# AUDIO®

. . . the authoritative magazine about high fidelity



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Component Systems Start Young —Cover Story

An Integrated Circuit FM Tuner

Build an Electronic Piano Tuner

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Light Listening—Chester Santon
Jazz & All That—Bertram Stanleigh
About Music—Harold Lawrence

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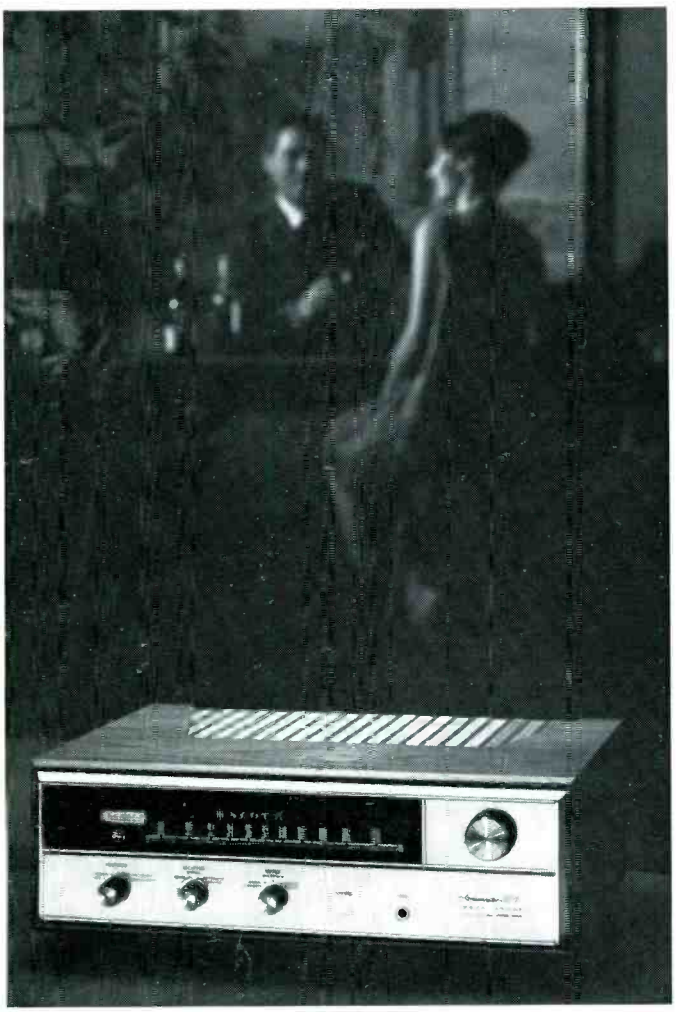
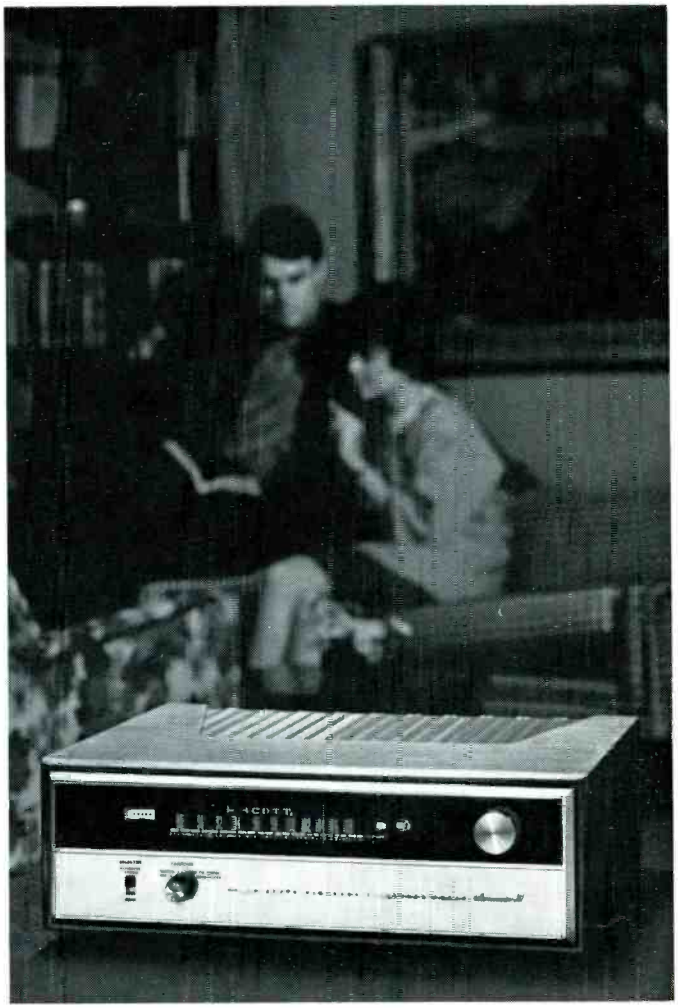
JANUARY 1967

60c

# SCOTT





# You'll hear more stations more clearly with Scott's new FET FM stereo tuners

Now, Scott's exclusive FET circuitry* is yours in a choice of tuners to fit your budget. Both the Scott 312C and 315 FM stereo tuners have new silver-plated Field Effect Transistor front ends, to give you almost complete freedom from cross modulation and drift along with better sensitivity, better selectivity, and lower inherent noise . . . both of these superb tuners include other Scott pioneered circuits . . . time-switching multiplex circuitry and all-silicon IF's. * Patent pending

Your choice depends largely upon your location and listening habits. If you are in a poor reception area, or if most of your favorite stations are located far from your home, then the 312C, with its greater sensitivity and selectivity, would be your logical choice.

**Scott 312C FM Broadcast Monitor FET Tuner.** The all-new 312C provides listening performance audibly superior to any other tuner available. Here are some of the far-ahead features that make the 312C the best tuner on the market regardless of price: 1. Switched front panel meter . . . can be used for signal strength, zero-center tuning, or multipath indication. 2. Interstation Muting Control for complete quiet between FM stations. 3. Front panel output for direct tape recording without the use of separate amplifier. 4. Ultra wide-band detector circuit for minimal distortion. 5. Oscilloscope output for laboratory-precise correction of multipath distortion.

**312C specifications:** Usable sensitivity, 1.7 μV; Cross modulation rejection, 90 dB; Selectivity, 45 dB; Stereo separation, 40 dB; Capture ratio, 2.5 dB; Signal/noise ratio, 65 dB; Price, $294.95.

**Scott 315 Solid-State FM Stereo FET Tuner.** No one but Scott could develop an FM stereo multiplex tuner at this unbelievably low price with the performance and features of this new unit. Most of the features found on much more expensive Scott components are here for you to enjoy. Included are precision signal strength meter for accurate station tuning, stereo indication light for positive, noise-proof indication of stereo broadcasts, and sub-channel filter for reduction of carrier-induced interference on stereo.

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**315 specifications:** Usable sensitivity, 2.2 μV; Cross modulation rejection, 80 dB; Selectivity, 40 dB; Stereo separation, 35 dB; Capture ratio, 3.0 dB; Signal/noise ratio, 60 dB; Price, $199.95.

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# AUDIO

January, 1967 Vol. 51, No. 1

Successor to RADIO, Est. 1917




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**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 Mid-City Press, 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

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

"Copyright Protection for TV Broadcasts," Albert W. Gray. Some interesting facts on the legal implications of broadcasts.

Arthur C. Davis and Don Davis begin a series on the subject: "Professional Tone Controls.

## Profiles

Shure V-15 II Stereo Cartridge
Wharfedale W-20 Speakers
Dyna PAS-3 preamplifier and Stereo 120 amplifier.

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

## About the Cover

Youth is no restriction to sophistication in the world of audio. Read about one young man on page 28.

# 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.

### Audible Output with Amplifier OFF

*Q. My equipment includes an electrostatic tweeter. This tweeter, for proper operation, must have the 115 volt AC line voltage applied to it. The manufacturer recommends that the linecord be plugged in at all times, even when the system is not in use. For some reason there is an emission from the tweeter of a loud, constant, buzzing noise, sounding similar to the static of an unbroken, and even intensity level. This noise which lasts from two to about 10 minutes occurs whether the system is operating or not. It can be stopped only by unplugging the linecord. To say the least it is quite annoying, and, even embarrassing if company is present in the living room.*

*I have checked all other appliances in the house at the time the noise occurs; I have shut the electricity on all outlets except the one feeding the speaker, and still the problem persists. I live in an individual brick cottage in a one hundred per cent residential neighborhood. There is no broadcasting tower nearby. I can think of no machines in the vicinity which would cause this problem. At the time of the noise I have turned on radios and observed the TV screen and can find no other evidence of static.*

*A letter to the speaker manufacturer did not help. The reply expressed 'puzzlement.' I am sorry to say there was almost an insinuation that I was hearing things. Local service technicians believe that something is feeding back through the a.c. line and that it may be possible to be filtered out.*

*Can you help? Morris Grossman, Baltimore, Maryland*

A. I, too, am puzzled as to what you are hearing. However, here is what I would suggest you do to find out what could be causing the trouble.

I would get a sensitive transistor portable radio and have it handy to the speaker. I would plug the speaker into the outlet as usual. I would plug a television cheater cord into the same outlet. When the sound appears in the speaker, turn the radio dial between stations and turn up the volume. Quickly place the radio loop antenna against the line cord of the speaker. Note whether the signal you hear in the speaker is heard in the radio. If you do hear the signal in the radio, disconnect the speaker from the outlet. Place the antenna near the cheater cord, plugged into the same outlet as described. If the noise is still heard, you will know that it is coming over the a.c. line. Once you establish this fact, call your public utility company. Have the company trace out the trouble. Utilities offer this service, but most people are not aware of it. Something may be arcing in the power line. (Very often, that something is an insulator which has become carbonized slightly—not enough to cause a complete short, but enough to cause a slight arc.)

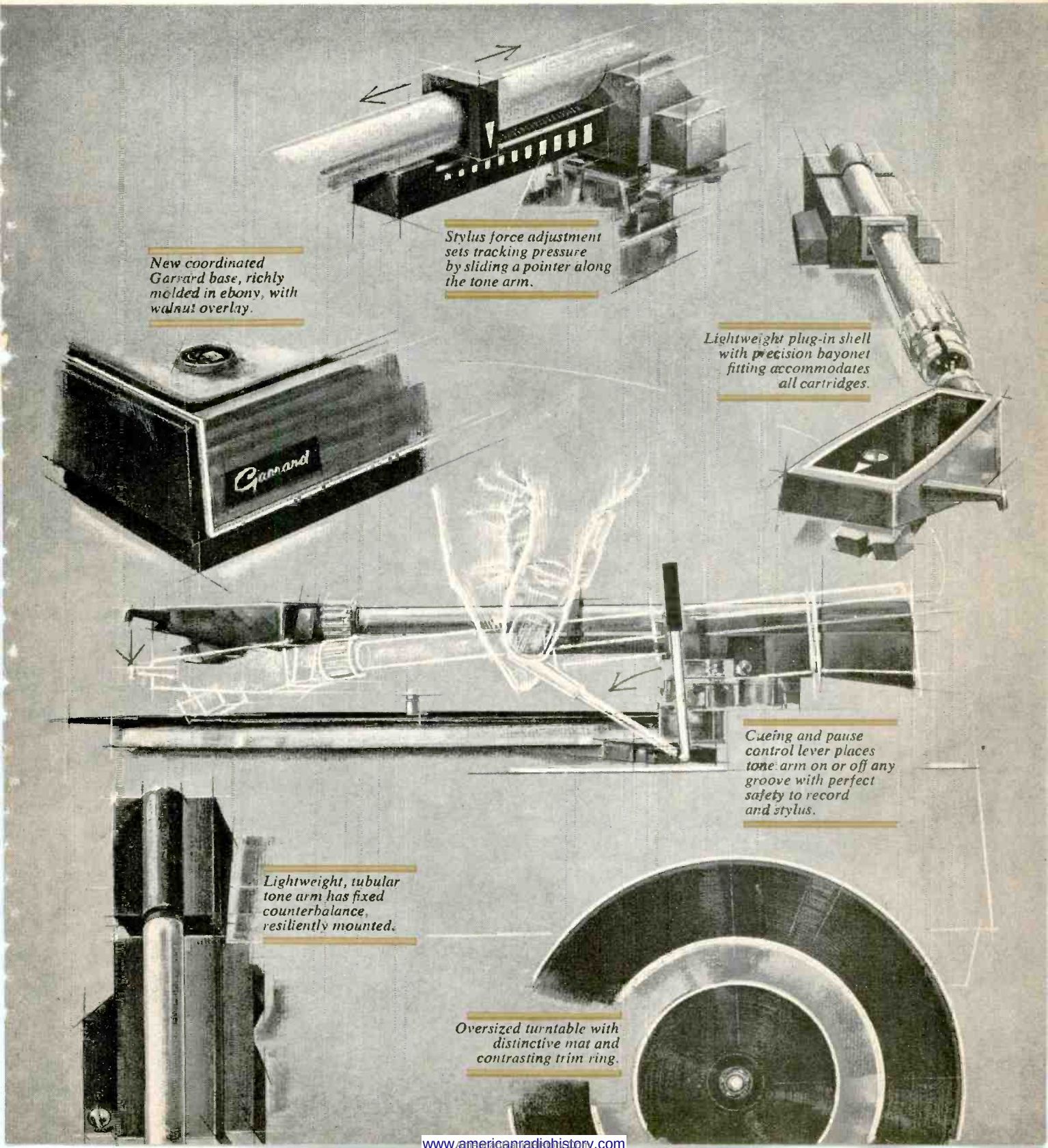
If you hear the noise with the speaker connected, but do not hear the noise with the speaker disconnected, you will know that the speaker is causing the trouble. If you do not pick up the noise in the radio, you will know with even more certainty that the trouble is directly a result of difficulties in the speaker. It is possible that humidity is causing a breakdown, or slight arc within the speaker elements or power supply system. (As you may know, an electrostatic tweeter works by virtue of a rather high polarizing voltage between two closely spaced diaphragms.)

I suggest that you plug the speaker into one of the convenience outlets of your amplifier so that it will not be energized except during the times of amplifier operation. This may be of at least partial help.

# GARRARD'S 50 MARK II

## A NEW COMPACT AUTOMATIC TURNTABLE WITH HIGH PERFORMANCE FEATURES AT ONLY $54.50

*Far from being keyed to the level of budget or even medium priced music systems, the 50 Mark II deserves comparison with the finest and most expensive automatic turntables. Its dramatic impact begins with styling . . . functional, handsome and beautifully coordinated. Operating features are equally impressive . . . encompassing the latest advances in convenience and performance. The 50 Mark II is one of five new Garrard Automatic Turntables. For complimentary Comparator Guide describing each model, write: Dept. 150, Garrard, Westbury, N. Y. 11590.*



# AUDIOCLINIC

### Transients When an Amplifier Is Turned On

*Q. I have a solid-state amplifier. When this amplifier is first turned on, I get a 'thump' from both speakers even when the level control is fully counter-clockwise. Can anything be done to diminish or cut out this transient? George R. Kirk, Stockton, Illinois.*

A. The 'thump' you hear when your amplifier is first turned on is possibly normal for the equipment. Hence, nothing need be done about it. Of course, if you know someone who has this same amplifier and who does not have this trouble, you will need to check into the matter further.

Assuming that the condition is normal, but you still wish to eliminate or reduce the magnitude of the thump, I can see a way in which the problem can be eliminated. A resistor can be placed in series with the a.c. line. The value of this resistor should be sufficient to allow the amplifier to receive a good portion of its power, but not low enough in resistance to cause so severe a transient as is now produced. After this transient has come and gone, a time-delay relay can be set to short out this resistor. The amplifier will then operate in the normal manner.

### Guitar Amplifier and Speaker Requirements

*Q. Can you advise me as to what is different, or special, about a speaker or a guitar amplifier as compared with a good quality high-fidelity speaker? Also, is there anything special about the associated amplifier, other than the mixing-type input? Robert E. Babcock, Hendersonville, N. C.*

A. The major consideration in terms of amplifier performance for a guitar is the ability of the amplifier to recover from the attack transients associated with guitar picking. Actually, any good high-fidelity amplifier should have this ability. The frequency response of the amplifier and of the speaker need not extend low into the audio spectrum because the lowest note of the guitar is about 80 Hz.

Guitar speakers and amplifiers should be able to handle transient power peaks and lots of power in general, but they do not require a wide frequency range. The average guitar pickup does not possess much in the way of high frequency response. If the amplifier and speaker are to be used for other applications, the frequency range would have to be extended. Æ

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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**Plainview, L. I., N. Y.**

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# LETTERS


### Helical-Scan Priority

SIR:

Recently we got notice of the SOUND AND SIGHT article in the February, 1966, issue of AUDIO. The sub-title was "The art of video recording and its pioneers."

We think the author is not right in his statement that the single-head helical-scan system was invented by the Japanese firm, Tokyo Shibaura Electric Co. Ltd., (Toshiba).

We would like to draw your attention to our German patent No. 927999 which already discloses the single-head helical-scan system, and which bases on a filing date of July 1, 1953, which is more than six years before Toshiba announced and demonstrated their single-head video recorder.

DR. JOHANNESSON and
VON BRUMMERSTEDT
Patent Department
Telefunken AG,
3 Hannover-Linden,
Postfach 21 345/21 347
West Germany

*(While S&S did not state the date of filing of the Toshiba patent, it seems unlikely that it could have been more than six years before their announcement. We are pleased to be set straight as to the date of the Telefunken patent filing. The patent was actually granted on May 23, 1955.* ED.)

### Crowhurst Replies on Amplifier Power

SIR:

I am a little puzzled at Larry Griesel's criticism (LETTERS, September, 1966)—if that is what it is—of my discussion in the March, 1966, issue about the amplifier power rating needed to handle cumulative musical power.

Did I fail to make it plain that amplifiers must handle peaks, in both directions? In his letter, he only talks, as far as I could judge, about continuous, single-frequency sinusoidal power. I was talking about a number of instruments, playing either different notes in a musical scale, or the same note, in which intonation is never perfect enough for them to be playing *exactly* the same frequency.

Where frequencies differ, not in perfect harmonic relationship, each sine wave "rides" the other waves, or is superimposed on them. So at some point on the composite waveform, a peak is going to be the sum of the individual peak values, in each direction in turn. Correspondingly, with a number of tones, at certain relatively infrequent points all the peaks will be additive. Let's take a hypothetical example.

Three notes, of frequencies 261.3, 261.9, and 392.0 Hz, which represents two C's with a 1⅔-second beat and a G—a very simple musical combination—are played together: the two C's will beat, having a maximum peak equal to the sum of their individual peaks once every 1⅔ seconds. In effect, they will be the same as a frequency of 261.6 varying at this slow beat period. The G will combine to produce the difference frequency of 130.4 Hz. So every 7.7 milliseconds these tones (the G and the composite C) will rotate through an approximately complete phase-relation change.

Half of 261.6 is 130.8. So at a frequency of 0.4 (or every 2½ seconds) the peak of the G waveform will coincide exactly with that of the composite C waveform. Every 5 seconds, all three peaks will coincide, in each direction. This note combination may not play for 5 seconds, but the coincidence *can* come within the period it is played or not—there is no way to be sure. If the note combination is held for 5 seconds, it must occur at least once, and maybe twice.

Multiply the number of instruments and notes played and the process extends. The amplifier has to be capable of handling this peak, if it should happen and when it happens (and the peak is in voltage or current waveform) not a simple power addition which is the sum of r.m.s. powers) *without distortion.*

Mr. Griesel's statement that at any instant in time some waves will be positive and some negative is undoubtedly true most of the time. But there *are* these times where they add up all together, one way or another. And because all the frequencies played are different—not the same, as Mr. Griesel suggests—this situation exists: for most of the time they will not coincide, but there are inevitably occasions when they do. These occasions make it necessary for the amplifier to handle these summative peaks.

I'm still puzzled by Mr. Griesel's letter, but I hope this has clarified the matter for him.

Gold Beach, Oregon 97444
NORMAN H. CROWHURST,
P.O. Box 651,

# UNEQUALLED VALUE

This combination of PAS-3X preamplifier, FM-3 tuner, and Stereo 70 amplifier will give you the very finest sound for your high fidelity dollar. Each of these has earned, through years of increasing public acceptance, an unprecedented reputation for quality and value.

Widespread word-of-mouth advertising by enthusiastic Dynaco owners has made these 3 Dyna products the most popular of all separate high fidelity components. No other stereo tuner can match the phenomenal popularity of the FM-3. More Dynaco stereo preamps and Stereo 70's have been sold than all other similar components **combined.**

There is unanimous recognition that Dynaco is "best for the money" but "best for the money" is an inadequate description. Those who have the proper test facilities agree with us that every Dyna unit should be judged on its merits in comparison with any equipment regardless of price, for Dynaco quality has never been compromised by cost considerations. But we are serious about economy, too. Each Dyna product is scrupulously engineered (we call it "distillation") to deliver top performance at the lowest possible cost—when you buy it, and for as long as you own it. Expensive designs may sometimes be good, but the best designs are rarely inexpensive. We insist on the latter.

The PAS-3X, FM-3 and Stereo 70 are all tube designs. We also make transistorized products, and in time we will have solid state units which will complement (but not necessarily replace) each of these. However, the day is still well in the future when transistorized designs can deliver the same quality and reliability at comparably low cost.

Our sole concern is sonic perfection. We don't follow the herd in engineering, styling, or promotion. Fads, status, "revolutionary new sounds" and planned obsolescence through frequent model changes have no place at Dynaco. We take the extra time to do things **right the first time.** It's why our kits are so easy to build, why maintenance is so easy, and service problems so few. We do, however, constantly strive to improve our products; and when we do, these changes are available to our customers to update existing equipment at low cost.

You can have confidence that current and forthcoming models will provide you with the same quality, economy and dependability for which Dynaco is world famous.


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# AUDIO ETC.

Edward Tatnall Canby

## New Antenna on the Old Mast

I'VE BEEN UPGRADING MY EQUIPMENT again. This time it's an element that has remained fixed in my set-up for quite a number of years—the antenna. Wow—what a difference!

Keeping up to date in hi-fi means for most of us a series of upgradings, mostly one at a time as progress moves forward. Not too many of us are the sort who splurge all at once, a total replacement with a grand flourish! Piecemeal upgrading, section by section, is much more economical and this kind of procedure wins out for all sensible souls who are reasonably unspectacular.

The thing to do is to study and study, to decide—and it isn't always easy—which element is your weak link in the chain of equipment. If you do it right, each upgrading shifts the balance to a new weakest link, and then you start all over again.

If you do it wrong, like, say, replacing those "fuzzy" speakers (instead of the fuzzy stylus that's really the trouble), you're right back where you started. Well this time I'm NOT back where I started. That's why I'm talking.

Often our upgrading involves a major technological change. Like the mass conversion from vacuum tubes to transistors over these last few years and, before that, the upheaval that took us from mono to dual-channel stereo. That was a whopper!

In FM radio, the biggest conversion (since we moved up to the present frequency band after the war) has been the swing to multiplex stereo, to complete the over-all stereo picture. It's still in full swing, that conversion, and it has been both dreadfully complicated and full of headaches. The compromise in procedure which finally got FM multiplex stereo off the ground and into the air has always seemed to me the most contrived and complex of any "approved" system I can think of. Phew! And there'd have been problems even with a simpler (non-storecast) arrangement. It has been discouraging.

### Still—FFFFFFFF

Frankly, for a long time I just couldn't help feeling that in my life FM stereo was a near total loss for half of my life, at least—the half that lives out in the fringe area in Connecticut's rural Northwest corner. Stereo was ok in the city. It's even better now. Or if you live nearby any old station that pleases your taste. But in a million and one other places, in suburbia, exurbia and the nearby country, not to mention thousands of miles of mountains, forests, populated deserts, tropical swamps and what-not, stereo broadcast just ain't. Not even worth a try. Mono is always superior.

I summed up this feeling of mine in an article not so long ago entitled FFFFFFFFFF. That's what you heard, out in those places—at best a noisy, constant background to stereo, and at worst a loud, scratchy HSSSSSSSSSS or even a roar of foreground noise. You just couldn't get rid of that stereo noise. Except by moving into the big city. (Haven't heard of anybody who did, just to get good stereo.)

And when you switched to mono on your tuner, exasperatingly, nine times out of ten, you got that sudden instant velvety silence and perfect in-the-room reception of the old traditional FM system. An awful contrast.

Worst of all, right alongside your stereo tuner you had a stereo record player. The contrast between stereo on disc (or tape) and stereo coming in via the air, through the very same loudspeakers, was cruel.

It wasn't only the hiss, either. For a long time the quality of the stereo sound itself via radio was dismally inferior to that on records. Sometimes it sounded just like mono—with hiss. Often it was seasick stereo, shifting around, unstable, minus any natural down-to-earth spatial fixity, dimensionally unrealistic and unconvincing. A negative impact all too often, as compared to that instantly available, rock-solid, utterly silent mono, at the flip of a switch.

The only silver lining I could have projected, a couple of years ago, was simply that now and then a bit of quite good reception did come through to surprise me—and thereby hint that, given time, stereo would solve its broadcast problems.

Maybe all this was just as well. For in this earlier and dismal period, while the station engineers were desperately battling the technical problems involved in getting out a stable, powerful, *listenable stereo signal* (some of them just ignored the problems and still do . . .) the tuner manufacturers were industriously feeding back their early customer experience, into new and improved receivers. Early annoyances like, for instance, the lack of a stereo indicator (and the first clumsy, half-impractical indicators) soon gave way to refined and near-standardized indicators that are now reasonably trouble-free. Much more fundamentally, the internal circuitries were vastly developed, upgraded in a dozen, a hundred ways; sensitivity, sadly lacking in the earliest stereo models, was upped to maximum. All sorts of things were improved upon . . . need I say more?

Thus by the time the broadcast stereo signal had settled into stability, the stereo receiver had done the same. Present models and those of the last couple of model-years are really highly usable, price for price.

Indeed, in *terms of the broadcast signal* and *in terms of receiving equipment*—at the two ends of the line—stereo FM is now *very* satisfactory and, at its proper best, sonically compatible in sound with that of stereo records played in the home. That's a lot of progress.

And yet—the weak link is still weak. There's still, for too many of us, that annoying, persistent FFFFF, the noisy stereo background. It's inherent in the system, above all due to the enormous loss of effective signal strength in stereo as compared to mono transmission. That, unfortunately, we must live with.

By this time, there isn't too much more that can be done (if I'm right) in the way of greater receiver sensitivity, unless we are to receive sounds of Brownian movement or interference from quasi-stellar bodies. Sensitivity, in the good tuners, is about at maximum.

Transmitting power, at the other end, is both competitive and bound up with the government's over-all balancing. Yet here a lot has been done lately, not so much in higher power as in much improved coverage—new and higher antenna locations, new two-way polarization, etc. This particular weak link is growing stronger all over, I'm glad to discover. Helps in every way.

My own FM audience, for instance (still non-stereo) has suddenly quadrupled for my New York city program after twenty years, due to our WNYC's recent shift to new-type bi-polarized antennas mounted 'way up on the Empire State building. Wow—you should hear us come in at a hundred miles! Like local. Given a good receiving antenna, of course.

### The Stereo Antenna

Ah—there we are! The one remaining MAJOR bottleneck in good stereo, the weakest of all the weak links in the chain, is increasingly (as other upgradings go forward) the individual home antenna. And it is in the more sophisticated kind of home antenna, the kind that goes up on the roof, or equivalent, that there has been startling new design progress in the last few years, only now getting into practicable commercial forms.

No doubt about it. The key to FM stereo is a good antenna. Not *just* an antenna on the roof. One of the new, improved models. But definitely! I should know. I've been trying one.

# Small. From the people who always made it big.

Altec took thirty years of big speaker know-how (would you like to try the speakers at Cinerama, Todd-AO, or the Houston Astrodome on for size) and put this know-how into the 890A Bolero.

The sound it puts out puts other "bookshelves" to shame.

One big reason is its all-new free-suspension phase inverter.

Though its face passes for a woofer, its backside has no magnet or voice coil. Just a low-resonance sympathetic cone. Tuned to perfection to work in precise phase with the woofer.

This gives our 2 cu. ft. cabinet the kind of big-hearted low-end response you'd never expect from 2 cu. ft.

As for the actual woofer, it's a hardy 10-incher with a hefty 10 lb. magnet structure. This gives you a big advantage over the 2-pounders some others talk about.

A magnet like that helps make the Bolero as efficient as a big speaker. (It develops an amazing 92 db for one watt input.) This means you can use a medium-power amplifier and make the walls shake. Or enjoy dynamic peaks at concert hall levels with absolutely no distortion.

The high frequency sounds are taken care of by our famous 3000H multicellular horn and driver. Mounted above the woofer and phase inverter, it handles anything and everything above the bass with silk gloves.

For adjusting the highs to your own taste there's a built-in 3000 Hz dual-element crossover network with a variable shelving control.

But there's more to the Bolero than just its inside beauty. There's its handsome hand-rubbed walnut cabinet. 14½" high, 25¾" wide and 12" deep. A unique snap-on grille makes changing the grille cloth a snap.

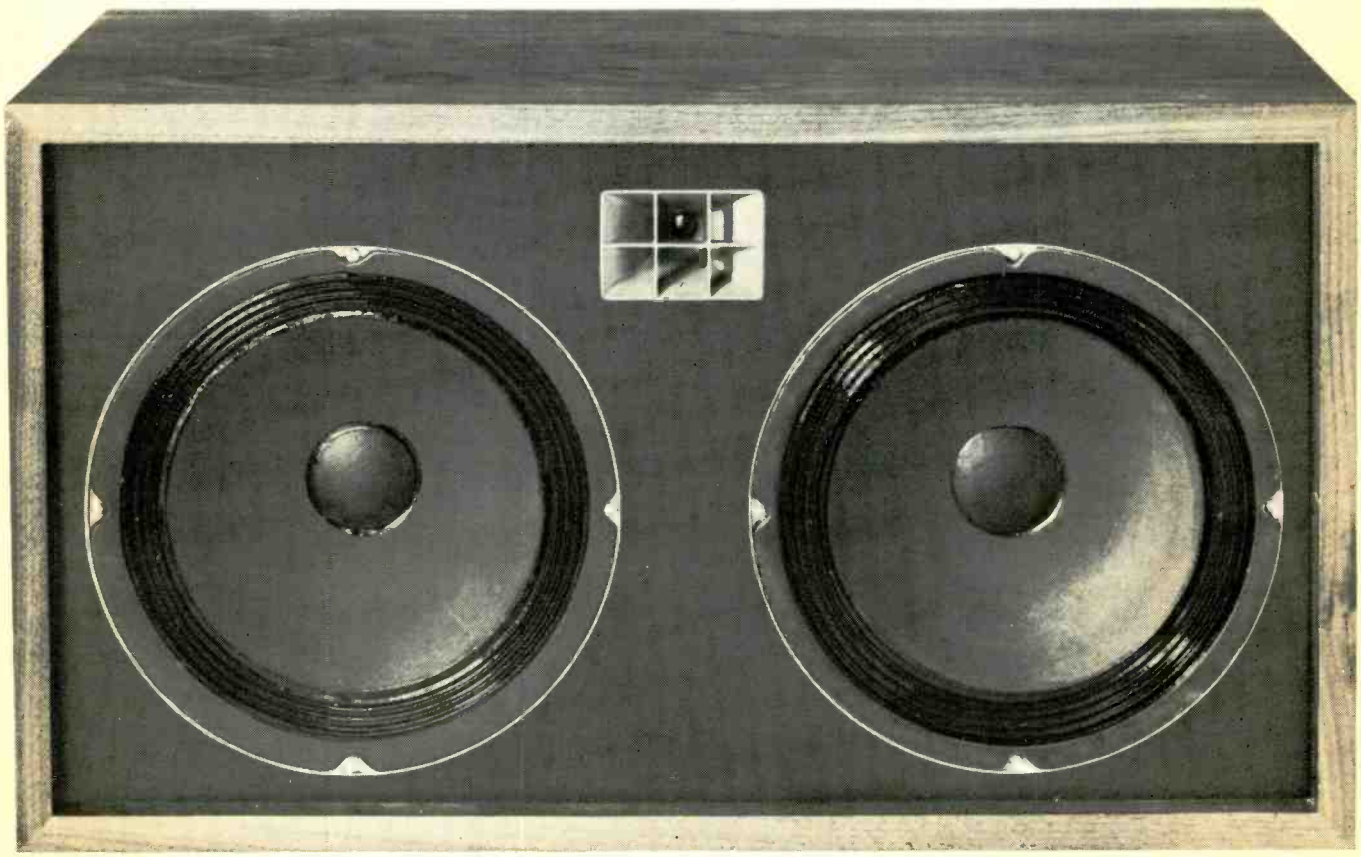
To make its small size even nicer, we've kept its price down, too. $169.50. Which makes it a giant among midgets.

