

# THE B.A.S. SPEAKER

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## In This Issue

This month's publications are equipment reviews. First, at long last, is a review of the PAT-5 by Mike Riggs followed by Harry Zwicker's comments on building the kit. Having learned a good deal about preamp design in the past few months, local BAS members are perhaps somewhat harder to please than they might have been a year ago. Although the review is generally favorable—indeed, at its price, the PAT-5 is a bragain—there are points with which the reviewers have taken issue.

Virginia member Collins Beagle then reviews the Dayton-Wright XG-8 electrostatic loudspeakers, and concludes that their performance is limited only by the electronics available to drive them.

Of special interest this month is an almost complete list and description of the various items BAS members are trying to sell each other. The BAS seems to have reached some critical mass—suddenly all sorts of goods and services are becoming available within the membership. All this is far beyond the usual orders of tape, cassettes, records, and the like. What we are seeing now are attempts by BAS members to produce—if only on a small scale—devices they feel to be distinct improvements over similar units commercially available. More power to the entrepreneurs, we say. One of the goals of the BAS always has been to serve as just this sort of specialized marketplace and now we seem to be succeeding in a large way.

It is appropriate to point out, though, that the BAS disclaimer at the top of this page applies equally to commercial products and to the products of the members themselves. The BAS, its meetings, and its publications must be neutral ground, so that information, goods, and services all can flow freely. So we say caveat emptor. But softly, softly, especially where the products of our audio society experience are concerned.

## What's Selling In and About the BAS

In response to a number of recent letters, we are devoting some space this month to a brief description of the various goods and services BAS members are selling each other. Some are available only locally; some are available by mail order. We thought it proper also to indicate what's sold out. To wit:

The BAS Oscillator. All these kits are sold out and the BAS has forwarded all requests received to date to the entrepreneur in charge, Peter W. Mitchell. Those already having oscillators with questions about their construction or operation are advised to communicate with Mitchell directly or through P.O. Box Seven.

Microphone Capsules. All 814 and 814C Thermo Electron microphone capsules have been snapped up. Unless some member decides to sell his own units, there will be no more of these to be had by any route, T-E having gone out of the mike business.

### BAS Record Importing Service

Dr. Brian Leeming is continuing to provide an imported-record buying service. At present records may be ordered by mail but delivery must be made at a BAS meeting.

At each meeting Dr. Leeming will distribute an order blank that lists current recommended records (mostly classical) selected from the British publication The Gramophone. Members should return their order form to Dr. Leeming (either at the meeting or c/o P.O. Box Seven) and include payment for the records ordered. Checks should be made out to Dr. Brian Leeming.

If members would like to add recommendations to the order form, they should contact Dr. Leeming at least three weeks before a meeting and provide him with the necessary information—complete record identification including the record number and list price. If a member wishes to order a record not on the recommended list, he may do so if he can provide the necessary record identification.

### A Phase-Locked Loop Demodulator for Older FM Tuners

We hope to print the results of the BAS tuner clinics soon; when you read how poorly the average tuner performed you'll understand why we are pleased that BAS member Abbott Lahti has produced a PLL multiplex decoder kit.

Built around the Motorola MC-1310P PLL integrated circuit, the demodulator is of sufficient quality that it will almost always be limited by the front-end and IF-strip performance of the tuner in which it is installed. The Lahti unit includes a variable-gain input amplifier (to optimize levels for minimum distortion) and a stereo light driver.

Motorola specs the MC-1310P's performance thusly:

Ultrasonic signal rejection	
19 kHz	34.4 dB
38 kHz	45.0 dB
SCA rejection	75 dB
Stereo channel separation	30 dB minimum, 40 dB typical
Audio output voltage	485 mV typical
(modulation unspecified)	

There's no guarantee that your greybeard FM tuner will meet these levels of performance, but from what the BAS has learned testing tuners for the past year, the addition of Lahti's PLL demodulator is almost bound to improve its performance. Few tuners came anywhere close to the basic specs for the MC-1310P in our tests.

As for the qualifications of its designer, Abbott Lahti is a former engineering consultant at Acoustech. Coincidentally, the 1- by 3 3/4-inch board is a drop-in replacement for the decoder used in the Acoustech Mk. VIII stereo tuner. Lahti also is co-holder (with Thomas E. Beling, President of Sigma Instruments) of one of the original patents on FM stereo demodulation using PLL techniques.

Price for a kit of parts including circuit board, schematic, parts layout, and full instructions is \$27.50 (this price may rise in future). To order a PLL demodulator kit, send \$27.50 plus \$1 to cover shipping (Massachusetts residents enclose \$1.38 state sales tax) to Power Systems Inc., 56 Bellis Circle, Cambridge, Mass. 02140. Literature (actually the abbreviated instruction manual) is available at the same address, but please enclose a stamped, self-addressed envelope; you won't get an answer without one.

If you wish a unit installed in your tuner and live in eastern New England, you'll be glad to know that Lahti has made arrangements with BKM Associates (aka, BAS member Scott Kent) to do the job. Cost estimates for your unit will be a bit wide of the mark without your tuner and/or an instruction manual to look at, but by way of a ballpark figure, Kent and Lahti figure that the cost of updating (for example) a Heathkit AR-15 would be about \$50 (including kit). This probably would include some RF and IF alignment, but no extra parts. Other tuners without the filters the Heath has might require a few dollars worth of additional parts. Interested members should write to BKM Associates, 6 Ledgewood Rd., Wilmington, Mass. 01887, giving as much information as possible about their tuner.

Those interested in the PLL kit also will be interested in an upcoming kit construction report, plus a before-and-after tuner performance evaluation. We hope to publish this in the Speaker within the next couple of issues.

Lahti also is developing a phono preamp, but has no commercial plans for it at present.

### Improving Revoxes and Other Equipment

If you suspect that your equipment—though already good—could be better, you're probably right. Compromises almost always are necessary in bringing a product to market. With this in mind, BAS members will be glad to hear about the services offered by Massachusetts member Scott Kent.

Revox A77. Kent has an improvement package for A77 Revoxes that reduces hiss and hum, assures record amplifier headroom of about +20 VU, and allows playback of "hot" tapes with less distortion than the unmodified machine is capable of.

The "low-hiss" modification for \$50 includes gain and level changes to record and playback circuitry which reduce hiss and radio-frequency interference. Even though the Revox already is one of the quietest machines available to the consumer, the Kent modifications make an audible difference. As part of the same package, Kent replaces some parts that have shown above-average failure rates, checks tape speed, checks and aligns heads, and sets bias and equalization for the tape of your choice; these latter services alone generally cost about \$20. Also, Kent makes a few updating engineering changes to Mk. I and Mk. II Revoxes.

For a second \$50, Kent cures the A77's historic hum problem. He removes the unit's power transformer, re-installing it in a separate carrying case with handle and connecting cable. This job is done only in association with the above hiss-reducing modification.

Depending upon the age and model of your Revox, Kent's improvements increase its unweighted signal-to-noise ratio by some 12 to 15 dB. Those concerned about Kent's qualifications should note that he is the Boston area's factory-authorized Revox service agent.

Advent Model 100 Dolby B. Modifications include added filtering for power supply hum and crosstalk reduction, replacement of some internal wiring with shielded cable to cut play-record crosstalk/echo, and complete RFI suppression. There are also feedback changes made in the FET circuit to cut distortion in the record mode and a change in the output section to decrease distortion, increase signal-to-noise ratio, and to guard against any chance tendency toward intermittent operation or oscillation. Finally, the distortion of the test tone is reduced, and its frequency can be changed if desired. This package costs \$45. Kent also converts Model 100's to Model 100A's with four line inputs and jacking for separate mike preamps; alternately, Kent will redesign the unit's built-in mike preamps.

Advent MPR-1. Circuit improvements to this popular mike preamp increase slew rate, improve RF rejection, lower distortion, and reduce hum (\$25).

Acoustech Products. Kent has a separate folder available on this line. Modification packages on amps, preamps, and tuners are priced from \$55 to \$155, and custom modifications can be quoted. Kent has modified more than 200 such units and for several years was Acoustech's customer service manager.

SWTP Octave Equalizer. Kent modifies this kit for lower noise, hum, and distortion than the "stock" unit. He claims that the modified equalizer compares very favorably with Soundcraftsmen units. Price is \$165 including the kit. Other modifications are available for those with electronic music applications.

dbx 120 and 150. Kent's modification allows switching among four compression-expansion ratios ranging from the standard 2-to-1 to 1-to-0.75. Price and information are available on request.

Miscellaneous. Kent also provides passive filter sets, switched attenuators, mixers, preamplifiers, and disco electronics among other things. Dyna PAS-2 and -3 owners may wish to ask for price and data on switched, stepped tone controls for these and other similar preamplifiers.

All prices mentioned above exclude transportation (usually via UPS), and persons interested in obtaining more information or in sending in equipment to be modified first should write Scott Kent, 6 Ledgewood Rd., Wilmington, Mass. 01887, or phone (617) 658-6565.

[Editor's Note: Listing products or services and their prices in this fashion is somewhat unusual for the BAS Speaker. However, several BAS members have had very good experiences as a result of Kent's modifications, and we therefore thought word of them well worth passing on to all. We hope to publish the results of tests of units with and without the Kent modifications in some future issue, but since this will take some time, we would suggest that interested parties go ahead and contact him. As noted, the results have been excellent to date. J.B.]

### The Mark Davis Phono Preamp

Mark Davis's FET Reference Phono Preamp is now becoming available for sale to BAS members. Prototype units sound superb and some of the following test data may help explain why:

- Open-loop preamp bandwidth: More than 1 megahertz
- Audio band frequency response: Flat to within tenths of a dB
- Cartridge complex-impedance interaction: None measurable
- Holman square-wave test: Even-harmonic products at least 81 dB below fundamental level at 2000 Hz and 4000 Hz. At higher frequencies, there are none measurable with available test equipment. This compares favorably with the -75 dB (at 2 kHz) for the best preamp noted in November 1975.
- Input overload: Approximately 200 millivolts

- Total harmonic distortion: Less than 0.01%
- Transient-intermodulation distortion: None measurable with Sound Technology and custom-made test equipment
- Noise: Preamp noise is swamped by the self-noise of the cartridge with which the unit is used. The cartridge now is the limiting factor in attainable signal-to-noise ratio.
- Filter performance: The preamp section itself is followed by an active filter that rolls off unwanted low-frequency information at 18 dB/octave below 20 Hz, and removes needle chatter and other unwanted high frequency products at 12 dB/octave above 20 kHz.

The preamp uses a separate  $\pm 15$  -volt regulated power supply which is connected by an umbilical cable. Thus the supply can be remotely located to minimize hum or to put it out of sight. The preamp itself is about 3 x 6 x 1.5 inches in size—small enough to be placed out of sight behind a turntable.

Price including power supply will be between \$100 and \$200. Deposits of \$25 now are being accepted from members only; checks should be made out and mailed to Preamp, P.O. Box 215, Wayland, Mass. 01778. Checks will be acknowledged but not cashed until final price is set; this should be within the next 30 days.

