze; for its records, many of them brand new and in stereo, sell for the lowest official price anywhere, except for Vanguard's equally superb Everyman series. The $2 tab for these is well below the $2.49 list asked by most of the new low-cost labels. (Discounts, of course, play hob with all sorts of prices.)

The Fitzwilliam Virginal(s) Book is a famous Elizabethan collection of keyboard pieces intended for the virginals, the tiny one-stop harpsichord, table-model type, that was then the rage. The music is now very popular among home pianists. It is available in a low-price printed edition too.

All I can say is that you will be amazed what can be done with this little instrument, with its single, unvarying tone color and fixed volume level, through sheer expertise in the playing. Never a dull moment in these excerpts from the collection, and there are many works of a virtuosity hard to believe. Miss Winogron knows more about playing *music* on the harpsichord-type keyboard than all the other keyboardists put together. They should study her here for hours and hours. All you have to do is just enjoy. E.T.C.

Boris Christoff — Mussorgsky Songs. French Nat. Radio Orch., Tzipine.

Seraphim 5008 mono

Boris Christoff, successor to many a great Moussorgsky-type basso — those cavernously enormous voices that sing Boris Goudonov, the dying Tzar, and Hans Sachs, Wotan and the like in Wagner—has specialized in Moussorgsky interpretation though, if I remember rightly, he is Greek born. These splendid EMI records have given the reissue engineers no great problems. The voice comes through most effectively. The recording has everything *but* stereo. It might as well be brand new.

In these relatively intimate songs, which were originally composed with piano accompaniment, Christoff seems almost a bull in a china shop—except that Moussorgsky himself had intended to orchestrate some of them and, in any case, he always thought big, whatever he wrote. Witness the well known *Pictures at an Exhibition*, originally for piano too. The Christoff vocal production and the diction are both superbly dramatic. A stunning basso-baritone! Others, though, have done these songs to good effect in a much more intimate fashion—several women included. They can be very subtle.

Side 1 is the *Songs and Dances of Death*. Gruesome. Side 2 offers four separate songs, also orchestrated from the original piano versions. E.T.C.

Four Rococo Quartets. (Rosetti, Ditters von Dittersdorf, Richter, Asplmayr). Oistersek String Quartet.

World Series PHC 9026 stereo/mono

For anyone who has a yen for the string quartet, these prototype models of the breed, so to speak, are quite fascinating. And they are beautifully played, too. A strong, accurate group, this Oistersek ensemble, with a good lead violin and an active cello to back up on the bottom and balance the inner pair of instruments.

Oldest man here is Richter, born in 1709, thirty years before Haydn and almost a half century before Mozart—Haydn and Mozart being the end-product composers in the style we hear emerging in these works. Richter's first movement instantly gives itself away; the tell-tale Baroque sound of the figured bass is still there, the cello sawing at lines and lines of repeated harmony-bass notes. But he tries valiantly and gets the cello into the action often enough—he knew where he was heading. And Richter knew all the elegant "Mannheim" tricks of melody and ornament that were then coming in, around the time of Bach's death in the 1750's and on. Good man.

Ditters von D., friend of Mozart and Haydn in Vienna and Haydn's age, is much more suavely elegant and not particularly exciting. He was no pioneer in the new and untried! As for the completely Viennese Asplmayr (now there's a name for you . . .) he was ever so definitely a minor operator on the scene in the same period; he'll help you gain perspective on the bigger men, at least.

The best of these, for my ear, is Rosetti, who was actually named Roessler, out of (German) Bohemia, recently known to us as the Sudetanland, one of Hitler's little conquests. Rosetti wrote a Requiem in Mozart's memory and he writes a really expressive quartet, a lot more than mere formula. E.T.C.

J. S. Bach: Sinfonia, BWV 1046A; Sinfonie from Cantatas. Deutsche Bachsolisten, Winschermann; Cologne Soloists Ensemble, Muller-Bruhl.

Nonesuch H 71120 stereo

This odd looking collection of unheard-of Bach turns out to be largely familiar material—in alternative versions. Bach re-used large numbers of his earlier works in new forms, often a number of times.

Thus the first "sinfonia" (an orchestral piece, in Bach's time often in one movement and used as an introduction—an overture) is no less than an earlier ver-

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sion of the *Brandenburg Concerto No. 1*, minus a couple of sections added later and with one unfamiliar part. The other works are all taken from cantatas; but several were previously parts of instrumental concerti, now mostly lost. Some of these movements will be familiar to many ears, in assorted arrangements that have long been popular.

The performances are conscientious and earnest, a trace on the heavy side. (But isn't it Bach's fault, not theirs?) The horns and oboes in the First-Brandenburg prototype are excellent, as is the solo oboe in the familiar F major Sinfonia, BWV 156. E.T.C.

Praetorius: Christmas Music; Dances from "Terpsichore."
Schein: Two Suites from "Banchetto musicale." Ferd. Conrad Instr. Ens., Niedersachsischer Singkreis, Trader.
Nonesuch H 71129 stereo

Three musical sections for this pleasant disc of old music out of the early 17th century. The Praetorius Xmas consists of pairs of settings of Christmas tunes (chorales), first for a charming and modest ensemble of old instruments, including the kazoo-like instrument in the shape of a J, the Krummhorn; then, in another version, for instruments plus a sturdy boys' and men's choir. The Praetorius dances, written for actual (court) dancing, are energetic little bits of tunefulness played here by a recorder group plus percussion.

Schein's dances are of a slightly later sort, already grouped into suites for listening use. Some are much like the Praetorius dances; others, more serious, already begin to suggest the later "dance suite" (for listening) of J. S. Bach—a century later. E.T.C.

Corrette: Concertos Comiques. Antiqua Musica Chamber Orch., Roussel.
World Series PHC 9012 stereo/mono

These little French-Baroque concerti, more or less after the Italian manner (Vivaldi, etc.), are "humorous" in that each is built on a popular French song of the time. I even recognized one myself, after all these centuries. To the savvy aristocracy of early 18th century Paris they must have been side-splitting, a bit like P.D.Q. Bach or the Hoffnung concerts, today.

They are of very slight substance, though full of gaiety in musical terms. I found them dull, however, because they are all alike and all in the same limited set of keys, with precious little contrast. I wouldn't suggest playing them straight through without a break.

A more serious reservation is the utterly zany "arrangement" of each of these by a lady named Huguette Grémy, for a group of Paris Conservatory wind players backed by strings. Yes, she uses instruments available at that time; but her styling of them is wholly out of the period, a mixture of late Mozart and Handel-Beecham, I'd call it. If you'll accept these pieces simply as modern transcriptions, à la ballet music, you'll be happy. But if you want your Baroque —even French Baroque—to sound like it oughta sound, then don't expect to be pleased. You'll only be baffled. E.T.C.

Solid State: Passion Guitars
United Artists SS 18007

IN SEVERAL RESPECTS, this is the best sounding disc I've heard of the new breed of recordings beginning to use solid-state componentry in their process of manufacture. So impressive is the job this record does on upper-frequency transients of guitars and percussion, I am tempted to call the disc one of the best sounding I've heard—no matter what processing componentry was used. While my neck is out, I'll inch it forward a bit more with the following observation. Records utilizing solid-state electronics in most stages of production, if made the way United Artists makes them, will go a long way toward resolving arguments still in existence between proponents of transistor gear and those who prefer vacuum tubes in home music systems. If you want the best of both worlds, try this disc through a top-notch system using tubes and you'll see what I mean by the phrase. The combination is very effective. You'll get a cleaner top-end sound than you do with a conventional record while still enjoying the rounded warmth in the rest of the spectrum that tubes alone seem to be able to deliver. The recording curve is standard RIAA yet I find the treble variable roll off knob can be left in a flat position, something I cannot do with comfort with most pop records. That's as good a sign as any of the genuine cleanliness in the upper frequencies. Three quarters of the time in this album percussion in profuse variety occupies the spotlight with four classical guitars assigned to the melody of old standard pop tunes. Each guitar has its own condenser mike placed, in the accompanying photos at least, two inches from the player's right hand. The scraping and tinkling elements of the percussion section must have enjoyed a few more inches of room. Nothing on the record sounds tubby. It's just that the percussion has a slight advantage in transparency. Even if you now have a special stereo disc used primarily to check the response of your system with percussive instruments, get this album to find out how much difference solid-state processing can make in a reference record. C.S.