If you want to hear how we've made a little go a long way, there's a Bolero at your Altec dealer just waiting to be heard.

While you're listening, ask for a free 1967 Altec Stereo Catalog. Or, write to us for your copy.

ALTEC LANSING

A Division of LTV Ling Altec, Inc., Anaheim, California



Check No. 57 on Reader Service Card.

**FM/Q**

It was 'way back, I dunno just how far (can't remember, for the moment) that I replaced the rusted-out old TV antenna that came on my house, when I bought the property in 1954, with what was then one of the very finest antennas of reasonable rooftop size, complexity and cost, the FM/Q yagi, promoted from Wethersfield, Connecticut by a super-active man by the name of Carini and his Apparatus Development Corp. His FM/Q antenna is beautifully made, with seamless aluminum and stainless steel throughout even to the nuts and bolts. It was just as good when I took it down last month as on the day it went up years ago (via Carini's muscle, up a very wobbly ladder).

I have passed it on to a friend who is upgrading his equipment—from an attic home-made folded dipole—and it will last him for as long as he stays mono (and may well be good in his location for stereo). This is exactly what it did for me with its six elements, half-wave, sitting on top of a Cornell-Dubilier TR-4 rotator.

(Side note: The TR-4 rotator is generously guaranteed for a full three months. Mine still works after maybe 8 years of below-zero winters.)

As of that time and as recently as several months ago, I was able to pick up, via any first rate tuner, a very satisfying range of stations, mostly in New York City and its Long Island suburbs, New Jersey, and Westchester, 80 to 100 miles away. But also occasionally beyond, out to Philadelphia and Wilmington, Del.—once even Raleigh, N.C., hundreds of miles out. It was a good antenna working under favorable mono conditions. I was entirely happy with it.

Indeed, I have an extraordinarily good location, for a fringe area. There's a sheer, unobstructed downhill view 20 miles to the South, where all the stations are (in our New England upper corner of the U.S.) and another view to the NW, where they mostly aren't. Only my rear, to the East, is dead duck on FM. Nicely shielded, thanks to the small mountain on whose steep side I am perched. It rises a couple of hundred vertical feet, all tumbled granite, to a ridge behind my house and it is impervious to radio. Boston, 100-plus miles to the ENE, is impossible to get. I had never identified a Boston station until now, with my new antenna.

With the old FM/Q working on mono I could log maybe thirty good stations any old time, every one with full limiting and absolute silence. Only the annoying pulsing and swishing of passing planes disturbed this monophonic idyll. (But, of course, the planes showed how perilously near the limit of good reception most of that wonderful silence actually was. It took stereo to spoil it.)

Stereo—no! Several years ago I got hold of a Scott 312, a superb stereo tuner, then and now. (This was the first model, with a nuvistor front end and, shall I say, a transistorized behind.) With it, I could pick up four or five stereo stations, depending on the hour, all of them 80 or 90 miles off. There weren't many, then, and some of them were on mono most of the time, on stereo only a few hours a day.

Not one of these stations was ever really listenable, though I tried and tried. Too much FFFFF, or worse. And, at that stage, too many seasick effects and entirely too much distortion.

So I just gave up on serious FM-stereo listening. I had to. Especially with a million or so first rate stereo discs lying around, waiting to be played.

But I did keep my hand and ear in. I listened to stereo broadcasts every so often, just to see what was happening. And so I began to be aware of real progress. There was an astonishingly rapid increase of stations and of stereo air time, for one thing. But even better, and in spite of the continuing and inevitable hiss, I definitely began to notice improvement in the stereo sound itself. Hiss aside, it was beginning to *sound like stereo*. Through the eternal FFFFF, I could hear that the signals were now much more stable, no longer seasick, no longer semi-mono. The boys in the engineering departments were working hard and well.

By early 1966, I felt that the time was coming for action. Stereo was obviously getting good, hiss or no hiss. Stereo-FM sound was getting closer to the sound of stereo disc. In fact, it occurred to me that if there were hiss on my records—or supposing I added a synthetic hiss signal to my phono circuit—then I really couldn't tell them from the broadcasts.

The hiss made the difference. It was the last barrier. I just HAD to get rid of it. Maybe one of those tricky new antennas was the answer?

Well, since this is going to be a continuing article next month—hold your horses. I HAVE got rid of it, almost entirely. And with NO change in my earlier equipment of several years ago except one—the antenna.

**Conscience**

You see, by a bit of sheer wishful thinking, I didn't quite ever get around to sending back that lovely 312 tuner from Scott, after I was finished with it. I got an extension of time, and went on extending it. Indeed, conscience began to tell me I was being naughty-naughty. Conscience actually persuaded me to pack up the thing in its box and get it ready for return shipment. But there, I ran sheer out of conscience.

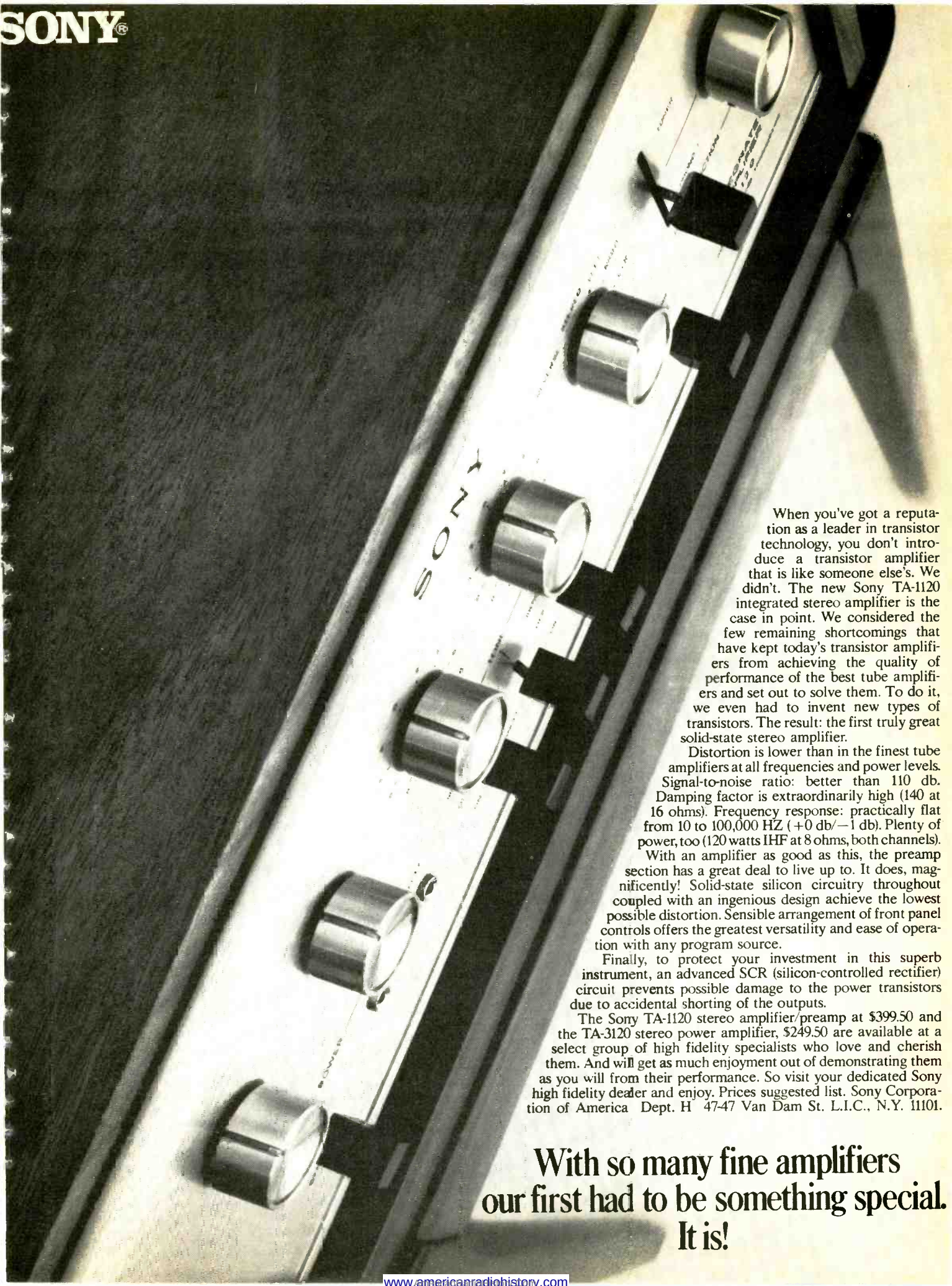
I pushed the tuner under my grand piano, where I put equipment that really *ought* to be shipped back just as soon as possible. And there it stayed, while polite memo slips kept coming in from Scott, reminding me of my still-floating debt of a couple of hundred smackers.

And then came my sudden interest in a new-type antenna—and there it was! The Scott, ready to go. The perfect test instrument.

Now I could try my new antenna with the very same equipment I had used before. Moreover, the Scott 312 had

*(Continued on page 65)*

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!

# Fundamental AUDIO

Martin Leynard

## On the Nature of Waves

LAST MONTH, we tossed off a cavalier reference to a microphone's "converting a sound wave to an electronic wave," and described all the things that happen to that wave before the speaker converts it back to sound again.

But before we can explain in detail how these marvels are performed, we'd best examine the nature of sound waves —and of electrical ones.

Pluck a taut string and you can see it vibrate back and forth. You'll notice that the wider it swings, the louder is the sound you hear, and the faster it swings back and forth, the higher is the pitch of the sound.

As the string swings in one direction, it crowds together the air molecules on that side, simultaneously creating a slight vacuum on the side it's moving away from. An instant later, it swings back the other way, crowding together the molecules that had been drawn into the temporary vacuum on one side, while creating a new vacuum on the other side that draws in some of the molecules that had been crowded together an instant earlier.

### How Waves Travel

As any billiard, pool, or marble player knows, an object colliding with another object imparts some of its motion to the object that it hits. And so it is with molecules of air. The molecules so rudely shoved aside by the string's first swing hit other molecules; and while the molecules that the string struck directly were sucked back into the vacuum formed by the string's return, the molecules they had collided with were propelled along the direction of the string's original travel.

The result looks something like (A) in *Fig.* 1—or would, if air were visible to us. We see the string vibrating to the left, creating a rarified area. But beyond that is an area of greater pressure caused by particles that rebounded from the string when it swung to the right . . . and beyond that is another low-pressure area, another high . . . *ad infinitum*.

The particles of air just swing to and fro, as does the string. But the pattern of vibration spreads through the air (in all directions, by the way—we're showing just one direction for simplicity's sake).

(B) in *Fig.* 1 is a graphic representation of the air pressures at each point of (A). Where the particles are most crowded, the pressure is highest, and where they thin out, the pressure is lowest.

Both halves of *Fig.* 1 represent a small slice of space at a single instant of time. But since the wave is travelling through space, we would get identical results if we were to chart the air pressures at a single point in space, over a small space of time. This, in fact, is how sound waves are usually graphed. *Figure* 2, in fact, is the same wave as in (B) in *Fig.* 1 with the horizontal axis now representing time instead of space.

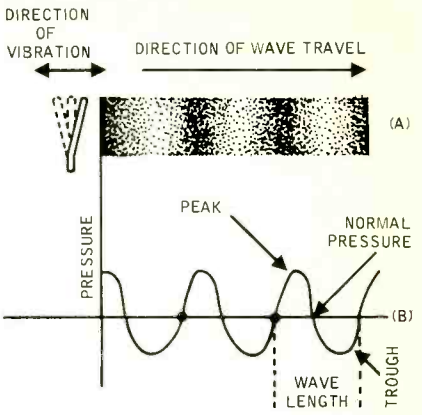
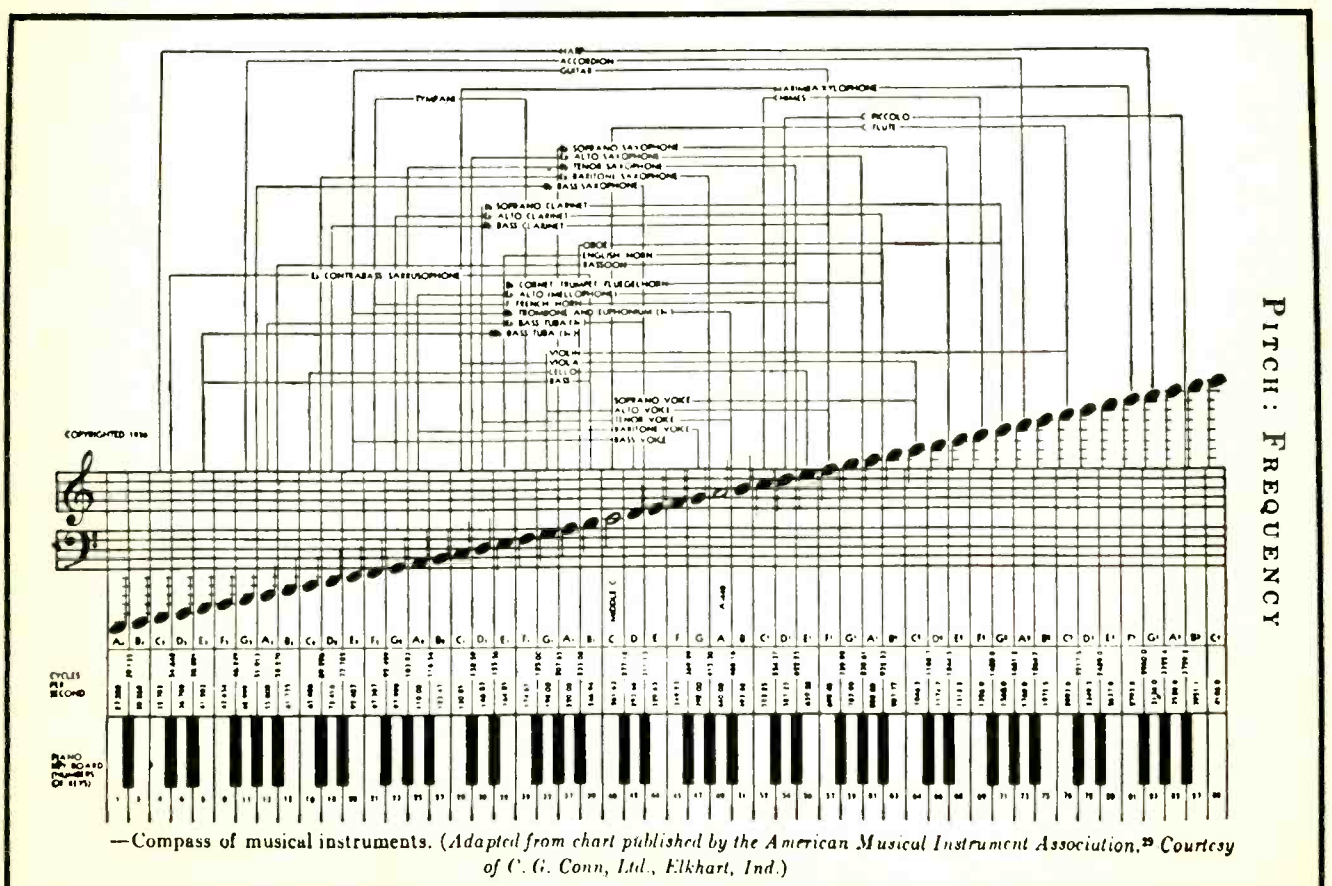



Fig. 1. This is a graphic realization of the generation of sound in air.

### Describing Waves

The height of the wave is called its "*amplitude*." The greater this amplitude, the louder the wave will sound. The connection between the width of a vibrating object's swing and the loudness of its sound should now be apparent: the greater its swing, the more it will compress the air molecules—and the greater will be the corresponding swing of our graphed sound-wave.




—Compass of musical instruments. (*Adapted from chart published by the American Musical Instrument Association.*[29] *Courtesy of C. G. Conn, Ltd., Elkhart, Ind.*)

# This twin-tonearm Dual 1019 belongs to a noted audio editor. We can't tell who.

# We can tell why.

When testing a 1019 for an equipment report, he found it to be the finest turntable he had ever used. With no exceptions. Not even his "reference" turntable and separately mounted tonearms...essential equipment for making accurate "A-B" comparisons of cartridges.

The 1019's tonearm tracked better ...and as low as 0.5 gram. (He didn't need his own gauge to measure tracking force. The 1019's direct-dial numerical scale proved equally accurate.)

**skating distortions eliminated**

With Dual's continuously variable Tracking-Balance Control, he was able to eliminate the distortions originating from skating, again just by dialing. And these calibrations were also exact.

**single play spindle rotates**

Rumble, wow and flutter were also better on the 1019. An important factor here was the rotating single play spindle which eliminates both binding and slippage of records that can occur with the usual stationary spindle found on all automatics but Duals.

**variable Pitch-Control**

Also exclusive to the 1019 is its variable Pitch-Control which allows speed to be varied over a 6% range...more than a half note. This feature is especially important to anyone who tapes from records or uses records to accompany voice or instrument. The 1019's powerful Continuous-Pole motor and massive 7-pound-plus dynamically balanced platter combined to keep speed constant within ±0.1% even when voltage was varied ±10%.

**automatic cueing**

Although the Cue-Control doesn't contribute to performance, it does to operating convenience, not to mention preservation of stylus and record. And it can be used not only for manually lowering and lifting the tonearm anywhere on the record, but also when starting automatically if an ultra-gentle descent is desired.

All equipment reviewers learned all this about the 1019's they tested. It's just that one of them took the next logical step.

**test reports available**

For ethical reasons, we cannot identify him, other than to note that his words appear in one of the seven test reports on the 1019 published to date ...all yours for the asking.

The second tonearm is not available as a standard accessory. One tonearm at a time seems to be highly satisfying for even the most serious of record enthusiasts. And so, we are pleased to add, is the total performance of the Dual 1019 Auto/Professional Turntable. $129.50

united audio Dual

535 MADISON AVE., NEW YORK, N.Y. 10022

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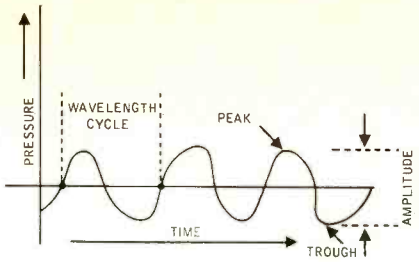


Fig. 2. Sound converted into a time cycle.

The faster the string in our example vibrates, the more vibrations there will be within a given period of time—or along a given length of the time line in *Fig.* 2. We call each complete vibration —from the beginning of one compression to the beginning of the next—a *"cycle"* and call the number of such cycles in each second the *"frequency"* of the wave. The higher the frequency, the higher the pitch. The international standard unit for describing frequency is the "hertz," named for Heinrich Hertz, discoverer of the electrical wave. One hertz (abbreviated Hz.) equals 1 cycle per second, and you are liable to run across both units in current hi-fi catalogs.

The distance *in space* between one point of the cycle and the corresponding point of the next cycle is called the *"wave length."* Obviously, the higher the frequency, the shorter the wavelength, since a greater number of cycles must occupy the same space in the same time as the frequency rises. A tone with a frequency of 20 Hz. (at the bottom of the average human hearing range) would have a wavelength, in air, of about 55 feet; a 20,000-Hz tone would have a length of about ⅔ of an inch, and the standard 440-Hz. "A" would be about 2½ feet long.

The wave form we've been looking at, as you may already know, is called a "sine" wave. Most naturally-occurring waves are not pure sine waves, but are mixtures of waves of different frequencies. It is the proportion of different frequencies in this mix that gives each wave its particular shape and sound. *Fig.* 3 shows a typical complex, periodic waveform. Despite its jagged shape, it can be analyzed into its component sine waves.

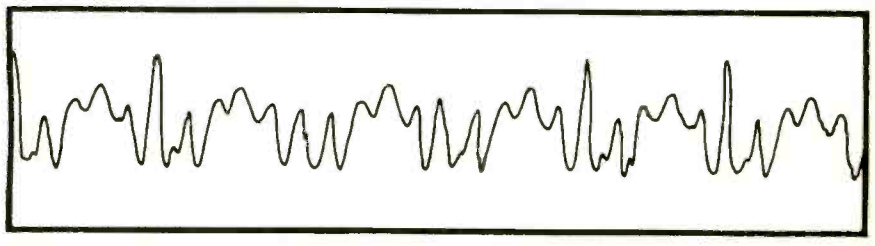

Fig. 3. The waveform of a typical, complex sound such as might be made by a single musical instrument.

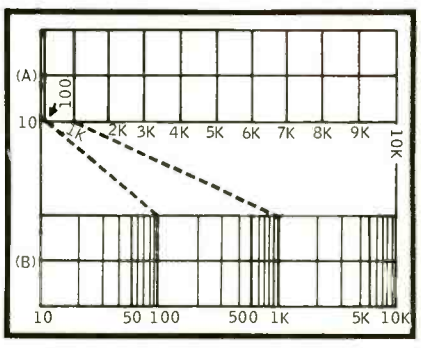


Fig. 4. Converting frequency from a linear to a logarithmic scale that keeps the distance between octaves equal.

### Frequency, Pitch, and the Logarithm

We can easily distinguish between a note with a frequency of 50 Hz. and one of 100 Hz. But the same difference of 50 Hz. is far, far harder to hear when the frequencies involved are 10,000 and 10,050 Hz.

That's because we perceive frequency changes proportionately, rather than in a linear, or arithmetic fashion. We hear a 50-100Hz. difference as a frequency ratio of 2:1, and call it an "octave," while the 200:201 ratio between the two higher frequencies we mentioned is perceived as only a fraction of a note—if we can perceive it at all.

This is part of a general pattern of human perception: that our perception of a stimulus varies roughly as the logarithm of the unit measuring that stimulus in other words, our perception of frequency changes is proportional not to the differences between two frequencies, but to the differences between their *logarithms.*

Hence, whenever characteristics of human hearing (or of hi-fi equipment) are being compared at different frequencies, we chart these characteristics on a logarithmic chart (*Fig.* 4). On such a chart, the distance from 20 to 200 Hz. is the same as that from 500 to 5000, since both represent a 10:1 frequency ratio. Similarly, the octaves from 20 to 40 Hz and from 500 to 1000 Hz take up the same space.

The range of human hearing is roughly from 20 to 20,000 Hz, which accounts for the frequent appearance of the magic numbers "20-20,000" in hi-fi spec sheets. I call them "magic numbers" because by themselves, they're meaningless. But they mean quite a bit when properly qualified, as we'll learn next month when we discuss the decibel. Æ

(Next month: sound levels, the decibel, and electrical waves.)


Step up, press the power button, and find out.

First, try the FM stereo. As you spin the heavy flywheel tuning knob, you experience the satisfaction of hearing and *feeling* each station lock in, sure and crisp. That's Harman-Kardon's new MOSFET front end working for you. What's a MOSFET? A metal-oxide silicon field-effect transistor—the latest, most effective device for reducing cross-modulation, increasing sensitivity and selectivity, and improving antenna match under all reception conditions.

Now put on one of your favorite stereo records. Notice things you never heard before? Better definition of instruments, inner-voice lines that were missing except at a live performance? That's Harman-Kardon ultra-wide frequency response, restoring the spaciousness and clarity that were there when the record was made.

This is the new Harman-Kardon NOCTURNE Seven Twenty, a solid-state receiver that constitutes a major step forward in high-fidelity design. What's behind that pretty face? 80 watts of startling stereo realism. $369.50*.

The Seven Twenty heads a new line of Nocturne receivers that includes the Two Ten (50 watts, AM/FM) at $269.50 and the Two Hundred (50 watts, FM) at $239.50. Unmistakable sound quality and long-time reliability are the family trademarks. We suggest you hear these new receivers soon at your Harman-Kardon dealer's. *Harman-Kardon, Inc., 401 Walnut St., Philadelphia, Pa. 19105*

*Prices slightly higher in the West. Walnut enclosure optional.

**harman kardon** LEADER IN SOLID-STATE STEREO COMPONENTS

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# EDITOR'S REVIEW

JANUARY IS THE MONTH when it is traditional for an editor to make prophecies for the coming year. Being one who is inclined to adhere to tradition perhaps to a fault, this observer will endeavor to follow the custom, even if we miss a few.

Hi-fi will continue to grow throughout the year. This in spite of the pessimistic outlook of some who feel that the market is saturated, that everyone who would buy hi-fi has already done so, and that there is no way to approach the "masses," all of whom, according to the pessimists, want furniture, or else portable compacts they could take to the beach.

Let's examine these outlooks. In the first place, there are some 1.8 million marriages every year, which means that the new family can no longer (in most instances, anyway) hang around home and listen to their parents' hi-fi systems—they'll need one of their own. And for a relatively small industry like the components business is, 1,800,000 potential customers ain't to be sneezed at.

And to the masses—everyone knows that with more take-home pay and more leisure *and* the status-building advantage of component hi-fi, the "masses" are just as good prospects as any other group of people. All we need to do is to educate them to the advantages of components and they are just as able to plunk down their signature on a "hire-purchase" agreement as anybody else.

And when it comes to building up a future insurance for business, we believe that the colleges and universities are a natural breeding ground for the hi-fi enthusiast. Every institution of learning in which there are hundreds or thousands of students should have its own hi-fi club. That is the logical market for the compact system—not the beach crowd. When this observer goes to a beach, he does so to swim and to enjoy the fresh air and the sun, not to lay around listening to a batch of scratchy phonograph records—and if you think phonograph records don't get scratchy at the beach, just take a few of your not-so-favorite ones with you some time and see for yourself.

As to the "furniture" buyers, they are in for some surprises, too. There are plenty of fine component hi-fi systems already in manufacturer-provided cabinets, and still more cabinets in which you or your dealer can put the system of your choice—you have only to select the cabinet and the components and pay your money.

## OUR OWN OUTLOOK

One of the chief complaints we hear at hi-fi shows is that would-be purchasers of this magazine can't find it on the newsstands. We expect that to be changed this coming year, along with an earlier appearance on the stands that now handle AUDIO, as well as the new ones. That will also apply to the subscribers' copies—they'll be getting to their destinations sooner, barring a complete snafu of the postal service, which has seemed imminent for the past few months.

Continuing our prognostications, we expect that our readers will be sending us many more construction articles—little or big, simple or complex, all the way from bright ideas to complete systems and the test equipment that keeps the complete systems functioning to the degree of which they can be capable.

## SUBSCRIPTIONS

Speaking of the college or university student, there is one way in which many of them will be earning the hi-fi equipment they want without any appreciable effort—simply by introducing AUDIO to their fellow students. We have a scheme whereby they can earn up to $100 per month (note that "up to" like you read in all the ads which promise "up to" nine more miles per gallon with the Yiffniff carburetor gadget. Never possible to get more than the limit of nine, yet the guarantee does promise increased mileage. Even 0.1 mpg more fulfills the guarantee.)

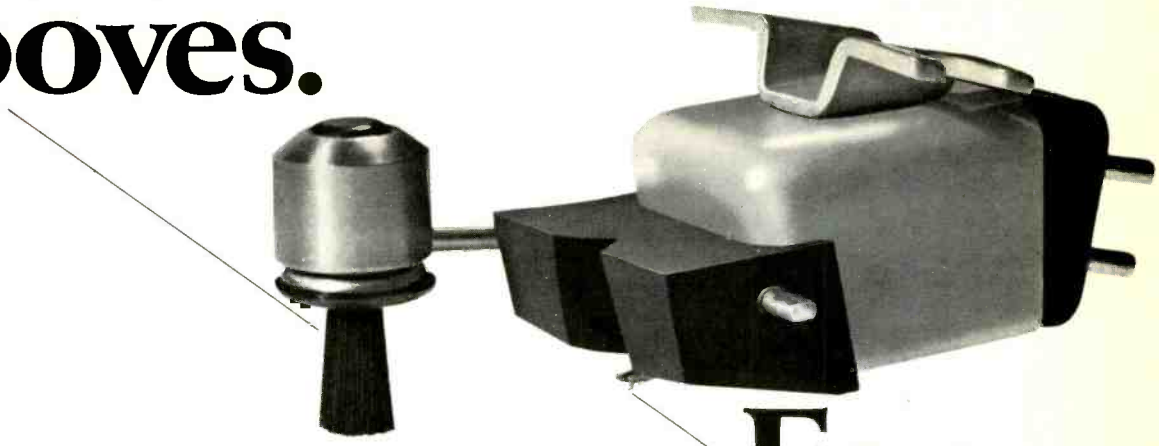
## BUT, SERIOUSLY

We don't know of any "major breakthroughs" in the foreseeable future. Integrated circuits are already par for the course in industrial and military electronics—why not expect more of them in consumer items—as you see in this issue, one company already has announced their introduction, and more are sure to follow. And while tube equipment is far from passe, most everything will be in the solid-state category within the year. If you aren't full transistorized, you just ain't with it.

The big speaker systems are again reaching the point they enjoyed before stereo downgraded them because "you need two to stereo." People put grand pianos in their homes because they actually sound better. Why not big speaker systems if your ear tells you they sound better? Especially in large homes, which probably have never been faced with the space problem, anyway.

So have a good year—and that is not an advertisement for an adjunct to your automobile—and continue to enjoy your hobby.

# 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**

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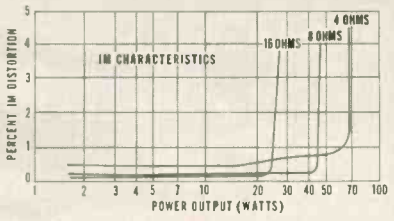
**Compare these new Sherwood S-8800 features and specs!** ALL-*SILICON* reliability. Noise-threshold-gated automatic FM Stereo/mono switching, FM stereo light, zero-center tuning meter, FM interchannel hush adjustment, Front-panel mono/stereo switch and stereo headphone jack, Rocker-action switches for 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 x14 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

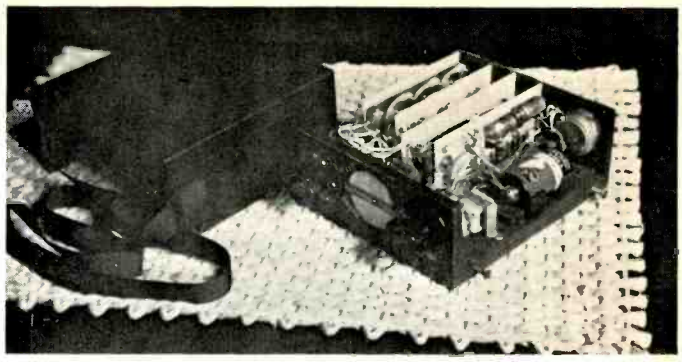
3-YEAR WARRANTY


Sherwood

*Sherwood Electronic Laboratories, Inc., 4300 North California Avenue, Chicago, Illinois 60618. Write Dept. A1*

# A Twelve Tone Tuner

James B. Hays



**Although tuning devices are commercially available, the real hobbyist would much prefer to build his own, especially when he can achieve the desired degree of accuracy at a considerable saving in cost.**

THIS TUNER IS NOT A new front end for a hi-fi set and it is not for tuning in twelve-tone music by Schoenberg. It is an oscillator designed expressly to produce the twelve tones of the musical scale as an aid in tuning musical instruments. The person who will appreciate this instrument most is one who is charged with keeping a harpsichord or a harp in tune. Done by an amateur ear, such a job can be time consuming and the results variable; with the tuner a beautiful tuning job can be done on the 57 strings of a one-manual harpsichord in twenty minutes. Another potential user is the person who likes to tune his own piano or electronic organ. The author falls in both categories and can vouch for the usefulness of the tuner and the results.

If anyone is under the impression that the harpsichord is an instrument normally kept in a museum and brought out occasionally for the use of a professional musician, the following information might be enlightening: One New York builder, Wallace Zuckermann, has made more than 5000 one-manual instruments over the last three years, primarily in kit form for amateurs. Like most harpsichords, they are constructed with wood frames, and with changes in humidity require rather frequent tuning. During the periods when the humidity is changing rapidly they can require tuning every week or so, depending, of course, on how critical is the ear of the performer.