#### Predistorters for Cleaner Sounding Tapes

BAS member David Griesinger is selling the predistorter modules mentioned in the December 1975 issue of the BAS Speaker. For a full description of these units and their use see pages 18 to 23 of that issue. Prices are \$40 per channel for assembled units and \$25 per channel for kits. Write Griesinger at 15 Bellevue Ave., Cambridge, Mass.

#### Want Ads

When you send in want ads, please indicate whether we should include your address as well as your telephone number.

- For Sale. Dynaco ST400 amplifier (factory wired), \$385; two AR-3A's with tweed grill cloth, \$300; Epicure Model 1 power amplifier (with 4-year warranty), \$400; Marantz 7T preamplifier with cabinet, \$175; SAE Mark XXX preamplifier with cabinet (3½ -year warranty), \$180; Sony 2251 LA direct-drive turntable with SME 3009 S2 arm, \$315; Sony KU1910 19-inch Trinitron with stand and full warranty, \$485. Everything in excellent condition; willing to bargain. Dan Bolger (617) 782-5763.
- For Sale. Phase Linear 400 power amplifier (3½ years old), \$385; Marantz 33 preamplifier (3 ½ years old), \$285; Decca International tonearm (new, never used), \$100; McIntosh MQ 102 environmental equalizer (3 years old), \$50. All in excellent condition; will pay freight charges. Gerald Johnson (405) 524-7233.
- Wanted. Revox A77 in good condition; two-track, high-speed only. Price negotiable. Ken (617) 646-3427.

#### Attention Detroit Area Audiophiles

We have just heard from Dave Carlstrom about an audio society in the Detroit area—The South Eastern Michigan Woofer and Tweeter Marching Society. Those of you who might be interested in the group should write SEMWTMS, 10155 Lincoln Drive, Huntington Woods, Michigan 48070.

## More on Damping Feedback

I concur with Ross Robinson's comments on the Micro Seiki MSB-1 Microsorbers in the January Speaker. Readers may be interested to know that the package can be obtained direct from the Micro factory in Japan at a total cost of \$7 (including air freight) versus \$11 asked by the British importer Howland-West. I obtained very rapid service (less than two weeks from order to delivery); those interested should write to: Mr. K. Usui, Export Department, Micro Seiki Co. Ltd., Kinsho Building, 37-6 Honcho, Itabashi-ku, Tokyo, Japan.

The MSB-1 is very effective when used with the Thorens TD-160C, especially when the suspension of the 160 is adjusted by tightening the three springs which support the platter assembly. The combination of the MSB-1 and tightened suspension results in near complete resistance to footfalls and feedback in the range from 20 to 50 Hz. — Gary Roboff (Massachusetts)

## Audio International

Many BAS members subscribe to Audio magazine, and probably saw the ad for Audio International. For those who didn't see it or don't subscribe to Audio, Audio International is a mail-order firm in West Germany that offers outstanding prices (from what I saw) and could be quite advantageous if the item you were ordering did not weigh much. The sample prices were \$249 for a Dual 701 turntable and \$499 for a Revox A77 (\$648 with Dolby B).

The brands they stock are Thorens, Braun, IMF, Gale, SME, Celestion, B&O, Decca, B&W, and many others. Note that it doesn't matter how perfectionist-oriented the product is, as long as it was manufactured closer to West Germany than to the United States.

The address is: Audio International GMBH i.g., 1000 Berlin 30, Postfach 4030, West Germany. Quotes may be obtained by including \$2 for airmail postage, so they say. All prices include insurance, freight collect. — David Sherwood (New Jersey)

## Wilmex (and Stax) Recommended

Asking for a price on the Stax SRX3/SRD7 headphones, I wrote to Wilmex Ltd., Import Division, Compton House, New Malden, Surrey KT3 4DE United Kingdom. To my surprise I had a letter back a week later with a quote of £88—including airmail postage and insurance. This is about \$176 at current exchange rates and compares well with a U.S. list price of \$235. Even though I placed my order near Christmas, I had to wait only about ten days for delivery, paying about \$6 duty at the post office.

As for the Stax headphones, I'm very impressed. The recent Philips recording by Colin Davis of Berlioz "Symphony Fantastique" sounded like any other good recording over my Sennheisers. With the Stax, it was scary. Transients, instrument placement, and response are like nothing I've heard before. One can listen at painful levels without distortion.

— John Tooley (Delaware)

## A Note on Quad

I also inquired as to the best amplifier for use with the Quad ESL's and got the following response: "The reliability of the Quad speaker is significantly reduced if it is used with an amplifier capable of producing an output of more than 33 volts peak . . . The loudspeakers should not be used close to a parallel wall, a spacing of about two to three feet between the speaker and a parallel surface behind it would be advised." — John Tooley

## More on the Holman Tests

I am beginning to wonder whether the CCIF system of intermodulation distortion measurement, using closely spaced high-frequency signals (e.g., 10 and 11 kHz or 10 and 10.1 kHz), may not perhaps provide a sensible test for phono preamplifier quality that correlates with what one hears, and that may be based on a sounder technical footing than the Holman tests. Certainly the sound of certain phono preamplifiers on massed string and voice passages has the congested, grainy quality that could be due to such IM distortion, but I have no technical evidence of my own, one way or the other. Perhaps someone might undertake such a series of measurements on a selection of phono preamplifiers to complement the Foster/Davis report on the Holman tests in the November 1975 Speaker.

In this regard, and to bolster my argument for a more detailed investigation of CCIF measurements, I refer you to the reviews of Bascom H. King in Audio over the last couple of years—he has made a point of displaying the IM distortion curves using 10- and 11-kHz signals to the phono preamplifier. I also refer you to the two articles "Build a High-Quality Phono Preamp" by Blair McKen in Audio Scene/Canada (Nov. 1975, pp. 58-59 and Jan. 1976, pp. 39-43), which also discuss this measurement using 10- and 10.1-kHz signals (a more severe test).— S. P. Lipshitz (Ontario)

[Editor's Note: See the January 1976 BAS Speaker for some other comments from Dr. Lipshitz on the Holman tests. Several BAS members, including Tom Holman and Mark Davis, have been thinking of investigating the CCIF tests, and their results will be reported in a forthcoming issue.]

## The Holman Cartridge Interaction Test: Two Views

I currently have a sample of the Audio General Model 511 preamplifier for evaluation. A complete test report will be submitted for a later issue of the Speaker. The unit so far is audibly and objectively one of the finest preamplifiers I have tested.

While reviewing the specification sheet of the 511, I noticed that it stated an input capacitance of 80 pF. I therefore phoned the designer to get his view of the Holman cartridge interaction test and the validity of his input circuit. He, David Spiegel, replied in the letter below. I then contacted Tom Holman for his response, which follows. — Alvin Foster (Massachusetts)

After reviewing the cartridge/preamplifier interaction test, I must still object to the method in which this test was carried out. The test, as you know, does not take into account preamplifier input capacitance, but instead, treats it as cartridge interaction. Input capacitance is not a preamplifier malady unless the capacitance is greater than that required for the phono cartridge. In all other cases, the preamp capacitance is of absolutely no consequence since it doesn't matter whether the cartridge's required capacitance loading is provided by a shunt capacitor or by that of the preamp. To experimentally prove the fallacy of this test, try repeating the procedure on some of the preamplifiers listed in the cartridge/preamplifier interaction chart using low-capacitance phono cable. Although the preamplifier and cartridge have remained the same, you will find the "cartridge interaction" has now increased.

As you may have suspected, we do not want our preamplifier measured in this way. The test would be valid only if the capacitance of the buffer amp and the PUT were made equal. To repeat your test under these conditions would be worthwhile because it might explain differences in subjective frequency response heard with equipment that, in the laboratory, measures flat. I must add, however, that such tests that we have conducted on many of our laboratory prototypes (different phono preamp circuits) have failed to indicate the existence of any cartridge/preamp interaction. This is not to say that such interaction cannot occur, but that we have seen no evidence to correlate subjective frequency response differences with interaction.

— David A. Spiegel (President, Audio General, Inc.)

The cartridge/preamplifier interaction test was designed as a straightforward method of looking at the total interaction between magnetic cartridges and phonograph preamplifier inputs. As such, it does not sort out the source of the interaction—be it input capacitance, lack of high-frequency loop gain (loop gain tends to keep the input impedance high), or interaction with the RIAA feedback network (the latter two are approximately equivalent). However, it does correlate with listening. Here is a test which does sort preamplifiers into rough categories—and shows a positive advantage for the more advanced designs.

The test conditions used do affect the measurement results. I used a "typical" system consisting of an Ortofon VMS-20E as the cartridge, a 200-pF silver mica capacitor representing a reasonable total wiring capacitance, and, of course, the load resistance. I have run curves which show the cartridge/preamplifier interaction. These curves show the unmeasurable difference associated with the Advent design. For a second case I used a similar system with the addition of buffering. The difference between the two is the addition of 100 pF of capacitance. The interaction is about +1/2 dB at 10 kHz, 0 dB at 14.5 kHz, and -1 dB at 20 kHz. By the way, the original presentation included curves at 0 pF. The interaction happens in the same general way over the range of possible test circuits (i.e., loading capacitance); however, the amount varies depending on the test circuit capacitance and the input capacitance simulation.

While a "non-zero" input capacitance can be defended given that other sources of interaction are negligible, I believe that the best system, in the best of all possible worlds, would be one where the cartridge maker gives the best load for his cartridge, the tonearm and cable maker gives the capacitance of that assembly, and the preamplifier maker specifies his input capacitance. Then the customer could be made responsible for adding the necessary additional capacitance for optimization. Barring this possibility leaves us in the more likely state where the problem is ill defined. Still, to have each designer choose his own value to compensate for an unknown cartridge/cable system will certainly produce differences between preamplifiers that are audible. Perhaps a standard input capacitance would be something to shoot for.

In the absence of a standard, and since negative capacitors are impractical (and would affect the noise performance in this application), I believe that the best input capacitance is that which is as low as practical. Then, at least, the customer with very strong interests can add an appropriate amount of external capacitance. An easy scheme to do this is to use ordinary phono jack Y adapters at the phono input. The Switchcraft 330F1P1 works fine and shows about 20 pF of self-capacitance. Then connect the proper terminating capacitor (silver-mica or NPO ceramic disc) across a phono pin jack and solder. This, when all plugged together, effectively puts the terminating capacitance in parallel with the cartridge, wiring system, input capacitance of the preamplifier, and Y adapter capacitance.

Also, an interesting note, the Shure V15, Type III with its laminated, less lossy, core structure is more sensitive to loading than more "normal" cartridges. This comes from Reg Williamson, the British designer who first pointed out that there was an interaction and who writes: "Interestingly enough, I too, had come to the conclusion after doing sums and breadboard mockups, that using a differential input stage would provide enough isolation between source generator and the feedback loop . . . All my tests confirm your results. In all cases, deviation from the RIAA curve was exactly as predicted from the cartridge and load parameters; in other words, no reactive component of any significance was contributed by the active device."

