THE B.A.S. SPEAKER

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In This Issue

This could be called our Quagmire Issue. A good place to start is with Mark Davis as he dons hip boots to evaluate Peter Mitchell's August talk on phase corrected loudspeakers. In the process he provides some insights and guidelines for evaluating audio research and equipment evaluations. With his commentary fresh in your mind, you should be prepared to dig into a rather large parcel of our members' equipment evaluations. You'll find further thoughts on the Denon 103S and write-ups on the Grado XL-Super, the Linn-Sondek LP12, the McIntosh C-28 in comparison with DB Systems and Levinson preamps, and the Rogers and Fried mini-speakers.

Next our readership slips into the bog and takes on DiscTraker, attempting to correct errors in their published "paper" on the product. (Some of our members take us to task for distributing it as well.)

We also unearth some legal quagmires, whose meanings you will have to unravel without the help of audio engineers. But then on solid ground, under sunny skies we bring you testimonials from happy owners of tuners and records and the usual assortment of quickie reports, literature surveys, etc. So wherever you start, we can promise you a worthwhile experience.

-- Henry G. Belot

Membership Renewal

All BAS memberships run out with this month's copy of The Speaker. Inside the back page of this issue is a new membership form; to renew, please use this month's form rather than one from any earlier issue, and thanks. (Those who are recent members may not have expected this end of the membership year, however all BAS memberships run from October to September with back issues of The Speaker being mailed to those who apply later than October.) -- Jim Brinton

Membership dues are $14 per year (October 1 to September 30) or portion thereof. Dues include a one-year subscription to the BAS Speaker. (Note that almost the full amount of dues is allocated to production of the Speaker. The local activities of the BAS are strictly self-supporting.) For further information and application form, write to: The Boston Audio Society, P.O. Box 7, Kenmore Square Station, Boston, Mass. 02215.

For Sale

*Quad 405 amp, hardly used, plus Quad 33 preamp. Both for $350. (401) 783-3255, evenings (Rhode Island).

*Dynaco tube equipment: Mk. III's, $150/pair; Stereo 70, $65; FM-3, $50. All in excellent condition with new tubes. Recently checked out in BGW clinic. Performance guaranteed. (617) 527-3008.

*Audio General 511 preamplifier, $225; one pair AR MST-1 loudspeakers, $140; Sony SQD-2010 four-channel full-logic decoder, $140; AR XA turntable, $50. Call 687-6016.

*Beveridge electrostatic loudspeaker and amplifier, $2, 800; Dayton Wright XG-8 Mk. 3 electrostatic speaker, $1,700; KEF Corelli, $300/pair; Ampzilla, $450; ERA turntable with dust cover, $150; Supex SD-900/E and Levinson JC-1, $150. Contact Larry Better, 4612 Henry, Pittsburgh, PA 15213, (412) 683-9550 evenings and Saturdays.

*Luxman PD-121 turntable with Denon DA-307 arm and DL-103S cartridge. System used eight months. Mint. $650. (617) 661-3331.

*Luxman 550 AM-FM stereo tuner, $225; dbx 119, $100. Both units are in excellent condition. (215) 233-2036.

*Crown IC-150 preamp; Rabco SL-8E tonearm. Both in excellent condition. Call Ron, (617) 453-1410.

*Crown IC150 preamp, mint with original packing, manual, and papers, $225 plus shipping; SME with nondetachable head, like new, with original packing, $115 plus shipping; Shure V15E Ill with extra elliptical stylus, $50 plus shipping. A pair of original Rectilinear III lowboys, not a scratch, in original packing, $350 plus shipping. Want to trade for PAS3x and Stereo 70 or pair of Mk. III's. Also want one original Advent speaker or AR-1W (will settle for AR3, condition of all but woofer unimportant). Must trade. Spouse won't let me buy until I sell some of the above! Dave, (215) 667-4190.

*Two Atlas mike stands, with adapters and 3' extension tubes, total height up to 8'. $20 for both. Call Ken at (617) 272-7070 x161 days or (617) 646-3427 evenings and weekends.