The Apple Tree (Original Broadway Cast)
Columbia KOS 3020

With the appearance of a new show by the team responsible for the long-running *Fiddler on the Roof*, the 1966-'67 season for Broadway musicals can be considered officially under way. Jerry Bock (music) and Sheldon Harnick (lyrics) are creators of musicals almost as well known to record buyers as they are to Main Stem habitués. *The Apple Tree* follows such worthy productions as the Pulitzer prize winning *Fiorello, Tenderloin* and *She Loves Me* in addition to the more recent *Fiddler*. Young Barbara Harris is very much the star in their latest musical. She has even more to do than in *On A Clear Day You Can See Forever*, her last major show. This is all to the good because her singing and acting talent is one of the very few tonic factors to hit Broadway in recent years. In her latest show the producers have solved one of the large problems facing the musical theatre today: a thin plot spread over an entire evening. *The Apple Tree* is made up of three separate stories, each one taking an act of the musical. The trio of tales is based on writings of Mark Twain, Frank R. Stockton and Jules Feiffer. Miss Harris and Alan Alda appear in all three "pocket-size" musicals while Larry Blyden joins them in the first two. Twain's *Diary of Adam and Eve* is easily the most appealing of the three stories and the most successful in establishing mood in the recorded form. The best songs of the entire production are to be found in this whimsical episode as Adam and Eve stumble upon bewildering discoveries that only initial humans had to cope with. A good example of the touching lyrics in this tale is a lullaby titled *Go to Sleep, Whatever You Are* and *It's a Fish*. Stockton's famous *Lady or the Tiger* is an excuse for exotic-type music befitting the gaudy trappings of an imaginary kingdom. Bock and Harnick are a little out of their element here. The third playlet, Jules Feiffer's *Passionella* gives Barbara Harris a field day as a necessarily dark-haired chimney sweep—yes, I said chimney sweep—who finds herself transformed in her dreams into an extremely blond movie star. Any original cast album is, at best, only a capsule version of a musical show. The coverage of three plots on one disc means the length of *The Apple Tree's* songs have had to be held down to a minimum. The record is over before you know it but this can be a considerable blessing if you've ever sat through a tedious show album with very little story line to sustain long songs. The sound provided for the home listener by Columbia's engineers is right up there with the very best they've ever done, which means it's as good as you'll hear in a musical on records. C.S.

Henry Mancini: Music of Hawaii
RCA Victor LSP 3713

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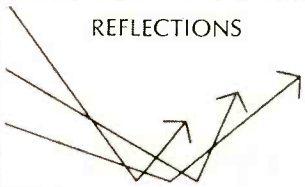
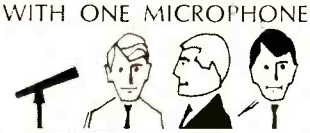
SITUATION	PROBLEM	CAUSES	SOLUTION
REFLECTIONS 	Feedback occurs where a so-called "cardioid" microphone is used and the speakers are placed to the rear of the microphone. A common occurrence in churches, auditoriums, and meeting rooms.	Sound bounces off hard surfaces on the walls, floor and ceiling, in and around the audience area and the microphone used is not effective in rejecting these sounds at all frequencies, and in all planes about its axis.	The Unidyne III rejects sound at the rear with uniformity at all frequencies. Sounds bouncing off floor or other surfaces are uniformly rejected.
 COLUMN LOUDSPEAKERS	Unexplained feedback. Column loudspeakers are used to distribute sound more evenly to the audience in churches and auditoriums.	Feedback occurs when rear and side sound lobes of column speakers coincide with rear and side lobes of so-called "cardioid" microphones.	The Unidyne III solves this problem because it has no rear or side lobes. Thus it rejects the side and rear lobes of the sound column speakers.
REVERBERANT BOOM!	A disturbing, echoing effect of low frequency sound often found in churches, large auditoriums, and arenas.	Low frequency reverberation and boominess occuring when microphone fails to retain unidirectional characteristics at low frequencies.	The Unidyne III maintains a uniform pattern of sound rejection at all frequencies, even as low as 70 cps. The response has a controlled roll-off of the low end—low frequency reverberation diminishes effect of boomy hall.

PROBLEMS CAUSED BY THE MICROPHONE'S INEFFECTIVENESS IN PICKING UP THE DESIRED SOUND

GROUP COVERAGE WITH ONE MICROPHONE 	A single microphone does not provide uniform coverage of a group. This is commonly experienced with choral groups, quartettes, instrumental combos, and speaker panels.	The particular "cardioid" microphone used lacks a uniform pickup pattern, so that persons in different positions within the general pickup area of the microphone are heard with varying tonal quality and volume.	The Unidyne III affords uniform pickup of the group with a resulting consistency in volume and sound quality among the members of the group.
USING MULTIPLE MICROPHONES 	Variation in the pickup level and tonal quality exists throughout the broad area to be covered. This may occur in stage pickup of musical and dramatic productions, panels and audience participation events.	The pickup pattern of the microphones used is too narrow, causing "holes" and "hot spots." The off-axis frequency response of the microphones also varies.	The Unidyne III permits smoothness in pickup as true cardioid pattern gives broad coverage with uniformity throughout coverage area. Eliminates "holes," "hot spots," and variations in sound quality, simplifies blending many microphones.
DISTANT PICKUP 	Too much background noise or feedback results when working with microphone at desired distance from sound source.	Long-range microphones are less directional with lower frequencies. Lobes or hot spots allow background noise or feedback.	Use the Unidyne III to gain relatively long range with effective rejection of sound at all frequencies at the rear of the microphone.

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Hawaii, Henry Mancini, in addition to leading the chorus and orchestra in his own arrangements, also found time to play an electronic harpsichord just coming on the market when the record was made. He performs at the keyboard of a Baldwin Solid Body Harpsichord. It's not exactly clear from the overall tonal effect of the album why he chose the instrument for Hawaiian music. Its full possibilities will have to await further exploration by other arrangers in some other musical context. According to a spokesman for Baldwin at their New York office, their new device weighs only 85 pounds in a body that is about 54 inches long. The keyboard is built to standard organ specifications. The strings are still plucked, but guitar-type pickups have replaced the traditional soundboard and a two-channel Baldwin amplifier has been added. Separate pickups at the center of the strings and at the bridge end give the player a choice of two completely different tonal effects. The range is five and three-quarter octaves and the tonal combinations, awaiting more exploration on future records, are brought about by mixing the pickup patterns with and without mute and multiplying them by the amplifier tone controls. Said amplifier also provides tremolo and reverberation. For the most part, Mancini uses the Baldwin Solid Body Harpsichord to produce the effect of a fuller-voiced lead guitar. In some selections, he settles for a quieter sound somewhat similar to the celeste. If there is a lot of flexibility inherent in the design of the instrument, it isn't particularly obvious in this album. Mancini at least breaks the ice. C.S.

Winchester Cathedral
Fontana SRF 67560

There are several reasons why this column makes little effort to discuss the topmost hit records on the popularity charts. These are the truly smash hits in popular music that come from nowhere only to disappear within a few months. In keeping up with such phenomena, the time element is more than I can hope to cope with. Only a weekly magazine could attempt to chart the meteoric rise and fall of an all-out crowd pleaser. The problems of reviewing such momentary favorites can be overlooked in the case of *Winchester Cathedral* on the Fontana label. Here is an exception to just about any rule you would care to mention. As performed by the New Vaudeville Band, the *Cathedral* may well revive a trend that could be with us for some time after this review reaches print. Music based on the styles of the 1920's and '30's has not been an unknown commodity on recent records but this disc is different on several counts. *Winchester Cathedral* is funnier than most throwbacks to the Twenties. An era that had its share of incongruous titles and inane lyrics in its popular songs has never been mirrored with such deadly accuracy by a young member of our generation. If you like 'em far out, this is the song for you. Geoff Stephens got the idea for the whole approach from lengthy listening to old 78 rpm discs dating back thirty or forty years. To get the right sonic effect when voicing his own "lyrics," Stephens obviously spent a good deal of time in the recording studios experimenting with mikes and filters. There is just a suggestion of the megaphone effect we used to get from crooners on old records. The dead-pan delivery clinches the matter. The rest of the album offers slightly less effective versions of actual songs of the era that are being spoofed in the main tune. C.S.

The New First Family, 1968
Verve 15054

The team of comedy writers responsible for the original *First Family* album is taking a somewhat more cautious course in its latest release. Bob Booker and George Foster are now aiming their barbs at an imaginary Washington administration instead of a real one and using the occasion to crowd in as many impersonations of show business folk as one record can hold. Some current political luminaries come in for their share of lampooning at the hands of skilled impersonators but the bulk of the material deals with prominent entertainers who are brought together to form a fictitious 1968 administration headed by Cary Grant. (It seems he was elected to the nation's highest office because of the way he says "Judy, Judy, Judy.") The rest of the idea behind the album is equally farfetched. Five New York actors imitate a staggering number of Hollywood and Washington celebrities. The impersonations range from average to startling in capturing the inflection of the original character. The best job of impersonation may be so regional that listeners across the country will not get the full flavor. New Yorkers, however, will get a kick out of Dave Frye's impression of William Buckley, who ran for mayor of the town in the last election here. Most of the material is bright and topical but in the final analysis the record will probably sink or swim on the strength of the impersonations. C.S.