— Tomlinson Holman (Massachusetts)

## \$/dB Altec Style

In a booklet on biamplication published by Altec they claim that a single amplifier of 175 watts rms is required to produce the same "undistorted output" as a biamped system using a 60-watt bass amp and a 30-watt treble amp. The figures they trot out to prove this show that the sum of the voltages produced by the two separate amps on their separate loads would produce 175 watts on a single 8-ohm load. 85 free watts? 2.9 dB free headroom?

I don't think so. Power (for a given load) does go up as the square of voltage ( $P = V^2/R$ ). However, a voltage equal to the sum of the two individual voltages never appears across a single 8-ohm load. In a biamped system, each amp's voltage is applied to its load only.

But if true, Altec's claim would make biamplification a way to decrease the \$/dB ratio. If not true, could two 60-watt/channel amps plus crossover be cheaper than a single 120-watt/channel amp?

A further point to consider: one of the advantages of the biamp approach is that overload of the bass amp doesn't affect the high frequencies. Therefore, even if two small amps plus crossover cost the same as the larger amp, the biamped system might well sound better, the effect being similar to better headroom, I would think. And since most of the "inefficient heirs to the AR revolution" are bass drivers, the biamped approach might be the best route to go until efficiencies improve. Power would be concentrated on the power-hungry driver. Instead of two 60-watt amps in the place of our 120-watt amp, we'd use a 90 on the bottom and a 30 on the top (similar to what Altec suggests).

If anyone can justify Altec's claim, I'd be very interested. I plan to write them about it.

— Jim Thoroman (New Hampshire)

### Additional Comments on Amplifier Power

I think the BAS deserves a lot of credit for publishing Tom Mashey's article, whose points are well taken. You wouldn't find this material published elsewhere. I noticed, however, a few errata: the McIntosh amplifier is the 2505 not 2305; as of September 15th the Dynaco Stereo 150 costs \$369, making the price in the table \$370 not \$360; and the SAE Mark XXXI B costs \$300 not \$250.

Another point about amplifier power and slew rates. Back in the October 1974 BAS Speaker Peter Mitchell gave a neat formula for relating amplifier power to slew rate:  $SR = 0.5 \sqrt{P}$ . I can't say I completely agree with his conclusions. In the first place, in light of FTC preconditioning rules (now apparently being re-interpreted) the short-term amplifier power available (a function of the power supply, mostly) may be considerably above the indicated rms power rating, which in big amplifiers is limited by thermal dissipation problems.

Four years ago Bob Carver wrote an interesting article for Audio detailing some of the design features in the Phase Linear 700 (Feb. 1972). This prompted a heated response from Dan Meyer of SWTPC (designer of the various Tiger amplifiers) in which he stated "given equal rms ratings on three amplifiers, the one having the highest IHF rating will sound the best" (May, p. 16). The point here is that while the use of peak power has been badly overdone, specification of the peak power is useful and may correlate in some respect with sound quality. Also, at 20 kHz we can increase the power output at the expense of distortion, the higher harmonics of which are inaudible. This further increases the slew rate.

All this is pretty much academic since no music is likely to have much in the way of full-power 20-kHz sine waves, except perhaps for some electronic music. On the other hand, lower frequencies may add in such a way as to require an equivalent slew rate.

In that same October 1974 issue of the BAS Speaker, Al Foster measured a peak-to-rms ratio of 20 dB on Sheffield III. It is not inconceivable to me that the various exotic discs on the market today with tremendous dynamic range could present heavy demands on the slewing capabilities of an amplifier. What we are looking for is transient performance.

Again in the same issue of the Speaker, Mark Davis noted that phase shift may be audible in transients while it is not under steady-state conditions. If there is indeed substance to the claims of TIM, I think it may be related to phase shifts, slew-rate limitations, and rise times.

At any rate, I do not believe a few numbers can adequately characterize hi-fi equipment, and I doubt anybody else does either.

— Dana Craig (Massachusetts)

### Comments on Fulton Speakers

The December issue's short review by Desmond Fretz of the Fulton J Modular was of special interest to me because his experience is similar to mine. Following the lead of Gordon Holt of The Stereophile I had my J's crossover updated to a more efficient one in July 1975. It cured the problems in my room that Fretz mentioned—they now fill a room 30 x 40 feet with a 15-foot ceiling playing from two Paoli amplifiers.

I recently heard the J's playing into a room of 4 to 5000 square feet with a high open-beam ceiling using one D-150 and a SP3-1 Paoli. It was enough beyond anything I've ever heard before, outside of a live performance, to make me feel there wasn't much of a gap left.

— Tom Johnson (San Diego)

When I was living in Pennsylvania, I helped a friend often with his live recording sessions and became familiar with the FMI 80, which my friend used as portable recording monitors. I concur with Mike Riggs assessment of their sound: I found them a bit bright and tubby, with no low bass. But they are the least deficient small two-way system I've heard. (For rock music the more forward sound of the Dyna A-25 may be preferred by some.) Used for playback of master tapes in a large, dead room, the FMI's did very well.

The suitability of the 80's for use as monitors, plus the fact that the 80 plus the FMI-6 make an excellent system for listening in the "permanent" listening room, should make the 80's very attractive to anyone needing both good monitors and a good system at home. The 80-6 combination (the FMI-6 is a modified RTR ESR-6 electrostatic tweeter) is a superb system over its range. With the addition of a single infrawoofers, the combination ought to be satisfactory over the whole spectrum.

The advantages of the setup are:

- 1) It maybe accumulated building-block style (like the Fulton "J"), which spreads the investment. The 80's are about \$180, the 6's are about \$300/pair, and a woofer can be built for around \$100 using the KEF B139 (the woofer needs an amplifier, of course).
- 2) Although performance is not quite up to the "J" level, total cost is \$600 to \$700 as opposed to \$1500 for the "J."
- 3) The "blocks" are easy to move if you move often, as I do.
- 4) A recordist needn't make an additional investment for monitors and the monitors will have the same mid-range character as his main system at home. The 80's are compact and relatively light. Thirty watts/channel is adequate power.

I guess I've written good ad copy for Fulton, but were I in the market for speakers right now, I'd probably buy the 80's. Anyone considering speakers in the \$600 range should audition the Fulton's (especially if you need monitors).

Finally, a comment on Paoli Hi-Fi Consultants. Gene Coggins is one of the nicest people I've ever met and an excellent dealer. His listening room is the best I've heard. He is associated with Music and Sound Limited, of Willow Grove, Pa. (they refer to him as "our other store") and I believe, like them, prepays shipping. I would recommend his services to anyone (except those with a pathological dislike of Decca cartridges, which Gene distributes.)

— Jim Thoroman (New Hampshire)

## On Record

Members of the BAS may be familiar with Advent Records no. 5009, "Michael Murray Plays the Organ of Grace Cathedral," which contains some genuine low-frequency information. Some of Advent's new releases which should prove interesting:

January — no. 5018, Metropolitan Opera Madrigal Singers

February — no. 5017, John Mack, Oboe

no. 5019, Daniel Majeske,\* Violin

April — no. 5020, Test/Demonstration Recording

A new catalog was released in January and is available from: Advent Records, 4150 Mayfield Rd., Cleveland, Ohio 44121.

Happy Cat Records' Volume Two, "I Hear Tigers" features the Tiger Rag Forever Jazz Band and sells for \$6.50. This album is recorded without processing, filtering, limiting, etc. It is very musical and natural sounding—a joy for the jazz buff (Dixieland jazz) or anyone who likes good sound. I have not heard Volume One and I understand that Volume Three will be available in February. Recordings are made in St. Louis by Robert Shaw (Happy Cat Records, 9528 Old Bonhomme Rd., St. Louis, Mo. 63132 — Gerald Johnson (Oklahoma)

I would like to point out a recording that I have not seen referred to before, "The Medieval Sound" with David Munrow on the Oryx label (EXP46). It is as quiet and clean a recording as AR's "The Sound of Musical Instruments," but the Oryx disc has more of an "alive" quality, where the instruments (especially the percussion) sound like they are physical entities in the room (surpassing the best Fulton discs in this respect). It is as close to a master tape sound as I have heard on a disc. I am not that familiar with Medieval music so I am hesitant to comment on the musical merits of this recording. I must say that I did not fully appreciate how lively and energetic Medieval music could be until I heard this disc. I just hope that other recordings on this English label are as good. — Collins Beagle (Virginia)

Insight Records (see Dec. 1975 BAS Speaker) has released its second volume. Called "Pigs Eye Jass", it consists of traditional Dixieland music played by about six musicians. There are no vocals; as with Insight's first release, the sound is smooth and lifelike (very listenable) and has natural impact and dynamic range.

Unlike Volume One, however, technical details are well worked out, which leads to a much better produced album. Miking and balance are very good, and are consistent from cut to cut. Also, the noises from lacquer master defects evident on one side of Insight's first release are absent on this issue. There's also far less lathe rumble, and overall, the record's background is very quiet.

My sonic favorites on this album are the cymbals, which seem to float out in space, and, as before, the brass and reeds, especially tuba and bass clarinet. I enjoy listening to this record on headphones more than I do most other albums.

The perfection of technical details carried over to the musicians, who although very good, seem a little stiff and disciplined — missing some of the spirit (spirits?) evident in the "jamming" of Volume One.

Volume Two and an improved, recut version of Volume One are available from Insight Records, 7726 Morgan Avenue ' South, Minneapolis, Minn. 55423 for \$11.50 each plus \$1.00 for handling per order. [Mention the BAS if you order.—Ed.] — Ira Leonard (Massachusetts)

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\*Majeske is concertmaster of the Cleveland Orchestra.—Ed.

Insight Records' Volume One "An Unrehearsed Experiment" is excellent. Volume Two "Pigs Eye Jass" is in my view even better. Even though the retail price will be \$11.50 as opposed to the original price of \$6.50 for Volume One, I believe it is worth it because, in comparisons on my system, it is much more natural sounding than the Sheffield discs and is very enjoyable listening.

— Gerald Johnson (Oklahoma)

## Letters

D-Stat by Discwasher. A few days ago I purchased a "D-Stat," the anti-static carbon mat imported and marketed by Discwasher. The D-Stat does indeed seem to help eliminate static noises when playing discs. Before I bought the mat, touching my tonearm usually produced a slight static "pop" in the speakers. Installation of the D-Stat has eliminated this quirk. I wonder, however, if the D-Stat has any negative side effects?

Problem With the Stanton 681EEE. Earlier this summer I purchased a Stanton 681EEE. Its serial number revealed that it was an early production sample. I felt that this cartridge was the most neutral and delicate cartridge I had ever heard. However, true to the Absolute Sound's comments in Issue 6, one channel suddenly went dead after less than two months. I returned the defective cartridge to Stanton for a replacement. The later production replacement I received, in comparison to my first sample, has a much harder, brittle sound, particularly in the high end. To say the least, I am very disappointed. Am I to conclude that the method Stanton employed to eliminate the mechanical defect in the earlier production 681EEE's has produced a new, less accurate 681EEE?

Capitol Music Tape—Cautions. I recently tried a few Capitol Music Tape C-90 cassettes. (See Dec. Speaker comments on article in Dec. PE issue.) Using a Wollensak 4760, I have found the sound of Music Tape to be bright and open but plagued by excessive oxide shed. The hiss level also is higher than that produced when using Maxell UD tape (contrary to PE's results). The oxide shed was very severe and I warn other readers to stay clear of Capitol Music Tape until this problem is solved.