*Thorens TD-125 turntable with Rabco SL8E arm. Both in excellent condition with very little use; arm has always been reliable. $300. Call evenings (617) 631-8971.

*Mint condition, guaranteed moving-coil transformers: Mark Levinson JC-1AC, Mark Levinson JC-1DC, Ortofon MCA76, Nakamichi MCB-100. Also mint condition barely used pickups: Ortofon MC-20, ADC Mark II, AKG PE8S, Grado 1 Plus, Fidelity Research II, factory checked Win with Power Supply, Audio Technica 20. Will mail at my cost. Write with best offer to: Mr. Daniel Karsch, 220 Madison Avenue, New York, NY 10016.

*Lux C-1000 preamp, mint condition, $600. Stan Cohen, Hartford, (203) 674-2150 (weekdays).

*Levinson JC-2 preamp with magnetic and moving-coil cards and case; Audio General preamp; AR-11 speakers; Pioneer TX-9100 tuner. All to be sold to best offers. (617) 492-1043 or (617) 868-4191.

*Otari MX-5050 QXH 4-channel professional tape deck. 7 1/2-15 ips. Includes XLR-to-phono adaptor cables, NAB hub adaptors, instruction manual. Excellent condition. Steve Sarper, 64 W. Broad St., Stamford, CT 06902.

Wanted

Equipment Comparisons

*I would be eager to hear from any members on their experiences in any of the following areas: (1) preamp comparisons involving the McIntosh C-28; (2) cartridge comparisons involving the Stanton 681EEE; (3) loudspeaker comparisons involving the ADS/Braun LV-1020's; (4) tape recorder comparisons involving the Revox A77 and/or the Tandberg 10XD. Ronald B. Freeman, (201) 949-4579, weekdays, 9-5.

BSO Tapes

*As a member living in Philadelphia, I very much miss hearing the concert radio broadcasts of the Boston Symphony Orchestra. I would like to arrange an exchange of concert tapes with a Boston-area BAS member. I can provide concert tapes of the Philadelphia Orchestra recorded from the

radio. I know these concerts are heard on radio in Boston, but WFLN here in Philadelphia plays especially clear first-generation tapes. All of my recordings are reel-to-reel, non-Dolby. I do not own a stereo cassette player. Charles Brown, (215) 233-2036, after 7 p.m.

Audio Dimensions Preamp

If any BAS members have had any experience with the Audio Dimensions preamp (a PAS-3x mod out of San Diego), I'm available to compare notes. The unit is very good -- superior to the Trevor Lees unit, to which it bears little circuit resemblance. It is also noticeably superior in definition, clean deep bass response, and "realism" (as I define it) to the latest Audio Research SP-3A. Transient response is superb. My PAS mod has a Centralab stepped attenuator supplied optionally by Audio Dimensions, which is well worth the extra money. -- James N. Rogers (Indiana)

Audio Forum Offer

The publisher of Audio Forum is offering BAS members a special subscription rate. The regular rate is $15 for six bi-monthly issues ($20 overseas). The club rate is $12 for BAS members ($17 overseas). If you are already a subscriber, please drop us a line and tell us whether you would like a $3 refund (to be sent in your next issue) or a one-issue extension of your subscription. Please note your subscriber number on your letter. The address is: Box 578, Fairfax, CA 94930.
-- J. A. Bertoglio (California)

Old Sound Museum

"Old Sound" is an antique phonograph museum, a few minutes from Route 6 at Exit 9 in E. Dennis, Cape Cod. It contains hundreds of items which trace the development of the phonograph: cylinder and disc machines (all in playable condition), old talking dolls and toys, advertising posters, book and record catalogs, etc. , and the proprietor, Ben Thacher, is delighted to answer questions and to demonstrate the machines.

I think those of us who are interested in the latest refinements in audio reproduction might be advised to stop by this window to the past for a look at the pioneering efforts which form the roots of our hobby. -- Rich Akell (Massachusetts)

Legal Matters

Mr. Audio

We are in receipt of a bewildering array of letters from Tam Henderson and Trevor Lees regarding the demise of Mr. Audio's Bimonthly. There are exchanges between Henderson and Lees, between Lees and Sound Advice, and excerpts of the partnership agreement. We have read these letters with considerable care, but even so, we feel about as unenlightened as ever. Perhaps if we were lawyers ...