Band of the Scots Guards:
Changing the Guard
Fontana SRF 67558

The full title of this release seems to have been dreamed up to produce a gleam in the eye of the typical sound fan. "The Pageantry and Color of Changing the Guard" is the legend on the cover that is spread in bold letters above the listing of the Scots Guards Band. The photo shows the band emerging from the courtyard of Buckingham Palace (the London residence of the Queen, you know) and immediately one begins to think of the wonderful sound we got years ago in the made-in-London album called *The Queen's Birthday Salute* (Vanguard VSD-2011). As it turns out, the major trouble this album has lies in the simple fact that the label says Fontana instead of Vanguard. Fontana, a division of the Mercury family of record labels, has had little or no experience in the production of sonic block busters. The quality of its pressings and the range of its frequency response have been a notch or two below the industry's best. The label has been able to get away with fairly haphazard pressings because its roster of artists has been primarily vocal talent aimed at the teen market. Here Fontana is sending a boy to do a man's job in engineering.

Recording a large band out of doors is not an easy task. Other labels have tried it from time to time but few, very few, have succeeded in emulating Vanguard's truly outstanding engineering performance in the Queen's Salute, taped way back in 1957. One would think that tape machines available to Fontana today could at least match those used by Vanguard in '57. The use of portable units by Fontana can not be ruled out but it doesn't seem likely. Fontana's disc apparently ran into several difficulties once the production got under way. The master tape is not up to snuff and neither is the pressing. The overall impression is of sound that is slightly off-mike, an out-of-focus effect that may be the result of the recording crew's inability to get their mikes into ideal positions. Another factor enters the picture but this one is hardly the fault of Fontana. The changing of the guard is nowhere near as exciting a ceremony in sonic terms as the Queen's Birthday Salute on the parade grounds of Hyde Park with its 21 gun salute and clatter of horses hooves on the hard pavement. In the area where the two discs can be compared on fairly equal terms—the sound pickup of the two bands—this new release just doesn't meet its promise. The musical program by the Scots Band is a relatively tame one. As for the ceremony, the bulk of it is covered on side one of the disc with descriptive commentary by Major A.J.R. Harrison punctuated by the throat-shattering commands of the drill sergeants. Then the band takes over on side two with a diversified concert that finds Sibelius and Mozart rubbing shoulders with composers-for-the-military. C.S.

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John Coltrane: Live at the Village Vanguard Again!
Impulse Stereo AS9124

Given the combination of an engineer who is more intent on recording music than club atmosphere and a serious group of sophisticated listeners who know when to remain silent, it is apparently possible to make recordings of decent quality in a night club. From the standpoint of technical quality, the present release will stand comparison with some of the best studio work. Musically, it is a further adventure in Coltrane's continuing creative quest for newer forms and more meaningful expression. As on the recent *Meditations*, Pharoah Sanders is on tenor. Once again, it is clear that these two men make a splendid team. Jimmy Garrison, bass, two drummers, Rashied Ali and Emanuel Rahim, and Trane's wife, Alice, make up the balance of the group. In the disc's major opus, a new version of *My Favorite Things* that begins on side one with a five-minute introduction for bass solo and extends over the entire second side. Coltrane is heard on bass clarinet in a lengthy dialogue with Sanders who switches to flute for this portion of the main piece. Earlier in the work Sanders plays tenor against Coltrane's soprano sax. The other number is Coltrane's *Naima*. Together they make a very moving experience. B.S.

Archie Shepp: Live in San Francisco
Impulse Stereo AS9118

The past two years have seen substantial development in Shepp's ability to organize his ideas and present them in a succinct framework. With this release it becomes clear that Shepp is out of the young talent department and can now be considered one of the major creators of the new jazz. He has achieved the kind of dynamic balance between pace and poise that makes possible complete artistic statements instead of the comments-in-passing that are often interjected into the frenetic rush that characterizes much of the new music. In addition to his work on tenor, Shepp demonstrates a fine sense of keyboard color in his reworking of Oley Speaks' *Sylvia*. Roswell Rudd, trombone, Beaver Harris, drums, and Donald Garrett and Lewis Worrell, bass, make up the balance of this smoothly functioning group. Shepp devotes one of the six bands on this new set to the recitation of his poem, *The Wedding*. It is read by its author to a lovely bass accompaniment by Worrell. B.S.

The Jazz Legacy of Bud Powell
Verve Stereo VSPS-34

Ten solos recorded between 1949 and 1956 have been gathered together and reprocessed in pseudo stereo as a memorial to the great jazz pianist whose tragic life ended in August 1966. Included are some of the most memorable Powell numbers, such as *'Round Midnight* and his own *I'll Keep Lovin' You* and *Parisienne Thorofare*. The spread-out sound of this artifically created stereo results in some rather diffused vocal sound when Powell hums as he plays, but the brisk fingerwork comes through cleanly, and the accompanying bass and drums are unblurred. George Duvivier, Percy Heath, and Ray Brown alternate on bass, and the drummers include Art Taylor, Max Roach, Osie Johnson, and Kenny Clarke. B.S.

Ella Fitzgerald: Whisper Not
Verve Stereo V6-4071

Consistency is one of the hallmarks of Ella Fitzgerald's familiar style. Everything she touches is transformed into first class material by her unerring sense of expression, tempo, rhythm, mood, inflexion, inuendo, and what have you. No Ella platter is ever less than superb, and the fact that there are a couple of dozen discs by this great lady that are just as good as the present offering shouldn't deter anyone from acquiring this beauty. A full dozen numbers includes such varied fare as *Sweet Georgia Brown, Whisper Not, I Said No, Thanks for the Memory, Spring Can Really Hang You Up the Most, Old MacDonald, Time After Time, You've Changed, I've Got Your Number, Lover Man, Wives and Lovers*, and *Matchmaker*. The recording is as fine as can be hoped for, and the rather large band under Marty Paich includes some of the best sidemen in the business. B.S.

Stan Getz and Laurindo Almeida
Verve Stereo V6-8665

This album represents one of those rare instances when the whole is greater than the sum of its parts. It has been years since Getz has done anything this good, and Almeida, for all of his Brazilian origin, has never before shown such mastery of his native style. The rest of the group is dedicated to supplying rhythmic support. It is made up of George Duvivier, bass, Edison Machado, Jose Soorez and Dave Bailey, drums, and Luiz Parga and Jose Paulo, Latin percussion. The recorded balance places Getz and Almeida smack in the center with lots of crisp percussion emerging from each side. Everything is bright, alert, and relaxed. But relaxed certainly doesn't mean listless in any sense. It's all very free, lithe, and supple. B.S.

Willie Bobo: Feelin' So Good
Verve Stereo V6-8669

With his third Verve album, Willie appears to have graduated from the status of first among equals that is normally accorded the leader of a jazz group and has stepped into the position of a pop star whose eminence makes any mention of his collaborators unnecessary. At least one might gather that idea from the jacket and label copy. From the music one can only conclude that Bobo is still playing the same kind of Latin jazz that was so welcome on his earlier discs and that adds so much color when he turns up in the percussion section of someone else's combo. This time he contributes a couple of pleasant vocals, one in Spanish, titled *Dichoso*, the other, in English, is Lennon and McCartney's *Yesterday*. Another innovation is the addition of a small studio audience to help "simulate the excitement of a live dance hall on this record date." Much as I deplore audience noise in live recordings, I must admit that when the sounds are deliberately incorporated into a performance, they are a legitimate effect, and Bobo has utilized them tastefully. I do hope; however, that such studio audience sounds do not set a trend. For all of their anonymity on the jacket, Bobo's companions on this new release sound very much like the nine men on *Uno, Dos, Tres*, and the sound on this new platter is almost as good as that on the earlier winner. B.S.

Kai Winding: More Brass
Verve Stereo V6-8657

A very baroque sounding introduction for solo harpsichord to *September Song* startled me into thinking that I had a wrong pressing. When a vocal group introdced the melody, I knew I had the right disc, even if it was very different from the kind of sound I had anticipated. This is a very far cry from Kai's recent *Dirty Dog*. That offering had four trombones; the present set has seven plus two bass trombones, guitar, bass, drums, tympani, bongos, two pianos alternating with two harpsichords, and the previously mentioned clutch of vocalists. Arrangements for this combination can be a bit tricky, and as a result this release turns out to be a showcase for its six arrangers, rather than for its performers. *September Song* and *Walk on the Wild Side* are Oliver Nelson arrangements. Wayne Andre contributes versions of *Laura* and *I'm Getting Sentimental Over You*, Dick Lieb offers *Star Dust, Stella By Starlight*, and *Strange*. Claus Ogerman sets *More* (from *Mondo Cane*) and *Harper: Invitation* is a Bobby Scott arrangement, and *It's All Right With Me* is heard in Winding's own version. B.S.