Advent/Wollensak. Advent confirms that they produced the electronics for the 4760 and that the only major difference between it and Advent's 201 is Wollensak's inclusion of two smaller and less expensive meters. When using CrO<sub>2</sub> tape with my unit, the noise level is very, very low but the high frequencies have a slightly veiled quality. Boosting the treble control on my preamp about 5 dB seems to restore the highs. Have others experienced this with their 4760's or 201's? (This occurs with the Dolby switched in or out, so I assume the playback equalization for CrO<sub>2</sub> is slightly off.)

Help Needed on Tonearm Damping. I own a Pioneer PL-61 turntable/arm combination. I would like to add damping to the tonearm. (Paddle damping as recently described in the Speaker and High Fidelity.) However, there doesn't seem to be enough room for the trough to be put in the optimum place. That is, the tonearm is mounted by Pioneer very close to the platter with very little room for such a modification. I wonder if any members might have had experience with this turntable and could offer me some suggestions. (The PL-71 is similar; maybe someone has successfully installed paddle-damping on one.)

An Antenna for AM Listening. I'm a fanatic Red Sox fan and try to listen to as many games as possible on the radio. I use a McKay-Dymek DA-3 AM antenna unit to improve the reception of these broadcasts. The unit is highly recommended for anyone who uses the AM band for serious listening. It does everything the manufacturer claims. It's not inexpensive, but the enjoyment it provides makes it more than worthwhile.

— Stephen Green (Maryland)

### A Plug for Maintenance

An audio tip that surely must be known to many and, yet, is still worthwhile to repeat: the components of most systems are connected together by phono plugs which must be disconnected, sprayed with No Residue contact cleaner, and twisted back and forth in their sockets to ensure clean metal-to-metal contact. Corrosion can build up a film that markedly reduces low-frequency response and which can eventually cause complete channel cutout. I have to do this little operation several times a year. The onset of the frequency response degradation is gradual and one does not realize it until some degree has been reached; hence, it is a good idea to make contact cleaning a part of frequent routine maintenance.

— G. B. Atwater (California)

### Hearing the Difference

Many people have reconsidered their thoughts about audio equipment when they found out that they could detect no audible improvement after buying a "better" component. In fairness to high-quality audio, I would like to share my experiences.

It is my belief that in order to realize the full advantage of a new and "better" component, you must listen to the new component and then go back and listen to the old component. Then, and only then, will you be able to realize the actual improvement.

I first noticed this in my earlier days of audiophilia. For several months I had been using a pair of Telex headphones, retail price about \$10. After I bought my Koss PRO-4AA headphones, all I could tell was that the Kosses sounded a little bit smoother. Then I thought: How could a pair of \$10 Telex headphones sound only a tiny bit worse than the highly acclaimed \$65 Koss PRO-4AA's? Well, I listened to the PRO-4AA's for several hours and then, just for curiosity's sake, I listened to the Telex headphones again. Compared to my recent memory of the PRO-4AA's, their sound was totally distorted and non-linear, as would be expected.

My next encounter with this phenomenon came after I had replaced my elderly Bogen amp with a brand new Sansui AU-7500. I can't say that I wasn't happy with my new amp, but I could detect no audible improvement compared to my memory of the Bogen. Then, when my Sansui was in the "shop" for a couple of days, I listened to the Bogen. Grainy as 30-grade sandpaper; the distortion was awful!

Now, remember, this will not always occur, but on the other hand, it is by no means uncommon. I would recommend this method of testing to those who lack elaborate double blind A-B testing equipment, as I do, and to the skeptics.

— David Sherwood (New Jersey)

### Teac and dbx

In the November 1975 Speaker you state that Teac has been licensed by dbx and that we may expect dbx noise-reduction systems in future Teac decks, but you do not state which dbx series, the 150 or 120, will be used. The reference to dbx discs suggests the 120 series (and this would make sense in terms of cost), yet I would think that in terms of sound quality the 150 series would be more appropriate for the Tascam series, which I understand has professional pretensions. Do you have any information on this subject?

— Collins Beagle (Virginia)

[Editor's Note: So far as dbx itself knows, 150-like equipment will be used on Teac's Tascam line, with commercial grade Teac products—down through cassette decks—using 120-series processor circuitry. But don't place too much emphasis on these designations as Teac engineers are going to be building equipment subtly different from dbx's. There will be minor changes in pre-emphasis and de-emphasis curves and a switch to greater use of integrated circuitry. This will be reflected more in relative price reductions than in performance changes—some dbx circuit functions just weren't available in IC form and the company didn't care to underwrite the cost of development. J.B.]

## Old or New Advent 201?

In March of 1975, I went to Bill Bell's Music Box in Wellesley to purchase an Advent 201. Bell informed me that the only one he had left was the display model in the window. After questioning him, he assured me that it was in top condition and had not been in the window more than two months.

After living with my 201 for eight months, the left channel started humming. Upon bringing it back to Advent, I was told that the unit was over three years old according to the serial number, and not covered by the warranty. I showed them my sales slip from the Music Box proving I had purchased it only eight months previous. Advent said they would repair the unit under the warranty, and suggested I have a talk with Bell at the Music Box.

Two days later, after picking up my unit at Advent, I went right to the Music Box with it. I talked to Bell, and I was told that they were sure the unit was received by them no more than a year ago, and the "fault" had to be with Advent, but that he would check into it.

A week later I received a letter from the Music Box stating that indeed the unit was made by Advent in 1972 and that they would be glad to exchange the unit for a new one. (A copy of this letter was sent to Advent.) To date I have no idea how this could have happened. I do know my new 201 outperforms my old 201 by a mile. — Ken Vicari (Massachusetts)

[Editor's Note: What's needed, obviously, is a way of keeping abreast of current serial numbers. Anyone who develops a manageable method of doing this should contact the BAS. But consider all the variety of components available first ...— J.B.]

## BAS Membership Preference Questionnaire

Approximately 50 members completed the questionnaire that was distributed last September. Generally members seem to be pleased with the newsletter and the meetings, with rankings tending to be mostly "good" or "excellent"—in fact, there were very few "poor" votes cast.

Assigning four points to "excellent" and one to "poor," meeting programs received an averaged score of between 2.69 (fair-to-good) and 3.48 (good-to-excellent). The ten most popular programs were:

1. Panel discussion on dealer/customer interface
2. A-B equipment comparisons: Damped vs. undamped arms, QDC-1 vs. XLM, Marantz 7C vs. SAE, tape vs. disc
3. Ron Dunlap, Dunlap-Clarke Electronics: Discussion and demonstration of the relationship between loudspeaker impedance characteristics and power-amp design requirements
4. Tom Horrall, BB&N: Description and demonstration of BB&N concert hall acoustics simulator
5. Rene Jaeger, dbx: Why the audiophile cannot get through the maze
6. Denis Colin, Rene Jaeger, and Mark Davis: Demonstration and discussion of audibility of phase shift through various hi-fi components
7. Sam Walinsky, Hybrid Systems: Demonstration of delay line
8. Roy Allison and Dick Burwen: Demonstration of Allison:One speaker and demonstration of Burwen dynamic noise filter
9. Howard Souther, Koss Corporation: Discussion of headphone design
10. Fred Barrett, Sequerra Company: Discussion and demonstration of the Sequerra broadcast monitor.

Interestingly the two musical programs were not among the top ten—and this despite members' stated desires for more musical input.

As for newsletter articles, the averaged rankings varied between 2.72 and 3.69 (between fair-to-good and good-to-excellent). The ten most popular articles were:

1. The Role of Damping in Tonearm/Cartridge Performance—Phoenix
2. Test Report: The Allison:One Speaker—Brinton, et al.
3. Comments on Records, Cleaning, and the Discwasher—Zwicker, et al.
4. Audio Myths—Shanefield
5. Improving the Performance of the AR Tonearm—Phoenix
6. Test Report: Scotch Classic and TDK Audua—How the New Open Reel Tapes Compare—Foster
7. Test Report: Cassette vs. Cassette vs. Open Reel: Advent 201, Lafayette RKD-50, Sony 152-SD, and Revox A-77—Davis
8. User's Report: The dbx 122—Brinton
9. Test Report: Tuners: Pioneer TX-9100 Versus McIntosh MR-78—Foster
10. IC Op Amps—The Audiophile's Friend—Mitchell  
Using the BAS Oscillator—Mitchell

The various newsletter features ranked as follows:

1. Table of contents (annual listing)
2. Criticisms of industry practice
3. Equipment survey
4. Notices of discounts or bargains
5. Technical notes
6. BAS meeting summaries
7. Letters from members
8. Membership directory
9. In the Literature
10. Industry news
11. Used equipment for sale or wanted
12. AES meeting summaries.

The members generally wished to see more of all the items listed, but there was a difference in the ratio of those who wanted more, to those who wanted less, to those who wanted the same amount on the various topics. Listed below are those ratios (more: less: same):

Use reports	18 : 0 : 1
Test reports	5 : 1 : 1
Do-it-yourself projects	3 : 1 : 2
Audio electronics education	5 : 1 : 1
Musical education	4 : 2 : 1
Letters	2 : 0 : 1
Industry news	4 : 1 : 2

It is interesting, however, to compare these desires with the rankings given to the various publications and meeting programs. For example, musical programs and publications generally ranked low but a majority of the membership wishes to see more of this material presented. However, use reports and test reports not only ranked well, but the membership obviously wants more of them. There seems to be an even split on do-it-yourself projects—those who are into construction want more; the rest of the membership does not care.

The things mentioned most often as best-liked were The BAS Speaker as a whole and, in particular, equipment reviews. Construction projects, discussions of new techniques to improve one's system (e.g., tonearm damping), and meetings also were listed frequently.

A few individuals liked the fact that the newsletter arrives on schedule and in good condition (in envelopes). Test clinics, group purchases, industry news, and an opportunity for information exchange also were mentioned.

Some of the things that people thought the BAS should do or should do differently are possible (and we'll see if we can get moving on them), others just aren't feasible. Among the latter are printing in two columns, printing on three-hole punched paper, and having a table of contents on the first page of The Speaker. This last suggestion is one we'd like to incorporate but our production schedule is so tight, we are unable to do so.

A number of questionnaires asked that we do more record comparisons—recommending records on the basis of performance and sonic quality. On the subject of records, it was suggested that we decide on several records (of different types of music) to use for tests; in particular, we should include an example of rock music and of jazz, a choral work, an organ work, an orchestral piece, a piano and/or chamber music piece, and a recording with solo voice. Suggestions for these "test" records are requested.

Several members indicated concern about reliability of components. One member suggested that when a piece of equipment failed, the member should notify the BAS, which periodically would publish a list of these failures. Obviously this wouldn't be scientific but it might give some general idea of reliability.

Another interesting suggestion was to report on the warranty service of various manufacturers—which are helpful and which are not. Input from members on this would be appreciated.