However, the following do appear to be facts: First, Lees is not an engineering student, but rather has an engineering degree, having graduated three years ago. Our apologies for misrepresenting that fact in our May issue. [Our understanding at the time was that Lees was a graduate student. -- Ed.]

Second, Tam Henderson has been invited to join the staff of The Absolute Sound, and has decided to give it a try. He is also associated with a new audiophile label, Reference Recordings.

Third, Mr. Audio's Bimonthly is not being published, and fourth, the whole situation is a mess.

One party (Henderson) regrets that he is powerless to refund the outstanding subscriptions, the other (Lees) promises to resume the magazine with a "reveal all" when the legal tangle has been resolved. In the meantime, any of you who subscribed will just have to hang by your thumbs.

The Sound Affair -- And How!

We have another letter before us, this one concerning member Zeke Zook's dealings with a mail-order firm in St. Louis, The Sound Affair. Mr. Zook wrote us a while back of his dissatisfaction with the firm. Sound Affair in turn has forwarded its letter to him detailing the transaction and their final response. Briefly, the facts as presented by Nicholas Butkov are these:

Sound Affair informed Mr. Zook at the outset that they were not a stocking dealer for AKG, but would endeavor to act as his broker in obtaining such a cartridge. The cartridge was in very short supply and was being rationed among the stocking dealers, but Zook agreed. to wait because he had been quoted an exceptionally low price -- the price of a stylus assembly. When Zook filed a complaint with the Better Business Bureau, he was sent a refund check. A letter from Sound Affair's bank confirms that the check issued in December never cleared. Therefore, Butkov closed the dealings in late July with a second refund check. In closing his letter, Mr. Butkov asserts that "no mail-order business would gamble its professional reputation for a mere $49.50. Mail-order businesses must exist solely on reputation."

In the light of that statement and our article entitled "A Warning on Sound Affair," it is easy to understand why Mr. Butkov has forwarded his correspondence with Zeke Zook to us. We take no sides in this question, but we invite any members who have had dealings, good or bad, with Sound Affair to write us of their experiences. Hopefully the record can be set straight.

-- Henry Belot

DiscTraker: In The Groove

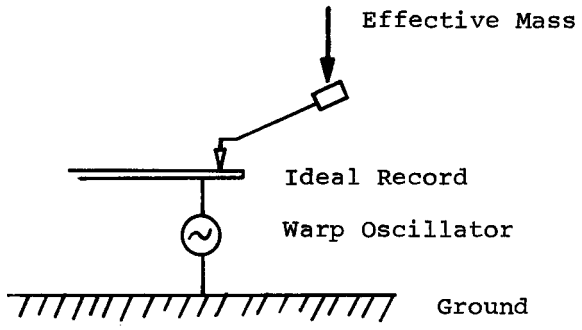
In June, when we published a paper provided by Discwasher, we invited your reactions to the paper and the practice of publishing material provided directly by manufacturers. Your responses have landed in greater number on the "pro" side of the fence, but perhaps with greater force on the "con" side. Some have suggested -- or demanded -- that we include suitable commentary with such articles to correct factual errors or impure marketing biases, and some of you have provided just such commentaries.

Frankly, we haven't yet firmed up a decision on whether we shall ever distribute such material again. It is plain from your commentaries that the DiscTraker article contained several "facts" which can be disputed, but your comments on many other articles submitted by fellow members make it clear that the Speaker is not, unfortunately, an unchallengable repository of The Truth. Because we can only try to approach "The Truth" through successive approximation, it is your active interest in what we publish that keeps us accurate. Therefore, we are happy that you have taken the time to offer your corrections, and here -- for the record -- is a selection of your commentaries to place DiscTraker in a more balanced perspective. (HB)