Tim Buckley
Elektra Stereo EKS 74004

A folk-rock singer-guitarist with a rich repertory of original compositions whose lyrics are filled with colorful imagery, Buckley is capable of a wide range of expression, and his vocal delivery is notable for its immaculate enunciation. His accompaniments consist of a strongly rhythmic guitar, bass, keyboard, and percussion group. In several cases, these forces are superimposed on a string section playing a long, sustained line. The effect is particularly suited to the material Buckley has written. The sound has the bright, forward quality that we expect from Elektra. B.S.

ABOUT MUSIC

Harold Lawrence

The Perils of Tape Splicing—(Or) The Operation Was Successful But The Patient Died

One of the games movie-buffs play is called—Spot the Editor's Blunders. Girl enters dressed in dark suit, camera pans in for close-up of head, long shot follows, girl now wearing *light* suit. Errors like this happen in the best of studios. Less easy to detect are variations in mood, background, and other subtle differences from shot to shot. Example: Two men arguing, first man facing cameras; switch to new angle, first man's back now to camera, dialogue continues uninterrupted. Suddenly we are aware that something odd has happened: the first man's body has gone slack, he is no longer leaning forward, and his arms, previously stiff with anger, hang relaxed at his sides. Obviously this is an inserted shot which the director hadn't bothered to check out carefully and which escaped the notice of the film editor. Drama critic Walter Kerr's description of a voice-view mismatch in *The Night of the Iguana* bears on all such examples of the faulty editing: ". . . illusion jars to a stop as though someone had pulled the emergency cord on a subway train."

Faulty editing in recordings of concert and operatic music is a more elusive affair. On screen, angles shift continually; in recording, our perspective remains, or ought to remain, the same throughout the work. However, a tape mismatch can be as jarring as its film counterpart.

If you never have been aware of tape splicing, don't read this article. You will begin to hear all sorts of things that may spoil your enjoyment of records. But if you must go on reading, here are some of the defects you probably will run across.

To the untrained ear, the most obvious tape bloopers involve outright mutilation of the score: the splice point occurs in the middle of a passage of sixteenth-note runs. In cutting from one take to another, the editor inadvertently has snipped off part of the outgoing take, or cut too late into the incoming take. The result: a tiny part of a sixteenth note is missing from the edited tape. The visual equivalent of such an error is the skipping of frames in a moving picture.

Another flagrant case of poor splicing, probably the most common, is the acoustical mismatch. This defect occurs frequently in the recording of operas and oratorios, where for economic reasons, sessions are planned so that numbers with chorus are recorded on certain days; recitatives with bass and harpsichord accompaniment, and arias and ensembles with full orchestral background, on other days. In piecing together the various numbers, the editor often finds that the recording producer had neglected to call for an "overlap," the few measures preceding the movement to be recorded. Without this overlap, the decay of the preceding music is missing from the opening bars of the number following; the notes are all

there, but not the overhang. The drop-out of background may last no more than a fraction of a second, but it is almost as conspicuous as the "beep-beep" of the television censor at a particularly ribald moment of the Johnny Carson Show.

Dead space, tape recording's zone of silence, is present in some recordings for a more prosaic reason: the tape join is imperfect. Either the editor has not quite brought the butts together or the tape has stretched away from the splice point on both sides of the cut because the adhesive coating of the splicing tape contained too much liquid. Adhesive "bleeding" also contaminates other parts of the reel by pulling away the iron-oxide particles of neighboring layers of tape which is why partial drop-outs often crop up around poor joins.

Any amateur can learn to perform the basic steps in tape editing. But it takes a trained musician to edit the tapes of a musical performance and come up with a master that is completely free of the many kinds of subtle musical distortions that still turn up in classical recordings, despite the advances in other aspects of the art of recording.

If the defects are that subtle, are they really worth examining? It is a well-known fact that a skillful and sensitive editor can always produce better results with the same set of unedited reels than a non-musical editor. The latter may emerge from his editing room with a master containing not a single drop-out, snip, bump or skip; in fact, you can't hear the splices at all. But the tape could still fall short of the mark.

Recently I heard a recording that could be used as an object lesson in how *not* to edit tape. To the casual ear, nothing would have sounded wrong; but careful listening revealed all the telltale seams of an inept assemblage of takes. The editor obviously had been handed a pile of tapes containing numerous re-takes of movements and parts of movements; and the variations in tempo, balance, and intensity were incredible.

Conductors have been known to change tempo in midstream, but no conductor could have brought about, or would have wanted to bring about, the instantaneous changes in speed, volume and instrumental balance that were present in this recording. Tempos shifted gears in mid-phrase, over-all levels rose and fell, and instrumental lines seemed to pop out of nowhere and then disappear.

Even if you couldn't spot all the editing faults, you probably would be aware that this recording has a cool impersonal quality. Maybe the performance was to blame. But the unedited tapes might have contained first-class material which the tape editor assembled poorly. At the recording session, perhaps the conductor listened to playbacks with the recording director and chose the preferred takes for the final *montage:* "Use the second take for bars one through twenty-four, the first till bar forty-eight, and the fifth for the rest of the introduction." Now each take by itself might have been technically and musically excellent, but could the takes be pieced together exactly as the conductor outlines? Would the tempos match? And what about the intensity; would the music lead smoothly from one splice to the next?

Obviously it is dangerous to make the final editing decision at the session. Each segment of tape in an edited reel may be free of defects, have the conductor's stamp of approval, and still fail the ultimate test.

The first thing a competent editor must do is to select the best over-all performance after hearing and re-hearing each take. If he is lucky, the producer will have captured the work on tape in one flawless take. Recordists call this the basic take; that is, when both the notes and spirit are present. Having isolated the basic take, the next job is to replace obvious blemishes with perfect retakes; the horn clinker, the cracked oboe note, the buried inner voice to be brought out, the imperfect ensemble in an a *tempo* bar, or the extraneous noises that plague recordings made on location in concert halls, churches, and other rooms not originally designed for recording.

If this was all a tape editor did, you would have the right to call him a musical cosmetician. However, his job is to help the conductor and the recording director achieve the flow, clarity, and *expression* which will make the finished recording not only a faithful representation in sound of the musical score, but a performance of integrity and conviction.

I am not going to discuss the question of whether an edited tape is preferable to a "straight" performance. That is a subject in itself. But if edit you must, make sure you know how to put the musical body together again after you've dismembered it. AE

Equipment Profile

SOLID-STATE KNIGHT-KITS— KG-895 INTEGRATED AMPLIFIER KG-790 AM-FM TUNER

Fig. 1. The Knight-Kit KG 790 tuner shown in its optional walnut enclosure.

Those who have followed the kit market cannot help but notice the increasingly higher quality of recent models. In the case of Knight-Kits, the introduction of the KG-415 Tape Recorder was a turning point—no one will deny that the electronics of the 415 are excellent, and the combination of the established Viking transport with the well-designed electronic chassis results in a great instrument.

We mention the 415 because of the similarity of some of the elements of it with those of the KG-895, since the preamps in the latter appear to be identical to those in the recorder. Furthermore, the over-all apeparance of the panels of the recorder and the amplifier are sufficiently similar as to make them an ideal matching combination. The KG-790 tuner panel is a perfect match for the amplifier—same size, same design, and same type of knobs. If we sound enthusiastic over these units, it is because we are.

The KG-790 Tuner

Of the two units, the tuner is the easier to construct because the entire FM-front-end-and-i.f. section is completely factory-wired, and simply mounts in a cutout on the chassis. The builder has only to construct the AM section, the multiplex section, and the chassis wiring, and the job is complete. The instructions are superbly detailed and we found absolutely no errors in them, nor did we find any steps which we would consider out of order to make the job easier to complete. This is in itself unusual, and of course the ideal condition, for kits are designed not for the experienced builder, but for the novice, and while an experienced builder might have no trouble even if there were errors or out-of-order steps, it is likely to frighten the novice if he finds some step difficult or almost impossible.

The circuit employs 22 transistors and 13 diodes, three of the latter in the power supply section. Both AM and FM sections have r.f. amplifiers, and four i.f. stages are used for FM, only two being required for AM. In the FM circuit, a.g.c. voltage is fed to the r.f. amplifier from the first i.f. stage, and a.f.c. is provided by a d.c. feedback loop from the ratio detector to the oscillator in the front end. The multiplex section is reasonably conventional for a solid-state tuner, except that the switching of the 19-kHz doubler is effected by a pair of transistors actuated by the a.g.c. voltage. Thus unless there is adequate signal, the set remains in the mono mode; not only does the 19-kHz pilot signal have to be present, but the over-all signal level has to be at a preset value. The 38-kHz switching signal is derived directly from the pilot through a doubler, and no 38-kHz oscillator is employed. Two other transistors are used in the muting circuit, and in the presence of a low level of signal, they cut off the collector voltage supply to the last i.f. stage and the first multiplex stage. These muting transistors are controlled by the third i.f. stage. In this circuit, all of the i.f. stages act as limiters, and consequently there is a control voltage available from any one of them. The muting level is settable by a panel control, and one panel-mounted switch controls a.f.c., while another switches in or out the SCA filter. One additional transistor is used for turning on the stereo indicator light, and separate output stages are provided for the right and left channels, of course.