One member listed industry individuals whom he had found particularly helpful in the past. We printed this list in the Speaker, but we'd like to add to it—not only to thank these people but to let you know to whom you might turn at various companies for help.

Since members often offer items for sale at meetings, it was suggested that we be clear about what is or is not available for mail purchase. If items are available for mail order, we will give ordering instructions in the future.

One member volunteered to pull together a list of those interested in doing live recording and to distribute the list among performers and performing groups who might be interested in being recorded. If you'd like to be included in such a list, please contact Rick Richardson, (617) 354-2522 or c/o P.O. Box 7.

### Suggestions for Future BAS Speaker Issues

We have in the past passed along to you ideas for possible articles for the BAS Speaker. What we really need, of course, are people who decide a topic interests them enough to follow through and write an article (or at least pull together the information and work with someone on the Speaker staff to write the article). If any of these suggestions strike your fancy, we would be very happy to hear from you.

- An update on the AR tonearm modification (since the arm itself has been modified)
- Review of the Rectilinear 5 and 7 speakers
- Articles on all sorts of musical topics
- Construction project for a 2- to 4-channel mixer
- A comparison of all the RIAA and DIN weighting curves—which manufacturers and testers use which, and conversions from one to another
- Automobile FM (and AM) radio reviews
- Use reports on graphic equalizers
- How to use test equipment and test records to optimize one's system
- Article on psychoacoustic topics

- Articles on speaker modifications
- Record and tape reviews
- Panel reviews of equipment
- Reviews of additional speakers—particularly Magnapan
- A consensus on what might be in the ultimate system
- A listing of where various pieces of equipment are available for audition
- Article on the theory of class-A amplifiers.

### Suggestions for Future Meeting Programs

The following are some of the suggestions we received. If you can help in arranging any of these programs, or if you know someone who could help, please let us know. If any of these ideas seem particularly interesting to you (or if any are particularly uninteresting), tell us. And if any other ideas occur to you, please pass them along as well.

- Live performance with the opportunity for making recordings
- Tour of WGBH or WBUR
- Factory tours
- Representative from MacIntosh to discuss their design philosophy
- Representative from AR's research and development group to discuss products in the design phase, some of the newer AR speaker products and how they differ from the previous models
- Discussions on psychoacoustics
- Question and answer session—open discussion
- Irving Fried of IMF to discuss transmission-line speakers
- Panel discussion on subjective testing (with some of those experienced in this area)
- Test clinics—particularly where equipment would be available to do equipment adjustments

We want to thank those members who did complete their questionnaires. Most who did, did so with care and with quite a bit of thought. We are particularly appreciative that so many members indicated that they would be willing to write material for the BAS Speaker and/or work on various BAS projects. If for some reason we fail to contact you about your offer of help, please get back to us—we haven't excluded you, we've merely forgotten or have lost your questionnaire (sometimes our organization is less than organized).

The questionnaire is useful to us in getting ideas from the membership and in giving feedback on what members like and don't like. Since there is always a split between the technologists and the music-lovers, we can't possibly satisfy either group completely, but we hope to continue to offer a variety of materials and programs that will at least partially satisfy each group and perhaps will educate each group a bit about the other's viewpoint. — Joyce Brinton (Massachusetts)

### In the Literature

[Major contributions this month come from Dan Shanefield and Ira Leonard.]

#### Audio, Feb. 1976

- Harmonic Distortion: Heyser discusses how he measures it in Audio's loudspeaker tests. (p. 16)
- Behind the Scenes: Bert Whyte manages to review the AES Convention in New York without mentioning the Holman paper. (p. 24)
- Build a Low TIM Amplifier: A build-it project for those of you who subscribe to this religion.(p. 30)
- Reviews: The Quintessence \$500 five-channel equalizer receives a review, along with the SAE Mark VIII Tuner, and to accompany the PAT-5 review in this month's Speaker, see the PAT-5 technical review on p. 64.

### FM Guide, Feb. 1976

- Feldman Lab Report: Review of the Design Acoustics D-2 loudspeaker. After presenting a photographically unreadable spectral response curve, Feldman apologizes for inaccurate data below 40 Hz, and similarly for an apparent dip at 1000 Hz and for the data above 10,000 Hz (the mounting of the tweeter caused interference problems). So, ignoring the test data, one might conclude that this three-cubic-foot floor-stander is fairly attractive for high efficiency and low (\$150) price. (p. 36) Also reviewed are the Empire 2000E/III cartridge (are any readers particularly fond of this latest Empire series?) and the Yamaha mini-mixer console.

### High Fidelity, Feb. 1976

- Reviews: Lux C-1000 preamplifier: B&O "phase-aberration-free" M-70 loudspeakers (which, at \$ 700, are notable for little else); and a (hopefully) poorly aligned Pioneer TX-9500 tuner.
- A very fine article on tape recording by Bob Long is this month's standout. Nicely done and well worth some study, both for its application to recording without tape saturation and for a comparison of the capabilities of open-reel versus cassette recorders. (p. 52)
- Musical America: Reviews the Bergman Flute. (p. MA-16)

### Popular Electronics, Feb. 1976

- Stereo Scene: Ralph Hodges didn't miss the importance of the still somewhat mystical Holman test for phono preamplifier quality, and he offers a nice review of the AES paper.
- A High Power Mobile Stereo Amplifier: This build-it project will provide 15 watts/channel at a cost of "about \$25." The heart of this (or any) mobile (12 Vdc) amplifier is the power supply, which uses a solid-state "vibrator" with a toroidal transformer to provide +/- 20 Vdc. Combine this with a compressor such as the SWTPCO \$30 unit and you will have extremely acceptable sound from, for example, A-10's or AR-7's in your car.

### Radio-Electronics, Feb. 1976

- FM tuner standards are discussed (p. 43) and the Yamaha TC-800GL ("flat-pack") cassette is reviewed (p. 55).

### Recording Engineer/Producer, Dec. 1975

- Hewlett-Packard has an Application Note (no. 192) on "Using a Narrow Band Analyzer for Characterizing Audio Products," available from HP at 1501 Page Mill Rd., Palo Alto, CA 94304.
- The Lacquer (Disc Master): A nice review, with photographs, of the heart of (almost) all phonograph discs.
- Magnetic Tape: Understanding the Print Through Phenomenon: By a 3M engineer.
- Multi-Track Tape Machine Alignment: Tabulations of the errors possible if alignment is not perfect.

### Stereo Review, Feb. 1976

- Hard Rock/Soft Ears: Report of the dangers in listening to too-loud music. (p. 52)

### Wireless World, Dec. 1975

- Current Dumping Audio Amplifiers: Quad describes their new design.
- High Quality Compressor-Limiter: FET control elements and 741 op-amps.

### Wireless World, Jan. 1976

- Audibility of Phase Effects in Loudspeakers: A rebuttal to the B&O-type theory. The final sentence reads as follows: ". . . but until some audible effect [due to phase effects] can be demonstrated I will remain absolutely agog—with indifference !"

## January BAS Meeting

### Business Meeting

The January meeting at GTE Labs drew almost 300 members and guests through near-zero weather to hear the latest in time-delay rear-channel synthesis technology and a rundown of new product development projects underway at ESS.

Abbott Lahti opened the meeting with a description of phase-locked-loop (PLL) multiplex demodulator for retrofit to existing FM stereo receivers. Jim Brinton then described the Mark Davis phono preamp, which was used during the ESS stereophone demonstration.

The imported-record buying service swung into action this month with the distribution of a list of recommended records culled from the December and January issues of Gramophone by Dr. Brian Leeming.

For more information on the PLL demodulator, the phono preamp, and the record buying service, see "What's Selling In and About the BAS" at the beginning of the newsletter.

Anyone seriously interested in doing live tape recording of recitals, concerts, etc., should contact Rick Richardson. He is often asked to make recordings of groups and many times has more requests than he can handle. He will be glad to make arrangements for those interested in assisting with this overflow.

Before the meeting began, and during the break, members were invited to listen to a demonstration of the Sound Concepts SD-50 charge-coupled device (also called "bucket-brigade" or CCD device) audio delay system for synthesis of concert hall ambience. After working for more than 6 months, BAS member Joel Cohen has perfected this technology to the point where it now is feasible to offer a consumer device for time-delay synthesis of rear-channel signals from stereo or mono sources which yields a sound field equal or superior to most quadraphonic recordings.

The SD-50 is a completely analog electronic system built around CCD integrated circuits. Incoming signals are pre-emphasized and compressed for noise reduction, then enter the CCD circuits. A front panel control provides continuously variable delay times from 5 to 50 milliseconds by adjusting the duration of storage time in each CCD or "bucket." After re-expansion and de-emphasis, the signals are available to feed any existing rear-channel amplifier/speaker system. The SD-50 also provides a continuously variable reverberation level and cross-channel mix control to simulate the multiple reflections from walls and ceilings that characterize real concert halls. Both fixed and variable high-frequency contouring are also provided to simulate the absorption of high frequencies that occurs with repeated reflections of sound waves and in propagation through air.

The demonstration was most impressive and could be favorably compared in all characteristics with the best discrete four-channel tapes. The SD-50 is available now from Tweeter, Etc., Harvard Square, Cambridge, for \$600. More information can be obtained by writing: Sound Concepts, P.O. Box 135, Brookline, Mass. 02146.

At a future meeting, the BAS hopes to sponsor a demonstration of the only other consumer audio delay line near production (another local product we are proud to say), that from Hybrid Systems' Audio Pulse Division. Price of the Audio Pulse unit is expected to be about \$ 585.

## Meeting Feature

Phillip Collella, Vice President, ESS, Inc., reported on various projects now underway at ESS, including progress on the development of a full-range Heil air-motion-transformer speaker, research on a straight-line-tracking tonearm, and development of a real-time tonearm-damping system. BAS members and guests were also treated to a demonstration of the soon-to-be-introduced ESS Mark I full-range Heil air-motion-transformer stereophones.

After taking a census of the audience's familiarity with the principle of the Heil air-motion-transformer, Collella opened with a brief review of the construction and operation of this transducer. The basic design consists of a diaphragm that is folded or pleated and immersed in a magnetic field, as in Fig. 1. Current running in thin metal-foil conductors on the surface of the plates reacts with the magnetic field to generate forces on the folds, inducing adjacent folds to move together or apart. This causes the air trapped between to be pushed out one side as it is drawn in the other at a velocity about five times the diaphragm velocity, thus the term "air-motion transformers." The diaphragm is very light (equivalent in mass to about 10.75 inch of air compressed to the same thickness) and therefore capable of the fast reaction times required to reproduce transients faithfully. This transducer design gains efficiency because of its low diaphragm mass and efficient coupling to the air, but loses efficiency due to the difficulty of producing a strong uniform magnetic field over the diaphragm. Overall efficiency ends up at about 1%.