The features of this relatively simple tuner that justify describing it here are that it uses inexpensive parts, is remarkably stable in frequency and results in a physically compact device of proven usefulness. It contains four inexpensive transistors—two for a Wien bridge oscillator, one for a buffer amplifier, and one to drive a small loudspeaker. A switch on the

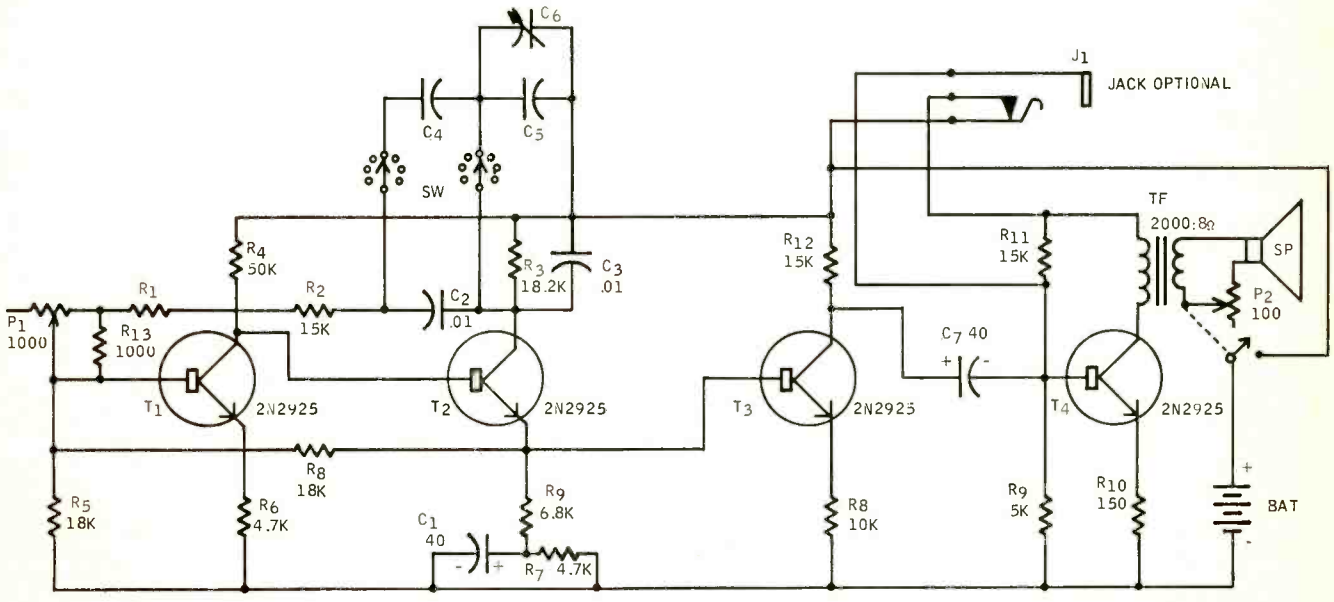



Fig. 1. Schematic of the author's tuning device, designed to facilitate the tuning of harpsichords, electronic organs, and even pianos.

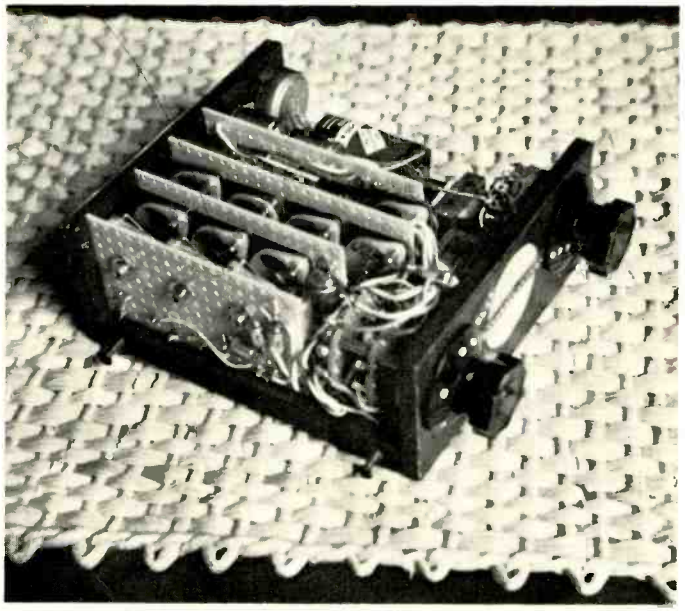


Fig. 2. One of the original models of the tuner. The drawings of Figs. 3, 4, and 5 differ in design, but are the recommended plans for the construction.

**TABLE I**

| Pitch | Frequency Hz. | Calculated Capacitance pF. | $C_4$ pF. | $C_5$ pF. |
|---|---|---|---|---|
| A | 880.0 | 10000 | 0 | 0 |
| A$^b$ | 830.6 | 10600 | 560 | 560 |
| G | 784.0 | 11200 | 1200 | 1100 |
| G$^b$ | 740.0 | 11900 | 1800 + 100 | 1800 |
| F | 698.5 | 12600 | 2500 + 100 | 2500 |
| E | 659.3 | 13350 | 3300 | 3300 |
| E$^b$ | 622.3 | 14150 | 3900 + 240 | 3900 |
| D | 587.3 | 15000 | 5000 | 4700 + 200 |
| D$^b$ | 554.4 | 15900 | 5600 + 300 | 5600 + 200 |
| C | 523.3 | 16800 | 6800 | 6800 |
| B | 493.9 | 17800 | 7500 + 300 | 7500 + 200 |
| B$^b$ | 466.2 | 18850 | 9100 | 8200 + 600 |

Table 1. Values for $C_4$ and $C_5$ for $R_3$ = 18,100 ohms.

volume control turns the oscillator on; a twelve-position switch selects the frequency; a master frequency control provides a small adjustment in pitch; and a 9-volt battery supplies the power. Largely responsible for the stability is the choice of oscillator circuit, which has been described elsewhere, and the choice of polystyrene tuning capacitors, which have a small negative temperature coefficient but good long-time stability. Silvered-mica capacitors would have been better from the standpoint of temperature coefficient, but are much more expensive. In this connection the capacitors seem to be the only contributors to the small change in frequency with temperature that the tuner exhibits. A previous tuner with a bridged-T network exhibited much more temperature sensitivity, caused by the transistors themselves. In the present design the temperature effect has never been a problem because the tuner is not subjected to changing temperature while in use. If the application is such that the tuner can not be allowed to come to room temperature before use, the silvered-mica capacitors could perhaps be justified for a critical user. One more feature is the use of small tuning capacitors for pocket radios as trimmers in this tuner. Besides being inexpensive, they provide a smooth adjustment necessary for the fine frequency control needed here and seem snug enough to stay in adjustment. A good grade of compression trimmer would probably be satisfactory in this application. However, in some crude vibration tests the specified radio tuning capacitor seemed slightly more stable.

### Circuit Description

A few things need to be said about the circuit before describing the con-

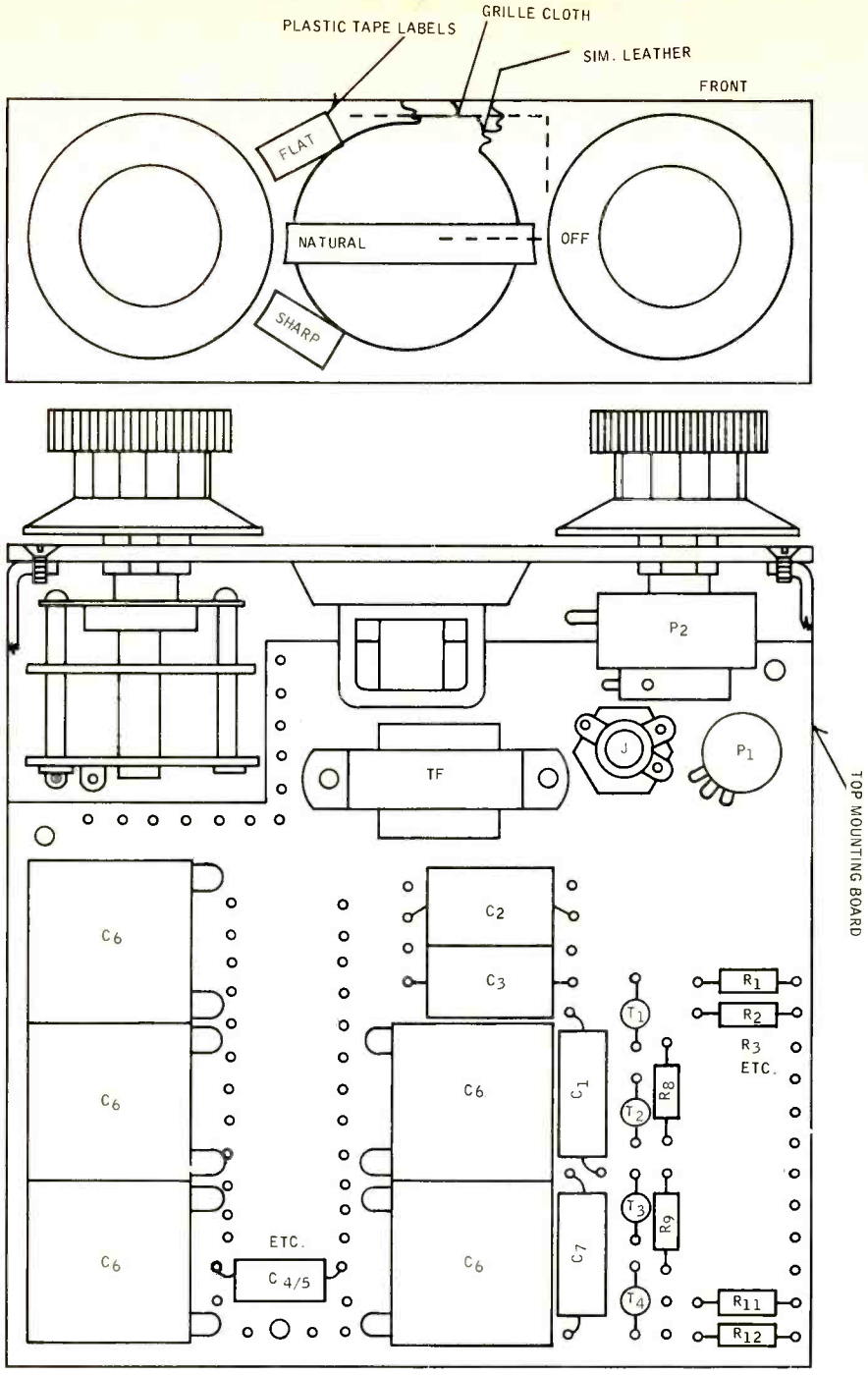



Fig. 3. Bottom and front views of the tuner chassis.

struction and use of the tuner. It will be noted that the resistors in the frequency-control arms of the Wien bridge are fixed and both capacitors are switched. There are, of course, other ways of controlling frequency that would use fewer or smaller elements. The reason for the present arrangement is to avoid any problems with the oscillator seeing different impedances at the different frequencies. As a result, the fixed negative feedback works well at all frequencies and the output waveform is uniform. Resistors protected against humidity effects are specified for the frequency control elements, again for stability.

The circuit is arranged to use convenient values of tuning capacitor starting with the .01 $\mu$F. capacitors for 880 Hz, which remain in the circuit while others are switched in parallel for lower frequencies. No variable capacitor is needed for 880 Hz since the master control $R_1$ sets this frequency. For this type of circuit, frequency is determined by the relation

$$f = 1/2\pi\sqrt{R' R'' C' C''}$$

Since the $R$'s are equal and the $C$'s are equal $f = \frac{159000}{CR}$, where $R$ is in ohms and $C$ in $\mu$F. At 880 Hz, when $C$ is .01 $\mu$F $R$ is 18,100 ohms. Table 1 shows the remaining calculated capacitor values, and the next lowest standard values. In all cases an attempt was made to keep the capacitors in the two arms nearly equal. It will be noted that the 365-pF variable capacitors cannot in most cases compensate for the 5 per cent tolerance of the fixed capacitors. To take care of this it would be well to have some extra 300-pF capacitors on hand to bring into tuning range any frequencies that are too high. If a frequency is too low, it can be raised by re-

moving the small parallel capacitor, if one is used, or by paralleling the associated trimmer capacitor with a resistor. Values of from 0.6 to 1.2 megohms for the resistor will raise the frequency by the same amount as a 300-pF capacitor will lower it.

It is most convenient if the switch has no stop, so that it can be rotated continuously. By drilling carefully in the proper hole on the front plate of the Oak switch, the stop can be removed. In this case, an 11-position switch will then have 12 positions, the 12th one being used for "A." If the stop is not removed, a 12-position switch must be used.

Resistors $R_2$ and $R_4$ control the negative feedback. More feedback improves the oscillator waveform, which is slightly distorted in this design, but too much is likely to invite a borderline condition in which oscillations sometimes cease.

An optional output jack is shown in the schematic, *Fig.* 1. This is for use in a special piano-tuning procedure to be described later. For control of loudness it is suggested that a 100-ohm potentiometer be wired as a simple variable resistor in series with the loudspeaker so that the sound cannot be reduced to zero without shutting off the tuner. The buffer stage prevents this control from affecting the frequency.

## Construction Suggestions

For the musician who may wish to carry this tuner in his brief-case along with his music, a thin compact shape is desirable. The dimensions of this tuner, 5½ by 5½ by 2⅜ inches, meet these requirements nicely. While the construction shown in *Fig.* 2 was fairly convenient to work with, a somewhat different arrangement shown in *Figs.* 3 and 4 has much to offer in the way of convenient access to components and controls, and more wiring space. Instead of the four vertical mounting boards shown in *Fig.* 2, there are two parallel mounting boards in the long dimension of the assembly. All the components except the battery holder and those on the front panel can be mounted on the inside surface of the boards, leaving the outside surface for wiring and for the last minute addition of small capacitors to bring some of the frequencies into range. Finally, the whole assembly is slipped into a box, open at one end, and held in place by a machine screw through the other end. Quarter-inch plywood glued and screwed together makes a very sturdy box. This plywood will take a #6 machine screw in its edge without splitting if a 7/64-in. pilot hole is drilled first, and only at places where the center ply is sound. A covering of artificial leather gives the tuner a professional appearance and a strap permits it to be hung from the neck when in use.

## Frequency Adjustment

Adjusting the frequencies of the tuner can be done in several ways. The most accurate method is by means of a frequency counter having a 10-second, crystal controlled period. Other methods include the use of a Conn Strobotuner, a Hammond organ having tone-wheel generators, or some other electronic organ or piano known to be in tune. In all cases the "A" is set first by means of the master frequency control, then the other pitches are set by means of the trimmers. If it is desired later to check and possibly reset the "A," this can be done by means of an oscilloscope and a 60-Hz sweep. Not everyone realizes that a stationary pattern results when 880 Hz is beat against 60 Hz on the oscilloscope, even though they are not even multiples. Because the 880 Hz is 20 Hz from the nearest harmonic of 60 Hz, the pattern is

*(Continued on page 25)*

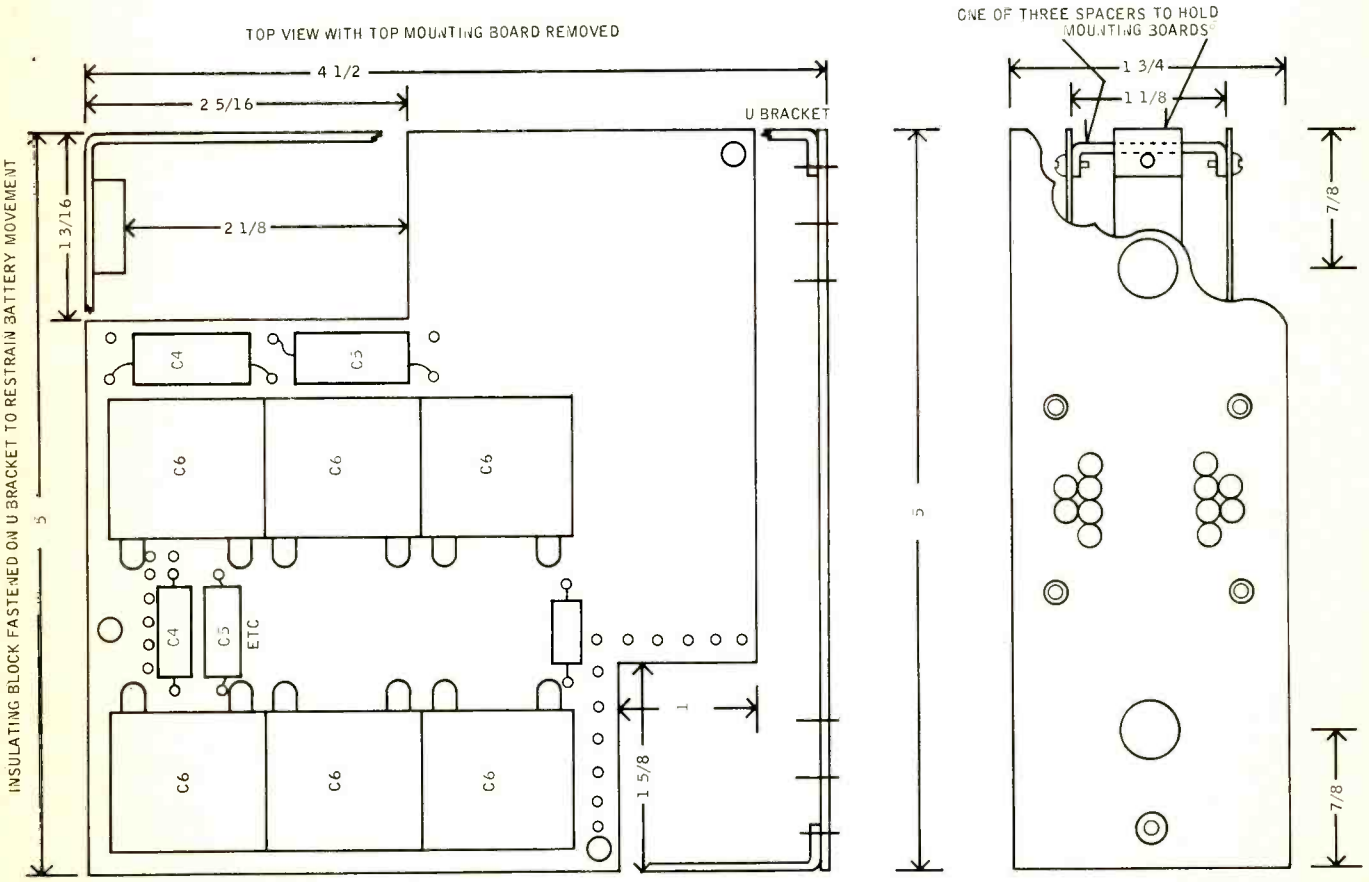



Fig. 4. Top and front views showing parts layout and construction.

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Some record players have uncorrectable speed errors as high as 1.5%—strobe card drift of 5 lines every three seconds—creating a pitch error of a quarter of a half tone. It is as though the conductor directed his orchestra to tune its instruments higher or lower.

The 2-speed AR turntable meets NAB broadcast Standards in rumble, flutter, wow, and speed accuracy.* The price is $78 including oiled walnut base, transparent dust cover, and center piece for 45-rpm records. In comparing prices be sure to count the cost of these accessories when, as is usually the case, you have to buy them separately.

Literature on AR turntables and speakers will be sent on request.

*Confirmed by many independent test reports. Four magazines chose the AR turntable for their top stereo systems from a field of competing units costing up to twice as much. We will be glad to send you their lists of selected components; you may also have, on specific request, a reprint of an article on how to check turntable characteristics at home.

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# HAYS

*(from page 22)*

shifted by 20/60 of a cycle each time the trace goes by. In three sweeps the pattern repeats. As a result there are three superimposed waveforms, but stationary. That is, they would remain stationary if the 60 Hz were perfectly steady, which it is not. The power-line frequency wanders slightly on either side of an average 60 Hz.

### Tuning Procedure

The tuning of a harpsichord by means of this instrument is simple, assuming one has some sense of pitch and beats. It is easiest to tune all the octaves of one pitch before going to the next. The starting note of any one pitch should be, say, the "A" of the same frequency that the tuner is sounding. Then, with the tuner still sounding, strike the "A" just tuned, along with an adjacent "A," and tune the new "A." Progress up and down by octaves until all "A's" are tuned.

It is possible also to tune a piano in this manner. However, it is a time consuming job for the amateur, not only because there are many more strings involved, but also because the tuning adjustment is stiffer and more critical. More often than not, one overshoots the correct adjustment a few times before getting it right. Also, when the adjustment is very close to being correct, as indicated by the slow beats, it is often difficult to tell whether the pitch is sharp or flat. The process of tuning a piano can be greatly speeded by the use of a microphone and an oscilloscope in addition to the tuner. When the signal from the tuner is used to synchronize the sweep of the oscilloscope, and when the sound from the piano string, picked up by the microphone, is displayed on the oscilloscope, the resulting pattern will move right or left if the pitch is sharp or flat. Then there is no doubt which way to correct the pitch of the piano string. As one progresses to the top octaves, the sound from a string dies out faster. It is usually necessary to tune the top octave strictly by ear. At the bass end other difficulties appear: the waveform becomes more ragged and the overtones are inharmonic. The latter effect causes one part of the waveform to move across the screen even when another part is stationary. Which component should one bring into tune? Despite arguments to the contrary, I prefer to tune the fundamental rather than the harmonic as long as a fundamental is recognizable. With a little patience and practice, an excellent job of piano tuning is possible. More of both qualities is required if you tackle an upright piano, primarily because of the difficulty of keeping in place the little rubber wedges that you need to silence the companion strings of the one being tuned.

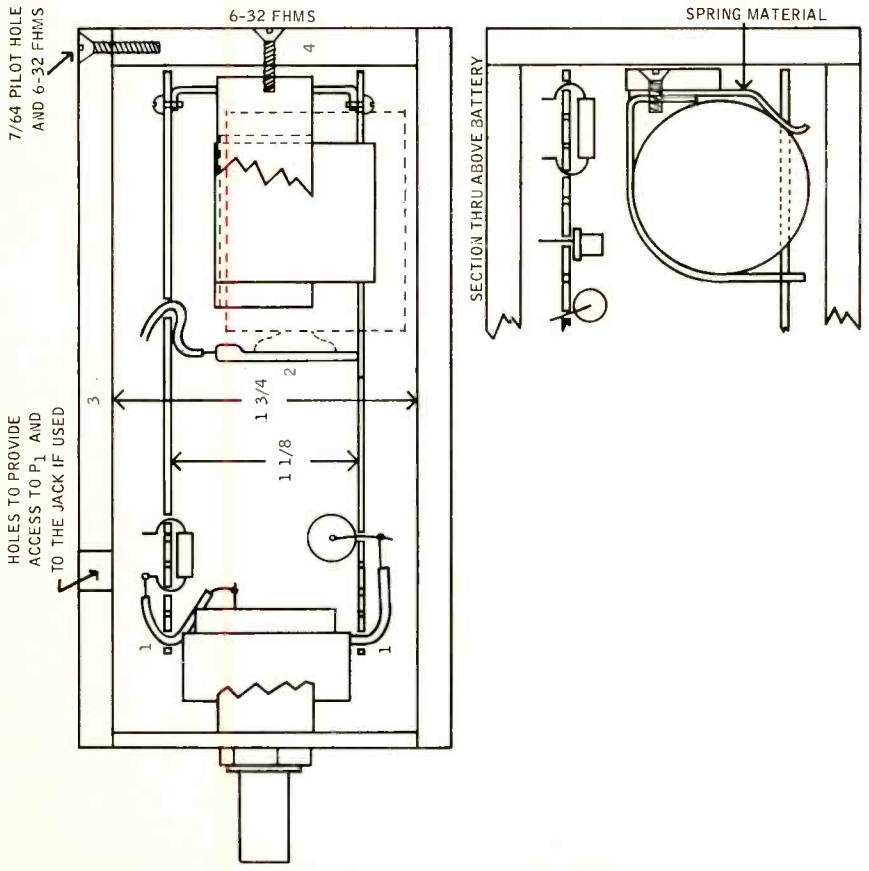



Fig. 5. Side view of chassis showing selected details.

### Some Scale Theory

The application of the tuner just described will be recognized by many as involving the same principle as the Conn Strobotuner, which, incidentally, is a handy and effective device for this kind of tuning. The present twelve-tone tuner is not offered as a competitor but rather as an alternate for the person who does only an occasional job of tuning and already has an oscilloscope, a microphone, and possibly a microphone transformer.

Anyone who is about to do some tuning ought to have a little conversational knowledge of the subject. If you are asked whether the tuner is set to produce a tempered scale, the answer is "yes." You may wish to point out further that many scales and many systems of tuning have evolved through the centuries, the scale being the general pattern of the intervals from note to note and the tuning being the more precise value of the interval in terms of frequency or ratio of frequencies. That many of the intervals turned out to be simple integrals like 1:2, 2:3, 3:4, and 5:6 has been known for a long time. Even Pythagoras in the 6th century B.C. was supposed to have studied some of these relations by means of an instrument with one string and a movable bridge so that he could sound the string on each side of the bridge for various bridge positions. A person with any sense of musical consonance and dissonance could, with this set-up, pick out all the above integral pitch ratios. Using tones based on these intervals, one can form a clean-sounding chord, namely, with frequencies proportional to 4:5:6:8. This could be C, E, G, C on the piano. Then, by saying that F should form a 4:6 or 2:3 ratio with the C above it, just as C does with G, one can fit F into the above series as 5⅓. With a little more such logic one has the tuning system called "Just Intonation."

The so-called "Pythagorean system" is built entirely on the "fifth"; that is, the C-to-G interval or 2:3 ratio, but in a different manner. This system is easy to visualize on the piano.

Start on the lowest C and count up seven half notes to G for a 2:3 interval; count up seven more to D for another 2:3 interval. Similarly, continue up the whole keyboard until you again arrive at C. You have now gone around the "circle of fifths" and have played all twelve notes of the scale, although in different octaves.

*(Continued on page 63)*

# Third Generation Hi Fi

## A New IC FM Tuner

LAWRENCE W. FISH, JR.*

**It had to come—Integrated Circuits have already become "old hat" in industrial devices, but this to our knowledge is the first time they have been put to use in consumer hi-fi tuners. While in this case there is not a great reduction in size, performance is measurably improved, according to the designer.**

DURING THE PAST FIVE YEARS we have seen the electronics industry change from tubes to transistors. We are now beginning a *third generation*—Integrated Circuits.

An Integrated Circuit, or IC, is a group of components such as transistors, diodes, resistors, and so on, that is carved out of a silicon wafer. Each wafer, approximately 1.5 inches in diameter, may contain as many as 600 complete circuits.

By a series of photo-etching and diffusion processes, the component parts of the circuits are formed. Since each IC is approximately 40/1000 of an inch square and could easily be misplaced, preliminary testing is done before the wafer is cut into individual circuits. Final testing is done when the IC is mounted in its package.

The reliability and long-term stability of silicon transistors is a well-known fact and it therefore stands to reason that a complete circuit made of the same material will have these advantages, plus some of its own. The most important advantages are close matching between all the components, miniaturization allowing much more circuitry per square inch, and uniformity of performance due to complete control of the manufacturing process of all the circuit components.

Integrated circuits suitable for use in high-fidelity equipment have been investigated for the past several years, and now receivers with an IC FM i.f. amplifier are available. This i.f. amplifier uses four type $\mu$A703 IC's. (See *Fig.* 1.) The design objective was to improve the performance of the existing silicon transistor design, make full use of the advantages of IC's, and reduce circuit complexity—a difficult task, but one that has been accomplished. (See *Fig.* 2.)

In this development it was necessary to have a circuit for the IC that would make a good, stable i.f. amplifier and would also provide broadband limiting without distortion. The circuit had to provide high gain per stage to keep the number of stages required within economic feasibility; and its loading effect on the tuned circuits of the i.f. amplifier could not impair selectivity. The basic circuit element meeting these specifications is the emitter-coupled transistor pair. The $\mu$A703 was developed with these requirements in mind. The $\mu$A703 is a five-transistor IC with self-contained bias and decoupling resistors. The circuit has useful gain for frequencies greater than 150 MHz, a stability-limited gain of greater than 40 dB, and an output impedance of greater than 50k ohms. With the proper source and load impedance, limiting does not occur by saturation, therefore detuning with signal, loss of selectivity, and phase distortion are minimized.

A quality FM i.f. amplifier and limiter must have at least seven high Q-tuned circuits for good selectivity and approximately 90 dB total gain for good sensitivity and limiting. The first requirement means that the circuit must contain four i.f. transformers and a ratio detector transformer. The $\mu$A703 has a minimum stage gain of 26 dB at 10.7 MHz. Four integrated circuit stages produce a total gain of 104 dB and, with double-tuned i.f. transformers in each stage (a total of eight tuned circuits), we have the required gain and selectivity. Some of the available excess gain was sacrificed to minimize loading of the tuned circuits and to prevent mistuning in the presence of strong signals. All limiting occurs within the integrated circuits without change in impedances.

*Design Engineer, H. H. Scott, Inc., Maynard, Mass.

Fig. 1. Assembly of a typical integrated Circuit. Note that this model has eight connections. The $\mu$A703 has six external connections.

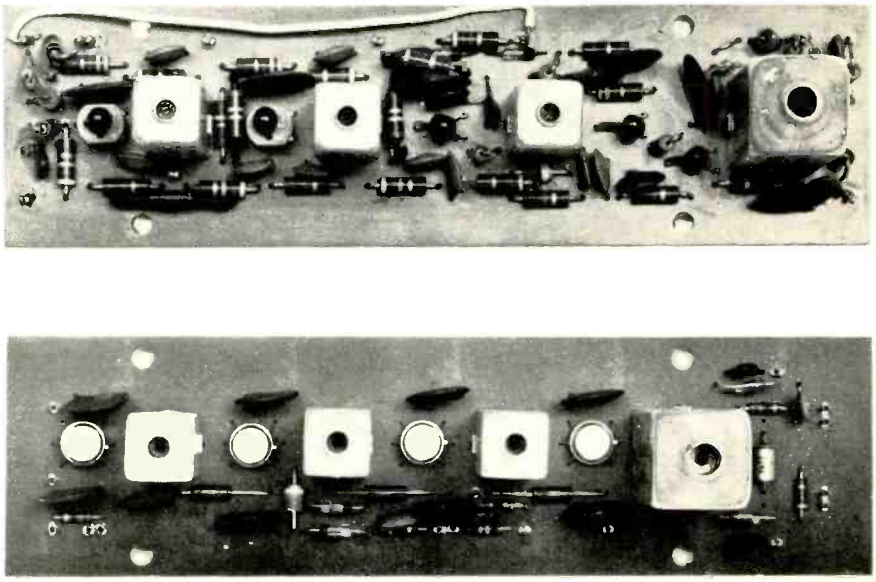


Fig. 2. Comparison of the complexity of the conventional transistorized i.f. amplifier (upper), with the equivalent unit employing IC's (lower).

The schematic diagram of the resulting design is shown in *Fig.* 3. IC301 and 302 operate primarily as i.f. amplifiers, with IC303 and 304 as amplifier-limiters. The tuned circuits were designed for best phase-linearity to produce low FM distortion. AGC voltage for the field-effect transistor front end and for other auxiliary circuits is developed by voltage-doubler rectifiers connected to the output collector of IC302. The filter network C307, R302, C316, and R303 removes the residual 10.7 MHz components and provides the proper time constant for automatic gain control. The ratio detector is floating and not grounded so that the proper composite signals are provided for the multiplex section.

Measurements on the i.f. strip were made per IHFM-T-100, the standard for measurement of tuners, in a typical tuner using an FET front end. (See Table 1.) A discrete component strip was also measured for comparison. The measured results are shown below. Note that only the i.f. amplifier-limiters were interchanged in the same tuner.

Table 2 shows the reasons for the measured changes.

Integrated circuits could, and did, produce improvements in FM tuner performance. These integrated circuits, as shipped from the manufacturer, are complete, pre-wired, pre-tested circuit elements. This enables the assembly job to be performed at a minimum of expense, making it possible to give you, the consumer, more circuitry and performance for your dollar. How else can you get a 20-transistor i.f. strip (five per IC) for the price of a 5-transistor unit? Æ

H. H. Scott, Inc. gratefully acknowledges the cooperation of Fairchild Semiconductor in the design and evaluation of this integrated circuit IF amplifier.