Two outputs are provided for each channel—one for the normal amplifier input and one for a tape recorder. In addition to separate level controls for the two output channels, there is another level-set control for AM. A rotary function switch with four positions—off, AM, FM, FM Stereo controls the circuitry and indicator lights show which position it is in.

In performance, the KG-790 leaves little to be desired. Its IHF usable sensitivity is approximately 2.5 μV, with i.f. rejection of greater than 80 dB, and AM rejection of 37 dB. Audio output measured approximately 1.0 V, both on AM and FM. AM sensitivity for 20 dB quieting measured at 3.4 μV. Both circuits are relatively wide-band, and the 10-kHz rejection filter in the AM side is needed because of the response. FM i.f. bandwidth is about 300 kHz at 6 dB down, and the detector bandwidth, peak to peak, is slightly over 600 kHz. Stereo separation measured 43 dB, and 19- and 38-kHz suppression was better than 50 dB.

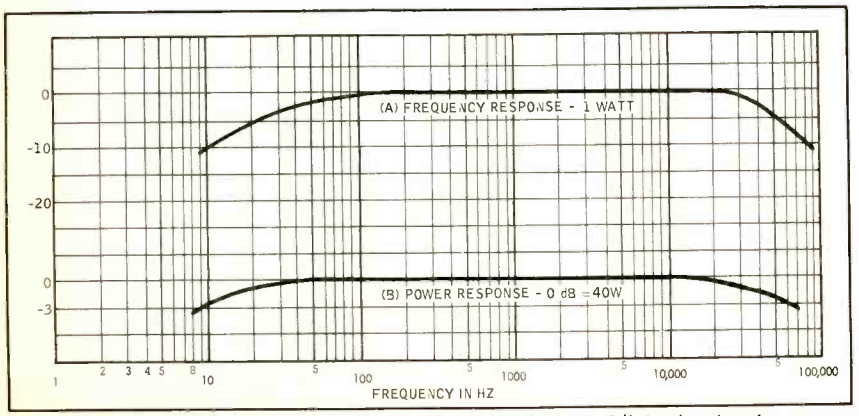

Fig. 2. The Knight-Kit KG-895 amplifier's power and normal-listening-level response.

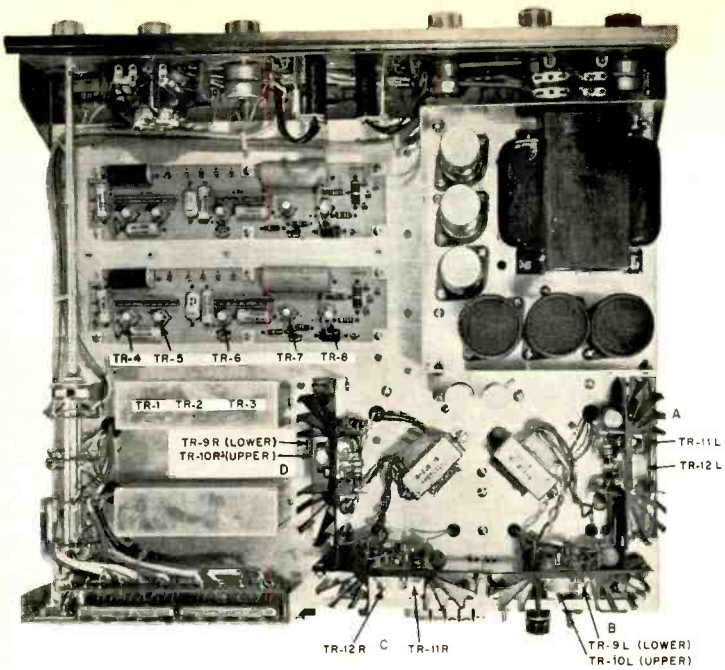

Fig. 3. A topside view of the KG 895 showing the circuit layout. The preamp circuit boards and power supply are evident. The lower right corner shows the array of heat sinks that hold the power transistors.

Construction

As previously noted, construction is relatively simple. Both the multiplex section and the AM tuner are constructed on printed-circuit boards, and the chassis is well laid out and easy to wire. One innovation is the use of Nylon cable clamps (which we first saw in the KG-415) that keep the wiring neat and almost professional in appearance. As there is no alignment of the FM front end or the i.f. strip, getting the tuner in operation is a cinch. The AM section aligns quite simply, requiring only the adjustment of one coil and three trimmers to ensure dial calibration. There are four coil adjustments and one potentiometer setting in the multiplex section, and these are aided by a test switch. Sliding the switch to position "A" enables one to adjust two coils for maximum indication on the tuning meter, showing the correct alignment of the 19-kHz circuits; then with the switch in the "B" position, two other coils are similarly adjusted, still using the tuning meter for indication of optimum setting. The potentiometer is then adjusted on a stereo station so that the indicator light just goes on. This should be done on a station of medium signal strength.

On the whole, this tuner represents a good value at $139.95. Another $19.95 gets you an oiled-walnut wood case.

The KG-895 Integrated Amplifier

Here is a kit amplifier which includes most of the features usually found only on the more elaborate factory-built units —illuminated windows to indicate the signal source, loudness control of the contour-switch type, speaker switch which cuts off all speakers for headphone listening, remote/main speaker switch, high-cut and lo-cut filter switches, tape-monitor switch, and even a speaker reversing switch for one channel to correct phasing. And with all of this, a total of 120 watts music power—40-watts continuous sine-wave power output per channel, and all for $149.95.

Referring to *Fig.* 4, across the top are the balance control, dual concentric bass and treble tone controls, the six indicator-light windows, level control, loudness switch, and selector—a six position switch with no stops so it can be rotated continuously. On the lower row are the phone jack, speaker on/off switch, remote/main speaker switch, stereo/mono switch, power switch, channel reverse switch, hi-cut and lo-cut switches, and the tape monitor switch. The phase reversing switch is on the rear apron, and on the input panel on the rear are separate input level-set controls, one for each channel on phono, tuner, and the aux inputs. Also provided are two convenience outlets, normally with one switched and one "hot" although instructions are given for making a simple change which will make both receptacles hot. Separate input pin jacks are furnished for feeding a recorder and accepting its output wired to the monitor switch.

The unit employs a total of 26 transistors—eight of them power types—and eight diodes. Input switching and equalization changing take place around the input module, which consists of three transistors (the same module as in the KG-415) followed by a driver panel on which are five more transistors per channel. Four power transistors per channel are used in the output stages, with each pair on a separate heat sink. These sinks are mounted over appropriate openings in the chassis for ventilation. The output circuit is similar to that used previously in Knight-Kit amplifiers, and uses a transformer between the driver and output stages. One half of each output stage is positive with respect to ground and the other half is negative, the junction between them being essentially at 0 potential for d.c., but at the speaker signal level for a.c. There are no output coupling capacitors, (which introduce a comparatively high impedance in series with the speakers at low frequencies), but instead are two 2-amp. circuit breakers, one in each channel. In case of a shorted speaker line, or a too-great signal, these circuit breakers open up for about three seconds and then close again. If the short still exists, or if the high signal is still present, the breakers will open again. We have kept them opening and closing for several minutes with no apparent damage, both with the speaker line shorted (accidentally, we admit) and with an excessive signal level.

The loudness-control circuit is interesting in that it permits the user to set it at 5, 10, or 15 dB below normal high listening level when it is desired to listen continually to the lower levels. Thus the degree of compensation is not dependent on the setting of the volume control, but only on the setting of the loudness switch. This is a desirable feature, in our opinion, because the user is likely to listen for a long period at the lower level—such as late at night—and would want everything compensated for the lower level, rather than being dependent on the volume-control setting.