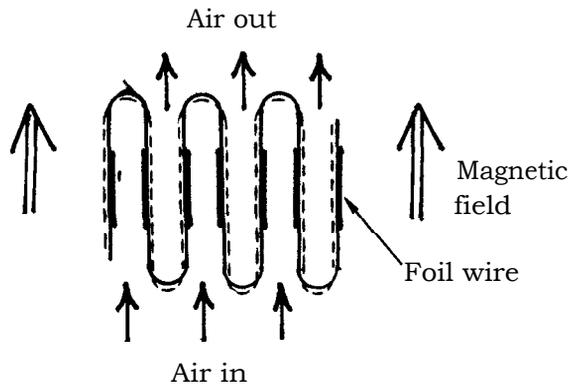


Fig. 1. Dotted line shows diaphragm in deflected position. Polarity marks on conductors indicate current direction.



Fig. 2. Detail of fold in diaphragm showing resonant mode

Since this transducer was introduced in mid-1973, work has continued on reducing the effects of a structural resonance and improving its power handling capability. The flat sides of the folded diaphragm, stiffened and driven by a uniform force from the foil, respond evenly with frequency. The curved folds, however, respond freely to the driving forces and exhibit a natural resonant mode (see Fig. 2) at 5.5 kHz. An approach which ESS has been pursuing to reduce this problem is to find a diaphragm material with a high internal mechanical loss that will tend to damp the resonance. In this respect, polyethylene has been one of the better materials used in diaphragm fabrication. Special coatings have also been employed to enhance damping. In applications where high acoustic powers must be generated, however, polyethylene cannot take the heat, literally.

An improvement in power-handling capacity has been obtained, while maintaining good damping properties, by switching to a diaphragm of specially prepared FEP film, a teflon-like material, formed in such a way as to maximize its internal loss mechanisms without compromising mechanical strength. The highest harmonic distortion of the FEP diaphragm is 0.5% at 5 kHz, while that of the older material was 1 to 2%. This new material will be used in a new line of speakers from ESS and will also be supplied as replacement diaphragms for repair of older

models in the field. This diaphragm has also been mated to a new high-flux magnet structure to produce a driver that will generate a 104 dB SPL at 1 meter with 1 watt input over a 1.5- to 24-kHz frequency range. Capable of taking a continuous 35-watt sine-wave input from 1 kHz up, this unit is initially destined for a new line of ESS sound reinforcement speakers.

Heil Full-Range Stereophones. Although stereophonic headphones would seem to be a natural and straightforward application of the Heil air-motion-transformer principle, these phones are only now appearing on the market. Besides designing a lightweight, efficient, magnet structure to improve wearer comfort, the major (and ubiquitous) problem that had to be solved was developing a full-range transducer with minimal structural resonance. The approach used here was to form the diaphragm into a series of pleats having a stepped variation in fold depth, as in Fig. 3, each section having its own characteristic resonant frequency. But these resonances tend to have broad, low-Q peaks due to the large air damping load on the low-mass diaphragm. Because the resonances are broad and are distributed over the frequency band, they overlap to give a smoother overall frequency response than if the diaphragm had been designed with only one resonant point.

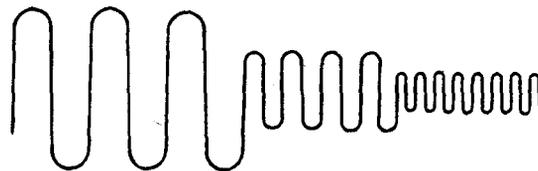


Fig. 3. Stepped transducer for ESS stereophones

The success of these efforts was established during listening sessions at intermission when members were invited to listen to their own records through these phones. To this auditioner the sound was crisp and clear with no hint of resonant peaks, inviting comparison with electrostatics. On the head the phones are comfortable although a bit on the heavy side and seemed to lack isolation when the cushion is not well sealed to the head. Connection to the preamp phone driver or amplifier is made through a 30-ohm resistor in the cable jack to raise the 0.5-ohm impedance of the phone transducer to a reasonable level at the amplifier. In the rear of the earpiece are 0.5-amp fast-blow fuses. Access to these has been made purposely difficult as they are intended to protect the ears, not the transducers, in case of amplifier failure, and are not likely to require frequent replacement. A BAS test report on these phones will be forthcoming.

Heil Woofer. The woofer that Oscar Heil described to the BAS in 1973 as his conception of the low-frequency companion to the then successful Heil tweeter has since undergone two years of refinement. Its present form maintains the essence of the original geometry while incorporating newly developed materials and manufacturing technology to improve stiffness and reduce mass in the dynamic elements.

Shown reduced to its basic elements in Fig. 4, the low-frequency embodiment of the air-motion-transformer principle is radically different from the tweeter design. The requirement for moving large amounts of air at low frequencies necessitated large diaphragm elements, which would have called for an unwieldy magnet structure had the tweeter design been simply scaled up. Instead, the woofer is made up of a series of disk-shaped diaphragms stacked in a column. Every other disk is attached to rods that travel through the stack and move axially as the rods move, driven by speaker coils at either end. The alternate disks are static, fixed to the frame of the speaker, and have clearance holes for the rods. Each disk is attached to the next around half of its periphery by a flexible membrane. Looking at the disks on edge, these

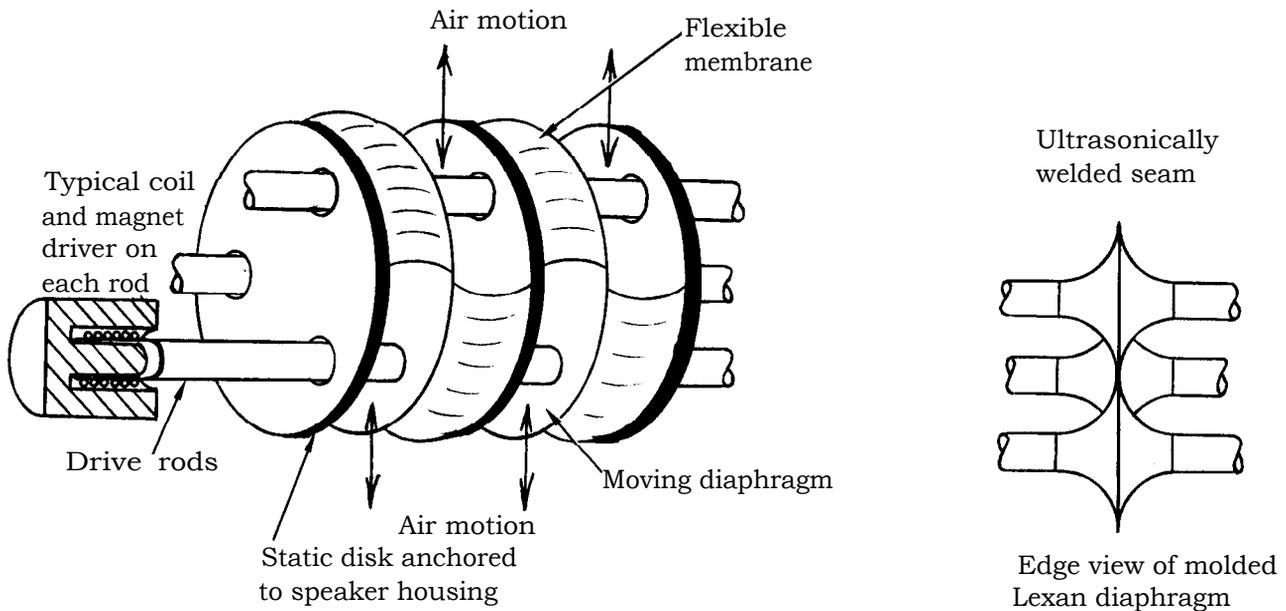


Fig. 4. Heil woofer

membranes alternate front and back sides so that an ant traveling from disk to disk would have to follow a weaving path similar to the folded geometry of the Heil tweeter. As the rods are moved axially in unison by an audio signal applied to the coils, they push the free disks or diaphragms toward and away from the static disks, squeezing air out one side and pulling it in the other.

To make all of this work properly, the motion must be transmitted from the ends of the rods to the edges of the diaphragms in much less than one cycle of the driving frequency, or phase shift effects will begin to reduce acoustic output. This calls for moving parts to be of low weight but stiff construction, having high sound propagation velocity. To this end, in the latest version the rods are made of graphite fiber-epoxy composite which has a propagation velocity five times greater than aluminum. Five rods are used to minimize the coupling distance between a rod and any point on the diaphragm. The diaphragms are vacuum formed of 5-mil Lexan plastic film, having a five-protruding-cusp configuration to stiffen coupling to the rods, and are assembled in pairs ultrasonically welded around the edge. Static plates interleaving the diaphragms have a matching female contour. A woofer with a 12-inch piston equivalent area has a moving element weight of 12 grams, a peak excursion of 1/2 inch, an effective mass equivalent to 4 to 5 inches of air, and an efficiency of about 1.5%. Overall dimensions will run close to 18 inches long and 4 to 5 inches in diameter.

Optimum response is obtained when the woofer is mounted as a dipole radiator in a baffle board open in the rear. But aesthetic considerations will probably dictate that the first full-range Heil speakers will be in an enclosure about the size of the Quad. Efforts are now underway to make the full-range speaker available this year at a price of about \$800 each. Heil woofers may be sold separately later.

Tangential Tracking Tonearm + DC Cartridge = Dynamic Damping. ESS is working on a tonearm that will maintain the cartridge tangent to the record groove as does the Garrard Zero-100, but with an entirely different mechanical configuration. Their design is based on the use of metal bands and cylindrical rolling elements that function both as bearings and as ele-

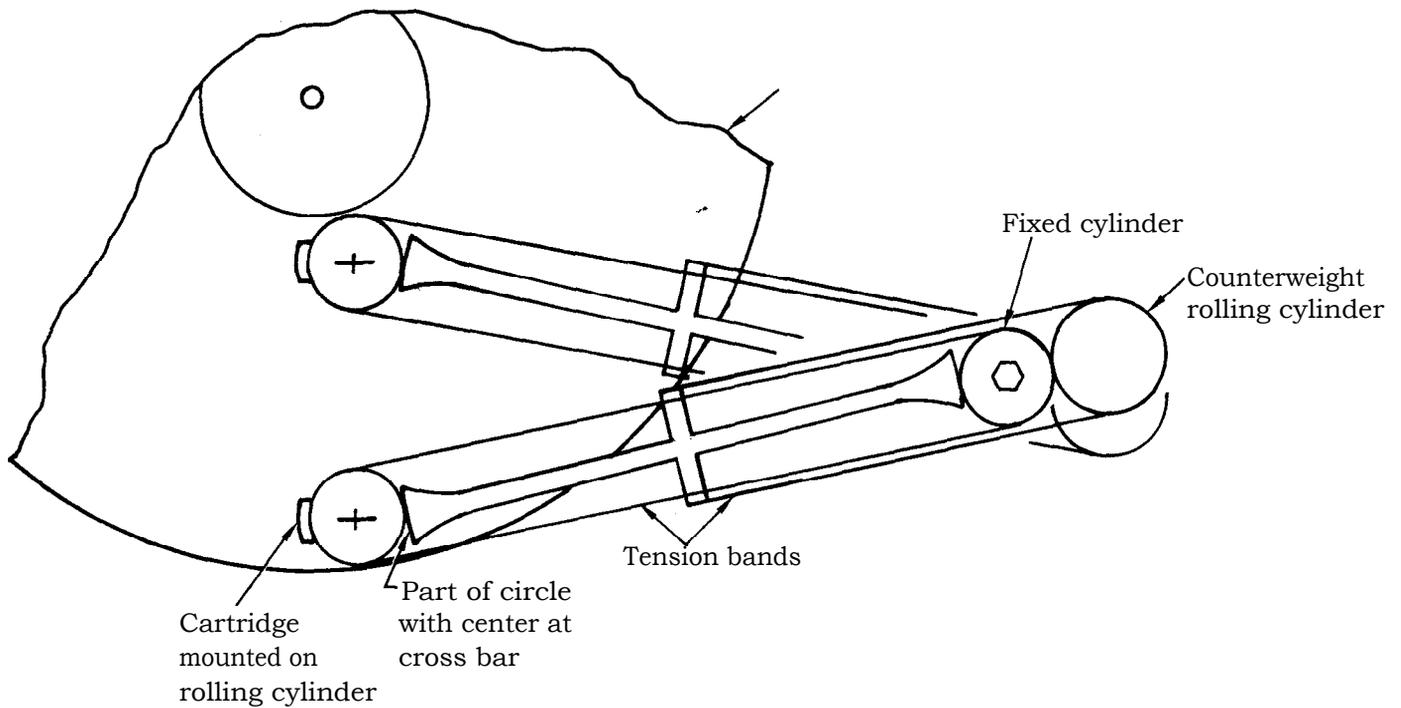


Fig. 5. Tangential tracking arm

ments for maintaining parallel alignment. Fig. 5 shows this arm in two positions. One of the main problems yet to be solved before this arm can become commercially practical is finding a technique for producing the rolling elements that will not require costly precision machining to maintain low rolling friction.