**Table 1**

| | Silicon Transistor | Silicon Integrated Circuit |
|---|---|---|
| 1. Sensitivity | 1.7 μV | 1.5 μV |
| 2. Capture Ratio | 3 dB | 1.75 dB |
| 3. Selectivity | 45 dB | 46 dB |
| 4. AM Rejection | —46 dB | —52 dB |
| 5. Distortion @ 400 Hz | .3% | .3% |
| 6. Stereo Separation | 35 dB @ 400 Hz<br>19 dB @ 15 kHz | 41 dB @ 400 Hz<br>30 dB @ 15 kHz |

**Table 2**

| | |
|---|---|
| 1. Sensitivity: | The transistors in the μA703 have a gain-bandwidth product of 900 MHz, and therefore have a better noise figure than normal i.f. transistors at 10.7 MHz. |
| 2. Capture Ratio: | Capture ratio is determined by limiter-detector bandwidth and frequency response of the i.f. amplifier. The useful bandwidth of the integrated circuit, being greater than 150 MHz, contributes a substantial improvement in capture ratio without any sacrifice of selectivity. Capture ratios as low as 0.8 dB have been measured in this design. |
| 3. Selectivity: | Selectivity is purely a function of the quantity and the quality of the tuned circuits. Both i.f. amplifiers have the same number of tuned circuits, so no substantial improvement is noted here. |
| 4. AM Rejection: | An integrated circuit is a better limiter than a transistor circuit. |
| 5. Distortion: | At 400 Hz the signal generator and the detector determine distortion. The same generator and detector design resulted in no measured change. |
| 6. Stereo Separation: | Stereo separation is dependent on the maintenance of phase linearity of the i.f. amplifier, particularly at high modulation frequencies such as a stereo signal with a 15-kHz audio frequency. The phase linearity of the IC's during limiting is the cause of the improvement. |

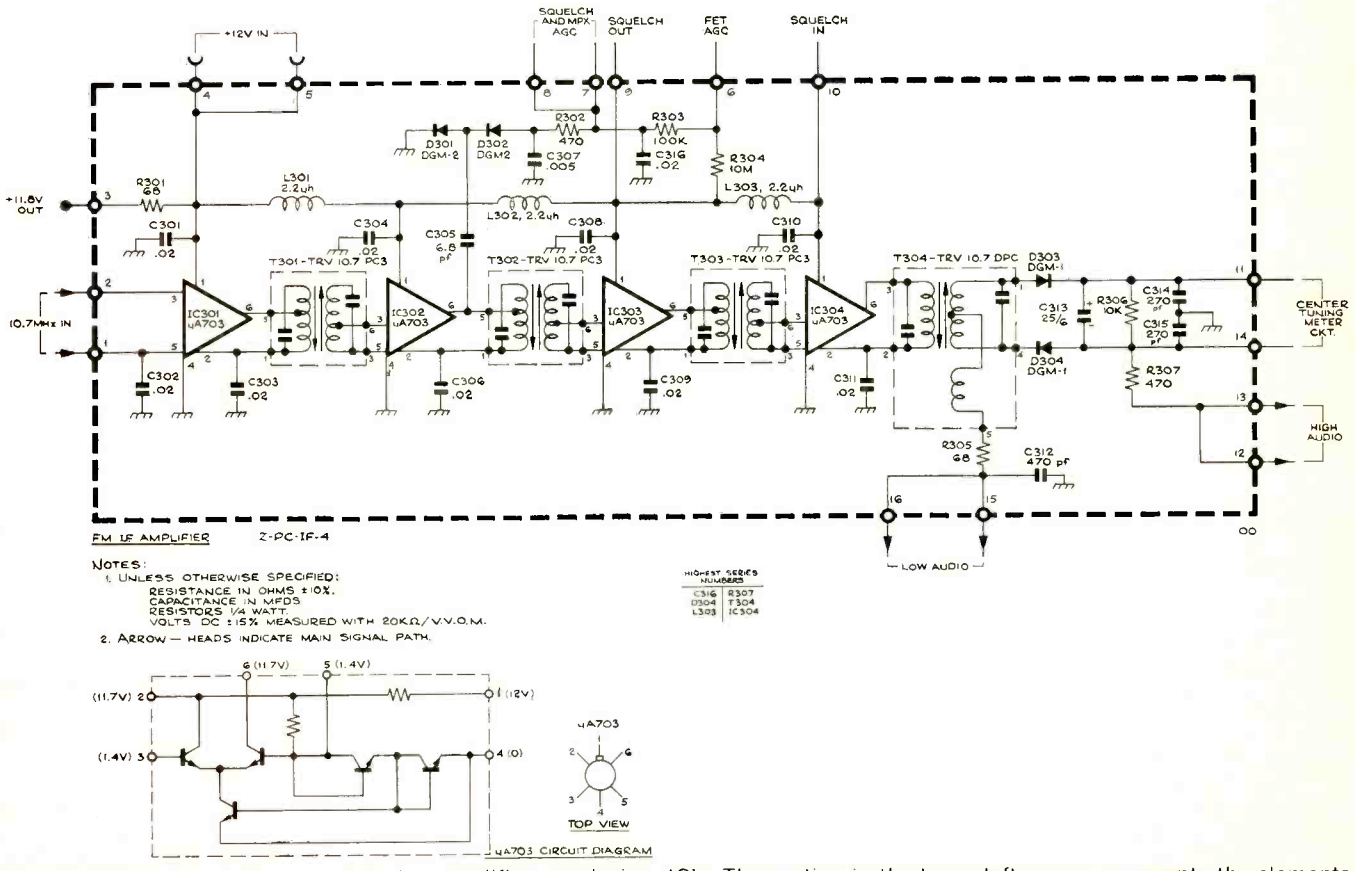



Fig. 3. Schematic of the complete i.f. amplifier employing IC's. The section in the lower left corner represents the elements in a single IC.

THIS MONTH'S COVER

# Youth's Pre-College Project—

## A Top-Quality Hi Fi System

**From the age of 12, Jim Ebbert had an unbounded desire for a hi-fi system of his own making which would compare with the best of many installations by his elders.**

"How I BECAME a full-fledged audio buff in only six years" might well be the title of the life-to-date story of our front-cover subject, James C. Ebbert, Jr., of York, Pennsylvania. Yet he is only 18 now, and a freshman at Bucknell College, in Lewisburg, a town of some 5500 located sixty miles from his home city.

Sparked by an early interest in music and a hi-fi enthusiast older brother, Jim first became involved in audio activities at the age of 12 when he acquired a record changer without electronics. Having on hand a small radio receiver, he found a way to make it serve as a phono amplifier in addition to its normal duties.

From this humble beginning, Jim's interest continued to grow, and his present line-up of equipment includes many of the best names in hi fi.

The photo on the cover shows our hero explaining the intricacies of hi fi to a friend—and to a *girl* friend that can often take a bit of doing. In the center of the picture may be seen his Webcor tape recorder, judiciously placed where any tape recorder should be put if the decor permits—just in front of the air conditioner. To the right of the recorder is a Harman-Kardon Citation III-X which he assembled from the kit, and to the left is a Citation I, also assembled from a kit. Below, in a former toy chest and normally partially hidden behind screening are two kit-built Citation II's (that's 240 watts, son) which also benefit from the proximity of the air-conditioner. The amplifiers are mounted with their backs out to facilitate metering the tube currents and adjusting the bias and a.c. balance controls. This is a logical way to mount these amplifiers, but it does make it difficult to change tubes (we did the same ourselves.) The Fisher reverb unit occupies some of the space behind amplifiers, with its control unit above and to the left of the Citation I.

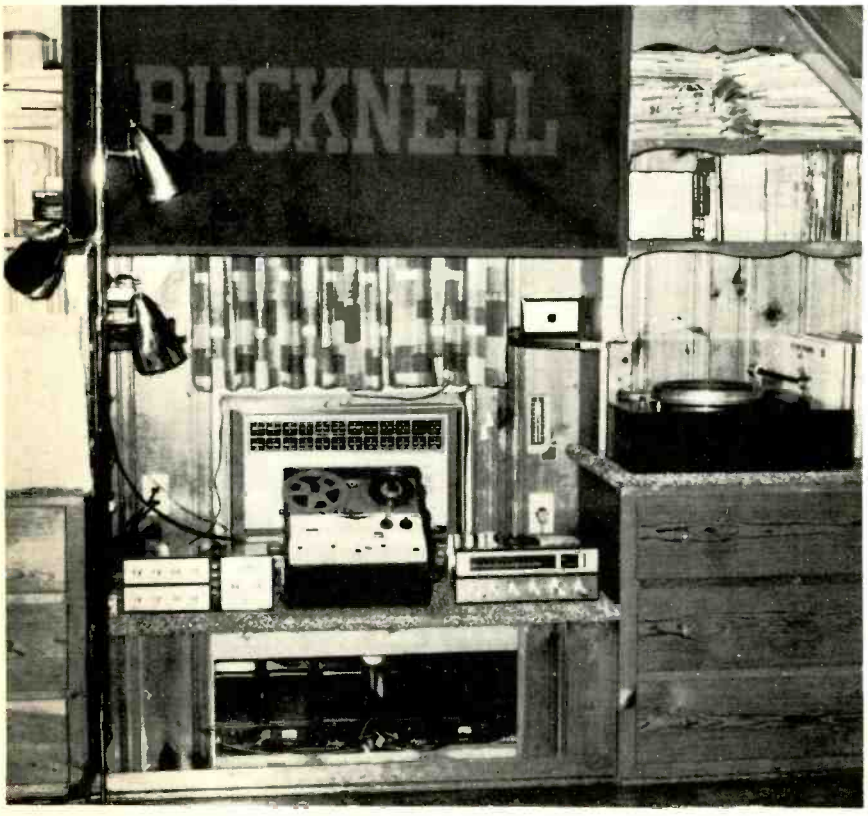
To the right of the center section and under his magazine files and some of his records, Jim mounted his Rek-O-Kut turntable, basically as a spare. The table has mounted a Pritchard art (ADC) with a Shure V-15 cartridge, and a Dust Bug. The arm is actually mounted on a Thorens tonearm board which permits easy removal for transfer to the Thorens turntable at the left of the center section, along with an AR turntable with an Ortofon cartridge. The Thorens TD-124 table is fitted with an SME-Shure arm in which is mounted a Grado cartridge.

One novelty at the left is an "acoustic wall" which hinges from the house wall to provide insulation from *direct* acoustic feedback. This wall is swung forward when playing at high levels to screen the arm/pickup combinations from direct-sound-wave impingement, often the cause of feedback in severe cases, and unsuspected distortion in minor ones. The unique suspension system employed by the AR and the design of the Thorens SW base effectively eliminate any *indirect* acoustic feedback through the wood cabinetry. The "wall" is really a 2-in. batt of fiber glass in a cheesecloth bag which hangs from a wooden beam hinged to the wall so it can be swung in front of the turntables when playing a record or pushed back against the wall when changing them. Though not yet acquired at the time the pictures were taken, dust covers are now hinged over the two turntables, with hooks provided above them so they may be latched upward while changing records.

The principal listening position is opposite the equipment installation, with two AR-3's properly placed for good stereo effect. When desired for reasons of family congeniality, Jim reclines in his favorite listening chair, dons his Koss PRO-4 headphones, and adjusts them to his satisfaction by means of a Jensen Space Perspective control.

That just about does it—though one more refinement should be mentioned. That is the ventilating fan barely visible as a white spot between the two Citation II's. This helps to move the heated air—and eight 6550's can heat a lot of air—from the amplifier enclosure. Nearly makes up for the air conditioner!

All in all, we think this is a most creditable system to be assembled by this enterprising young man. Æ

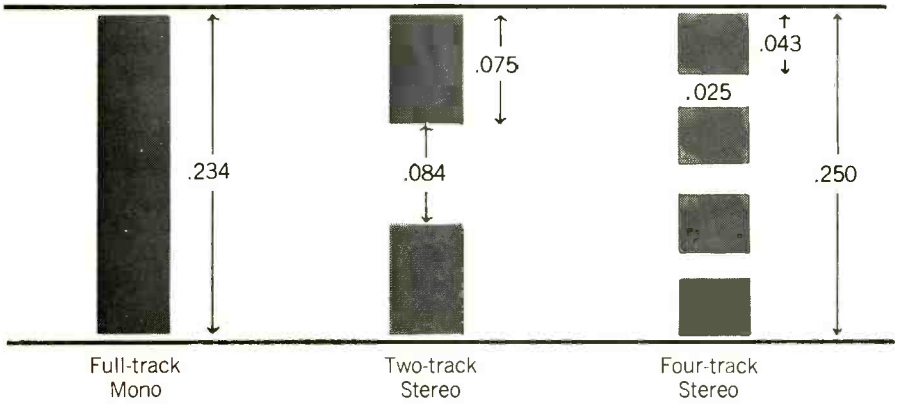



Another view of the center section of Mr. Ebbert's installation.

Some plain talk from Kodak about tape:

# The big squeeze—Multitrack Stereo

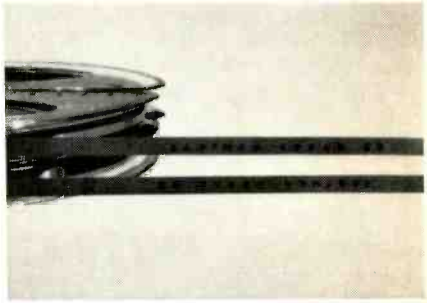
Remember the college fad a few years back—how many brawny brutes could be squeezed into a little car built for plain folks? For a while, it looked like a somewhat similar situation was about to take place in the tape-recording field—first monaural, then 2-track, then 4-track, and now even 8-track recording. Even though these developments continue at a fast clip, 4-track stereo is still the name of the game as far as high-fidelity applications are concerned. And very nice it sounds, too, thanks to the precision built into modern heads. But you do have to watch yourself. Having double the information on a given length of tape means everything has to be just so—including the tape you use.




**4-track star.** The first thing to worry about in considering a tape for 4-track stereo is output. As you can see in the chart above, adequate separation must be maintained between each track to prevent cross-talk. And as the actual width of the recorded tracks drops down, the output per channel on the tape drops in proportion.

Thus, to make the most of what you can record, you need a tape with a high-powered oxide layer—one that's going to give you a high output with a good signal-to-noise ratio. KODAK Sound Recording Tape, Type 34A, fills the bill—gives you 125% more undistorted output than conventional general-purpose tapes. You get practically the same per-channel output on 4-track stereo with Type 34A that the other tapes would give you on 2-track! But there's more to recommend the use of Kodak tape.

**Staying on the right track.** Because everything gets smaller in proportion when you go to 4-track, dimensional precision becomes that much more important. Take a tape that suffers from a case of drunken slitting. (That's when the edges of the tape snake back and forth even though the width is constant.) It's not hard to see how this tape isn't going to "track" straight past the head. A slight case of this and you get alternating fluctuations in output on both channels. If the condition is bad enough, a poorly slit tape can cause your heads to drop out the signals completely, even pick up the signals on the tracks going the other way. Horrors! Lucky for you, you have nothing to worry about with Kodak tapes. We keep our tolerance to .001 inches. That's twice as close as industry standards. To make your life even easier, we also backprint all our tapes so you can always tell



whether a reel has been wound "head" or "tail" first. Simply note which comes first off the supply reel, the "E" of "EASTMAN" or the "O" of "CO"... and note it on the reel.

Kodak tapes—on DUROL and Polyester Bases—are available at most electronic, camera, and department stores. To get the most out of your tape system, send for free, 24-page "Plain Talk" booklet which covers the major aspects of tape performance.


EASTMAN KODAK COMPANY, Rochester, N.Y.

Check No. 67 on Reader Service Card.

# sound&sight

HAROLD D. WEILER

EACH DAY NEW APPLICATIONS are being discovered for video recording. The two presented this month are as far apart as the poles yet the video recorder serves both perfectly. A video recording implants its impressions in the form of picture images. And since people tend to remember what they see better than what they hear alone, the impressions burned into their minds via a video recording have a better chance to endure—to inform, teach, persuade, inspire, and compel action. In short, motivate.

Video recording with its "instant-playback" feature, already used extensively in many sports, football, basketball, and golf, is now helping bowlers improve their scores at Morris Cramer's Bowlers Club in Latham, New York.

Located near Albany, Cramer's bowling alley offers customers an opportunity to analyze their bowling styles immediately after bowling. This bowling self-analysis is made possible by an Ampex VR-7000 portable video recorder, a video camera and a receiver mounted on a specially constructed mobile platform,

The bowler's approach, delivery and follow-through are captured on video tape much the same as sound is recorded on audio tape. The bowler then steps back to the side lines and is able to view his performance on the TV receiver as the tape is instantly played back. He then walks a few steps back to the alley and attempts to correct any flaws he has seen.

Morris Cramer, owner of the Bowlers Club stated, "Video recording introduces something entirely new and valuable to bowler training. The bowler no longer need rely on someone else's evaluation of his form and style. With video recording, the bowler can view, analyze and correct his own errors.

"In some cases, our bowlers want to have specific trouble areas pointed out as they view the tape. To accomplish this, we attach a microphone to the recorder and a spotter's commentary is recorded on the video tape. As the bowler views the tape, he can pay special attention to the flaws noticed by the spotter."

The Ampex recorder employed in this particular installation also allows recorded action to be stopped and viewed at any desired point. Flaws in style almost impossible to detect in normal viewing can be picked out when a moving sequence is viewed as a series of still pictures.

After viewing a playback of his bowling, Bob Daubney, a championship bowler from the Albany area, commented, "Stop action gives the bowler insight into specific movements. The 'stills' can reveal flaws that might be missed in observing a bowler."

Cramer expects to expand use of the Ampex recorder during this season. "Video recording has been so successful and accepted at the Bowlers Club that I plan to tape portions of the league competition and play the tape back in the bar," he said. "This will give both observers and bowlers a chance to see portions of the competition they've missed. It should also give every one a chance to second-guess bowlers in critical situations."

### Opera Training

Boris Goldovsky a prominent operatic stage-director, producer, and teacher, thinks grand opera can take a few cues from modern technology.

Dedicated to improving the quality of professional opera, Goldovsky has recently added video recording to his list of innovations in the field. With a compact video tape recorder he permits his operatic pupils to see themselves as others see them and benefit by the experience.

The Ampex VR 7000 he uses records pictures and sound for immediate or repeated playback through a television receiver. On playback, sight and sound are perfectly synchronized because both are recorded at the same time on the same tape.

Goldovsky who conducts the Goldovsky Opera Institute for promising young opera singers, believes the video tape recorder will be a valuable teaching aid.

"We noticed that when the singers of the Goldovsky Opera Theater viewed videotaped re-runs of their performances on local television stations, they became acutely aware of their weak points. This led to the idea of using a video tape recorder as an aid in teaching operatic acting," Goldovsky said. This method was first used at the Oglebay Institute at Wheeling, West Virginia in August. He continued, "For the first time, we were able to let singers observe their own actions, immediately after they had performed them. As a result, they learned faster and made the opera workshop function smoother than before.

"We plan to show our pupils video tapes made by successful opera singers. The students' own performances of these very same scenes will then be recorded and played back immediately to permit a comparison and an evaluation," Goldovsky added.

Some tapes will have comments by Goldovsky, who plans to analyze what his pupils are seeing. Recording of these demonstrations has already begun at Goldovsky's "Studio 95" in Carnegie Hall. Nancy Williams, soon to join the Metropolitan Opera Association, and Ronald Holgate, well known star of numerous Broadway musicals, have both made instructional video tapes for Goldovsky.

In addition to helping young opera singers further their careers, Goldovsky directs a Leadership Training Program. Brilliant young conductors, stage directors, coaches, scenic and costume designers, and some who combine two or more of these abilities are invited to work with Goldovsky. Although the students receive no degrees or diplomas at the end of this intensive training, to be a graduate of the program greatly enhances their futures and the futures of the productions with which they are associated.

At present, former trainees hold top positions in leading universities, conservatories and civic opera companies across the naton. Goldovsky believes video tape recording techniques will benefit those operatic centers.

"It is my great hope to push ahead in the conservatories and other music centers across the nation. I plan to show those in the Leadership Training Program how video tape recording can work in their various fields," he said. Æ

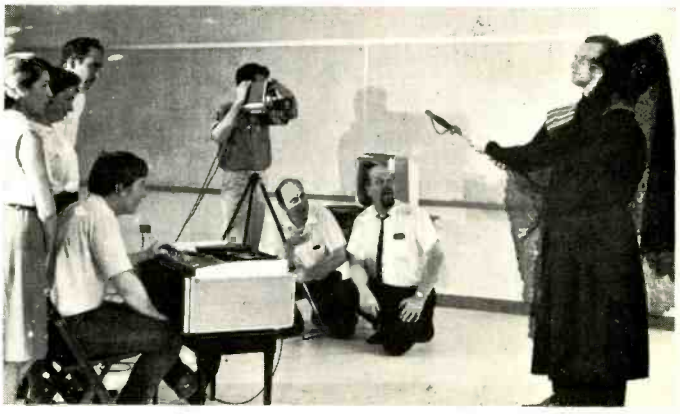


Fig. 1. An Ampex television camera and videotape recorder record an opera rehearsal at the Oglebay Opera Workshop, Wheeling, West Virginia, while Boris Goldovsky and Arthur Schoep, kneeling, provide instruction.

# How to make a scene
## (that everybody will love you for)

**a.** With this Sony TV camera you can film almost any scene

**b.** Record it in both sight and sound with this Sony video tape deck

**c.** See and hear it on this large screen Sony monitor/receiver

Total cost of this Sony TV Studio $1340

It's as simple as A, B, C to enjoy this year's most enjoyable product, the home video tape recorder. You can produce instant movies in sound of memorable family events. Tape TV programs off the air. The compact, low cost Sony Videocorder® has hundreds of uses in business and education.

You can enjoy an hour's video tape for less than the cost of an hour of processed black & white film. There's no processing cost and you can erase and use the tape over and over again. It's instant movies in sound. This instant visit your Sony Videocorder dealer or write for details. The Videocorder is the only quality, low-priced video tape recorder available for immediate delivery. Sony Corporation of America, 47-47 Van Dam Street, L.I.C., N.Y. 11101

Products pictured above include: **A.** VCK-2000 Camera ensemble (solid-state camera, microphone, tripod) $350. **B.** CV-2000D Videocorder deck, compact video tape recorder in handsome walnut-finish cabinet, $695. **C.** Model CVM-2300U 22″ (measured diagonally) monitor/receiver, $295. *The Videocorder is not to be used to record copyrighted materials. Prices suggested list.*

**SONY® VIDEOCORDER®**

# Equipment Profile

## MARANTZ 15 AMPLIFIER

If there is any belief remaining that solid-state amplifiers still leave something to be desired when related to the best vacuum-tube units, we can only suggest a careful examination of this new all-transistor-operated amplifier from Marantz.

We received neither technical information nor a schematic of the unit—this sample is one of the first off the production line at the new Marantz plant in Woodside, New York. So there is little that we can tell you beyond what physical examination reveals.

It is well known that stereo amplifiers suffer from an interaction problem at the power supply. Heavy demands by one channel leave little reserve should the opposite channel require like power. This is the reason why it is standard to test stereo amplifiers with both channels operating simultaneously (even though you are only measuring one at a time). This results in a somewhat lower power rating than would be the case if one channel were operated while the other merely idled. Just how much of a difference actually exists is a function of the quality and regulation of the power supply. We suppose that the perfect power supply construction would show no differences, but this would be prohibitive in cost.

Marantz, mindful of this problem, solved it in the most obvious way. The Model 15 is not, strictly speaking, a stereo amplifier. Rather, it is two separate mono units, each with its own power supply right up to the power transformer. The two are bolted together with a common face plate.


Fig. 1. The Marantz 15 stereo basic amplifier.

Needless to say such an arrangement means that there is no crosstalk. And testing one amplifier is the same as testing both together. (Marantz is making one unit alone available as a mono amplifier).

A weakness of transistor amplifiers has been their sensitivity to damage from short- or open-load conditions. The 15 has dual automotive-type lights in the output circuitry that absorb short circuits without damage to solid-state devices. We placed a short across the output while driving the amplifier to full power at 20 kHz. The output dropped to zero and the lights came on brightly. With the short removed the lights faded out and power quickly came up. No damage, and hardly any delay in power restoration.

The lights shine through dual lenses around the pilot lens on the front panel. There are two such sets, since there are two amplifiers. These lights will also glow while the amplifier is operated at high power into 4 ohms. But they have no effect on power output.

*Figure* 2 shows power response and frequency response. Note that the maximum power is dependent on load with the highest at 4 ohms and the lowest at 16 ohms. Marantz specifies the unit to provide 60 watts at 8 ohms. This the amplifiers do. In fact, each one provided 69 watts at 8 ohms; 80 watts at 4 ohms, and 42 watts at 16 ohms. Our graph only shows 8 ohms; the other two impedances present identical curves.

In fact the similarity of performance between the two amplifiers is quite astonishing. We would have expected close approximation knowing the Marantz reputation. But the fact is that we could not find *any* significant differences between the units. Channel A measured 69

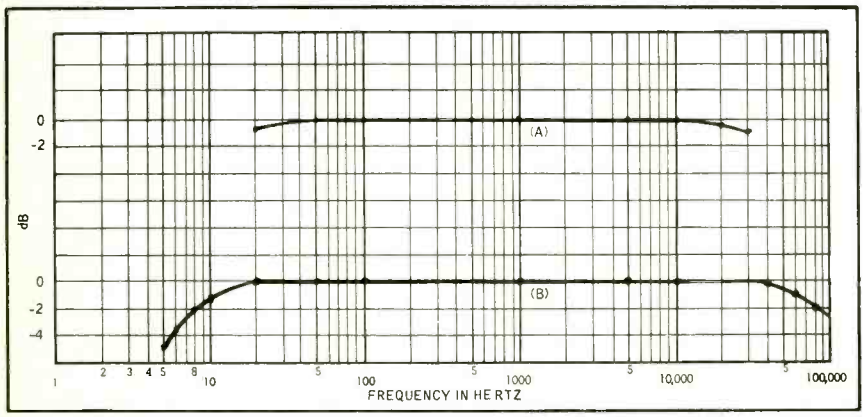



Fig. 2. Power response (A) at 60 watts into 8 ohms and frequency response (B) at one watt.

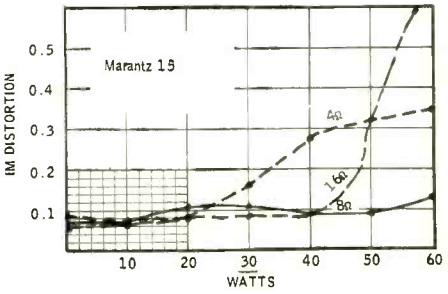



Fig. 3. An expanded scale display of IM distortion at the three nominal impedances. Note that there is no camelback hump at low power. Up to twenty watts the distortion is close to instrument residual at all three impedance load measurements.

# 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®

A Division of LTV Ling Altec, Inc.,
Anaheim, California

Check No. 69 on Reader Service Card.

watts and channel B measured 69 watts.

IM curves are also identical for the two amplifiers. These may be seen in *Fig.* 3 and show the three load-impedance measurements. They are close to the residual of our meter—certainly they are without quarrel no matter what standards you want to set.

We failed in our attempt to measure signal-to-noise. Failed only because it is well in excess of the 100-dB range allowed by our meter. That is below rated output—noise is certainly no problem here.

Square-wave observations showed some tilt at 50 Hz. This would conform to the bass rolloff of the amplifier. A 10-kHz wave showed slight rounding of the leading edge but absolutely no fuzziness or roughness. Not even when we placed a capacitor across the output. Rise time is 4 $\mu$sec.

Marantz is asking a pretty price for this unit—$395.00. But it is one of that select few amplifiers that are completely characterless. The sound it produces is the sound fed in. No more and no less. Combine this with a listening quality that simply confirms what we hear and we must report this unit for what it is. Simply a nearly indestructable, nearly distortionless, amplifier. In two words, nearly perfect.

CIRCLE 1

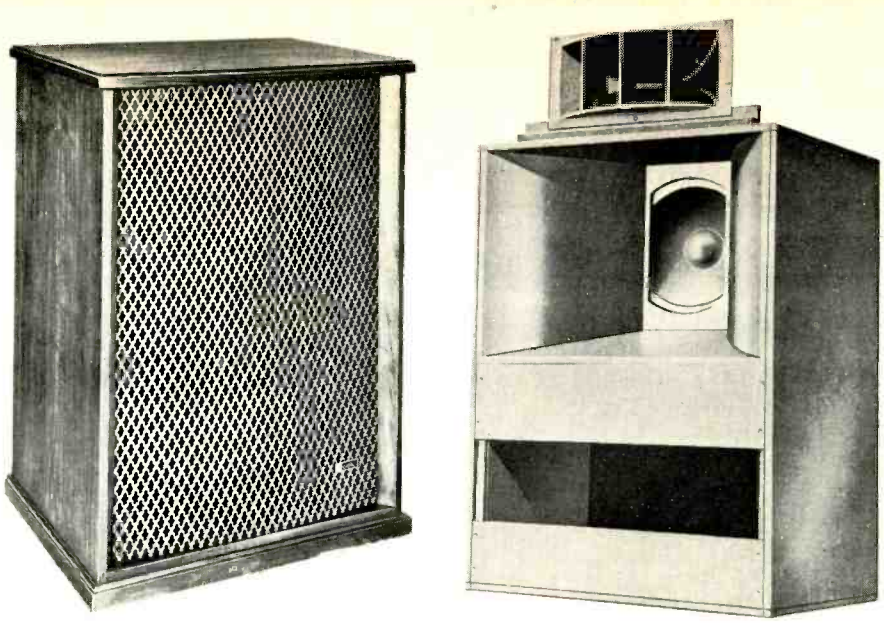


Fig. 4. The complete Altec A7-500W speaker system (left). At right is the inside view with the 800 Hz horn atop the unit.

## ALTEC A7-500 SPEAKER SYSTEM

It is not at all uncommon for the "old-timers" in the hi-fi fraternity to favor large loudspeaker systems, particularly those which derive from moving picture theatre systems. In the early days of hi-fi, it was practically necessary to "liberate" a theatre system, or as many components as could be obtained, in order to put together a speaker which would be completely satisfactory to its proud owner.

This observer is no exception to the type of individual who assembled speaker systems from theatre components, starting with the old Western Electric 555 "Loud Speaking Telephone" which was one of the first driver units to be used in theatre systems at the beginning of sound pictures. Of course, everybody knows (now) that these units were practically useless above about 8000 Hz, but then there was little program material in the high end anyway. A few years later, the W.E. 596 and 597 units became available, and while these extended the high end well above 10,000 Hz, they could not be crossovered below 3000 Hz. But with a good wide-range (for those days) 15-in. speaker, a fairly good system could be put together with the 596.

The first two-way system to achieve a wide acceptance was probably the Iconic, which employed an eight-cell multicellular horn with a driver which would permit a crossover frequency as low as 800 Hz. Together with a high-quality woofer, this resulted in a great speaker system—again for its day. The woofer housing in the old Iconic was a bass reflex cabinet of about 6 cu. ft., and the horn was mounted on top. Unfortunately, if you could *see* the two sources, you would *hear* two, so unless the unit was covered or enclosed in a furniture-type cabinet, the illusion of a single source was lost.

The current embodiment of this type of system is the Altec A7 series, available with either an 800- or a 500-Hz horn. Both horns are now of the sectoral type, which employs three deflecting "partitions" equally spaced in the horn casting, which is an aluminum alloy. While the 800-Hz model is an excellent loudspeaker, most listeners prefer the more solid performance of the 500-Hz system, although both usually employ the same driver unit—an 802D. The 800 is also assembled with the 806 driver, which is perfectly adequate for the higher crossover frequency. Both use the same low-frequency enclosure, the 825 cabinet, which houses a 15-in. 416A low-frequency cone of massive construction. The aperture or throat of the woofer is reduced to 8-in. wide, and expands in an exponential horn to a width of 28 in. at the mouth, with the height increasing from 16 in. at the throat to 19½ at the mouth. The enclosed portion of the cabinet serves as a bass-reflex housing, with a volume of about 10.8 cu. ft. and a port area of 215 sq. in. The over-all cabinet depth is 24 in., width is 30 in., and the height is 42½ in.