DiscTraker vs. Koni

The DiscTraker blurb so borders on being a compendium of technical flim-flam that I shall cancel my membership [This is one of the "cons." -- Ed.] if you publish such promotional literature again. My criticism is not directed toward the device itself, but rather toward the technical description furnished by the manufacturer. I am addressing attention to the philosophical purpose of the BAS -- to seek out the real reasons for a given piece of equipment sounding as it does rather than accepting the information given by the manufacturer's ad department as gospel. Your disclaimer of non-endorsement does not absolve you of your responsibility to print technically accurate information or to refuse to publish erroneous claims without editorial comment. Specific points:

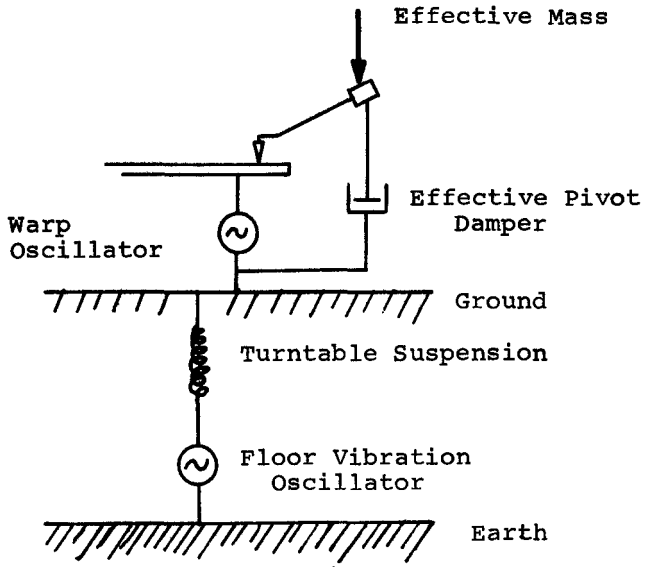
(1) Figures 2, 6, and 9 are incorrect. Tonearm-cartridge effective mass does not act on the stylus tin directly, but through the stylus suspension.



(2) Page 2, paragraph 3, item 1. Tracking force does not hold the cartridge at any instant as claimed -- inertia does. Consider the hypothetical case of an arm-cartridge having zero mass. No audio will be generated regardless of tracking force.

(3) Page 3, last paragraph. In this same paragraph two conflicting statements are made: "This effective mass is not the total mass of the assembly which you might determine by removing the pivoted arm and weighing it," and "a crude approximation of effective mass can be gained by actually weighing the tonearm and headshell, and adding approximately .5 gram for medium-mass tonearm systems." Wouldn't the inclusion of Finagle Factor "f" make things more scientific?

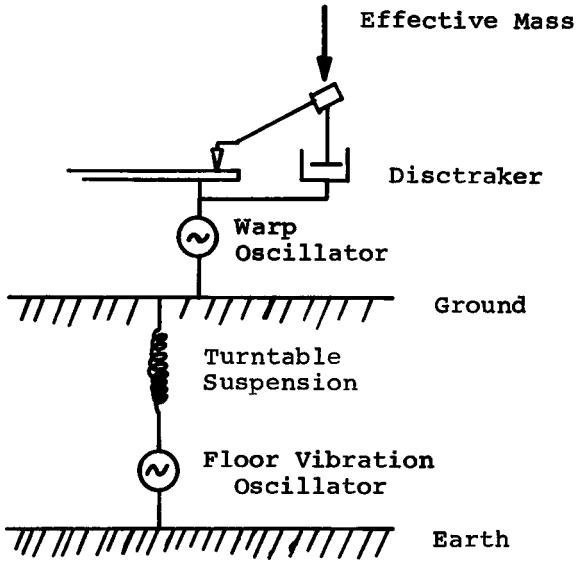
(4) Page 9, paragraph 2. This one is subtle. Pivot damping does not make the playback system more sensitive to floor vibration and airborne resonances, and if you compared the performance of an XLM in, say, a Decca International and an SME, you would see that the damped arm is <u>less</u> sensitive to these problems, though warps may be more likely to generate an electrical signal. A corrected version of figure 6 shows why this is true.