It is planned to combine this arm with a strain-gage cartridge with response to dc, also under development. The cartridge would provide information on low-frequency displacements of its stylus. These subaudible frequency motions would be due to warps, cartridge-arm resonances, tracking force variations, and the forces exerted on the stylus by the groove to move the arm. Signals generated in the cartridge by these effects could be used in a feedback arrangement, driving small torquer motors acting on the arm at its pivots, to dampen or cancel undesired low-frequency stylus displacements and to control arm motion. This system depends upon having a cartridge that responds down to dc, as the strain gage does, and could probably be implemented with other tonearms as well. These items are still undergoing development and no product plans have yet been formulated.

— John Schlafer



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## A B.A.S. Users' Report

### The Dynaco PAT-5 Preamplifier

Michael Riggs

A few months ago, I traded in my Citation 11A for a new Dyna PAT-5. The quality of its construction is traditional Dynaco, which is to say it's adequate but not much more. Fresh out of the box, mine had a loose selector knob (easily tightened with an allen wrench), a right treble control that crackled slightly whenever the knob was turned (this quirk vanished without benefit of human intervention), and a tendency to pop faintly when switched from phono to tuner or when the mode switches were pressed. But those were the only aberrations. Dyna's pots and switches, though lacking the smooth action and secure feel characteristic of the best, seem to work reliably, and the pushbuttons are certainly an improvement over the rockers that grace the PAT-4.

The new unit's front panel is blessedly uncluttered. Dyna has chosen to eschew the usual gaggle of frills, providing instead a few functional, well laid out controls (among them an "external processor loop" that makes it easy for the user to patch in whatever collection of signal benders he likes). The tone controls, especially, are first rate. One can give a little lift to the bottom without thickening the midbass or touch up a hot high end while leaving the overall tonal balance substantially intact. Their effect on voice ranges from nonexistent to insignificant. If they do anything else to the sound, I can't hear it. They are, in fact, the only genuinely useful and unobtrusive tone controls I've ever had in my home. The high filter, though of questionable utility, is also the best in my experience. Its slope is steep enough that the designers could select a relatively high knee frequency, still cut the noise, and hang on to more of the music than is possible with amore conventional filter. Unfortunately, the low filter—a potentially useful device—is not in the same league. It's something none of us will ever use, because it chops off too much bass in the process of attenuating rumble we don't have. Dyna would have done better dropping the high filter altogether in favor of a really good low filter, flat to 20 Hz with a sharp infrasonic cutoff. As for the speaker selector, well, it's a good idea, but I don't know whether mine works. Citation 12's don't like to see common grounds. If you're not sure how your amp feels about it (most don't care), check with the manufacturer.

How does it sound? About as good as the best I've heard (the Marantz 7C), though the two have different strengths and weaknesses, and certainly better than anything else with which I'm familiar. (In ascending order of sonic distinction, those others are the Dyna PAT-4, the Dyna PAS-3, and the Harman/Kardon Citation 11A.) Most solid state preamps I've heard are over-bright and sound as though they're straining to deliver the goods. The PAT-5 has neither of those qualities. It sounds more like a tube device—relaxed—but without the mushiness most tube preamps exhibit at the frequency extremes. Only at the very top, where it's a trifle sharp (especially when driven to high levels), does it show vestiges of "transistor sound." Compared to its lesser brethren, the PAT-5 is cleaner and more transparent, with better definition and superior resolution. No other preamp in my experience individuates and locates instruments and voices

as well as this one. When the recording allows it, one hears, instead of a mass of human voice, voices in chorus. There is a sense of solidity and integrity that others don't quite achieve, and though it's not a pronounced difference, it's nonetheless remarkable. In some ways, the change from my Citation 11 is reminiscent of what I noticed when I switched to a damped tonearm. Not only is the projected image more precise and three-dimensional, but the bass is firmer and more detailed and the treble smoother. Noise is inaudible under normal listening conditions, the noise from the phono section being below the level of the output stage noise until the volume control is advanced to about 11 o'clock.

As mentioned above, the only other preamp I've heard that sounds as good as the PAT-5 is the Marantz 7C, which is slightly less harsh at the top—i.e., it's not harsh at all—and without any tendency to sibilance. But it's not as tight and solid in the bass as the PAT-5 or as sharply focused, and it seems to me just a shade too warm in the lower treble. Which one prefers is likely a matter of taste, or perhaps of associated equipment (all my listening has been through large Advents or AR LST's). Neither, to my mind, is clearly superior to the other, and what differences there are between them are not great. I suspect that the Dyna's ready availability and low price (about \$200 discount, assembled) will be decisive in most cases.

Of course, one can really get in cheap by building the kit. I didn't, so I can't say how difficult a task it is. I have, however, peeked at the creature's innards and studied the manual: it looks to be chore. I don't recommend this one to the beginner. If in doubt, one should send \$1.50 to Dyna for a copy of the very useful and informative assembly and operation manual.

To round things out, I've selected some interesting excerpts from letters from Bob Tucker and William Phillips of Dynaco and run them together. My comments are in brackets:

"As to your comments about the PAT-5, there has been some variability in the absolute noise levels achieved on the phono input, largely due to variations in the individual transistors. It has been a problem of adequate availability which has necessitated our providing a relatively lenient specification which is not nearly as impressive as many of the units measure. We have not had problems meeting the specification. Also, it is normal for the left channel to be slightly noisier on a high level input than the right channel. The specification is written for worst case.

"As to your concern about phono equalization accuracy, there are few specifications of less significance (and a future issue of Stereophile magazine may explain some of the reasons for this). Although you will not have an audible difference by using 1% or 2% components for equalization, you may certainly substitute them on the PC-33 board. All of the components on these boards should be changed to 1% or 2% components if you wish to have very high accuracy. The preamp is designed to prevent cartridge interaction with the RIAA equalization. We experimented with a rolloff below 20 Hz but found that, all else remaining equal, it degraded the sound [the end of David Carlstrom's letter about the PAT-4 equalization in Volume 5, Number 3 of The Audio Amateur, page 20 may bear on this]. We don't know why this should be, but it is. The low frequency filter . . . was decided upon because it seemed to provide the best control of excessive low end rumble in most high fidelity systems involved with the engineering and marketing force here at Dyna. While it might be possible to alter this operating range simply by changing the value of the 0.33-mfd capacitors on LFB, we think you will like the arrangement as it is."

Obviously, this review doesn't cover everything one might want to know about the PAT-5. Other relevant information can be found in the Summer 1975 issue of The Stereophile, in the September 1975 issues of Stereo Review and High Fidelity, and in the November 1975 Speaker's preamp test summary. Those wanting information from the manufacturer should write Dynaco, Inc., P.O. Box 88, Blackwood, New Jersey 08012. Another address that may be of interest is:

Jensens Stereo Shop, 2202 River Hills Drive, Burnsville, Minnesota 55337. For \$100, they say they will modify PAT-5's for better sound, or they'll sell you a modified one for \$300. They also modify Stereo 400's, 410's, and 150's. In their words: "Our modifications to the PAT-5 turn a great preamp into the best preamp. All coupling capacitors are replaced with high quality tantalum types, the power supply to the phono section is improved, the good old LM301 IC's are replaced with incredibly fast and linear FET IC's, phono transistors are replaced if necessary, phono rolloff is removed, and phono 2 is modified for direct acceptance or moving coil cartridges." They say that Dyna knows and approves their work, to the point of maintaining the factory warranty for modified units. Jensens offer their own one-year parts and labor warranty for their own work. I'd ask Dyna first. Brave souls are encouraged to report their findings to the [Speaker](#).

### Afterthoughts

Since I put together the main review, a few things have happened. First, I got a line from Dynaco on Jensens Stereo. They've been a Dyna dealer for several years, and all their modifications have been either suggested or tentatively approved by Dyna's engineers. Dyna says the changes won't materially affect a unit's specs, but that they may make some audible improvements when used with a handful of "state-of-the-art" speaker systems.

My own PAT-5 and my Citation 12 were stolen a while back. I managed to get back into business with a new PAT-5 and a Stereo 150, but local prices seem to have gone up a bit. My new preamp cost \$230 from A. Smith in Cambridge, up \$30 from what I paid a few months ago at the same place. It appears that K&L is now underselling them by about \$5 on the PAT-5 and on the Stereo 150. My current PAT-5 is obviously a later production unit than my first and has none of the original's mechanical or electrical peculiarities. Used with the Stereo 150, the speaker selector works quite well. Unfortunately, the 150's input sensitivity is high enough (1.0 volt for 75 watts, as compared to the Citation's requirement of 1.5 volts for 60 watts) to make audible some hiss from the PAT-5's high level section, though it's still well below the level of disc surface noise. The sound of my system is noticeably more transparent and three-dimensional than it was before but is also somewhat edgier. Deep bass is reproduced with greater impact. I have yet to sort out which component is responsible for what. For those who are interested, a very thorough review of the PAT-5 by Bascom King appears in the February issue of [Audio](#).

Finally, Al Foster, to whose 7C I compared my PAT-5, has read the body of my report and feels that I've overpraised the Dyna. He may be right. The comparison was relatively brief and somewhat limited in scope. And, of course, all my previous listening experience had been with preamps that sound significantly worse than either the PAT-5 or the 7C. Al contends that the differences between the two preamps are greater than I say and that I've missed a few altogether. Specifically, he says that the PAT-5 is overbright, that it is not as three-dimensional as the 7C, and that the 7C puts more "air" around instruments. As Al has had more time to listen than I have (and with his own system), he may well have caught some things I failed to notice. As far as I know, we're in agreement over the merits of the other preamps mentioned in the report. So, until my ears tell me otherwise, my conclusions stand, but perhaps you should take them with a small grain of salt and decide for yourself. Good advice with any reviewer, I should think.