With the 500-Hz horn, the front of the horn is flush with the front of the cabinet, while with the 800-Hz horn it is 4½ in. back from the front of the cabinet. This brings up a most important point—that of phasing. With two separate sound sources, it is readily understandable that the effective source of the sound waves from each must be in the same plane. With a system employing a horn which is not integral with the enclosure, but which can be moved forward or backward as necessary to place the sound sources in the same plane, it is easy to phase the two units exactly at the crossover frequency. While two sources can be phased at a number of places *on a sine wave*, they will not necessarily be correctly phased on musical material, particularly on transients. The h.f. horn could be moved back, for example, one half wavelength at the crossover frequency and its leads reversed and still be phased on a sine wave. Similarly, it could be moved forward the same amount. But when the positions of the several speakers in a system are fixed by simply mounting them on a baffle, it is always possible—even likely—that they are not exactly phased at the crossover frequencies. With a microphone, amplifier, and audio generator, phasing is easy—simply apply the crossover frequency to both units and move the h.f. horn forward or backward to obtain the maximum sound level as picked up by the microphone. This may be an over-simplification, but it is the basic idea.

The 511 sectoral horn used with the A7-500 system measures 23½ in. wide by 10¾ in. high, and is 23½ from the front to the back of the driver unit. Thus when mounted on top of the 825 cabinet, it extends to an over-all height of 53 in. To reduce this height, the horn may be mounted inside the cabinet, which is then inverted, and the mouth of the horn is in the reflex port. This reduces the internal volume slightly, though it is doubtful if the difference can be heard.

Either way, the crossover network is


Fig. 5. The EICO 342 FM/Multiplex generator.

the same, providing a 12-dB/octave cut-off beyond the crossover frequency. The network is packaged in a metal housing, and equipped with a h.f. attenuator to reduce the level of the high in 1½-dB steps up to 6 dB—necessary because of the higher efficiency of the h.f. driver.

With the horn inside the 825 cabinet, the whole assembly can be had in a dress housing, and is then known as the A7-500W. While the A7-500 by itself is suitable for monitoring or for use in locations where it can be behind a screen or a grille cloth, it is hardly suitable in the average living room. But where its sound quality is required, the A7-500W gives the same performance, which is that commonly referred to as "theatre quality."

### Performance

While it is practically impossible to provide valid measurements on any speaker system without elaborate facilities, calibrated microphones, and so on, we do resort to the microphone to determine the upper limit of reproduction, since most of us "cut-off" somewhere around 14 or 15 kHz. The A7-500 provides usable sound output up to 22 kHz, and is relatively smooth throughout the range of the h.f. unit. On the low end, there is no doubling down to 30 Hz, but there is plenty of sound output even below that. The over-all sound reproduction of the A7-500 systems can best be characterized as "gutsy," with its good, solid bass, smooth mid and high ranges. In all, a superb loudspeaker system, even though it is priced at $498.00 for the furniture-finish model. If your home has the space for a pair of them, and if the budget can also accommodate their cost, they are well worth considering.

CIRCLE 2

## EICO 342 FM/MULTIPLEX GENERATOR

The servicing of FM/Multiplex receivers and tuners is a specialized procedure which requires some out-of-the-ordinary equipment. It is true that there are some well-designed tuner kits which are "self-aligning," in that the original set-up of the circuitry has been designed to be aligned without instruments, such alignment or servicing information is rarely available with factory-built units, even assuming that the alignment could be made at all without instruments. We have had some experience with tuner kits which could be aligned perfectly by following the kit instructions—and by perfectly we mean the rechecking with an FM/Multiplex generator could produce no improvement, but in most such instances, there was some special provision in the original circuit to make such alignment possible. In making the rechecks of these units, however, we had to resort to a multiplex generator, and the one then readily available was the EICO 342. Although EICO has long been known as a kit manufacturer, as well as a producer of factory-built units, the 342 is one of a series of instruments (of which the model 902 W distortion analyzer was the first) which is available only as a factory wired unit. The 902W was profiled in these pages in February, 1964.

The 342 provides a wide variety of test signals for multiplex tuner alignment which will be recognized as the necessary ones. As a composite audio signal, it is possible to present L — R, L + R, or L or R signals alone, with or without the 19 kHz pilot signal. Furthermore, the 19-kHz signal may be fed out by itself, or the instrument will accept stereo signals from an external source, thereby becoming a complete stereo generator. In addition to the composite audio output, the unit will provide a modulated r.f. signal in the vicinity of 100 MHz, and this frequency is adjustable over a small range. A built in low-distortion 1000-Hz oscillator furnishes the audio modulation, and the sync output for the scope may be synchronized to either the 1000-Hz tone or to the 19-kHz pilot. Provision is also made for the application of any desired external frequency. This brief listing of its available functions should be enough to point out that it has what it takes to align a multiplex decoder.

### Circuit Description

The generator employs a total of nine tubes, four of which are multi-purpose Compactrons with three separate sections each. The 1000-Hz generator is a 6BL8 in the stable, low-distortion Sulzer circuit. The "preamplifier" or input stages employ the three triode sections of the first Compactron, a 6K11. Another 6K11 serves as the amplifier for the audio signal which feeds the selector switch and becomes routed to the remaining two sections of the second 6K11. The third Compactron generates the crystal-controlled 19 kHz and amplifies and doubles it to provide the 38-kHz switching signal which is fed to two diode bridges. The three stages of the fourth Compactron, a 6AV11, provide amplification, phase-linearity adjustment, and a cathode-follower output for the composite audio signal. This signal is also fed to a 6EA8 FM oscillator/modulator to furnish the r.f. test signal. Pilot amplification and sync output are provided by a 6FQ7, and the whole unit is powered by an EZ80, with the plate voltage being stabilized by a voltage-regulating 0A2. Separate controls are provided to adjust pilot level and pilot phase, jobs which must be done to ensure a signal which is equivalent to that from a properly adjusted FM stereo transmitter.

Space does not permit elaborating on the processes involved in aligning a tuner with this instrument, but with the extremely detailed instruction book which accompanies the 342, practically anyone should be able to align a multiplex tuner just as correctly as the factory technicians did in the first place. The instruction book by itself is an education in the "art" of multiplex alignment.

The 342 is a compact instrument, measuring only 5¾ in. wide, 8½ in. high, and 12½ in. deep. At its relatively low price of $149.95, it is a good investment, either for a service technician or for the hi-fi buff who wants to maintain his own equipment at its operational peak.

CIRCLE 3

### Correction

Freud might have something to say about this. On page 14 of the October issue we wrote about the Ortofon S-15 cartridge. In the second paragraph we mentioned how the S-15 is derived from a long line of Ortofon moving-magnet cartridges. Now we really *do* know that the Ortofons are moving *coil* cartridges. Our face is red.

# Audio Measurements Course

NORMAN H. CROWHURST

Part 12

**Have you ever wondered how microphone or loudspeaker curves were determined? This installment shows you some of the problems involved in making measurements of this type and also why the results obtained are not always as reliable as the serious engineer or the careful user would like.**

IN THE PRECEDING INSTALLMENT, we discussed how to calibrate a microphone and a loudspeaker, using either a Rayleigh disc or the reciprocity method. Now we come to practical measurements involving loudspeakers and microphones. For all acoustic transducers, one thing is necessary that has no counterpart in purely electrical responses—the taking of polar characteristics: various plots that show the directional characteristics of the transducer.

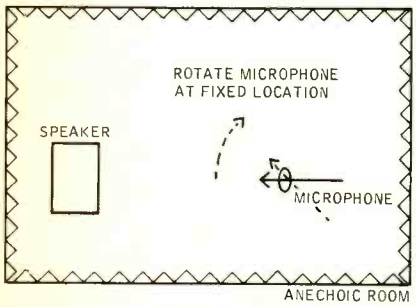



Fig. 12-2. How to take directional plots (polar diagrams) for microphones.

### Directional Characteristics

There are two ways of plotting these curves, and the method of measurement naturally depends on the type of presentation chosen for the final information. The choice will depend to some extent on the purpose to be served.

One method of plotting fixes frequency at a variety of points and measures the response in different directions at that frequency, to achieve a polar response. *Figure* 12-1 shows a variety of microphone polar responses. To take these responses, only the angle should change, not the environment.

So to take the polar response of a microphone, the microphone should be rotated in the manner prescribed by the curve plotted, and the position of the speaker in the chamber, as well as the position of the microphone (but not its angle) is kept constant (*Fig.* 12-2).

If the directional characteristic of a speaker is required, then the speaker is rotated in the direction required, and everything else left unchanged (*Fig.* 12-3). This is how the directivity of horn types is checked, for example. Or that of column assemblies. To check the vertical polar characteristic, it may be easier to mount the unit on its side, and rotate it on a vertical, rather than a horizontal axis.

Such polar diagrams show directionality variations at different selected frequencies. If directionality is the important feature, this may be the best presentation for the information. But more often directionality is a means to a specific end: reduction of pickup or radiation in unwanted directions.

From this viewpoint, the more informative presentation may be comparative responses, taken at different angles (*Fig.* 12-4). The important thing to note is that no two-dimensional presentation can give complete directivity information, with continuous presentation of both angle and frequency.

The first method selects fixed frequencies and gives complete polar plots at those frequencies. The second selects fixed angles and gives complete frequency responses at those angles. The general polar plot will not change too much at lower frequencies, although it may become erratic at higher frequencies. But frequency re-

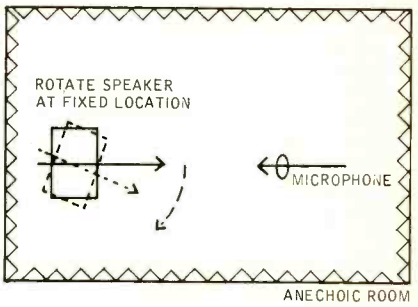



Fig. 12-3. How to take directional plots (polar diagrams) for loudspeakers.

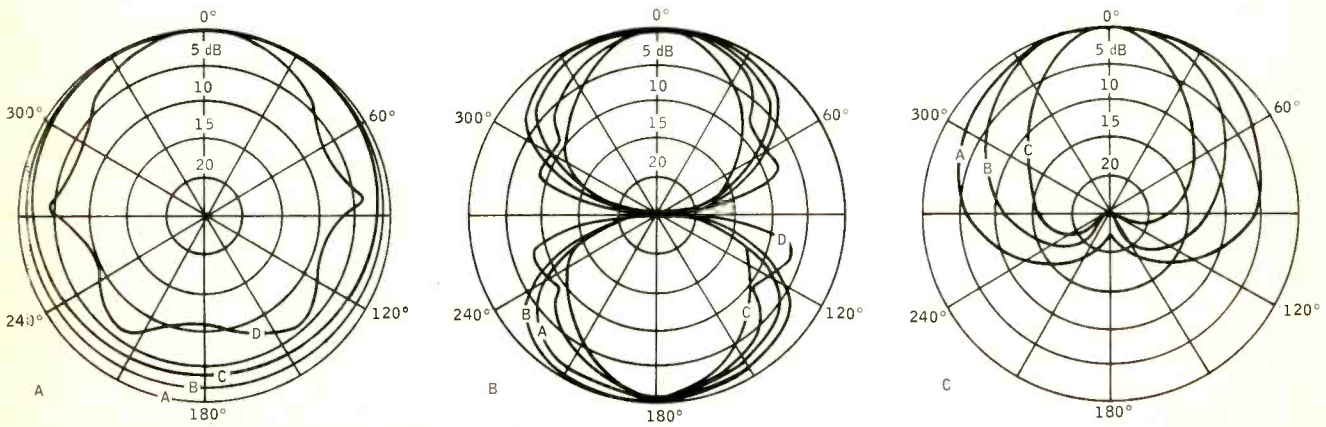
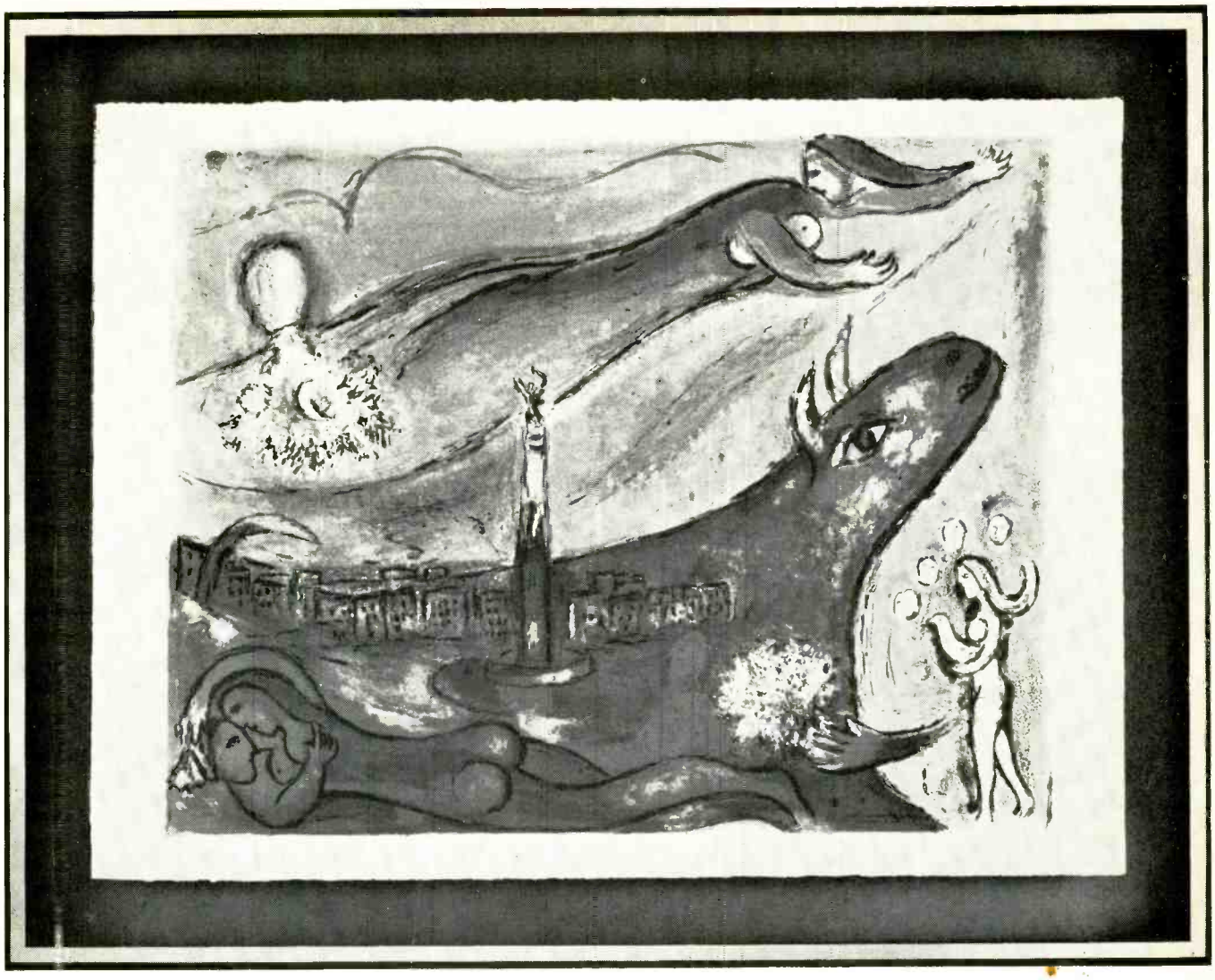



Fig. 12-1. Three typical polar plots for microphones: (A), a quality omnidirectional; (B), a fairly good bidirectional (ribbon); (C), a cardioid, or unidirectional.

"LA BASTILLE" by Chagall.
An original lithograph artist's proof edition of 75. From the collection of James B. Lansing Sound, Inc.



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sponse will "catch" irregularities more unfailingly in these upper frequencies.

The on-axis response shows the fidelity of the microphone or loudspeaker for the wanted pickup or radiation. The off-axis response will show how good the rejection is for other directions. Both should be level and as smooth as possible, with the biggest possible level differential between them.

### Interpretation

In any directional characteristic, measuring the response where it's supposed to be relatively high is no problem. The problem comes where reduced response or a null is expected. Under these circumstances, the properties of the anechoic room may not be reliable.

Various aspects of this must be checked by different methods. If residual standing waves are suspected of invalidating the result, then the responses should be repeated (in the null-point orientation) in exactly the same relative positions, but differently located within the anechoic room (*Fig.* 12-5). If the response changes its shape significantly, standing waves are contributing. If the response is sensibly identical, standing waves are not occurring, but some residual reverberation or reflection may be.

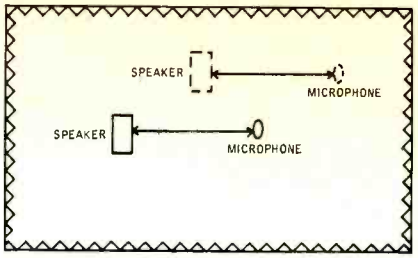


Fig. 12-5. How to check whether standing waves are invalidating effects: change the position in the room, but keep the spacing and relative positions between the units the same.

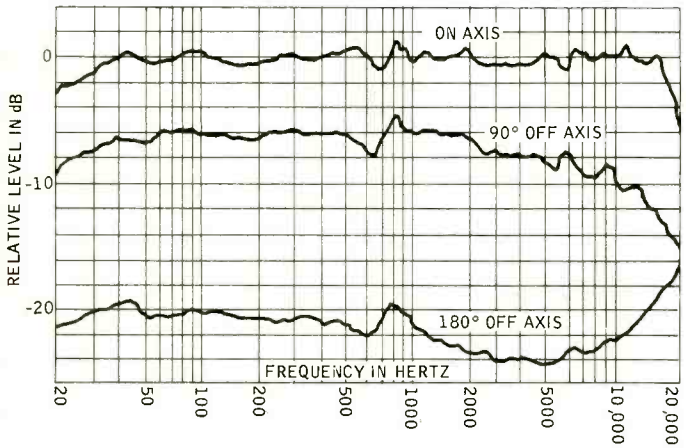


Fig. 12-4. The other way of presenting directivity information: frequency responses taken at various positions: in front, at the side, and behind.

To check this, check the response (complete polar diagram) with the distance between microphone and loudspeaker varied. The polar response will vary at different distances —this is normal. Directionality varies with the distance at which it is measured, even in a perfect (completely anechoic) environment. If a microphone is designed to provide complete rejection of a distant signal from the rear (more than a few feet away) it may not provide equal relative rejection of a signal generated so close that the wave is rapidly expanding, instead of more or less a plane wave (*Fig.* 12-6).

But if there is a greater significant improvement when the units are put closer together, which would happen by creating a greater differential between direct and reflected sound, then residual reflections were bothering you (*Fig.* 12-7).

Thus two possibilities exist: directionality may be expected to deteriorate when source (loudspeaker) and pick-up (microphone) elements are abnormally close together (*Fig.* 12-6), unless (as in close talking microphones) they are designed for that kind of use; directionality will also deteriorate when the elements are placed far enough apart so that most of the anechoic chamber is filled with sound at level comparable with the direct transfer level (*Fig.* 12-7).

To separate these effects, directional measurements should be taken at various distances, by either of the methods, and the results at different distances compared. The effects of deterioration with closeness or with distance can then readily be separated, so the ideal response can be identified.

A good way to compare traces made by an automatic curve tracer

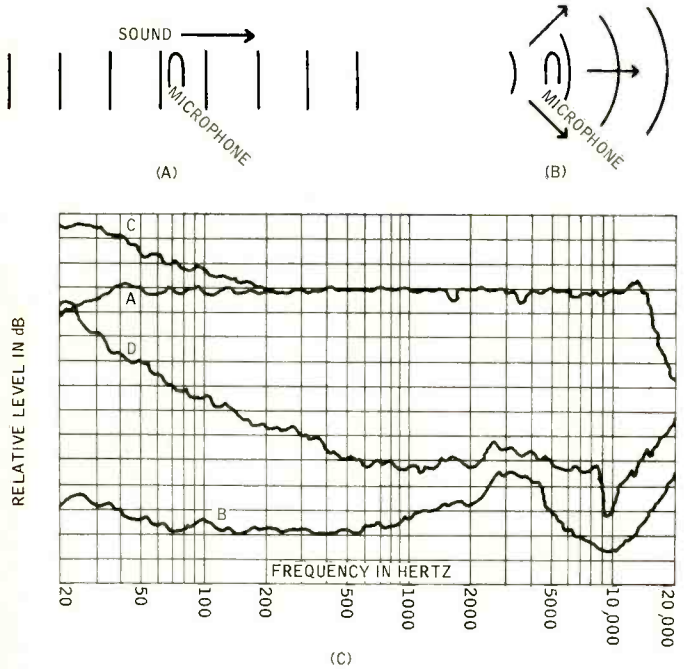


Fig. 12-6. How changing distance between microphone and loudspeaker can alter relative response: (A), the plane wave on which most microphones are designed to work; (B), when too close, the wave is a rapidly expanding spherical one. The curves show these effects (A), response in front, taken at normal distance (3 to 10 feet); (B), response from rear, taken at same distance as (A); (C), response in front taken at less than normal distance; (D), response from rear, taken at same distance as (C).

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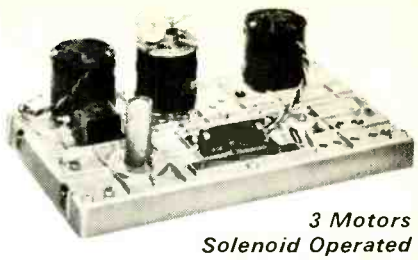

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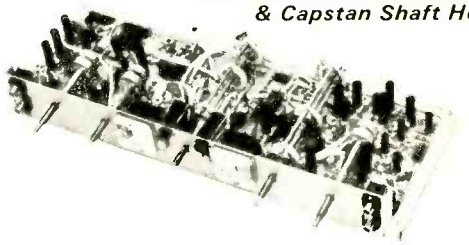

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is to hold them up to the light, superimposed, aligned so the responses are the same (level or dB) at 1000 Hz, or other suitable reference point.

### Close-Talking Microphones

These are designed for different usage. They should be tested under the intended usage conditions, using a dummy mouth, as well as taking some tests to indicate how they perform if the condition is varied (*Fig.* 12-8).

### Distortion

Measurement of distortion is also complicated in transducers, as compared with simple electronic devices, such as amplifiers. In general, especially in loudspeakers, the magnitude of distortion measures higher than in amplifiers, but it tends to be less evident in listening comparisons. This may be partly because the form it takes is related to forms of distortion that occur in the human ear, and in the natural generation and propagation of sound, which amplifier distortions are not.

But there is another aspect: the integral sound waveform generated by a loudspeaker is difficult to measure, being four-dimensional. Measurements made, using the same methods applied to amplifiers (but not the bridge method), will show mainly motor distortion effects (where the transfer from electrical to mechanical or acoustical, or vice versa, is nonlinear). But at low frequencies, higher distortions may be registered; these readings are difficult to evaluate significantly, because of the wave-development complexity.

It is only possible to read pressure or particle velocity at a variety of points, sampled by the respective types of microphone, and all fairly close to the loudspeaker in terms of wavelength for the frequency involved (when considering the lowest frequencies). Thus it is difficult, if not impossible, to get a complete representation of the radiated wave at these frequencies.

Specifically, in amplifier measurements there is a correlation between low-frequency harmonic measurements and the SMPTE-type intermodulation measurements. The inter-relation may not be a tight one, as we pointed out when discussing it, but the same curvature that causes low-frequency distortion normally causes a roughly corresponding intermodulation of higher frequencies present.

This is not necessarily true in loudspeaker distortions. Harmonics may appear within the close-in range of the speaker, where the measurement microphone has to placed, due to complicated air movements, which do not represent harmonic distortion in the electro-mechanical transduction. Thus the acoustic generation of harmonic-distortion effects do not generate the related intermodulation effects that would appear to correspond in a purely electronic or electrical circuit.

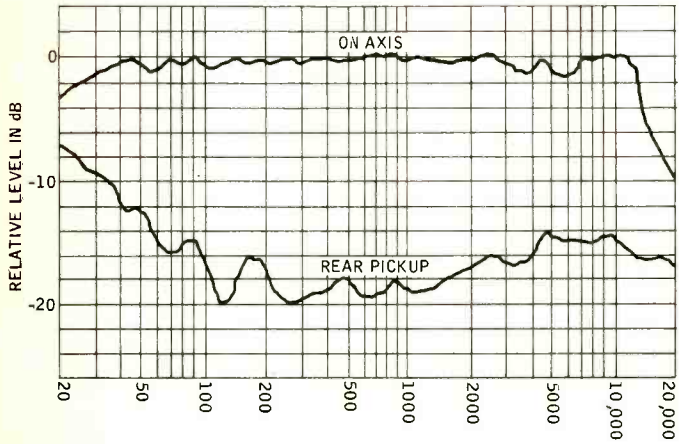
For this reason, intermodulation tests are more meaningful on loudspeakers than are harmonic measurements. This is also true of the other form of intermodulation test, using difference-frequency detection.

Any non-linearity of transduction in this range will show up most strongly by the generation of difference-frequency effects and their harmonics (multiples). Thus 5000 Hz and 5100 Hz may generate 100 Hz and its harmonics, 200, 300 Hz., etc.

### Subjective Testing

Because of these differences, and the repeated observation that objective measurements (made with instruments) are not always confirmed by listening experience, subjective tests have long been important in audio measurements. These fall into two groups:

1. Tests aimed at determining what forms of distortion, or deviation from perfect fidelity, are important, and of what relative importance, in the listening experience.



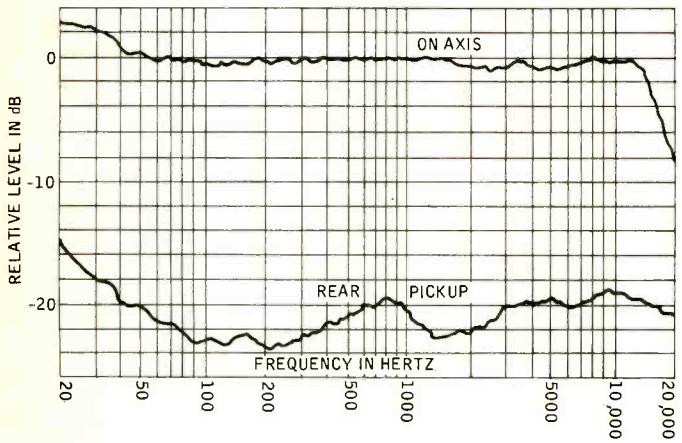




Fig. 12-7. How changing distance can alter responses due to environment, rather than distance effect: top, responses taken at too great a distance so reflected sounds invalidate rear pickup; bottom, responses taken closer together (but still at adequate distance) showing improved differential.

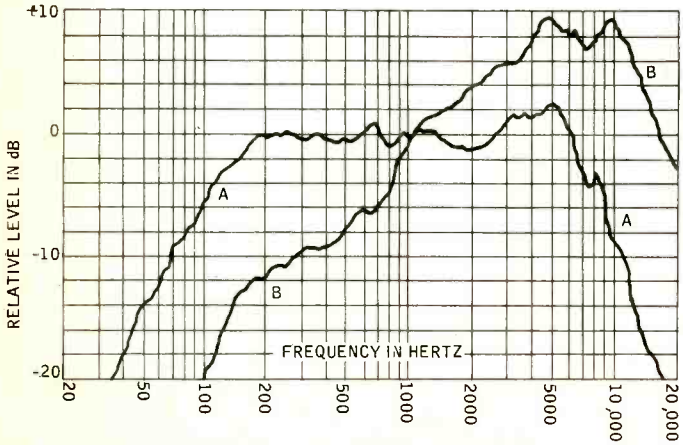
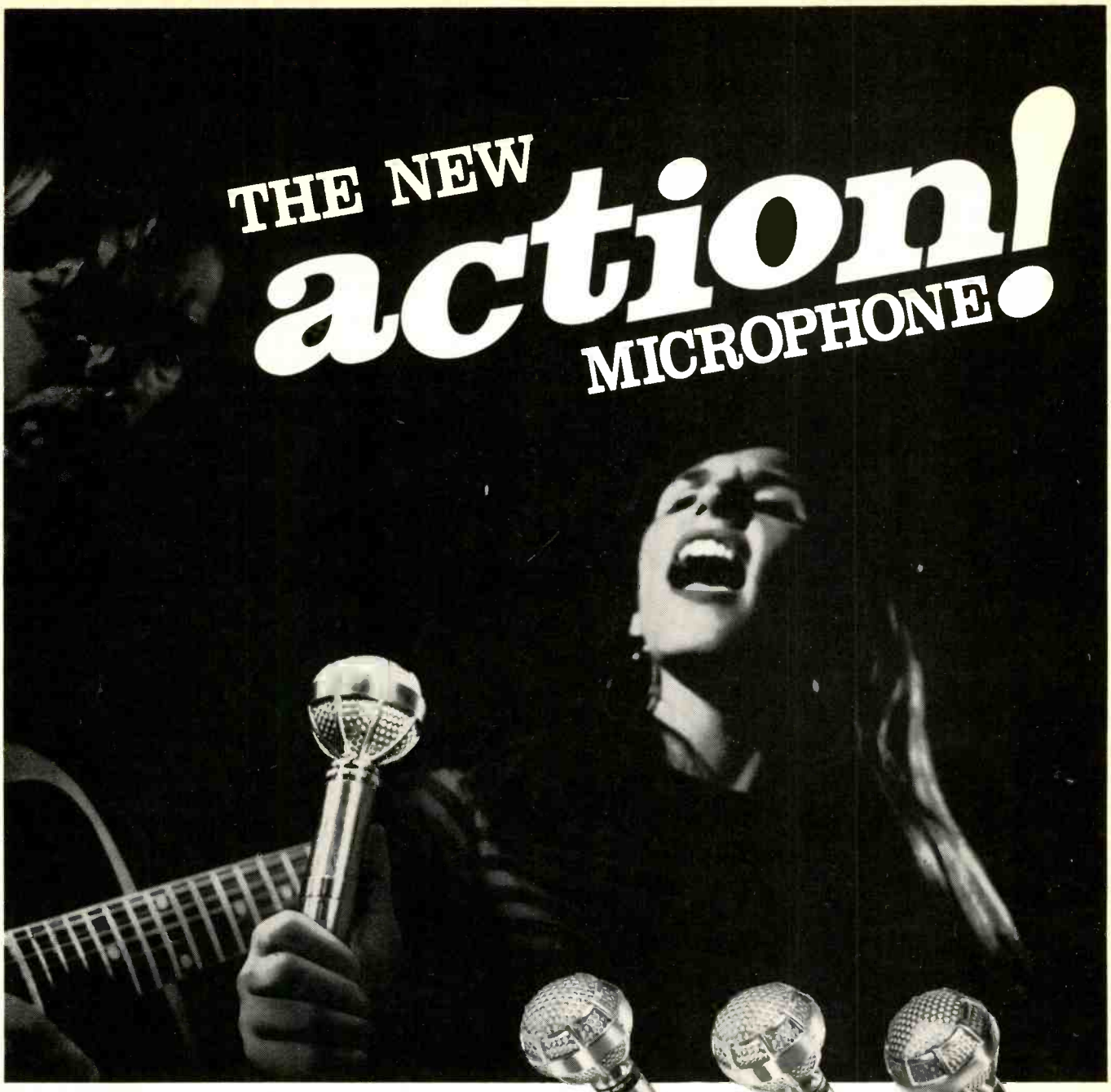



Fig. 12-8. Tests on a close talking microphone: curve AA, taken with microphone in specified relationship to artificial mouth; curve BB, taken with considerably greater than intended spacing.

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**MODEL 5050** Switch and Swivel Stand Adaptor, 15 foot cable.

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2. Tests to evaluate the relative performance of different items of equipment, as judged by listening to them.

For both forms of subjective testing, it is simple to specify that only relevant changes shall be made. For example, if two loudspeakers are being compared subjectively, then they shall be compared in identical surroundings and with identical program content. Unfortunately this apparently simple rule is not always valid. This is a big field and all we can hope to do in this course is point out a few significant examples of problems and potential invalidities.

## Importance of Frequency Range

A number of subjective tests, under carefully controlled conditions, have been run to find out how important various frequencies are to an impression of fidelity, or in the case of stereo, to the stereo illusion.

The method would seem simple: just cut off at various points and see "how much" of the sense of fidelity, or illusion of separation is lost. Control by the development of A-B, or even A-B-C identifications, to which each participant indicates a yes-or-no answer, is easy for psychologists to work out.