In performance, the KG-895 is consistent. It doesn't make much difference whether both channels are putting out the maximum signal or only one—the distortion remains about the same. With both channels fully driven, the power output per channel is about 1 dB less than with only one channel operating. The half-power points are at 9 Hz and 65 kHz, which is excellent. Frequency and power response are shown in *Fig.* 2, the former at 1 watt. Both channels measured within ½ dB of each other, in high-level and low-level positions,

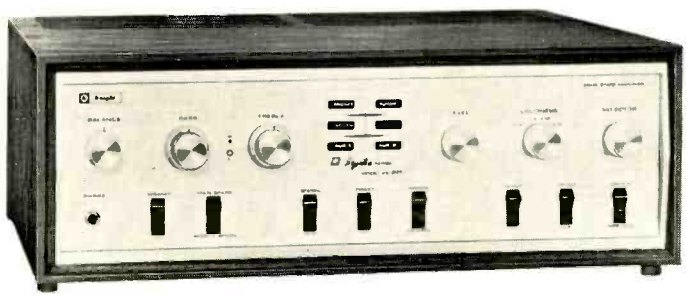

Fig. 4. The Knight-Kit KG 895 Integrated Amplifier shown in its optional walnut enclosure.

with volume-control tracking within 2 dB throughout (to —40 dB). Loudness-control bass boost measured 3, 5½, and 7 dB at 50 Hz for the +5, +10, and +15 settings of the switch. Specifications claim a harmonic distortion of 0.7 per cent at 40 watts output with both channels operating. This figure was met easily, and the figure remained at that value down to about 10 watts, then lowered to 0.5 per cent at 1 watt. IM distortion 0.9 per cent at 40 watts output per channel, with both channels operating.

Hum and noise measured 67 dB down on phono, referred to a 10-mV input signal; the high-level inputs ranged between 70 and 75 dB; tape head was 62. Separation at 1000 Hz was 57 dB, and the output for a tape recorder was just over 0.5 volts.

As a general purpose amplifier for stereo use, the KG-895 offers excellent value; as a companion for the KG-790 tuner, it is a perfect match. It was not difficult to build, and from the first time it was turned on, it worked and tested as indicated.

Check 1

Shure V-15 II Stereo Cartridge

As phono cartridges get better and better, we find ourselves with less and less to say. Perhaps ultimately we will get to one-sentence reviews. This report is short because we find this new version of a cartridge we already liked a significant improvement.

We refer you to James Kogen's articles in November and December 1966 for a complete discussion of the technical development of the V-15II. The frequency response and channel separation shown in *Fig.* 6 is self-explanatory.

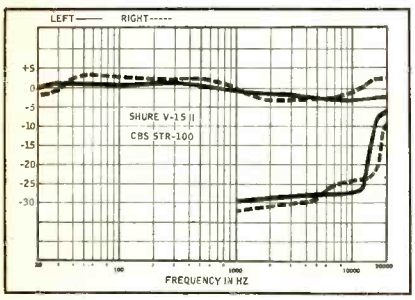

Fig. 6. Frequency response and channel separation of the Shure V-15 II. The test record is the CBS STR-100.

So are our other measurements:

Dynamic compliance—6.5x10⁻⁶ cm/dyne vertical or lateral.

IM Distortion, CBS-STR111—
+ 6 dB is 1.3 per cent
+ 9 dB is 1.8 per cent
+12 dB is 2.5 per cent
+15 dB is 4.2 per cent

Output—Left channel is 4.2 mV; right channel is 3.8 mV, referred to 3.54 cm/sec. recorded velocity at 1000 Hz.

These are fine figures. Add to them a square wave that confirms the above 20-kHz resonance that is apparent on the frequency-response curve and you come up with a first-class cartridge.

This gives only a hint to the superb sound that this cartridge extracts from a disc. The fact is that we are hearing things more clearly than we have heard before. And that is what an improved model is supposed to do.

The biggest audible improvement is on the higher frequencies. Where the older cartridge tended to touch a bit of *edginess;* there is no such case here. The V-15II is as sweet as you could want.

That says a lot and it says all that

Check 2

* * *

Purchasers of the Shure V-15 II are entitled to send away for a free 12-in. record designed to test the tracking capabilities of a cartridge. The record contains a series of musical samples, instruments selected to display specific tracking problems. Within each series there are several bands of progressively increasing loudness. The object here is to see if your cartridge will track all the bands successfully. The design of the record is such that small tracking errors will show themselves readily.

Our Shure V-15 II sailed through the record with near perfection. Of several other cartridges tried, one other also did so; some others revealed one or more slight deficiencies.

We believe that this is an impartial and valuable tool. With this record, any number of cartridge faults may be isolated. (And identification is the first step to cure.) V-15 II owners get the record free as we said. Non-Shure purchasers may have the record for $3.95. Order it directly from Shure Bros., 222 Hartrey Ave., Chicago, Illinois.

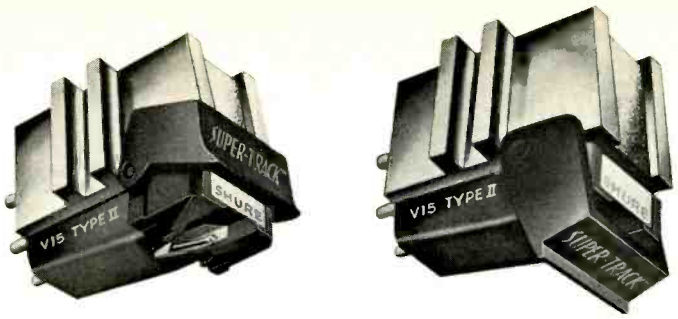

Fig. 5. The Shure V-15 II Stereo cartridge. The two photos show the built in "flip-action" stylus guard in playing or protecting positions.

IMC Boxer Fan

Do we have to tell you that even in this age of cool-running (relatively) transistor gear, proper ventilation of audio equipment is necessary?

But this is not always possible. The demands of decor, particularly when promoted by the hobbyist's distaff side, can be quite overwhelming. So the alternative soon becomes some form of forced-air cooling.

No one has ever discovered a method for moving air violently without making some sound. But careful design of the parameters of blade pitch and motor/blade balance can make significant strides over the usual kind of fan. Then too, the common household fan is simply more than is needed for discrete cooling.

This Boxer fan from IMC Magnetics is a specific product made to do a specific job. It will not cool a room; it's not meant to. But it can be placed in an enclosed cabinet where it will exhaust warm air (improving tuner stability, amplifier power output, and general component reliability). And it will do this with a minimum of noise and vibration. We were frankly surprised at the degree of quietness possible.

We do not have proper facilities to measure the cfm output of the fan. But it seems to us that it will be quite sufficient for a hi-fi cabinet or a television set. And installed properly with the mounting accessories supplied, it will produce very little noise. In fact our installation on the back of a Heath color-TV produces so little sound that it has proved no problem at all.

Check 3

Fig. 7. In addition to these parts the accessories included with the IMC Magnetics' Boxer Fan include an adhesive strip of sponge-type rubber.

Alabama
BIRMINGHAM
Likis Stereo Center
DECATUR
Forbes Distributing
DOTHAM
Wiregrass Electronics
HUNTSVILLE
Electronic Wholesalers
Industrial Electronics
MOBILE
Electronics World
Specialty Distributing Co.
MUSCLE SHOALS CITY
Sound City Electronics

Arizona
GLENDALE
Merritt Electric
PHOENIX
Arizona Hi Fi
Goway Dept. Store
Woolco Dept. Store
SCOTTSDALE
Empire Audio
Goway Dept. Store
TEMPE
Woolco Dept. Store
TUCSON
Save-Co Dept. Store

Arkansas
PINE BLUFF
Raley House of Music

California
ANAHEIM
Anaheim Electronics
Henry Radio
Save-Co. Dept. Store
White Front
AZUSA
Rancho Sound
BERKELEY
Cal Hi Fi
Robert E. Lee
Pacific Electronics
BEVERLY HILLS
Sound Center
CAMPBELL
Alco Home Electronic Center
CANOGA PARK
White Front
CARMICHAEL
Cal Hi Fi
CASTRO VALLEY
Audio Emporium
COSTA MESA
White Front
COVINA
Acorn-Gem
White Front
WEST COVINA
Save-Co Dept. Store
CULVER CITY
Barshel's
DOWNEY
White Front
FRESNO
White Front
GOLETA
Disco Fair
HERMOSA BEACH
Active Sales & Equipment
HOLLYWOOD
Hi Fi Corner
Yale Radio Electric
INGLEWOOD
Acorn-Gem
Inglewood Electronics
Olson Electronics
LA MESA
White Front
LONG BEACH
L. M. Barcus
Acorn-Gem
LOS ANGELES
ABC Premiums
Acorn-Gem
Bel-Air Camera
Henry Radio
Save-Co. Dept. Store
Shelley's Stereo Hi Fi Center
Warsco Sales
White Front
MONTEBELLO
Coastron
MOUNTAIN VIEW
Alco Home Electronic Center
Audio Video Forum
Cal Hi Fi
NORTH HOLLYWOOD
World Electronics
OAKLAND
Fisher Electronics
White Front
ONTARIO
White Front
OXNARD
Disco Fair
PACOIMA
White Front
PASADENA
Acorn-Gem
PICO RIVERA
Save-Co. Dept Store
PLEASANT HILL
White Front
RICHMOND
Pacific Electronics
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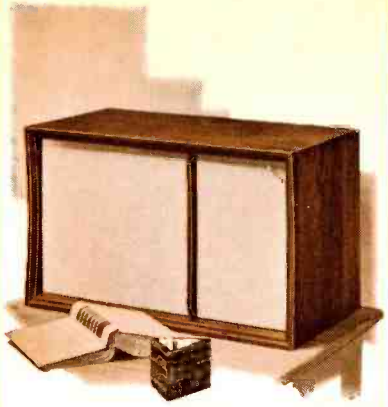

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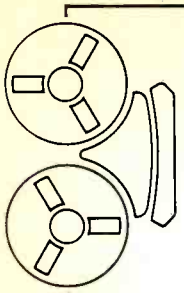

Tape Guide

HERMAN BURSTEIN

If you have a problem or question on tape recording, write to Mr. Herman Burstein at AUDIO, 134 North Thirteenth Street, Philadelphia, Pa. 19107. Please enclose a stamped, self-addressed envelope. All letters are answered.