### Comments on PAT-5 Kit Construction

The PAT-4 kit could have been recommended to almost anyone for its ease of construction; not so for the PAT-5.

Like its predecessor, the main electronic PC boards of the PAT-5 come preassembled. These include two phono-preamplifier boards and two high level boards, but do not include the power supply/regulator board. Although the prewired circuits do ease construction and remove

many possible sources of error and component damage, assembly of this kit is anything but a piece of cake.

The major wiring difficulties occur at the front panel controls—the volume, balance, and tone pots, and the switching for the tone circuits, filters, tape monitors, "external processor loop" (EPL), and the speaker selector. These are all point-to-point wired (no PC mother board is used), and the front panel contact density is quite high. Switch lugs are also brittle, and completion of the front panel without breakage is greeted with a sigh of relief.

The selector switch is also no simple matter, again with individual point-to-point wires, many of which must be twisted into pairs or threes; no wiring harness a la Heathkit is provided. (The wiring complexity is, of course, the price paid for control flexibility.)

The back panel isn't too bad, although again the density of phono-jack lugs is high. The stiff ac-power wiring is a bit hard to work with, and the speaker input/output connectors are densely packed and somewhat inaccessible.

This leaves the internal power and signal-distribution wiring, which is straightforward. Wires are simply passed through appropriate eyelets among the various boards, although an error with the dc-power wiring could result in damage to the boards when power is applied.

All in all, that wiring that must be performed plus the large amount of hardware installation make for a rather unenjoyable construction project. Alignment of the tone-control knobs is simple, although a square-wave generator and an oscilloscope were found to be useful. Similarly, alignment of the balance knob isn't critical, although this again was assisted by simple test equipment. With the wired unit selling for about \$190 to \$200 (mail order) and the kit for about \$130 to \$135, I would recommend the kit version only to the experienced builder who also really enjoys this sort of tedious work. Figure more than 12 hours at less than \$5 per hour.

The finished unit did work as claimed as far as it has been tested. The only instant complaint was a hum level higher in the left channel than in the right, but this may be within spec. One incorrectly shipped switch wafer also required a two-month wait for a replacement, but this occurred early in production of this unit. After about one year in service, the volume control is beginning to develop a strange intermittency (as did most of the controls of the PAT-4). The tricky action of the PAT-4 tone controls (they were switched out of the circuit in their center positions by an open or short on the resistive element internal to the custom-made pots) is no longer a problem with the separately defeated PAT-5. The input selector switch is also first class, in contrast with the cheap and unreliable wafers of the PAT-4. I have never experienced any switching "pops" with this control, even when used at high volumes.

Operationally, the "EPL" trick is a super extra, as are the dual tape selectors. Even with this flexibility I could wish for additional input positions, tape circuits, and even a second EPL, but the connector density on the rear panel is already about as high as it could be. (As it is, the adjacent phono plugs interfere with one another unless their barrels are a bit smaller in diameter than is normal. The use of phono-jack assemblies six connectors long also makes for flexing as plugs are inserted, but thus far no breakage has occurred—merely a rather flimsy feel.)

One is not paying "Mark Levinson" prices for this unit, so military-spec components cannot be expected. Nevertheless, the audible and electrical performance place the PAT-5 in company with the best, but at a retail price that should have been standard for (electrically simple) preamps long ago. My satisfaction with the unit is well nigh complete. — Harry Zwicker

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## A B.A.S. User's Report

### Dayton-Wright XG-8 Electrostatics

Collins Beagle

I acquired Dayton-Wright XG-8 Mk. III electrostatic speakers last June, replacing a pair of Crown ES212's (at the same time I replaced a Crown IC-150 preamp with a Dayton-Wright SPL unit). Initially I used a pair of Crown DC300A amplifiers strapped for mono use to drive each speaker. After placing the speakers as recommended by the manufacturer (two to three feet from the rear wall, preferably a foot or two from the side walls, at least four feet from each other, eighteen inches or so off the floor, and angled in slightly), I was impressed with their excellent midrange and upper bass. My own recordings of singer friends of mine (from sopranos to baritones) are reproduced with no apparent colorations. Good recordings of cellos (such as on side two of AR's "The Sound of Musical Instruments" reveal the proper warmth of that instrument without glamorizing or emaciating it. The speaker is smooth and very coherent over the full frequency range. This coherency must be due partly to its crossoverless reproduction from 30 to 16,000 Hz. When listening to voices or instruments, there is no doubt that it is the same voice or instrument throughout its frequency range. This coherency is in contrast to an otherwise excellent speaker such as the Dahlquist DQ-10 whose woofer seems to change the character of the musical source, and there was a similar problem with my earlier Crown ES212's.

This coherency over the frequency range seems also to be responsible for the very stable stereo image which the Dayton-Wrights are very good at producing. When one overcomes the visual cue of two one-meter-square black boxes, the sound source seems to spread out behind the speaker in an even stereo image.

The normal beaminess of electrostatics has been overcome by mounting the electrostatic panels as if on the surface of a sphere, with the outer panels producing greater output. Thus, even far off axis, such as sitting three feet directly in front of one speaker, the stereo field remains, though there is some loss of depth and airiness. As in most electrostatic designs, transient reproduction is superb. This characteristic is specially notable in recordings of percussion instruments such as Nonesuch's "Percussion Music" (H-71291).

The surprising thing for me about these speakers was their extraordinary dynamic range. When playing recordings at my normal volume levels, I was startled by how loud were dynamic peaks. (The change in preamps could have been as much a factor in the improved dynamics as the change in speakers, however.)

The Dayton-Wrights are unusual in that they have a very long charging time (would you believe a supposed six months!) before they reach full efficiency and capability. I am not sure how crucial the above period is, but I have to admit that I became more aware of how good the speakers were after three to four months. I do not know if they actually had improved sonically or if the critical comparisons I was making of various speakers at the time had furthered my

education on how to listen. In any case, I noticed that the character of the sound source seemed better defined with specially noticeable depth and airiness. The sound source seemed more like a solid presence in a three-dimensional field. The Dahlquists have the ability to create a three-dimensional field but the sources seem quite two-dimensional. The Magnapans are better than the DQ-10 in that they can create the sense of a solid musical source present physically (allowing for the Magnapans' restricted high-frequency response, bass response, and dynamic range). But the most comparable speakers to the Dayton-Wrights I am familiar with are Magnaplanar lcs driven by Audio Research electronics, but the lcs are not quite as detailed in the midrange and perhaps high-frequency transients are dulled a bit.

The one area about which I have reservations concerning the Dayton-Wrights is their reproduction of deep bass. It seemed subjectively that I could hear bass to well below 40 Hz (incredibly tight bass at that), but a certain amount of bass "punch" seemed to be missing. I was compelled to reexamine my own concepts about what natural bass sounded like. After attending a few symphony concerts I concluded that the tight bass of the Dayton-Wrights was more natural than the punchy bass of cone drivers to which I was more accustomed. I had to learn to realize that what I had expected in bass response was partially just the coloration and distortion of cone drivers. Friends of mine who are not used to an electrostatic bass have made the same transition and usually come to appreciate the tightness of the Dayton-Wrights.

The only instruments I have heard which the Dayton-Wrights do not seem to be able to handle are loudly played tympani, kettle drums, etc., but I have never heard any speaker that was able to convey the full impact of live tympani; here perhaps one is dealing more not with what one hears but with the pressure waves one feels.

I have heard first a prototype and then a production model of the Koss full-range electrostatic speaker, and found its sound bottom heavy with a slightly boomy bass, and otherwise undistinguished. The Magnaplanar lcs have what is at first an impressive bass response but more critical listening reveals that this quality is partly the result of a slight upper bass boominess. The Magnapans have the closest bass tonal balance to the Dayton-Wrights, though the Magnapans do not go nearly as deep. I have heard the Allison I's on a few occasions, and have found them slightly bottom heavy (but they were being driven at very high levels—seemingly the practice in most audio shops—which seems to shift the subjective tonal balance toward the bass) without the coherency and depth of the DQ-10's (but the Allison did not suffer from the Dahlquists split personality when its woofer is driven).

The Dayton-Wright factory (Michael Wright) suggests that the performance of the speakers is greatly dependent on the amp—Dayton-Wrights are perhaps the most difficult available speakers to drive. Mike Wright recommends the Dunlap-Clarke Dreadnaught amps as the best available to drive his speakers, but due to the dealer situation when I made a change in amps I purchased the best I could find locally, an SAE 2500. With the SAE the sound was more open, less veiled, but perhaps the speakers had lost some fullness in the bass (a friend suggests that this may reflect the power difference between strapped Crown's and the SAE 2500—1000 watts versus 450 watts into 4 ohms, which is the rating of the Dayton-Wright, but I am not convinced). The sound was also a bit brighter, but I cannot decide if this was a positive or negative change. The most prominent trade-off was in how loudly the speakers could be played. The Crown amps could reach around 110 dB (measured with a Radio Shack meter from my seating position, which is about eleven feet from the speakers) when hard clipping was followed by thermal cutoff. With the SAE 2500 one can reach between 94 and 100 dB depending on the recording before clipping or cutoff occurs. Since my loud volume levels rarely exceed 75 to 85 dB, I have no problems, but some friends of mine listen at much higher levels and they would find this combination unacceptable. If Mike Wright gets his own promised amp into production, perhaps then we can see more clearly of what the speakers are capable.

In summary the Dayton-Wrights are the most "transparent" speakers I have heard. The speakers do not seem to exist as objects in the sound field. They are the finest speakers I have heard in terms of "aliveness," of that ability to create an illusion of the music source (whether full orchestra, chorus, or solo folk singer) as a physical entity in three-dimensional space. Their phase coherency, which results from the same surface operating over such a broad frequency range, combined with the superb transient response and low distortion of an electrostatic design result in excellent detailing, sense of depth, stereo imaging, etc., those factors which lead to the solidity of the sound source. (One must realize that the above description is based on good sound sources such as the AR record, Fulton, Levinson, and Sheffield discs, the better European and Nonesuch pressings, Ambiphon and master tapes. These speakers are terribly analytical and reveal just how poor average record pressings are.) The only reservation I might have about the speakers is in their deep bass response, but this does seem to be more a function of the related electronics than of the speakers themselves. In fact, overall, I would guess that the full potential of the speakers has not been realized and that this will not occur until compatible equipment of similar capabilities is mated with them. I would be interested in hearing about any other person's experience with these speakers with different electronics (especially tubes).

[Editor's Note: Local experience with the Dayton-Wrights agrees with Beagle's, but we have had the use of Dunlap-Clarke amplifiers and can well understand why Mike Wright recommends them. The Dreadnaught appears to be the only amplifier capable of driving the XG-8's obscene load without damage to itself or the sound. We understand that more DCE amps are going to Canada—where Dayton-Wright speakers are more widely available—than are being sold stateside.]