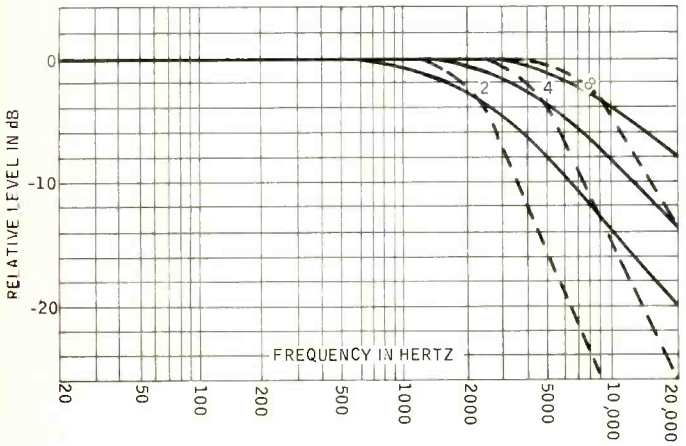



Fig. 12-9. Filter responses for rolling off at 6-dB/octave (solid lines) or 12-dB/octave (dashed lines). Turnover points are identified (in KHz) by the numbers at the 3-dB points.

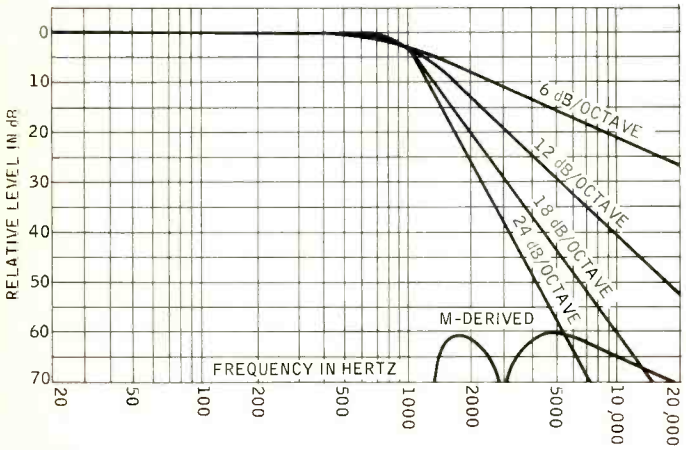



Fig. 12-10. Sharper responses, repeated on different dB scale with 6- and 12-dB/octave, as well as an m-derived response, which will give the best impression of "sudden death" to frequencies outside the nominal range.

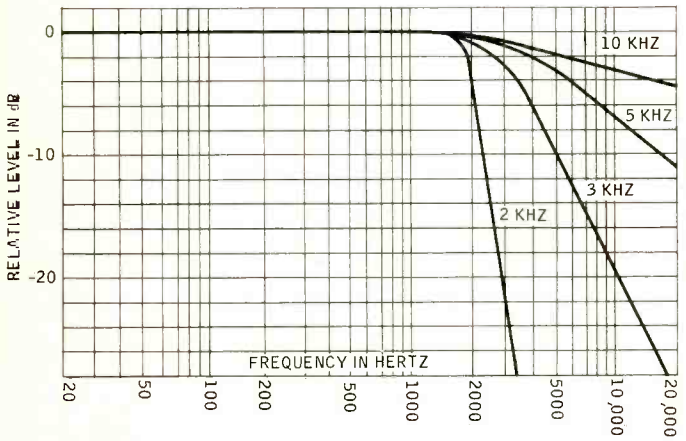



Fig. 12-11. Variable responses, incorrectly labeled (for true subjective effect) as described in the text.

The results are conclusive, for any individual test series. But different tests are contradictory. A variety of reasons that weren't considered by either the engineers or the psychologists who designed the tests contribute to these contradications.

One is electrical. It's easy to specify cutting off at different points on the frequency scale: the engineer does it and the psychologist assumes it's done and that's all there is to it. But anyone who has studied audio a little more deeply knows there is no way to lose a bunch of frequencies suddenly. How sharply should the control circuits (filters) cut off?

A gradual roll-off—from 6- to 12-dB/octave (*Fig.* 12-9) does not "get rid" of frequencies beyond a specific turnover point decisively enough. A frequency run does not convince listeners that the band ends where the filter cut-off says it does. So this argument suggests a more abrupt filter (*Fig.* 12-10). A frequency run with one of the sharper filters will be much more convincing.

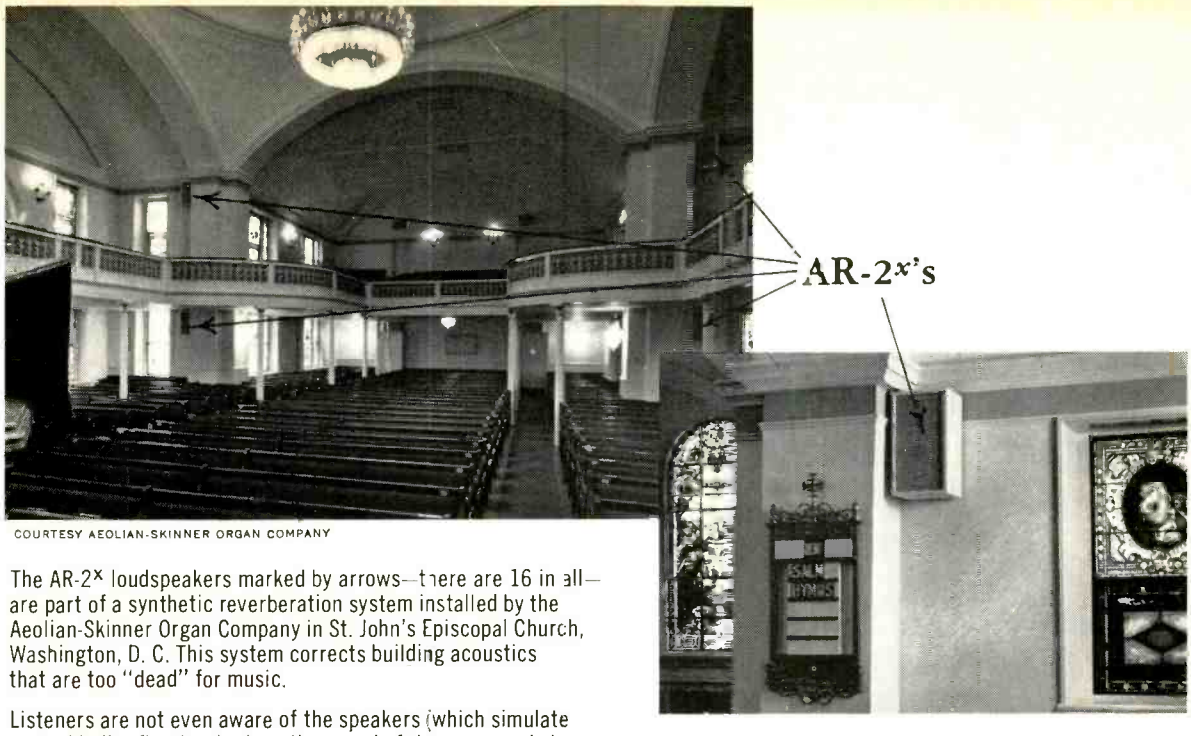
But when program is played through the two types of filter, the gradual roll-off gives the impression of low- or high-frequency loss, while the abrupt cut-off is most noticeable for a ringing effect. So the psychologist's A-B reactions are invalidated since they do not indicate *what they were devised to tell.* The subjects are not judging when they can detect frequency loss, but when they notice spurious ringing effects, in all probability.

An even worse arrangement would be one that uses variable slope with a frequency-loss nomenclature (*Fig.* 12-11). Such can result by using "available" filter components and then making an arbitrary designation, based on where the level drops by the usual 3 dB, or some other designated loss.

The reader may think such an error so obvious that only a neophyte would ever make it. A prominent laboratory, operated by a company with international reputation, once did this very thing! So don't feel too bad if you goof once in a while.

Other effects contribute to different conclusions: the environment, the kind of program used, and the kind of system. Keeping these constant means only that only the things changed will be judged, but it also means that any correlation with these variables will not be.

Some speaker systems sound better in some listening rooms and others sound better in other listening rooms. And program used to listen by can also affect conclusions. We will discuss these problems more fully in the next installment. Æ




COURTESY AEOLIAN-SKINNER ORGAN COMPANY

The AR-2x loudspeakers marked by arrows—there are 16 in all—are part of a synthetic reverberation system installed by the Aeolian-Skinner Organ Company in St. John's Episcopal Church, Washington, D. C. This system corrects building acoustics that are too "dead" for music.

Listeners are not even aware of the speakers (which simulate normal hall reflections), since the sound of the organ and chorus is completely natural. AR speakers were chosen by Aeolian-Skinner for this and other installations because of the need for full range, undistorted bass, absence of false coloration, and reliability.

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The artist and recording staff must listen for technical as well as musical quality, and therefore require loudspeakers that provide the most natural sound possible—no bass where there shouldn't be any, no "speaker sound." AR-3's are used.

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# AUDIO MUSIC AND RECORD REVIEW

Record Review • Edward Tatnall Canby

Light Listening • Chester Santon

Jazz & All That • Bertram Stanleigh

## BELCH, GURGLE, SNORT

**The In Sound from Way Out. Electronic Pop Music of the Future Created by Perrey-Kingsley.**
**Vanguard VSD 79222 stereo**

The elongated title is all you get here in the way of supplementary information; the jacket backside is blank, at least on my review copy. But you can tell plenty from the sound itself. It's musically corny. But it has one enormous saving grace—a sense of humor! That's what too much electronic music needs, these days.

I dunno exactly how they did it, but these little pops ditties (with funny names) are made up of part live, part synthetic sound, some from tape, some played "live" (if on electronic instruments) for the mikes, the whole assembled via the now-usual overdubbing by which most pops and rock'n roll-type hits are put together, a layer at a time. The technique, then, is standard for now. The harmonies and melodies are unutterably standard, too, maybe a shade higher than Donald Duck. But the sound effects (and their rhythms) are (sometimes) utterly delightful.

What effects? Well, almost every piece begins with a sort of Latin-Americanish background rhythm made up of outlandish noises. Obscene belches, gurgles, snorts, wails, screams, demoniac sighs, grunts, plops, bombs. The tunes are mostly "live" against these backgrounds and there's an inevitable deadpan electric bass, discotheque style, groaning away on the bottom. Ugh. But the "breaks" between phrases are also used for superb (sometimes) outlandishness. Like one that is "musique concrète" gone nuts—a zany baby, crowing and gurgling in strict time with the music (via tape editing, natch). 'Nuff said?

E.T.C.

**The Golden Age of Piano Virtuosi. Record 1: Joseph Lhevinne.** Ampico piano rolls. (See also records 2 and 3).

**Argo DA 43 mono**

Extraordinary! Here is a true "hi-fi" recording of one of the greatest pianists of the early part of the century. It has me entirely convinced—the man really sits down and *plays* this piano, for a set of recent BBC microphones. The impact is terrific. There's nothing mechanical at all—I'd rate the "fidelity" perhaps 95 per cent perfect.

The sound comes from Ampico piano rolls played on a meticulously, fanatically restored master player piano of the Ampico type. It's by far the most convincing sound so far of this sort and, for my ear, a long way ahead of the rival Welte-Mignon records, which have been heard on three occasions via tape and LP, once on Columbia and twice on Telefunken.

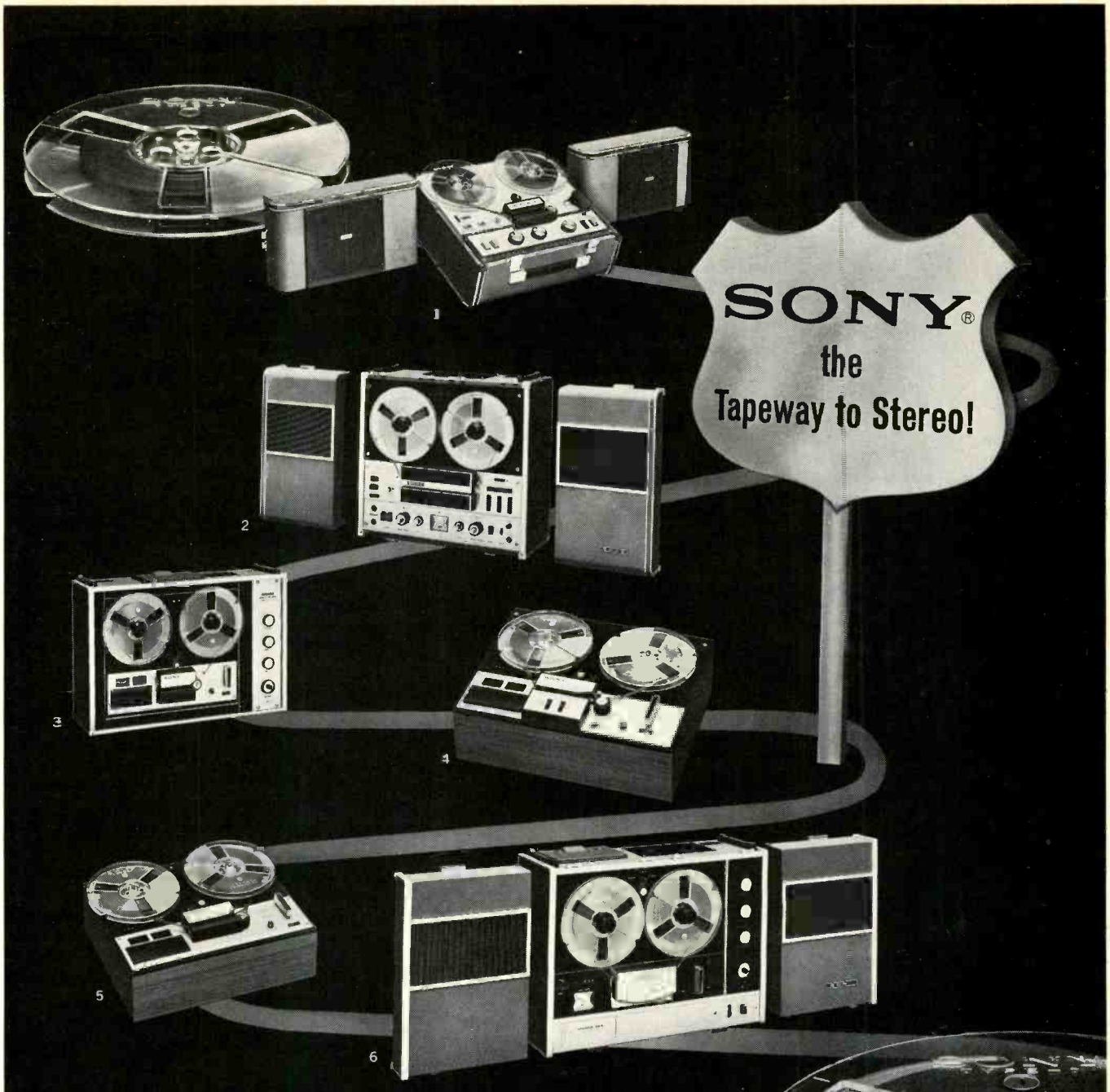
There were a number of celebrated piano-roll systems around the turn of the century, all of them of an extraordinary subtlety and complexity, in a day long before electronics when the entire system had to be worked out in terms of ordinary electrical macro-circuits and pneumatic power. To record the piano in this mechanical fashion, for playback on a "live" piano, the various systems had to take account of the crucial factors affecting every individual key—not only the duration of the tones, their rhythmic patterns, but the exact dynamics of each individual sort, and, even note, loud or soft, and even more important, the precise action of the individual felt dampers on the string, plus the over-all effect of the foot-pedal, lifting all the felts together, often half-blurring the tones by partial damping of the strings! An almost inconceivable complexity. If I am right, Ampico recorded thirteen aspects of every single note played, then reproduced them all mechanically.

Welte-Mignon, I recall, used carbon rod resistors variably dipping in mercury for some of this information gathering. I think I know why these Ampico rolls are the best yet. Ampico used an early and remarkable sort of telemetry, astonishingly like that which now records data and TV photos from space.

The recording mechanism did not directly punch out the paper rolls. Instead, the performer electrically activated a series of recording graphs, paper rolls located in another room. A "spark chronograph" made marks, as small switches opened and closed in the recording piano —the exact place and duration of each tone, the position and movement of the damper felts (even the extent to which they pressed into the wires) and, most important, the speed of hammer motion in the last ⅛ inch of travel (when it was already free from the striking action). From this last measurement could be determined the impact and hence the sound volume of each tone. All this and more for every individual note and for each separate piano key! Some circuitry.

From these graphs, accurate to within 100th of an inch, the master playback rolls were derived note by note, over weeks of concentrated work. A labor of love, all right, and worth it. But if the pianist didn't like what he heard—then another "take" and the same slow processing, all over again.

The reproducing piano was, of course, equally complex and sophisticated, a mass of delicate valves, miniature bellows, rubber tubing, springs and whatnot, to operate the complex pneumatic drive. The present instrument was restored to the Nth degree by its fanatically industrious owner, one John Farmer, who virtually rebuilt the entire mechanism piece by piece. Hence, surely, the superb musical playback. Two minutes of listening and you'll realize how subtle this mechanism can be in the details of polished pianism! The nuances, *staccato, legato,* from faint to very loud, individually note by note, and especially the crucial pedalling, are virtually perfect. A real triumph of ingenuity and musician-

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ship. It is easy to imagine hobbyist Farmer's pleasure when these old fashioned keyboard giants (playing so differently from today's pianists) first walked into his living room, so to speak, and sat down to express their personalities on his very own private piano, "live."

One sad fault, the BBC's. There's flutter on the tape, noticeable on all the longer piano notes. How *could* they? And why not in stereo? Imagine it—a stereo piano as of, say, 1910! Maybe they should try again. E.T.C.

## PHILADELPHIA

**Beethoven The Nine Symphonies. Ormandy Philadelphia Orchestra.**
**Columbia D7S 745 (7) stereo**

This is not a review but a mention. Ormandy has done all of the Beethoven symphonies and here they are. Unplayed, so far, by me.

Sure—it would take me days and days to play through all 14 sides of this mammoth album and I can't wait that long. But what really matters is simply that Ormandy's performances have had such a discouragingly predictable quality of routine perfection—*very* high level but none the less, for my ear, routine—that I simply haven't yet been able to face the thought of squandering so much of my sincere love of Beethoven upon these particular versions. (Nope, I will *not* skip through, sampling here and there in bird's-eye style.)

Don't take me too seriously. This is the famed Philadelphia sound—the Ormandy sound. And it'll be impeccably smooth, beautifully produced, recorded as smooth as oil in Columbia's best Philadelphia manner, which by this time is very, very good. The strings will shine like no others anywhere in their playing, the winds will be spotlessly perfect in ensemble, the phrasing everywhere will be just right, beyond any possible reproach—no temperamental excesses, no foibles, no eccentricities. You'll never find a more gorgeously turned out set of Beethoven, I can assure you!

And in the Ninth Symphony you'll hear the Mormon Tabernacle Choir, a guarantee of full-throated enthusiasm. Good soloists, too. All you could ask for. Everything tops.

Anybody else's Beethoven is going to sound thin and ratty by comparison. Take my word for it.

This will be the most-acclaimed Beethoven of the year. No doubt about it.

But will Beethoven really turn human, in all this perfection?

You try. I'm probably quite wrong.
E.T.C.

**Claire de Lune. The Swan, Elegie . . . And Other Romantic Favorites.** Philadelphia Orch., Ormandy.
**Columbia MS 6883 stereo**

Here it is. Here's what I mean. The Ormandy-Philadelphia sound, in one of those typical "favorites" records that no doubt sell millions and keep the Columbia operation handily in the black. But what can one *say* about such a record? Does anything really need to be said?

Well (since I skip nine out of ten, and this is a good one of its type . . .) I'll just hafta describe it. Highbrow Montovani. Classical mood stuff. Moonlight and roses and . . . nope, not *schmalz;* the Philadelphia plays much too well for that. But the effect is schmalz, by association. Especially in this big, moonlit stereo sound.

Half the items, thus, are originally piano music, unctuously transcribed for the Philly's creamy orchestral sound. (One arrangement is by producer Thomas Frost himself.) They're all perfectly good as music and several are superb. The "Afternoon of a Faun," with famed William Kinkaid on solo flute, gets a classic performance. So does the Bizet, and the Offenbach, and the Humperdinck.

But taken in the whole it's all just an elevated background sound, right out of one of those swank hi-fi console ads. He and She drooping tastefully in their evening clothes over a brandy *Napoleon.* You can have it. E.T.C.

**Dvorak: Violin Concerto in A minor, Op 53; Romance, Op. 11.** Isaac Stern; Philadelphia Orch., Ormandy.
**Columbia MS 6876 stereo**

The very qualities of slickness and outward perfection which make the Ormandy-Philadelphia sound too often overunctuous by itself are perfect for accompaniment whenever a vigorous, persuasive solo performer is on hand to bring excitement. Isaac Stern is just the type. He does it here, in a big, fat, super-Romantic concerto that is not too well known to most Romantic listeners.

The Concerto is middle-early Dvorak, some 14 years before the familiar "New World" Symphony and straight out of Dvorak's "Brahms" period. The Brahms Violin Concerto had came out only a year or so before and there are surprising similarities between the two in mood and texture. There's little of the later Czech styling here, nor the exuberant bounce of the later music—this could as well be German as Czech, though a milder, less intense music than that of Brahms.

Columbia sticks to the traditional close-up big-fiddle sound of pre-stereo days for Stern's violin, but he is well immersed in surrounding orchestral sound, thanks to the fine stereo spread of the orchestra.

The Romance, a still earlier piece, is a gentle but lengthy slow movement, originally out of a string quarter and expanded to stand on its own feet in this larger form. E.T.C.

**Nielsen: Symphony No. 6 "Sinfonia Semplice."** Philadelphia Orch., Ormandy.
**Columbia MS 6882 stereo**

Now here's the sort of thing the "Philly" does extremely well, since it requires a superb orchestra, and this sort of music happens to be Eugene Ormandy's special *forte.* Nothing routine about this performance! Right in the late-post-Romantic groove. That is, if you are looking for this kind of music.

Funny how in every period of rapid change, like ours, there are excellent practitioners who manage to continue the older ways, traditions, styles, while somehow adapting them (whether they admit it or not) to current conditions. This is a late-Romantic symphony composed in the middle 1920's—it could not have been composed a day earlier, either. It *is* of its time, and would have been incomprehensible to, say, Brahms. And yet it has all the old fashioned Romantic virtues and faults—the big, colorful orchestra, the ever-changing instrumentation, the sighing and dying-away, the big climaxes, the long, long, loose organized movements. It is simply a projection of late Romanticism into 1925! Interesting.

Same thing happened, for instance, in the Baroque period when the "olden style" was assiduously practiced by conservatives who fondly thought they were writing like Palestrina, up to a century later. They weren't. Now, they are unmistakably of their own time. So is Nielsen.

So if you like Sibelius, Rachmaninoff, even the big Shostakovitch (more of the same projection, even later), you will enjoy this milder, less craggy Nielsen music. Without a doubt it is beautifully written and honestly expressed, though Baroque fans and Mozart lovers, not to mention modern-type cats, will find the going tough. E.T.C.

## OLD-FASHIONED MODERN

**Charles Ives: Music for Chorus.** Gregg Smith Singers, Texas Boys Choir, Ithaca College Concert Choir, Columbia Chamber Orch., Smith.
**Columbia MS 6921 stereo**

Old Charles Ives is wild enough in his turn-of-the-century *avant garde* music for instruments; but when voices chime in, things get pretty complicated!

He was never very far from church music (of the small town, gospel sort). And so he applied his new-fangled originality (always mixed up with old-fashioned conventionality) to numerous church pieces, as well as to any poetry of an inspirational nature that happened to come his way. Like, say "William Booth Enters Into Heaven" by Vachel Lindsay (he of the famous Congo), sung here.

This recording lumps a comprehensive array of these extraordinary pieces, six secular works on one side, five psalm settings on the other, in performances that are loud, bright, confident, metallic and thoroughly professional—even to the little Texan boys, who are virtuoso pros, especially trained for unlikely jobs like this. Nobody but a strong-minded crew of this sort (aided by Ithaca's more collegiate voices) would be likely to get through the outlandish effects Ives writes into his music—not to speak of the abysmally anticlimactic moments of pathos. These people tackle both with aplomb, and they are sentitive enough to make fine music out of the many good spots, too. As always, Ives gives us everything *and* the kitchen sink, all mixed up in one package. E.T.C.

Maybe if you're not a chorus fan you'd better stay away. But if you like choral music, vocal music, you'll find *something*

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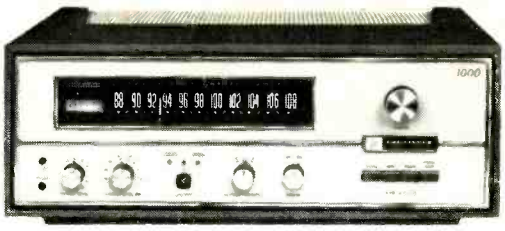

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in this record to please you, even if most of it makes your hair curl up, or bores you to tears. He was a great old experimenter. Boy, what wild music this was, back from 1895 or so until 1914 or thereabouts! But almost nobody got to hear it, so all was right in the musical world. E.T.C.

**Varese: Arcana (1925-27). Martin: Concerto for Seven Winds and String Orch. (1949).** Chicago Symphony Orch., Martinon.

**RCA Victor LSC 2914 stereo**

In case you look for it in the stores, this one's display title is "The Virtuoso Sound of the Chicago Symphony Orchestra." It *is* just that. I'll have to admit. Very beautifully done, and the RCA recording brings that company back into the hi-fi lists again, after what some of us have thought of as a rather major slump. This is good. And Dynagroove too!

(As the Dynagroove type gets smaller on the RCA label, does the sound quality get better?)

First—Varèse. This is one of his screaming incredibles, full of howling banshee dissonance, screeching, thumping, noises that you can scarcely believe could be written down in disciplined notes for a symphony orchestra—but that was Varèse's typically French *forte*. He knew his music and his technical trickery. The stuff is really marvelous to hear. *And* to record! Just listen to the bass! Phew!!

Oddly, it all sounds very old fashioned in a way, for this is oh-so-definitely out of the "Sacre du Printemps" period, which still used the big-style Romantic approach even for music of this amazing sort. It's a lot better, this piece, than the recently-recorded "Amériques" (Vanguard) of 1915. Much more content, more compactly organized, full of the now-familiar Varèse "themes"—the belching explosions of the brass, the steam-whistle piccolos, the whooping trombones, the 1920's Chinese blocks clattering away (everybody used 'em then). It's a well built piece of "music," I tell you.

Martin's eclectic, dry, neo-classic Concerto, nicely scored for seven winds against strings, is one of the most listenable pieces I've heard from him. In true Swiss style he tends towards the murkily grandiose in many works. Not here. Nice sonorities and pleasingly astringent after the Varèse.

Both works are really marvelously played. You can tell! It's not merely a batch of guys sawing away, blowing and pounding, at a lot of funny notes. It's a *team*, playing, phrasing, speaking as one. Better watch this newly energized Chicago; it hasn't been like this since Fritz Reiner left. Must be Jean Martinon who gives them the leadership. E.T.C.

**Stravinsky conducts Pulcinella. (Ballet with Song, in One Act, after Pergolesi.)** Irene Jordan, Geo. Shirley, Donald Gramm; Columbia Symphony Orch.

**Columbia MS 6881 stereo**

All hail Columbia's ever-continuing Stravinsky series which, if music and records—and people—manage to survive at all, will surely be of immense future historical importance. It has already been going on since the early 1930's, with occasional breaks. This is an updating of a 1953 recording.

If you follow Stravinsky you may be startled by this one. "Pulcinella," I had always thought, came in two familiar forms. One was the now popular orchestral suite of this name; the other was a *Suite Italienne*, the same arranged for cello and piano. Actually, like "Petrouchka" and "Firebird," this was originally a big ballet, with vocal music—songs. And like them, it had been reduced to a short suite practical for concert performance. Records, however, have brought back the complete original forms of all of these and many more works, once shortened in the same fashion. Here is the whole ballet score, songs and all, at length, the same wonderful mixture of Pergolesi, out of 18th century Italy, and Stravinsky's own idiom, neatly combined in a sort of modernized Baroque. There's twice as much music as in the familiar suite, the well known numbers alternating with "new" and unfamiliar material, including the vocal items.

Mysteries, two of them. First—this is stated to be a 1953 recording. That was surely before Columbia had even tried stereo—but maybe not? The stereo here is surely real, hugely spatial with very sharp separation. (If it is synthetic, then, as we once used to say, I swan!) So maybe Columbia *did* do it in early stereo, of course not at that time released in the disc format, which arrived some five years later. Come to think of it, there is the big-space effect and a certain occasional image-shifting that was characteristic of stereo in those early days. Could be.

Second—the well known "Columbia Symphony" here met with Mr. Stravinsky in Severance Hall, Cleveland. Odd place to meet him. The implication is that this was actually the Cleveland Orchestra, temporarily assuming the much-used Columbia title but otherwise very much itself. E.T.C.

## THE HAYDN-MOZART STYLE

**Haydn: Concerti for Lira (Nos. 1, 3, 5).** Instr. ensemble, Hugo Ruf, lira.

**Turnabout TV 34055S stereo**

I jumped to try this one—and was I disappointed. This "lira," as far as I can make out, has no discernable relationship to the zany crank-played machine for which these concerti were originally written on commission—for the nutty King of Naples, who liked to turn the crank himself. The concerti are often played in transcriptions for other more standard instruments (there's a Nonesuch record of some of the music, for which I wrote the notes and had a wonderful time doing it!). But this was to be the *original*. It ain't.

Turnabout has obligingly put a picture of the instrument itself on the cover, two dames holding a pair of them in their laps, with Haydn (?) looking out of a picture frame in the background. The thing was a popular street instrument, the original hurdy-gurdy, with strings against which rollers turned. The King's fancy version, the lira organizzata, had a built-in keyboard to play on and, in addition, a set of tiny organ pipes and a bellows, operated also by the crank. Some noise!

Turnabout's lira has no strings that I can hear and it doesn't fit on your lap—in fact it is simply a small organ, with three stops and an electric air pump, the whole thing standing on the floor in console form. Phooey. That's the way it sounds, too, like the upper notes of a small Baroque organ.

The concerti were composed for *two* liras (the King needed an accomplice, maybe in case he made too many mistakes), but this player manages both parts on one instrument. Easy. He has two hands. The King had to crank with one of his and play with the other.

Still—the music *is* lovely and nicely played by this small group. Surprise: quite a bit of the music was used later in later in larger, better-known works. You'll hear the slow movement of the "Military" Symphony, for instance. I still would like to hear a *real* lira, cranks, strings, pipes, and all. But this is better than nothing. E.T.C.

**Haydn: Symphonies No. 70 in D, No. 59 in A, "The Fire Symphony."** The Esterhazy Orch., Blum.

**Vanguard VSD 71161 stereo**

This is one of two new series of Haydn "rediscovered symphonies," done up in the modern fashion with an orchestra like the original, easy, light tempi and a generally de-Romanticized approach. There are numerous Esterhazy discs already on Vanguard. Nonesuch has the other current series, out of the Little Orchestra of London under Leslie Jones. (At half the price, of course.)

The Esterhazy Orchestra is excellent, playing these and other Haydn works with an unerring naturalness and verve. I can only carp at a seeming slight lack of crispness and brilliance, as compared to the more polished players of the Little Orchestra of London. The recording, too, is not one of Vanguard's most brilliant, whatever the reason may be. I would guess a combination of acoustics and the actual sound of the players. Blum could do with some more virtuoso string players, especially the always overworked first violins. But then—it may merely be that these aren't Englishmen and they prefer the more restrained Austrian-type approach, along with Mr. Blum himself? A perfectly legitimate preference. E.T.C.

**Haydn: Three String Quartets. The Lark, The Bird, the Joke. (Op. 64, No. 5; Op. 33, No. 3; Op. 33, No. 2.)** Hungarian Quartet; Dekany Quartet.

**Turnabout TV 34062S stereo**

Now that the Haydn symphonies in their hundreds are becoming so popular, it's time we had more of the string quartets—paralleling the symphonies and almost as many of them. They are superb, especially in modern stereo. Even more are they superb when played as beautifully, as strongly, as they are by these two excellent groups. E.T.C.