Q. I have been told by a friend that when I make recordings at 3.75 ips I should turn the treble control of my hi-fi preamp way up, and when I play the tape I should turn the treble control to its normal position. This is supposed to make the normally higher hiss level (at 3.75 ips compared with 7.5 ips) less noticeable. Is this correct?

A. A good modern tape recorder provides adequate treble response at 3.75 ips. In fact, there is often a tendency to peakiness in the treble range. Following your friend's advice will get you into trouble on two counts: (1) You will exaggerate the treble peak. (2) Additional treble emphasis when recording will overload the tape, making for excessive distortion. If, nevertheless, you do follow your friend's advice, then in playback you should turn the treble control "way down" instead of to normal (flat) position. I also have a question whether turning up the treble control of your hi-fi preamp will emphasize the high frequencies of the signal going into the tape recorder. Most hi-fi preamps feed the signal to the tape recorder from a point ahead of the preamp's tone controls.

In fairness to your friend, I should mention that some special professional machines do employ his stratagem, except that a special type of treble boost is used in recording. Here the treble boost is mainly in the mid-high frequencies, around 3000 Hz, where hiss and noise are most pronounced to the ear. Treble boost in this region is less apt to raise the problem of distortion than at higher frequencies. In playback, the special machines provide corresponding treble cut in the region around 3000 Hz.

Q. My tape recorder has separate record and playback heads, but not separate record and playback amplifiers to permit monitoring. I plan to add a tape playback preamp to permit monitoring. The tape recorder has two pairs of output jacks, one pair marked tape amp out, and one pair marked monitor head. My hi-fi system preamplifier has a pair of input jacks marked tape amp, and a pair of jacks marked tape output. The preamp has a tape-monitor switch. How shall I connect my tape recorder, the tape playback preamp, and the hi-fi preamp so that I can use the tape-monitor switch for instant monitoring? How does all this work?

A. Connect the monitor-head output of the tape recorder to the tape preamp. Thus the signal travels from the playback head to the monitor-head output and thence by cable to the tape preamp, which supplies amplification and equalization. Connect the output of the tape preamp to the tape-amp input of your hi-fi preamp. Thus the signal travels by cable from the tape preamp to the hi-fi preamp. When you move the tape-monitor switch to the tape-playback position, the signal going into the tape-amp input is connected to the electronics of the hi-fi preamp, which amplify and otherwise modify the signal and pass it to the unit's output, from where it ultimately goes to the power amplifier and speaker. When you move the tape-monitor switch to the monitor position, the signal coming into the hi-fi preamp from a tuner or other source is connected to the preamp's electronics for amplification, and so on. The tape-output jacks of the hi-fi preamp should be connected to the input jacks of your tape recorder.

Q. I am what you might call an enthusiast about tape recording and would like to learn as much as possible about it. Perhaps you could refer me to some up-to-date literature on the subject. I am particularly interested in the technical aspects and theory of the recording and playback processes.

A. You may find the following helpful: W. Earl Stewart, *Magnetic Recording Techniques* (McGraw-Hill Book Company, Inc., New York City; $8.50); Eastman Kodak Company, *Some Plain Talk From Kodak About Sound Recording Tape* (Rochester, N. Y.; free; deals with the magnetic recording and playback processes as well as with tape); Herman Burstein, *Getting the Most Out of Your Tape Recorder* (John F. Rider, 116 W. 14th St., New York City; $4.25); Herman Burstein and Henry C. Pollak, *Elements of Tape Recorder Circuits* (Gernsback Library, 154 W. 14th St., New York City; $2.90).

*Q. I have been using a **** tape recorder into a **** preamplifier. The results have been less than satisfactory. There seems to be a considerable loss of signal level and of high frequencies. The recorder is connected through about 4 feet of standard shielded cable to the tape input of the preamplifier. Even with the recorder's playback volume control near maximum, it is necessary to turn the preamp volume control much higher than the setting required for the tuner and the phonograph. The sound is more satisfactory when I bypass the preamplifier and power amplifier of my audio system and connect my speaker directly to the speaker output of the tape machine. Any suggestion you can make will be appreciated.*

A. There may be a wiring fault in the tape input of the preamplifier. Check this by connecting the "preamp output" of the tape machine to a different high-level input jack of the preamplifier, such as the radio input. There may be a fault in the "preamp output" of the tape recorder. Check this by connecting the "speaker output" of the recorder to the preamplifier. There may be a fault in the cable between the tape machine and the preamplifier.

Q. I have been wondering whether any standard procedures exist for measuring signal-to-noise ratio in tape recorders. What method is employed by AUDIO *for its* PROFILES? *As nearly as I can determine, most manufacturers' ratings are based on measurements made with a signal recorded at such a level as to produce 3 per cent total harmonic distortion on the tape. Since the normal practice is to reduce the maximum record level approximately 10 dB from the level corresponding to 3 per cent T.H.D., it follows that the practical or useful signal-to-noise ratio is also reduced by about 10 dB. It would also seem that it is common practice for manufacturers to use a weighting network when making their measurements. The weighting network tends to reduce low- and high-frequency noise at the input to the measuring device, while passing the 1000-Hz signal at a relatively unattenuated level. The resulting signal-to-noise ratio is impressive but has little practical significance to me as an individual playing back tapes through a wide-range reproducing system. In a bulletin on its low-noise tapes, the 3M Co. specifies values for an R-C network to be used in making signal-to-noise measurements. Is this network to be considered as a standard one by all parties publishing such measurements?*

A. Let me get a breath and I'll try to answer your complex of questions.

You are right in that most manufacturers of tape recorders, at least high-quality ones, base the signal-to-noise specification upon the recording level that produces 3 per cent harmonic distortion on the tape. For example, Ampex and Tandberg do. Sometimes the reference level is the tone on the Ampex test tape which contains 1 per cent distortion. The difference between the 1-per cent and 3 per cent recording levels

is about 6 to 8 dB. Hence if the signal-to-noise ratio is stated with respect to the tone on the test tape, one can add 6 to 8 dB in order to place the ratio on the basis of 3 per cent distortion. Sometimes the ratio is stated with reference to the recording level which results in a 0-VU indication on the recording-level indicator; this level can be almost anything. In a high-quality machine it is usually the recording level that produces 1 per cent harmonic distortion on the tape; so again you can add 6 to 8 dB to get back to a ratio based on 3 per cent distortion. I am not sure what the PROFILE writers do in measuring signal to noise ratio, and I think you should query the editor of AUDIO about this. I haven't done a PROFILE in quite a while, but when I did I employed 3 per cent harmonic distortion as the reference level.

(*We use the standard Ampex test-tape tone. Ed.*)

So far as I know there is no official standard as to the reference level for measuring the signal-to-noise ratio at home speeds, namely 7.5 ips and less. There is an NAB standard applicable to professional machines operating at 15 ips or higher. This level is 2 per cent distortion at 400 Hz.

In any device the signal-to-noise ratio is based upon maximum level rather than average level. Thus the ratio of a power amplifier is usually based upon maximum power output. Whether the "practical or useful" ratio of a tape recorder is reduced by 10 dB depends upon the particular program material. In some material the average level may be only 6 dB below the peaks, whereas in other material the average level may be as much as 20 dB below. Experience indicates that if one can keep system noise at least 55 dB below the *peaks* of program material, results are good enough to be called high fidelity.

I don't know that it is common practice for high-fidelity manufacturers to use a weighting network when making signal-to-noise measurements. I know that such a network is *sometimes* used, but I believe it to be the exception rather than the practice for high-fidelity components, including tape recorders.

The situation of 3M low-noise tape is a special one. Here the manufacturer has been able to concentrate the tape noise into a portion of the audio spectrum where it is less audible. Although such tape may *in total* produce about as much noise as another tape when measured by instrument on an unweighted basis, it is preferable to this other tape if it *sounds* less noisy. Therefore 3M prescribes a network so that its low-noise tape will appear to an instrument more or less as it does to the ear. I do not know whether this network is one of several that have been established by professional societies, nor do I know whether other tape manufacturers are using weighting networks in evaluating tape noise nor whether those others who do use weighting networks employ the same one as 3M. This is a query best answered by 3M.