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The Hungarian Quartet plays the late work, Op. 64, No. 5, called the "Lark." (Much of Haydn has similar semi-frivolous names, fancifully referring to some quirk in the music.) The peculiarly shiny sound of this group recorded a bit distantly in a big liveness, and its hearty vibrato too, are familiar in older recordings. Vibrato or no, they are first rate, if a bit old fashioned. The Dekány group, presumably also Hungarian, sounds younger and more modern and is recorded closer and more intimately. They are also superb, in a more restrained but equally profound fashion. The sound in their pair of recordings is a bit distorted, hardly enough to notice, though. No impediment to enraptured listening—if you dig Haydn the way I do! E.T.C.

**Mozart: Divertimento for String Trio in E Flat, K.563.** Trio a Cordes Francais.
**Nonesuch H-71102 stereo**

This one has been waiting around a long time—I gotta mention it. The music is written for no more than three puny strings, a violin, a viola, and a cello; but it is one of Mozart's really big pieces in content. Which, if you like Mozart, means it is an Experience.

Moreover, this French trio of players knows all about this, and plays the music with both excellent feeling and a remarkable precision in the ensemble, three players thinking and playing as one. A fine Mozart record, any way you listen. E.T.C.

**J. B. Wanhal: Symphony in G Minor. Mozart: Symphony No. 25 in G Minor, K.183.** The Mozart Society Players.
**Baroque 2859 stereo**

The "Little G Minor" of Mozart, so-called, and a parallel Symphony in G minor by one of his older contemporaries, the prolific and much respected J. B. Wanhal—now, like so many others, on the road to rediscovery. It's a very nice combination, and the playing by the Mozart Society—wherever it may hang out (we aren't told) is really excellent. They don't even have a conductor, apparently. But they play with excellent rhythm and lots of intelligence.

The Wanhal is out of the early school of Viennese symphonic writing that was a major influence, along with the more elegant Mannheim music and—of course—Italy, on the mature Mozart and Haydn style. It's good to hear some of this Viennese music; it is mostly unplayed, and ought to be played more. Wanhal was of Haydn's generation and lived longer, until 1813. No date on this music, but it might be in the 1780's or so, about the time Mozart himself moved to Vienna. E.T.C.

## BROWSE DEPARTMENT

**Peter Ustinov tell the stories of Babar the Elephant, The Little Tailor.** Music by Poulenc, Harsanyi. Paris Conservatory Orch., Pretre.
**Angel 36357 stereo**

"Both stories are nourishing bread," says Ustinov, "and the music is good jam." True, true. But this whole-hearted attempt to cash in on Ustinov's success with "Peter and the Wolf" nevertheless seems to me like bread and jam in separate cupboards. They barely meet. They don't stick together.

The highly effective entertainment that music and narration can provide when they are really well combined is known to all of us—from "Peter" to "Tubby the Tuba" and a couple of million Disney shorts and longs, plus a zillion imitations. But whether the music itself is highbrow or low, whether the speech is dignified or cornfed, the two media *must* somehow be joined. They aren't here.

Instead, what you have is a series of nice little concert bits for big symphony orchestra, periodically interrupted by Ustinov's voice, and *vice versa*. There seems only a dim relationship between story and music, in the most casual sort of way, and occasionally the time sequence is actually addled. As when the King of the Elephants while on a walk (in "Babar") eats a bad mushroom. The ominous statement is followed by gay promenade music—the walk, not the mushroom; *then* we are told that it made him very, very ill—in fact he died. There is a sort of anticlimactic drum roll, and that is bad. Bad timing. (I suppose it *is* logical, but it doesn't sound it, to me.)

No—in both "Babar" and "The Little Tailor" the continuity is rudimentary, the music pleasing but half irrelevant. When once in a blue moon the stilted succession of speech, music, speech, music (the pauses often too long, as though cues were given tardily) is relieved by simultaneous speech and music—then the balance is clumsy, the music drowning out Ustinov's words. You have to go back and listen again, to see what he said.

If you want to remind yourself of how this sort of thing *can* be done, just try "Peter" again. It was the world prototype and is still the best after some thirty years (and it wasn't even meant for electronic processing). There, your bread and jam really meld! Music and speech are one drama, perfectly integrated.

The music itself is pleasant enough here and free of corny Disneyisms. But I'd say the suave Poulenc (orchestrated by Jean Françaix), with its usual urbane, snazzy mixture of every imaginable style, is not exactly an art for childlike innocence. Harsányi's "Tailor" music, supposedly tailored to this story (whereas the Poulenc is adapted after the fact), is more consistent in its innocuous modernism but only *very* vaguely related to its action—sometimes you'll forget just what *is* supposed to be happening, in its longer moments.

And what if Harsányi's huge wild boar sounds exactly like Peter's loveable Grandfather???? It does. E.T.C.

**A Heritage of Folk Songs from Old Russia.** Maria Christova, sop., Dobrynia Choral and Inst. Ens., Salmanoff.
**Nonesuch H-72010 stereo**

Russian folk music out of Russia! Many of us jump at every record of the sort, thinking maybe of the Piatninsky choir and the Red Army. This one is interesting but not wildly exciting, I'd say.

It's actually a solo recital by Maria Christova, who sings on every single band, both sides. Bit too much. She is accompanied in oly two ways, by a standard-type balalaika band (playing café-style 19th century harmonies) or—just twice—by an excellent vocal solo group complete with enormous, cavernous low bass. Too bad there isn't more of this.

Christova is a rather reserved, sophisticated voice for folk music, classical-style, (of course) and with quite an operatic vibrato, plus a tendency to slide up to the notes. But she is fervent and honest and emotes with dedication, so you'll like her. (She sounds oddly like the late and much-worshipped Kathleen Ferrier of England.) Recording is decidedly so-so, OK but lack-lustre, and so is the stereo, which just might be added after the fact by the sound of it. E.T.C.

**A Baroque Christmas (Praetorius, Buxtehude, Charpentier, Schien, Hammerschmidt, C. T. Pachelbel, M. Haydn).** Amor Artis Chorale, Somary.
**Decca DL 79427 stereo**

Decca, the foremost gatherer-up of New York City musical organizations, has picked an effective one here—though it does have a very NYC stamp upon it, as heard by an out-of-towner.

Johannes Somary, the conductor, is young and highly ambitious—also musical in an impetuous sort of way. His "chorale" (which unaccountably includes a considerable orchestra, completely unmentioned anywhere here) is made up of young trained vocal pros (and maybe young instrumentalists?) who sing with professional gusto and energy plus good diction and accuracy—but have the usual fault of today's American singers, loud, rich, high-tension powerhouse production of sound.

Nevertheless, Somary is able to make them sing lightly, here and there, and to think of the music once in awhile instead of their own voices. That, for New York, is a triumph! He also has among them some first rate soloists. In the lovely little Charpentier Christmas cantata, for instance, they are excellent, even to accurate Baroque-style added ornaments—and the larger choral group is good for the Baroque type of choral commentary.

But whenever there is a trace of a lighter, more gentle style, the powerhouse approach fails badly. The Buxtehude "In Dulci Jubilo," for example, well known in many a lovely choirboy version, is slow, ponderous and humorless here. So is the five-part texture in the Schein setting of the familiar Christmas hymn, "Vom Himmel Hoch." Too many wobbles, too rich, too much voice-power. Too much opera training.

Neverless, given the right music—a lot of it is right here—the Amor Artis people are very good. And Decca's recording is spaciously realistic, too.

Decca has them also in other Baroque music, Bach, Purcell, Scarlatti. See catalogues. E.T.C.

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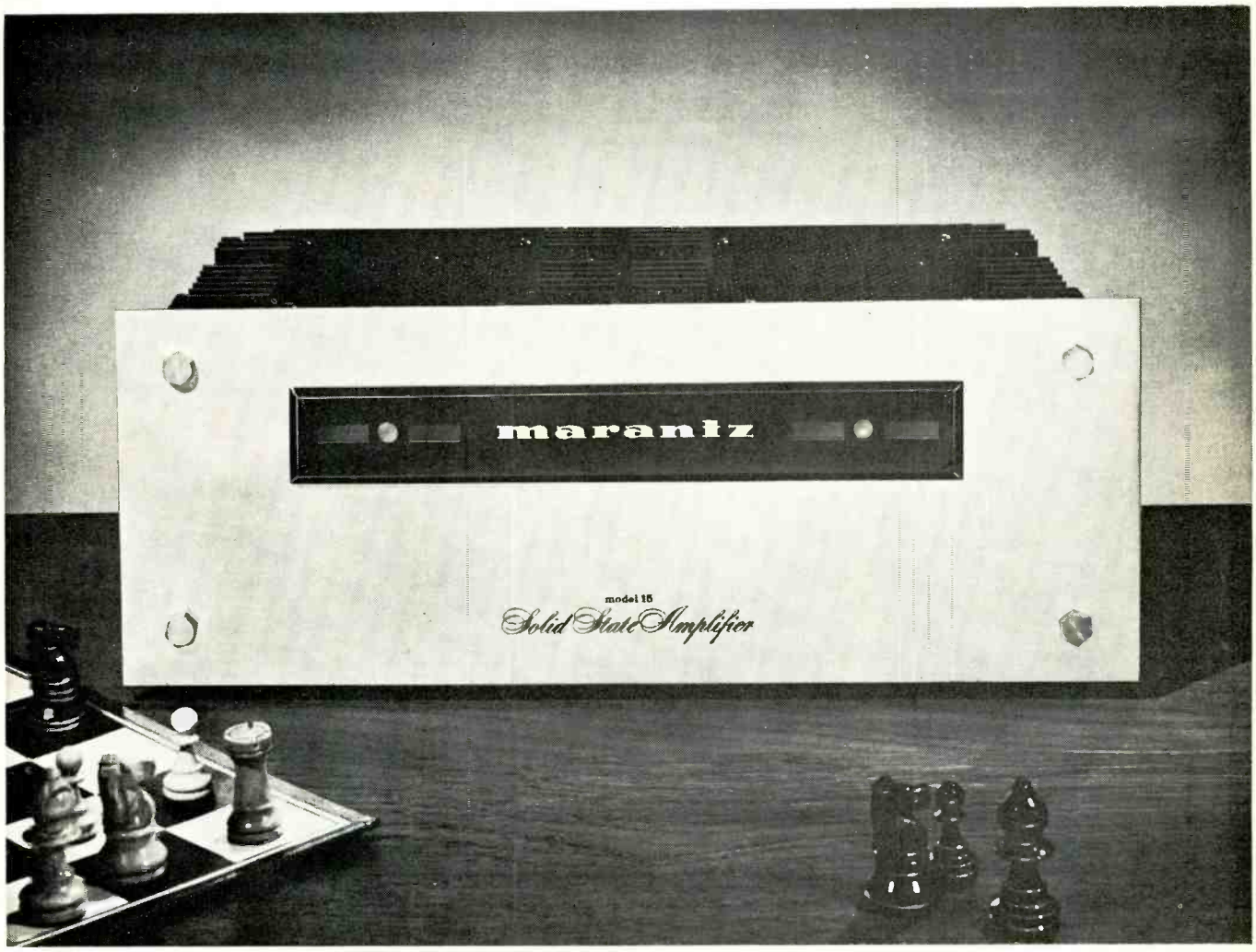


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**Louis XIII: Ballet de la Merlaison; Chanson: Tu Crois; Diminution on Tu Crois. Charpentier: Messe pour Plusieurs Instruments au lieu des Orgues.** Ancient Instr. Ensemble of Paris, Instr. & Voc. Ens., R. Chailley.

**Nonesuch H-71130 stereo**

Music by a King! Interesting, but not spectacular, though the external account of the King himself and the extraordinary hunting-style ballet for which he wrote this music (he also directed, choreographed, etc.) makes fascinating reading. (I translated it from the French for the backside annotations.)

The ballet, all about the King's favorite sport, hunting the *Merle* or Blackbird, was something—a fabulous walk-on costumed show, even to actual horses. But the music is short, fragmentary and not easily translated here to the elaborate ballet itself—there doesn't seem to be nearly *enough* music, the movements being very short. After the ballet come four other short works by King Louis (who was a first-rate musician), a song, a set of "diminutions" or variations for keyboard on the same song, and two vocal settings of psalms.

The Charpentier Mass music, composed to substitute for the organ in halls which didn't have any, is the real meat of this record. Lovely short sections, more or less based on the plainchant appropriate to the various parts of the service, played in stereo by several spaced-out groups of instruments. E.T.C.

**Serge Koussevitsky, Boston Symphony Orchestra.** (Brahms, Tchaikowsky, Rachmaninoff, Rimsky-Korsakoff, etc.)

**RCA Victor VCM 6174 (3) mono**

About time old "Koussie" was brought back! This man was an immensely important influence on 20th century music, first in Paris (the famed Koussevitsky Concerts), then for more than 25 years with the Boston—and since then posthumously via the Koussevitsky Foundation. His characteristic Russian-French background was very much of its time, and is a thing vanished forever nowadays. He was a specialist, of course, in Romantic music; but in particular he excelled in the Russian sort, from Tchaikowsky and Moussorgsky to Prokofieff and even Shostakovitch. He was marvelous with Ravel, and did many a Ravel premiere. And he promoted all sorts of other important composers via performance, from Ravel to Copland, Prokofieff and on to Lukas Foss and Lennie Bernstein—his protégés.

These noble old RCA Victor 78's, recorded from 1938 through 1947, a good many made right in the middle of WWII, are not exactly models of hi-fi waxing. But for their time they were pretty good and we didn't used to object, as I well remember. What matters is the musical performance—and there we have the cream of Koussevitsky, in Brahms, Tchaikowsky, a symphony of each, plus the Brahms Academic Festival Overture and four or five other 78 one-siders, originally used to fill out odd sides in larger albums.

I played the Brahms Fourth Symphony straight through and it was worth it—such a naturalness and honesty in the playing, out of a time when Brahms wasn't a bit old fashioned! It really sings, and there is a classic economy and restraint about it that may surprise those who think these older conductors always wept in their beer. I well remember, too, the lovely Suite for Strings by Arthur Foote, a Boston composer—very lush and Impressionistic in a forthright Bostonian way. I first got to know it via this 1940 recording. As for the Shostakovitch Ninth (1946), it must have sounded pretty modern back then, but it is as suavely clean here as the rest of these Boston performances. In his rightful bailiwick, Koussevitsky knew what he was doing.

Just as well RCA avoided his Bach, and maybe even his Beethoven. The Bach had a flair to it, but by today's standards it would be monstrously out of style—Bach à la Russe. And the Beethoven was somehow half Moussorgksy, sort of like "Pictures at an Exhibition." Well buried. That is, until we reverse our tastes again. We will. Sooner or later. E.T.C.

**Mahler: The Youth's Magic Horn.** Janet Baker, Geraint Evans; London Philharmonic, Wyn Morris.

**Angel S 36380 stereo**

In listening to Mahler, especially these orchestral songs, we keep hearing the soulful echo of Bruno Walter's indelibly great humanity in this music—influencing a whole generation of Mahler listeners. It is a ???? to find how different the music can be under a new musical crew, beyond the older influences. This version is startling in that respect.

The opening march, *Revelge,* a terrifying but intensely human dirge in Walter's generation, is here a fast, mechanized bit of chilly horror, hard as nails and unrelenting, as is the baritone Geraint Evans in his vigorous portrayal. With Janet Baker, a superb mezzo soprano, we are back to sheer humanity—she couldn't sing otherwise—and apart from a rather too rapid tempo, her songs, the gentler, dance-like ones, are just lovely. Whenever she opens her mouth, the music comes to life. Remarkable.

The trouble with Geraint Evans (aided by the conductor, Wyn Morris) is that his splendid, brassy big baritone and his excellent diction convey only one unchanging mood, always loud, forceful, masculine and tough. Not much subtlety.

The Angel sound is gorgeous, bringing out the best in Mahler's superb orchestration, keeping the voices back and in balance, as per today's enlightened new understanding of stereo recording. (You don't need to put them close up any more.) E.T.C.

**Twilight of Steam, vols. 3 & 4.**

**Mobile Fidelity MF 16, 17 stereo**

Will these people *ever* run out of steam? Not for a dog's age, I guess!

I just couldn't travel all the way with the assorted steam excursions on these four new RR sides, but I did do 80 mph or so with Burlington's ex-5632, right in the tender (and, no doubt in the middle of a cloud of greasy smoke!). Some baby, a big one and of the best. Same for Espee 4460, a semi-streamliner from 1943 and another whopper. These two occupy the two sides of Vol. 3, the tapes made several years back. Vol. 4 is more miscellaneous, from a revived Shay (a sort of sidewinder affair) on a tourist narrowgauge line to a big Minnesota iron hauler with five drive wheels on each side.

Well, as usual, they all go choo-choo-choo and they all (mostly) blow their whistles much too often. They start, they roar, they stop. Then they start again . . . And yet, I'll admit, there *is* a difference from one to the next. If you have the time to study.

Mobile Fidelity's technique still lacks the wonderful imaginativeness of O. Winston Link's now arrested series. He knew how to "re-create" the sense and atmosphere of steam railroading as these people don't. Their editing isn't anything to glory in. Too-quick cut-offs, mediocre sense of timing, etc. But the sounds are splendid in stereo and make up for all. E.T.C.

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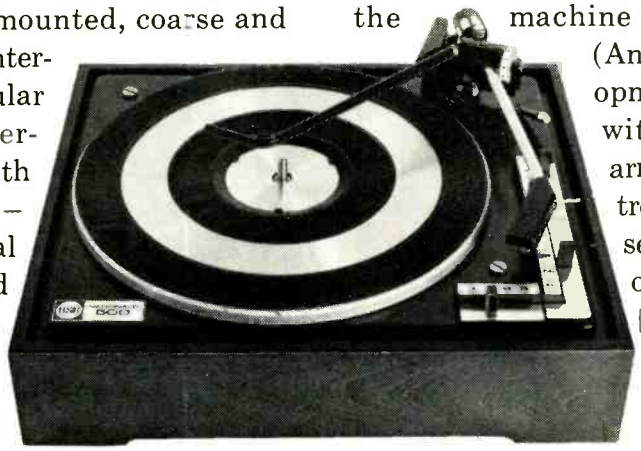

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# Light Listening

**Perry Como in Italy**
**RCA Victor LSP 3608**

We've always had record buyers who've never expected much from discs devoted to the lighter forms of entertainment. They have been inclined to look down their noses at pop material for any one of several reasons. A few of these reasons are quite valid. Those objecting to some of the corny or more juvenile forms of entertainment have always had an ally in this column. There is a lot of stuff being issued these days that I bypass each month without feeling that I'm committing a serious disservice to the adult reader. Then too, a lot of pop discs in these days of sonic gimmickry fall short of the mark for technical reasons. Being an optimist, in every instance where a record label has the facilities and personnel for the production of a decent disc, I have tried to encourage use of said facilities to turn out sound that will hold up under the searching playback of today's wide-range systems. Now and then, a record comes along to vindicate anyone's trust in what the industry can turn out in the way of light entertainment. "Perry Como in Italy" is such a record. It's a bit ironic that much of my praise for the disc's outstanding sonic features will end up at the feet of a foreign technical crew but such are the breaks of the game. Perry's latest was recorded in RCA's Italiana Studios in Rome, Italy. Considering what has been accomplished here in artistic as well as technical matters, RCA Victor would be well advised to schedule as many future pop releases in Rome as the hard laws of economics will allow. I am not suggesting wholesale shipment of the personnel of the Boston Pops or even Morton Gould's more moderate-sized orchestra to the lavish Rome studios. It should, however, be an easy matter to transport an individual name artist and back him or her in Rome with a local orchestra and chorus as has been done so successfully in the case of Como. Although Perry was born in the mining town of Canonsburg, Pennsylvania, his parents are natives of the Abruzzi district of Italy, not too far from Rome. The occasion of his first recording session in that capital was obviously an exhilarating one for Como. In English and Italian he sails effortlessly through a very attractive collection of songs ranging from current hits on the Italian scene to internationally known veterans such as "Santa Lucia," "Oh Marie," and "Toselli's Serenade." Nick Perito arranged the music and conducted a first-rate orchestra made up of twenty violins, eight violas, eight cellos, six woodwinds, two mandolins, and rhythm. With every musician pulling his weight, this grouping can make an effective and flexible orchestra. The mixed chorus, heard at far left in the listener's living room, was directed by Ray Charles, indicating a travel budget of at least three air fares from America. The most refreshing change the album offers is a return to authentic stereo depth that no longer can be found on the vast majority of domestic recordings. This alone should win support for Como's release among record fans who remember when full stereo was common on two-channel popular discs.

C.S.

**Nighttide**
**Philips 600-213**

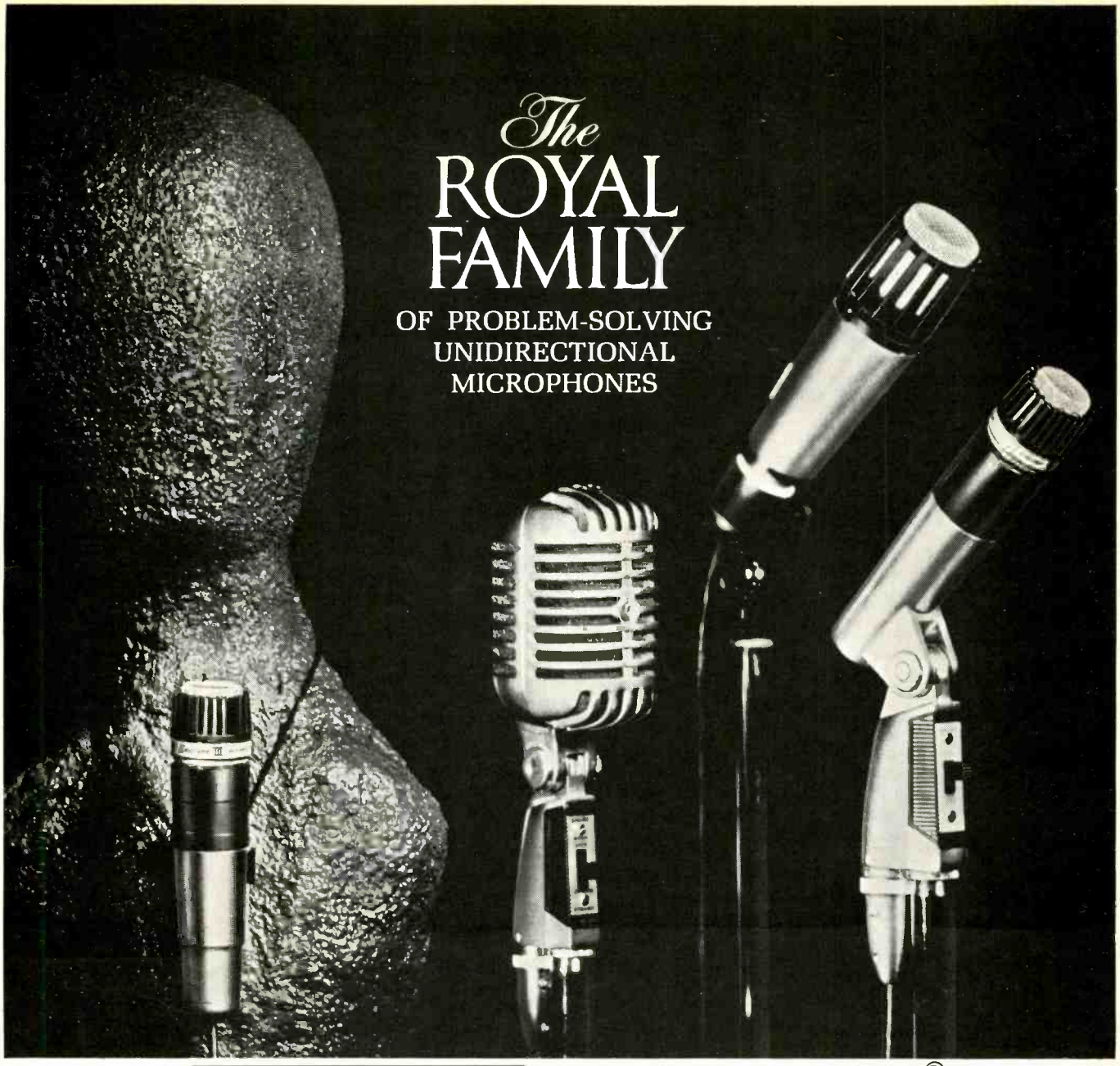
The Mystic Moods Orchestra is at it again. Obviously the reaction to its earlier melange of music and sound effects ("One Stormy Night") has been cordial enough to merit a sequel. This time the musical repertory is taken from the soundtracks of Hollywood and once again the recorded sounds woven into the music on the master tape come from the files of Mobile Fidelity Productions, famous in the field of realistic recording of the few steam railroads still in existence. Those who found the marathon rain storm of the first Mystic Moods disc a mite wearing after the first twenty minutes or so will have an easier time with these sound effects-within-music. Coastal dwellers in California will enjoy the chance to judge the authenticity of the sound of surf recorded by MF at Carmel and now used as accompaniment for "Theme from a Summer Place." The scenario of sound effects continues as hoof beats of two riders are heard in the course of "Shane." Crickets chirp a background for "Days of Wine and Roses" and give way to a thunderstorm in the background during "Strangers in the Night." So it goes through a rainy backdrop for "Singin' in the Rain" until the inevitable denouement is reached with the appearance of Mobile Fidelity's star attraction, a live train performing prominently during Lara's Theme from "Dr. Zhivago." Production of records such as this one seems an innocent enough pastime and undoubtedly gives a great deal of pleasure to the normally unsung sound-effects technician. C.S.

**Cy Walter at the Drake**
**M-G-M E 4393**

Few will disagree that the cocktail circuit is somehow easier to follow when Cy Walter is at the keyboard. What may be a bit more difficult to understand is the paucity of recordings available by an artist who stands head and shoulders above the general run of cocktail-lounge pianists. A flashier, more commercial style may account for the dismal fact that pianists of considerably less taste than Cy Walter's have far more records in the LP catalog. MGM is now doing what it can to set the record straight with the general listening public unable to attend the places he embellishes with his music at cocktail time. Cy Walter has been a fixture at the Drake Room in New York for most of its twenty-one years, except for an absence of some eight years during the early 1950's. This album attempts to recreate the pleasant atmosphere of one of New York's nicer night spots. Nowhere on the album cover is there explanation of the actual locale of the recording. If the recording, in fact, was not made in the Drake Room itself during a typical evening of wining and dining, then the sound effects added to a normal studio job are among the most effective I've ever heard. These include the smooth and discreet activities of a bartender who emerges as the second star of the album. Three Walter originals appear in the lineup of more familiar tunes as Cy occupies himself with Music To Get Thirsty By. C.S.

**Boston Pops:** All the Things You Are
**RCA Victor LSC 2906**

Just about everything one could demand to know about the sound of a current Dynagroove recording can be found on Band 2 of the first side of this disc. In the course of just one selection —a soft hued arrangement of "Misty" by Richard Hayman—the orchestra covers enough of a gamut in dynamics and frequency range to delineate quite accurately both the strong and the weak points of Dynagroove in its latest form. The gently atmospheric opening bars of the arrangement find the orchestra setting a mood reminiscent of a mist-shrouded landscape in a typical tone poem by the famous French impressionist in classical music, Claude Debussy. It is here that the Dynagroove process really gets a chance to shine. Nothing happens in either the strings or woodwinds that requires the extreme top- and low-frequency response we used to take more or less for granted in the days prior to Dynagroove. Very much on the plus side, the close miking conveys to the ear a very good impression of robust health in the mid-range sound of the instruments, an area of the frequency spectrum where Dynagroove can hold its own in presence with any system. So far, so good. At this point in the band, a sound fan putting his first Dynagroove record through a system he's proud of could easily feel that any adverse comments he's heard about this particular process have been quite uncalled for. Not until the full orchestra finds its voice and the volume rises to the maximum reached in the rest of the record will our newcomer begin to wonder if he's really getting the complete sound range of the Boston Pops Orchestra. A quick check against any Pops stereo disc made during the 60's prior to Dynagroove (if he's a bona fide sound fan, he'll have several on hand) will show him what's missing. Our newcomer to Dynagroove, if he's a perservering soul with a genuine regard for the wonderful things the Boston Pops can do for our standard songs of the past, will try the best he can to improve the sound of the rest of this well played album by means of judicious juggling of tone controls. The first procedure he'll attempt as a gambit to help the highs may prove the only effective one. That ancient law of equalization we first encountered as youngsters with our first car radio will work to some extent on this 1966 record. Attenuation of bass frequencies will appear to make more prominent such upper frequencies as are to be found on the record.

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With that feeble tip we leave what would have been, under other circumstances, a thoroughly enjoyable record by the industry's most luxurious vehicle for the production of background music. C.S.

**Kate Smith Today**
**RCA Victor LSP 3670**

It's the unexpected angle that keeps show business fascinating. Had anyone told me three years ago that I would someday recommend an album of leading Hollywood and Broadway songs of 1966 by Kate Smith, I would have dismissed the idea as preposterous. Yet that is precisely what I find myself doing at the moment and therein must lie a tale. Prior to January of 1964, the buyer of phonograph records could easily be pardoned for assuming that Kate Smith had gone into retirement after a fabulous career as one of America's great popular singers. The revival of interest in Miss Smith on the part of record companies is only three years old. Before that time she was represented (if that is the word) by only two recordings in the LP catalog. One a stereo release by Kapp Records dating from 1958—the other a low-priced souvenir in mono on the Harmony label, a rather feeble reminder of the fact that Columbia, Harmony's parent label, once counted Kate Smith as a key attraction. Then, in the last months of 1963, someone at RCA Victor decided to gamble on the memory of a portion of the record buying public and brought out a new recording by Miss Smith. This turned out to be the first in a series bringing up to this new release which I find the most interesting of the lot. It would seem that all it takes is a complete voice and seasoned skill in knowing how to use it, to bring out the best in show tunes that have survived some of today's new crop of singers. The fact that "Kate Smith Today" deals only in new songs doesn't bother her in the slightest. The Broadway songs I enjoyed most in the velvety Smith treatment are "The Impossible Dream" from "Man of La Mancha," "On a Clear Day You Can See Forever," and "If He Walked into My Life" from "Mame." Running these a close second is "The Ballad of the Green Berets," a pointed reminder of what Kate Smith accomplished in World War Two with the patriotic songs of Irving Berlin. The arranger and conductor in this album is Peter Matz who wisely decided that simplicity in arrangements can go a long way when you're working with Kate Smith. C.S.

# Jazz & All That

**Benny Carter:** Additions to Further Definitions
**Impulse Stereo A9116**

Two sessions on March 2 and 4, 1966 will go down in jazz history. On those dates veteran altoist, Benny Carter, surrounded by some of the finest musicians on the West Coast, produced a recording of well-nigh stunning impact. The music, arranged by Carter for two altos, two tenors, a baritone, piano, drums, bass, and guitar, includes six Carter originals, several of them familiar from earlier Carter versions: *Come On Back, We Were in Love, Prohibido, Doozy, Rock Bottom,* and *Titmouse.* The band at the first session included Bud Shank, Buddy Collette, Teddy Edwards, Bill Hood, Don Abney, Alvin Stoller, Ray Brown, and Barney Kessel. For session two, Mundell Lowe, Al McKibbon, and Bill Perkins replaced Kessel, Brown, and Collette. The sound has a bit less bite and a trifle more surrounding atmosphere than is characteristic of the Impulse waxings made on the East Coast, but this kind of acoustic envelope is well suited to the rich reed arrangements, and there is ample presence for rhythm instruments. Chief attention is naturally centered on Carter, who has not been heard frequently on discs in the last few years. There is no noticeable deterioration in Carter's technical prowess, and as this notable performer approaches 60, it is encouraging to encounter such emotional strength and intensity. B.S.

**John Coltrane:** Meditation
**Impulse Stereo A9110**

Since his religious reawakening, Coltrane has had a tendency to apply grand titles and ambitious scopes to his creative efforts. The present release is in keeping with that practice. Side one consists of two selections titled *The Father and the Son and the Holy Ghost* and *Compassion.* The flip side consists of *Love, Consequences,* and *Serenity.* While the conception is grandiose, and the titles make sophisticated listeners a trifle self conscious, the intensity of Coltrane's expressiveness and his instrumental eloquence force one to accept his music on its own terms. It is deeply felt, and it is deeply probing. This newest expression is also noteworthy for the addition of Pharoah Sanders, tenor, and Rashied Ali, drums, to the regular group consisting of McCoy Tyner, piano, Elvin Jones, drums, and Jimmy Garrison, bass. The high-pitched intensity of Pharoah's frenetic tenor is a perfect match for Coltrane's strong, sustained line. B.S.