Q. There seems to be one subject on which very little has been printed, and that is the cross-field recording system. Could you please give me some information on the subject?

A. Information about the cross-field head can be obtained from Roberts Electronics, Inc., 5920 Bowcroft St., Los Angeles, California, 90016, which uses this head in some of its tape recorders, and from the Illinois Institute of Technology, Chicago, Illinois. In essence, the cross-field technique involves the use of a separate head, opposite the record head and on the other side of the tape, to supply bias during recording. It is claimed that bias applied in this way does not result in as much high-frequency erase as when bias is applied by the record head.

*Q. I own a **** tape recorder, which I have had for over a year, but there are still many recording techniques that I still have to learn. I want to make sound-on-sound recordings, but the tape recorder manual does not explain this clearly. Can you instruct me how to do this step by step? Also echo effect?*

A. I don't have a copy of this manual, but I can outline the basic procedures for sound on sound and for echo effect.

Assume you wish to record program material A, B, and C on one track of the tape in sequence and in synchronization. L denotes the left channel of the tape machine, and R the right channel. (1) Record material A through channel L. (2) Rewind the tape and play back through channel L; and feed the A signal into a loudspeaker or earphones for monitoring; at the same time feed this signal into the input of channel R for recording. (3) Simultaneously feed material B into the R channel while recording through this channel. (4) Add program material C by the same process, but this time playing back through channel R and recording through Channel L. And so forth for additional program material.

For echo effect on, say, Channel L, simultaneously record and play back through this channel. Feed the output signal into the input for Channel L, along with the material being recorded. Depending on the input facilities of your machine, you may or may not need a Y-connector at the input in order to accommodate two signals at once. Control the level of the playback signal fed back to the input by using the playback gain control for Channel L. Excessive playback signal will culminate in loud and unpleasant breakup. The nature of the echo effect will depend on the amount of signal fed back, on the tape speed, and on the spacing between the record and playback heads. The best effect will probably be obtained at the highest tape speed of your machine, sounding somewhat like the reverberation of a very large and very live hall; the term cathedral effect is sometimes used to describe this. At slower speeds your machine will probably produce a series of distinctly repeated echoes. Æ

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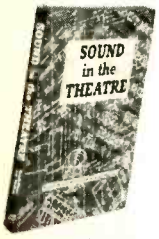

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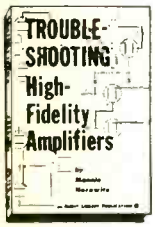

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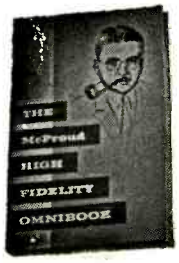

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2 Monitoring Amplifiers, 2 Filters, Test Equipment, Jack panels, etc. Would make a package deal on all equipment. Johnny Price, DA 1-6576, 11819 Lippitt Dr., Dallas, Texas 75218.

AMPEX 2070 tape deck. Automatic threading and reversing. Hysteresis motor. Condition like new, in original box. New $499.95. Sell $295.00. J. M. Edelman, M.D., 4550 North Blvd., Baton Rouge, La. 70806.

ACROSOUND Ultralinear II 60 watt power amplifier. Pair for stereo, $120.00. J. M. Edelman, M.D., 4550 North Blvd., Baton Rouge, La. 70806.

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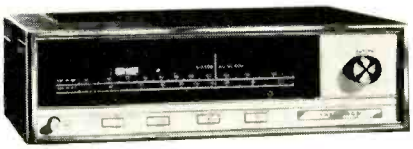
NEW PRODUCTS

All Silicon Tuner



Sherwood's newest is AM and FM with automatic switching to stereo when a stereo signal is sensed. Silicon transistors are used exclusively. These, combined with a dual AGC system will maintain selectivity under the strongest signal conditions. A zero-center tuning meter is used to aid in selecting stations; a front-panel volume control permits the tuner to directly feed a power amplifier. Rocker action switches control automatic STEREO/MONO; AM-FM selection; interchannel hush; and power ON/OFF. Specifications for this model S-2300 are: IHF FM sensitivity—1.6 μV; typical selectivity— 250 kHz at —6 dB and 820 kHz at —60 dB; AM sensitivity is 2 μV at 60 per cent modulation of a 6 dB s/n and a 4 kHz selectivity at —6dB; stereo separation—35 dB; FM capture ratio—2.2 dB: FM stability—± 10 kHz; FM cross-modulation rejection—85 dB; FM distortion—less than 0.25 per cent IM or harmonic at 100 per cent modulation; and hum and noise in FM is 70 dB below 100 per cent modulation; for AM it is 56 dB below 100 per cent modulation. Price is $199.50 for the custom-mounted chassis or $208.00 in a walnut-grained leatherette case. CIRCLE XX

Microphone Mixer

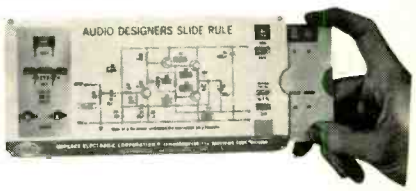
The model M68 is the latest product to carry the Shure Brothers name. It features inputs to accommodate up to four dynamic or ribbon microphones. These may be high or low impedance; each position has a switch-selector. In addition to the four mike inputs the M68 has

a single high-level input. An A68P Phono Pre-Amp accessory can convert this into a magnetic or ceramic phono input. Each of these five channels has its own volume control. A separate master volume control is also present. Output of switch-selected high or low impedance is available to feed the microphone input of a PA amplifier or tape recorder. A second high-level output for direct connection to an amplifier is also provided. Several accessory items are available. These include a battery power supply; a panel cover that locks to prevent tampering, the aforementioned phono preamp; a stacking kit that allows convenient interconnection and stacking of several mixers; and a rack-panel mount kit. List price of the M68 is $125.00. CIRCLE XX

Instrument Pickup

This interesting device crossed our desk a while ago and made us stop to take a second look. The illustration shows one of these transducers securely mounted in the mouth of a saxophone. In point of fact the unit may be used with most wind or brass instruments and is designed to operate directly into a high-quality amplifier. Koss Electronics is the manufacturer. President John C. Koss states that the pickup adds full-bodied drama to tones and actually makes instruments easier to play because the musician need not blow so hard. Certainly it suggests applications beyond that. The transducers are available through music stores. CIRCLE XX

Slide Rule



Here is a useful tool for the experimenter and construction buff. This Amperex unit provides a dual function.

First, it gives the circuit designer a quick means of determining the component values and transistor types required in a series of seven basic audio amplifier circuits ranging from a 1 watt amplifier to a 5 watt car radio. Merely by moving the slide you will arrive at the complete circuit layout from input to speaker. But the really valuable function of this slide rule is its use as an audio calculator. If you know either the value of the load resistor or the output power, you can calculate the related values required within a circuit of complimentary symmetry. The slide rule is priced at 50c and is only available from Amperex Electronic Corporation, Semiconductor and Receiving Tube Division, Hicksville, Long Island, New York 11802.

Industry Notes

Remember CONRAC? They remain, of course, a well-known manufacturer of broadcast, industrial, and educational television equipment. A recent release announces a new plant of 120,000 air-conditioned feet will be used to consolidate all operations under one roof. CONRAC is now spread over six separate locations in the Glendora, California area. The new plant will provide a 50 per cent increase in floor space. Can we hope for a return to the consumer market?

A. W. PRESKILL, v.p. and general marketing manager of ALLIED RADIO has announced the appointment of JULES BRANDELL as director of advertising for the Chicago-based corporation. Formerly he was ALLIED's mail order manager. In his new duties he will coordinate the national mail order, industrial, and store advertising. He will continue to direct the production of the company catalogs, direct mail, and other promotional material.

WALT FLIESLER, well-known to us easterners as a representative of several high-fidelity manufacturers will now become, we are sure, equally well-known (and well-liked) to westerners. WALT has recently moved to San Francisco and formed ELECTRONIC MARKETING ASSOCIATES. He will initially represent JBL INTERNATIONAL and BOGEN for the Northern California and Nevada areas.

At the national convention of the National Electronic Associations, held recently in Winston-Salem, N. C., MORRIS L. FINNEBURGH, SR., chairman of the board of the FINNEY COMPANY was awarded a special citation which read: 'In appreciation for the personal time and efforts expended during the past years as a speaker of inspiration to thousands—For the interest taken in individuals, groups, and causes that has given encouragement and hope, and has helped to bring about a more responsible and high-caliber association, and association member. This special citation is presented to Morris L. Finneburgh, Sr. by the Second Annual NEA Convention!'

Advertising Index