**Lalo Schifrin:** The Dissection and Reconstruction of music from the past as performed by the inmates of Lalo Schifrin's demented ensemble as a tribute to the Marquis de Sade
**Verve Stereo V6 8654**

That Lalo Schifrin is a facile arranger and deft keyboard performer has been demonstrated many times. Alas! it has also been made manifest on several past occasions that Schifrin is prone to place has talents at the service of ideas that are beneath the calibre of his gifts. The present collection is just another case of sophomoric parody. Schifrin proves that, like any talented composition pupil, he can write in the style of a minor baroque kapellmeister. In this case, the baroque parodies have been hotted up in much the same spirit as those old waxings by the Chamber Music Society of Lower Basin Street. The instrumental performances, by some of the most impressive names in professional recording circles, are literally flawless, and the recorded sound is superb. What a pity it has all been lavished on such raffiné garbage. B.S.

**Count Basie with the Alan Copeland Singers:** Basie Swingin' Voices Singin'
**ABC Paramount Stereo ABCS 570**

Not exactly the kind of platter we might expect from Basie, but the Count has been the source of several surprises lately, and this is probably not the last of them. The most prominent element on this offering is the 12-voice chorus of Alan Copeland, a group of adequate merit but certainly not in the same class as a great man like Basie. On most of the eleven bands, Basie's accompaniments are augmented by Freddie Greene, guitar, George Duvivier, bass, and Eddie Shaughnessy, drums. The accompaniments are elegant enough to make one want to listen around the vocals, and it is likely that the swinging tempos can be credited to the Basie influence. On a couple of bands, the rhythm group has been supplemented by Roy Eldridge, Al Grey, Billy Byers, and Eddie "Lock" Jaw" Davis. The recording suffers from excess reverb, ping-pong chorus effects, and overly prominent sibilents. The music includes such priceless drivel as *You are My Sunshine* and *Down By the Old Mill Stream.* B.S.

**The Kentuckians**
**Melodeon Mono 7325**

The enthusiasm that these four bluegrass performers inject into such traditional numbers as *Froggie Went a' Courtin'* is characteristic of the spirit and vigor that they manage to invest in each of their dozen numbers. Although they performed together for only a year, their work on the disc displays a high degree of cohesiveness. To my mind, their solid, rather than polished, style is much the most satisfactory way to treat country music. The boys do not have voices of spectacular quality, neither do they display rare instrumental talents, but they do hit a high level of professionalism, while retaining a rare freshness. The mono recording is crisp and clean without any of the gimmics that are becoming so popular in Nashville. B.S.

**Javier de Leon's Fiesta Mexicano**
**Monitor Stereo MFS 472**

Recorded by Monitor in Mexico City, these performances offer the impressive Javier de Léon dance and vocal group, with mariachi orchestra, in a concert that includes regional music from many parts of Mexico. The program, probably designed to incorporate the highlights of the group's performances on its current tour of the United States, includes popular songs, traditional ceremonial dances,

ancient Aztec and Mayan dances played on native instruments, and a mariachi fiesta. Throughout, the music is punctuated by the sounds of the dancers, and the bright, spread-out stereo helps to recreate all of the lively color of a brilliant theatrical pageant. B.S.

**The Portuguese Hits of Fernando Farinha, Vol. 2**
**Monitor Stereo MFS 467**

One of Lisbon's most popular singers of *fados* and other popular songs, Farinha has already made a strong impression on his earlier Monitor album. The new collection is a welcome addition in spite of some rather cramped sound on the "electronically enhanced for stereo" version. The words of the fado often have a degree of significance lacking in most folk music, and the titles of several of these numbers are particularly stimulating to my curiosity, but Monitor has omitted the translations that have so frequently added to the enjoyment of their releases. Nonetheless this is superior music making that will delight all lovers of the form. B.S.

**Folk Songs and Dances from Czechoslovakia**
**Monitor Stereo MFS 465**

These Czech recordings from Supraphon offer three leading folk groups: The Czechosolvak Song and Dance Ensemble, conducted by Radomil Eliska; Eugen Farkas and his Ensemble; and Michal Piroska and his Gimbalom Quartet. To this listener, who is largely unfamiliar with the material, the disc seems to be made up of well-known traditional folk songs and instrumental pieces. The songs are well sung with that slight implication of quotation marks that repertory artists always seem to employ when performing old chestnuts. But no such reservation exists in the instrumental accompaniments and instrumental numbers. They are brilliantly done by groups that are past masters of the style. Particularly fine are the cimbalom solos and the work of the Cimbalom Quartet. While we generally encounter this instrument in Hungarian music, it is clear that the Czechs are no less gifted performers on this colorful instrument. B.S.

**The Lovin' Spoonful**
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# ABOUT MUSIC

**Harold Lawrence**

NOT SO LONG AGO the closest the average music lover came to Baroque music was in hyphenated form: Bach-Walton, Handel-Beecham, Vivaldi-Molinari, Corelli-Kindler, the "free" orchestral transcriptions by Stokowski of Bach, and other arrangements. Those were the days when the Baroque composer was treated like the tie-less and jacket-less customer who is stopped at the door of a fancy restaurant and invited by the maître d'hôtel to visit the check room first, where the attendant would provide him with the missing items of apparel. Baroque-style orchestras may have been fine for the 18th century, but they were much too plain for modern audiences.

This condescending attitude was a hangover from the last century when Baroque composers were thought of as musical relics. Today the revival of early music has captured the imagination of public and performers as never before. In the past twenty years new chamber ensembles and small orchestras specializing in early music have sprouted in America, England, France, Germany, and other countries; new departments of Baroque and Renaissance music have been created in universities and music schools; touring attractions like the Julian Bream Consort are smash hits on the college circuit, and Baroque repertory fills the pages of the Schwann LP catalog. Probably the best indication that Baroque music has arrived is the fact that the Time-Life organization saw fit to inaugurate a new series of classical music record albums with a sumptuously illustrated release called "The Baroque Era."

With the zeal of mining prospectors, recording producers, musicians, and impresarios have been digging their packs into the rich veins of Baroque repertory. Each month, carloads of 18th-century music emerge from recording halls throughout the world, and the entertainment pages of *The New York Times* are sprinkled with announcements of Vivaldi, Telemann, and Handel Festivals.

Has the revival eliminated the late-Romantic approach to Baroque music? Hyphenated Bach is still with us, of course, but performances of hybrid arrangements are no longer as common as they once were. It is in the *interpretation* of Baroque works that the 19th century makes itself felt. Venerable performers like Pablo Casals and Andrés Segovia still serve up their Bach seasoned with ritards, swoops, and modern dynamics; hopelessly outdated piano editions of early music issue annually from the presses of leading publishing houses; and the most rudimentary principles of Baroque ornamentation are ignored by many conductors and performers.

Ignorance of the law is no excuse. Any musician who takes the trouble to crack open a book like Robert Donington's *The Interpretation of Early Music* immediately would be in a better position to play Bach or Telemann or Corelli than he was before. He would be bypassing the 19th-century "tradition" to get right at the source; namely, descriptions by musicians and composers themselves of contemporary performance practices. One can only assume that the artists and music educators who perpetuate the errors and omissions of the late-Romantic approach do so out of ignorance.

Other musicians who *have* studied Baroque performance traditions insist on "modern" interpretations of early music and offer reasons for deliberately ignoring the work of musicologists. It is impractical to attempt to re-create 18th-century conditions, they say. To begin with, they point out that instruments were pitched lower two centuries ago than they are today. The pre-Tourte bow, less string pressure, and the exclusive use of gut upper strings all resulted in a smaller string sound. Early wind instruments were much less efficient than ours. Finally, it is virtually impossible for most players to maintain correct intonation on ancient instruments. So rather than stick your hand in a Baroque beehive, wouldn't it be better to use modern instruments (the only concession to the past being a harpsichord for continuo) and avoid the knotty problem of ornamentation and rhythmic inequality by playing the music as written?

On the other end of the Baroque performance spectrum are such specialized groups as the Schola Cantorum Basiliensis conducted by August Wenzinger. In his recordings for Archive, Wenzinger restores works by Baroque composers to

their original pitch (almost a whole tone lower in the case of the Telemann *Musique de table,* for example), uses recorder, viola da gamba, and so on, when called for, decorates melodic lines with 18th-century embellishments, and asks his continuo players to improvise. He probably comes closer to the Baroque "sound" than do most conductors.

Short of assembling an orchestra of ancient instruments, the conductor can cope with the problem of preparing Baroque scores by observing the essentials of 18th-century musical styles. It may take a little more time to instruct his players, but it would be worth it. Take the case of the Bach Suite No. 3 in D. Here are some of the things he can have his musicians do: attack the trills on the note above; double-dot the French overture; avoid the big ritard at the end of movements; ban the tight and rapid vibrato; reduce the strings to provide for better wind-string balance; and separate the first from the second fiddles.

Until a conductor or performer learns to read 18th-century scores correctly, his participation in the Baroque boom can only turn into a bust. ÆE

### TO OUR READERS

A new post office directive requires publishers to pre-sort magazine mailings by 5-digit zip codes. In order to ensure the same prompt delivery of your copy of Audio, please check the address label from this issue. If it does not contain the 5-digit zip code, please write it in and mail it back to Audio, 134 N. 13th St., Phila., Pa. 19107.

# 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. All letters are answered.

Following are the last commentaries, at least for the next several months, on the question of using synchronous motors in non-synchronous fashion to drive the supply and takeup reels. These two letters have a sufficiently authoritative stamp so that I can't resist presenting them here.

Mr. Edward Latta, 1901 Osaukie Rd., Owosso, Michigan, writes: "As an engineer with the motor division of Controls Co. of America I am familiar with the use of hysteresis-synchronous motors in tape recorders . . . I do not know of any company that is using three hysteresis-synchronous motors. To me the answer is simple—cost. The price on this type of motor . . . is from $10 low to $25 high. Why pay this much for a motor when a $5 shaded-pole motor does an adequate job? This is not to say that the hysteresis-synchronous motor has not been considered; it has, and for very good reasons:

"1. The stalled rotor torque of a hysteresis synchronous motor is *greater* than the maximum synchronous speed torque. (This is somewhat different than the starting and running torque characteristics of a shaded-pole motor.) This means that a hysteresis-synchronous motor will accelerate the reel and tape to full speed *faster* and *smoother*.

"2. At very low speeds, when the motor must drive the takeup reel while in record or playback mode, the hysteresis-synchronous motor applies a steady torque to the takeup reel. It is not a pulsating torque such as a shaded-pole motor produces.

"3. When changing the recorder from full-speed-rewind to stop, the braking action of a hysteresis synchronous motor is *smoother* and more precise . . .

"I hope you don't mind if I go on and tell you about another type motor which I feel is ideally suited for takeup purposes. This is a permanent magnet d.c. motor. I tried this out on an old tape deck using 15-in. reels. I could control the rewind speed from nearly zero rpm to 2600 rpm (nearly double the speed of a shaded-pole motor). Stopping was simple and smooth as silk . . ."

Mr. Joel C. Hertsche, Jr., 2105 N.E. Klickitat Street, Portland, Oregon, writes: "I wish to take exception to Mr. Tiffany's reply to you regarding synchronous motors in the August 1966 issue of AUDIO . . . In the first place, a synchronous motor, no matter what the type, is exactly that—a motor which keeps accurate and absolute step with the alternating current used to run it; that is why it is called synchronous . . . If it runs at any other speed than the synchronous speed, it is no longer operating synchonously and cannot be termed a synchronous motor.

"There are several types of synchronous motors. There is the type used in paper and steel mills, for example, to keep machinery running together, so that the ribbon of paper or steel will not be ruptured by variations in speed from one end of a mill to the other. These motors have a d.c. field and draw excessive amounts of current when they go out of synchronism. Usually these motors are started as induction motors by shorting the field and applying a reduced voltage to the armature; since the motors are generally three-phase, it is quite possible to do so without trouble.

"The field in the 'hysteresis-synchronous' motor is a polar field. The iron in the rotor, as all iron, has a tendency to hold its magnetism, once magnetized, and to lag behind the magnetizing force. This tendency of iron is called hysteresis, and hence the use of the term in the name of this type of motor. Due to the hysteresis of the rotor, as this rotor gradually nears synchronous speed, the iron in the rotor assumes poles (the rotor is notched so this can happen), and the motor falls into synchronism. Until it reaches synchronous speed it is operating as an induction motor. Should such a motor be used at any other speed than its synchronous one, it is being used as an induction motor, which does operate below synchronous speed and is built to be used that way. However, to use an hysteresis-synchronous motor as an induction motor to drive supply and takeup reels is using the motor in a pretty inefficient manner, to say the least."

*Q. I have been having a rather odd trouble with a **** tape recorder that I bought a year ago from the manufacturer's official dealer in my city. Briefly, after the recorder has been operating in the record mode for some time, the recorded signal gradually fades out over a period of 30 minutes or so. When the tape is played back, previously recorded*

*material comes back as the new material fades out. Sometimes this trouble doesn't happen. When it does, the recording eye gives no hint. After bringing the machine back to the dealer several times, only to have the trouble recur each time, I wrote to the distributor. After some delay I received an answer to the effect that my trouble was due to failure to keep the heads clean or to the type of tape I am using. This was the same as the dealer told me. Perhaps you can diagnose the difficulty.*

A. I think you have to be patient with long-distance diagnosis, both mine and the distributor's. Perhaps your best course is to send the machine to the distributor (who has service facilities). My experience with this particular distributor is that he is conscientiously trying to do a good job. But you must appreciate that the most difficult kind of problem to solve in any electronic component is an intermittent one, such as yours. It is even more difficult to solve from a point remote from the machine in question. My guess is that the difficulty lies in the oscillator circuit or its connection to the record and erase heads, inasmuch as the difficulty consists not only of failure to record new material but also failure to erase old material. The oscillator tube may be defective. The oscillator coil may be defective. Any of the resistors or capacitors in the oscillator circuit may be defective. There may be a hairline break in a lead somewhere in the circuit which opens as things warm up. A resistor or capacitor may seriously change value under temperature change. I suggest that during the recording process the oscillator waveform across the heads be monitored, while a qualified person carefully pokes around the oscillator circuit with a prod to find out what causes the oscillator to fail. If prodding doesn't reveal the culprit, it becomes necessary to replace oscillator components one at a time or a few at a time.

*Q. How would the frequency response change if the tape heads are changed?*

A. I assume you refer to changing the existing heads on a tape machine for heads made by a different manufacturer. In the case of a playback head, there should be virtually no effect on response if both heads have the same gap width. In the case of a record head, a difference in impedance may require a different amount of bias current and of audio current. Improper bias may result in treble loss or emphasis; also in excessive distortion if bias is too little (which causes treble exaggeration). In the case of the erase head, a different impedance may require a different drive current; possibly a different oscillator frequency for efficient operation. If the audio current to the record head is changed, there must be a corresponding change in the calibration of the record-level indicator. For example, if 6 dB more audio current must be pumped through the record head in order to reach a specified level of distortion, then 6 dB more signal has to be supplied to the record-level indicator in order for it to give the same indications as previously. In all this there is a lesson: unless you are knowledgeable and have the necessary instruments, replace the tape heads only with new heads having identical characteristics.

*"Some time ago there was a question about uneven tape wind. I believe I have the solution. Place one's finger or some smooth object against the tape as it goes on to the takeup reel, pressing the tape down or up against the reel. The tape will have even edges as if it had never been used, and the tape will be tighter-packed than normal."*—Jerry C. Smith, 8116 Eastern Avenue N.W., Washington, D. C.

Comment: Appearance of this item does not constitute endorsement of the suggested procedure. It is offered merely as a suggestion from one reader to other readers who may be plagued by uneven tape edges.

*Q. I am interested in buying a Sony Model 263D, but first want to know whether it will allow me to monitor the program material so I can compare the tuner signal with the tape playback. I have visited several audio stores but they were unable to give me this information. I have written to Sony but have not heard from them. Any information you can give me will be appreciated.*

A. Strange, all this lack of information. A telephone call to Sony informs me that the model 263D (replaced by the 263E) has separate record and playback heads and permits monitoring from the tape as you are recording.

*Q. I have a pair of 80,000 ohm earphones. How can any signal come through so large a resistance when the earphones are connected to the output of a power amplifier?*

A. Some earphones are sensitive enough to provide adequate response on a few milliwatts of signal. Remember, it is power that counts. To illustrate, assume the earphones produce sufficient sound when supplied 3 milliwatts of power. Assume that the voltage at the 16-ohm terminals of the power amplifier is 16 volts (which would supply 16 watts to a 16-ohm load). Virtually all this 16 volts would appear across the 80,000 ohm load presented by the earphones. Dividing 16 volts by 80,000 ohms yields a power of 3.2 milliwatts, which in our example is enough to drive the headphones.

*Q. I am intrigued by the advantages offered by cross-field bias and am discouraged by the lack of information on the subject in the popular publications. I notice that the cross-field head on the Akai (Roberts) tape recorder has a visible gap spacer. Would I be better off using an erase head (which has a wide gap) for supplying cross-field bias?*

A. I *guess* that you would be better off

*(Continued on page 65)*

# INDUSTRY News And Notes

### Companies on the Move

The Newport, Tennessee plant of ELECTRO-VOICE has been increased significantly in size. A total of 20,000 square feet of space have been added to the plant. This facility manufactures cartridges, needles, and solid-state electronics.

PIONEER has made a big move to Farmingdale on Long Island in New York. Expanded warehousing, servicing, and office facilities will be under one roof at the new location. This is all part of Pioneer's efforts to back up their entry on the component market scene with the necessary warehouse and quick service facilities.

Minnesota boasts the newly expanded facilities of several TELEX facilities. (The company is headquartered in Tulsa, Oklahoma.) Included in these facilities is the newly completed TELEX ACOUSTICAL PRODUCTS DIVISION building at Glencoe, Minn. Here stereo headsets, hearing aids, and related products are manufactured. Then there is the VIKING OF MINNEAPOLIS plant and its subsidiary, the VIKING TOOL AND DIE COMPANY. The first-mentioned manufactures tape recorders while the subsidiary is involved in tool and die manufacturing. Finally, Minneapolis also has the TELEX ACOUSTIC PRODUCTS DIVISION offices.

SYLVANIA recently dedicated a 221,000-square-foot entertainment products facility in Smithfield, N. C. It will be used for the manufacture of color TV, stereo phonographs and radios. Initial production began on September 6.

### People in the News

ROBERT FURST, v.p. and general manager of HARMAN-KARDON, INC. has announced the appointment of LEONARD GAYNOR as National Service Manager. In this post, LEN will serve as liaison between customers and dealers and will be responsible for the network of HARMAN-KARDON warranty stations. He will also serve as supervisor of the preparation of technical and instructional manuals. He is no newcomer to HARMAN-KARDON. LEN GAYNOR has been with the firm since 1956 as a component engineer and later project engineer working in kit design. He is well qualified to fill his new position.

ROLF HAAG, long the advertising manager at AUDIO DEVICES, has been appointed Manager of Marketing according to HERMAN KORNBRODT, v.p. of the firm. In his newly created position ROLF will have over-all responsibility for the marketing services of this leading manufacturer of precision magnetic tapes for computer, instrumentation, and sound application. AUDIO DEVICES is also a leading producer of tape cartridges. ROLF HAAG'S former position will be filled by CLIFFORD SHEARER. CLIFF was previously promotion director of DAVIS PUBLICATIONS and earlier had been advertising director of the REK-O-KUT company. Æ

# HAYS

*(from page 25)*

The trouble is, if you work out this series mathematically (e.g. 1, (3/2), $(3/2)^2$, $(3/2)^3$, etc.), you *will not* arrive exactly at 64, the number equivalent to the note seven octaves above the starting point. It will be slightly off. Music played on an instrument tuned in either of these systems will be nicely in tune in some keys and slightly out of tune in others, or there may be certain intervals that are out of tune. For centuries people have tried to compromise these tunings and have even added extra notes in the scale (e.g. an F# *and* a G♭) in order to make them usable over a wider range of keys. It remained for someone to compromise all the way and compress each 2:3 interval slightly so that a trip around the circle of fifths returns to the starting note. Now every

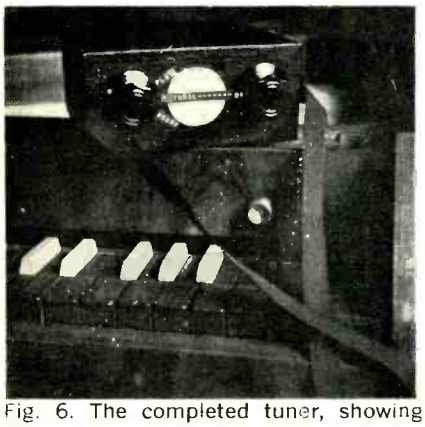

Fig. 6. The completed tuner, showing the strap which is convenient for carrying the unit suspended from the user's neck.

interval except the octave departs slightly from the integral frequency ratio. On the other hand, every similar interval has the same ratio no matter at what starting point. Every fifth, for example, is like every other fifth; and every key is as true as every other key. This is the "Equal Temperament" tuning that results in the frequencies given in the table.

It is the private hope of the author that those of you who would enjoy building this Twelve Tone Tuner and the people who would love to have one will somehow discover each other, if you are not already one and the same person. AE

**Notes:**

[1] All leads to components on front panel pass through holes on front edge of mounting board. Leads are 24 ga. stranded.

[2] Battery leads terminated in snap connectors. Insulate or otherwise arrange them to prevent shorting on adjacent metal parts.

[3] Box made of ¼-in. plywood covered with imitation leather.

[4] Screw to hold inner assembly in box. Both chassis plates are "pegboard."

**Notes on Components:**

| | |
|---|---|
| $P_1$ | Miniature potentiometer, Mallory 13L, with shaft modified to provide a screwdriver slot. |
| $R_1$ | Select value so 880 Hz tunes midrange on $P_1$ under normal temperature conditions. |
| $R_2$, $R_3$ | Use resistors that are protected against humidity effects (Dale, type DCS). |
| $R_4$ to $R_{13}$ | ½-watt carbon, 5% (See Table I). |
| $C_1$, $C_7$ | Electrolytic, 12 V. (Mallory type MTA). |
| $C_2$ to $C_5$ | Polystyrene, 5% (Centralab type CPR). |
| $C_6$ | 365-pF transistor radio tuning capacitor (see text). |
| *SW* | 2-pole, 12-position switch (Oak type K) see text. |
| *Knobs* | 1½-in. dia., with skirt (Harry Davies 4104). |
| *SP* | 1¾-in. square miniature speaker. |
| *BAT* | 9 V. (RCA VS-300) or 8.4 V. mercury (Mallory TR-286) 9 mA drain with plug out; 0.5 mA drain with plug in jack. |
| *TF* | Output transformer (Lafayette 99-6101). |

# CLASSIFIED

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## FOR SALE

**TAPE RECORDERS,** Hi-Fi components, Sleep Learning Equipment, tapes. Unusual Values Free Catalog. Dressner, 1523T, Jericho Turnpike, New Hyde Park, N. Y. 11040.

**"CROWN"** Professional Recorders: New and used. Reasonable prices. Wiegand Audio Labs, 221 Carton, Neptune, N. J. 07753.

**DISC RECORDING EQUIPMENT:** Cutterheads, Recording Amplifiers, and Lathes. New and used. From Rek-O-Kut to Scully. Send requirements. Wiegand Audio Labs, 221 Carton, Neptune, N. J. 07753.

**PROFESSIONAL AUDIO DEALER:** Altec, AKG, Ampex, Bozak, C/M Labs, Crown, Hartley, Magnecord, Marantz, McIntosh, ReVox. Information write: SOUND STUDIO, 1201 Ellis, NW, Cedar Rapids, Iowa 52405.

**FOR SALE:** two Fisher XP7 Speaker Systems, $80 each, $150 pair. Two Knight 1284A Enclosures, with Wharfedale Super 8 Speakers, $25 each, $40 pair. AR-XA Turntable, $45. All in excellent condition. Prices plus shipping. John Haner, 683 Locust, Galesburg, Ill. 61401.

**TAPE RECORDER.** Roberts 144 or 440, Sony 200-600 or 777S4, Concertone S505-4R, Ampex 4460—Speaker Amplifier 620 or 2012. Advise condition, price. T. A. McIntire, Box 3267, Wilmington, N. C. 28401.

**KLH ELECTROSTATICS**—$800.00.
MARANTZ TUNER—$650.00.
2 McINTOSH 75 Watt Amps—$150.00 each. Bob Pelton, Box 207, Medina, Ohio.

**SELL**—Ampex 354P stereo tape recorder, one year old, like new condition and used about 50 hours; with manual $1,650.00. Elvis Hughes, 401 Fifth St., Carmi, Illinois. Phone 382-8836.

**HEWLETT-PACKARD** 400D (Rack) VTVM, $129.00. Hewlett-Packard 522B (Rack) Counter, $299.00. Waterman S-14A Oscilloscope, $69.00. Alvin G. Voigt, 230 Oneida Street, Pittsburgh, Pa. 15211.

**REVERBERATION UNITS** (Hammond). All models and types. Available without electronics. Write for details, specifications and prices. Harvey Organ Electronics, P.O. Box 268, Harvey, Illinois 60426.

**SELL**—Two Ampex SA-10 Amplifier-Speakers, new condition, $200.00 each. Also one Electro-Voice Georgian speaker system, $200.00 and one Electro-Voice Centurian speaker system, $150.00. Both dark wood in excellent condition. Elvis Hughes, 401 Fifth St., Carmi, Ill. Phone 382-8836.

**THORENS** TD-124 with SME 3009, Ortofon SPE/GT, Extra Shell. Bought 1965, Perfect, $175. Heathkit AA-151 Amplifier, $45. W. Van Roosbroeck, 19 Whittredge Road, Summit, N. J. 07901.

**PRC** Military Trans-ceiver. Will accept any reasonable offer. Sgt. J. J. Dacey, U.S.M.C. 3/3 M-Co., 2nd Plt., FPO San Francisco, Calif. 96602.

**TAPE RECORDER** — Ampex PR10-2 — Stereo 7½/15, Portable Case, Recent Model, excellent condition. $500. Pete Kuykendall, Box 505, Falls Church, Va. 22046.

**ALTEC LANSING** franchised dealer. Price list and brochure sent upon request. Superior Sound, 2219 Brewerton Road, Mattydale, New York 13211.

**AMPEX** #601-2, and #910 (¼ & ½ track playback—3¾ and 7½ speed). Ideal tape copying pair—mint condition $700. Pair of AMPEX #620 Speaker-Amplifiers, $250. Dr. C. F. Tuma, 7701 Fitzwater Rd., Cleveland, Ohio 44141.

**TWO** EV Georgian 400's Speaker Systems. $325 Each. New condition. If dissatisfied return prepaid within 10 days, money will be refunded. Dr. W. Steve Shepard, 3230 Heritage Rd., Columbus, Ind. 47201.

**AMPEX** 1260 ½ Track Stereo, 3 Heads. Excellent condition. New $550, sell for $275. R. Murray, 314 Jackson, Mich. City, Ind. 46360.

**FOR SALE:** Golham PFB 150 WA amp; Neumann DST Cartridge; 25 phenomenal Orthophase speakers (recently advertised at $50 each) mounted on demo frame, divisible into 2 or more systems. Make offers, or swap all for Nagra recorder. Shapiro, 50 Beverly Rd., West Orange, N. J.

**HARPSICHORD:** Same as owned by Philadelphia Orchestra and RCA Victor. In kit form for home workshop assembly, $150. Clavichord kit, $100. Free brochure. Write: Zuckermann Harpsichords, Dept. R. 115 Christopher St., New York, N. Y. 10014.

## WANTED

**WANTED:** Stanley Furniture Co. Modulus units, especially china hutch. Donald Bisbee, 685 South Roys Ave., Columbus, Ohio 43204.

**WANTED:** Klipschorn speaker system. Please state finish, age, condition. D. J. Vanderbilt, 228 Eldorado Drive, DeBary, Florida.

**WANTED** ARI-W (Woofer only) Fairchild Compander Blondor—Tongue Audio Baton Ionovac Tweeter. Send lowest price & condition to: Robert Bartok, 561 Mill St., Lincoln Park, Mich. 48146.

**WANTED:** Used Fisher X-1000 Integrated Stereo Amplifier. Please state price and condition. W. O. McKnight, 2219 Wilson Ct., St. Joseph, Michigan 49085.

## SERVICES

**HIGH FIDELITY SPEAKERS REPAIRED**
AMPRITE SPEAKER SERVICE
168 W. 23rd St., New York, N. Y. 10011
CH 3-4812

**REPLACE** worn Lp jackets. White 20c. Colors 25c. Samples 50c. Min. order 20. Jacket Supplies, Hillburn P.O., New York.

**HI-FI SPEAKERS EXPERTLY REPAIRED**
USED SPEAKERS BOUGHT
AUDIO SPEAKERS TECHNICS
22 Astor Place, New York, N.Y. 10003
AL 4-2140

**PROTECT** your Lps. Heavy poly sleeves 5c, min. 60. Light inner sleeves 3c, min. 100. Poly Products, Hillburn P.O., New York.

**TAPE DUPLICATING.** Low prices. Any quantity. G&G Recording Service, Box 412, Peekskill, N. Y. 10566.

## POSITION WANTED

**YOUNG MAN** 20 years old, with competent basic knowledge of electronics; sound and recording systems, components-theory and practice. Also knowledge of systems and components requirements and specs for pro. and/or hi-fi recording and reproduction equipment. Desires position with recording studio or sound co. in N. J., N. Y. area. Reply Box No. AD-3.

**AIR FORCE VETERAN:** Desires job as High Fidelity Salesman; extensive Practical Knowledge in High Fidelity. Experienced Audiophile. Martin Caulfield, 4026 68th Street, Woodside, N. Y. 11377.

# TAPE GUIDE

*(from page 61)*

using a record head for application of bias current. Because of the greatly different impedances of a record head and of an erase head (erase head impedance is lower), it seems you might get into trouble using the latter. On the other hand, since the cross-field system applies bias from the base side of the tape, you may need substantially more bias current to penetrate the base than if you applied bias current from the coating side in the normal manner. So I must confess that I don't really know the answer. You might write to Akai or to the Illinois Institute of Technology, Chicago, Illinois, which developed the cross-field system. To my knowledge, there has been virtually nothing in the popular electronic literature on the cross-field principle and its application. The Illinois Institute of Technology has published several technical papers on the subject. AE

# Audio ETC.

*(from page 10)*

some valuable test features. An accurate tuning meter, for instance, to tell me the signal strength. And, indispensable, a stable and accurate dial calibration that enables me to tick off frequencies with great confidence. (Many a tuner is so vague as to tuning frequency that you can't tell within four or five FM channels.) Still more useful, the Scott tuning scale is linear on the dial, whereas some tuner scales are loggish, all spread out at one end and cramped up at the other. Not good for logging operations.

So out came the Scott and back into service, with a new lease on life. It's working like a stereo dream, after all this time. A very nice machine.

### Pay-Off

So, space being used up, let me briefly titillate you with what happened when I put a new-type antenna on top of my old rotor, and made no other changes at all. The antenna did most of it. The changes in broadcasting itself make up the rest.

First—on mono I have actually identified by name (and you know how hard it is to wait around for station breaks) exactly *sixty-one* fully limited mono signals, to date. I have them all checked off in my *North American Radio-TV Guide* (Howard Sams), without which I could not operate. There are many other stations, in the remaining cracks, which have not yet been identified—how can you identify Mantovani or rock-and-roll or Winston cigarette ads, Chevrolet, etcetc.?

Second—at 11:30 pm one recent evening, well past the top of the evening stereo broadcasts, I counted *thirteen* usable stereo stations, received either with NO background hiss at all or with a minimum of gentle, unobtrusive FFFF sound. Most were entirely silent—no change in background sound as between mono and stereo. Almost all of these stations, again, were between 60 and 100 miles off, none nearer than 30 miles.

Only one station, with a very weak signal, had really objectionable stereo hiss. Didn't identify it.

So is the battle to eliminate FFFF actually won? *Yes*—for me. And all it took was a new antenna on the old mast. More about this next month. AE

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