First of all, floor vibrations must be referenced to "earth," not "ground," which is the platter and arm support: in most turntables, the subbase housing the product. Floor vibration acts on the subbase through the turntable suspension and is then transmitted through the warp oscillator to the groove. Just as arm-cartridge mass is converted to an equivalent or "effective" mass

at the headshell, so too must the pivot damping be converted to an equivalent damping at the headshell. Pivot damping does not act as "a shock absorber literally extended 20 feet behind the car," just as the mass of the car is not 20 feet behind it. Note that as the "floor vibration oscillator" acts on the subbase (ground) it is transmitted through the warp oscillator to the record surface, and that the equivalent pivot damper actually helps the arm move with the record surface, thus minimizing relative movement between the headshell and the record surface and thereby making the damped arm less sensitive to floor vibration than an undamped arm. Any "airborne resonances which are expressed in the turntable base" are likewise suppressed.

(5) Page 10, "The DiscTraker Damper." Let's look carefully at the analogy of effective arm-cartridge mass being a car body, damping being a shock absorber, stylus tip being wheels, and record surface being road surface. Consider the statement: "What is really needed for true damping of the tonearm/cartridge combination is a shock absorber between the record surface warps and the effective mass of the tonearm/stylus." (The stylus contributes zilch to the effective mass of the arm-cartridge system. I'm sure this was a slip of the pen.)



Obviously, to insure good tracking of the groove, it is desirable to remove all possible forces imposed on the stylus tip by warps, etc., and this is indeed what the DiscTraker does. But how is this accomplished? If you think carefully, it will be evident that the DiscTraker bypasses, or "shunts, " warp forces around the stylus tip by coupling the surface warp directly to the headshell. Compare the corrected versions of figures 6 and 9 and notice the difference between DiscTraker and pivot damping. It turns out we are, in fact, putting the shock absorber between the car body and the road surface. But then again, this is the most effective way to take the strain off the wheels and suspension (stylus assembly).

The reason the DiscTraker works [If it works. See John Puccio's comments below. -- HB] is this: it bypasses warp-generated forces around the stylus tip by putting the shock absorber between the car body and the road surface.

Conclusion: The DiscTraker concept does indeed work, but Messrs. Discwasher clearly do not comprehend how or why. -- Raymond Kilmanas (Michigan)

How Finite is "Infinitely?"

I feel the inclusion of the DiscTraker article was an excellent idea. However, the manufacturer of a device wishes to present the most forceful case possible, and this sometimes leads to

ambiguities and implications that can be misleading. For instance, the DiscTraker article contains a curve (Fig. 7) which claims to show "what pivot damping does ... to tonearm resonances." An article by B. B. Bauer in the Journal of the Audio Engineering Society (7/63), to which the DiscTraker article refers, shows a more complete set of curves and portrays the situation more accurately. [See also Leigh Phoenix's article in the January 1975 Speaker. -- Ed.] The DiscTraker article states that pivot damping makes the arm-cartridge-turntable "infinitely more sensitive" to a variety of disturbances. What the Bauer article indicates is that this low-frequency-response extension occurs for very high levels of pivot damping, but is relatively small for lower values. In other words, this effect depends greatly on the amount of pivot damping. As with all things, too much is indeed too much. But this does not mean that any amount is too much.

The article inspires another consideration. It seems obvious after studying the warp incidence curves in the article that an arm-cartridge resonance between 11 Hz and 18 Hz or so is desirable. If we juggle the formula for f_r in the article (which is incorrect; it should be $1/2\pi\sqrt{MC}$) we see that to meet the above resonance criterion, the product of the system effective mass (effective mass of the arm plus the cartridge mass) and the cartridge compliance (expressed in cm/dyne times 10) should be between 80 (18 Hz) and 210 (11 Hz). The interesting thing is that with a five-gram cartridge in an arm with five grams effective mass, the compliance should not be greater than 21×10^{-6} cm/dyne. With higher mass arms and cartridges (most of those now on the market), compliance becomes even more limited. Notice that most moving-coil cartridges have low compliance. Could this be yet another reason for their superiority? In any event, this situation clearly implies the need for damping in those systems whose mass-compliance product is too high (or too low, though this is harder to achieve in practice).

-- Thomas B. Martin (Wisconsin)

DiscTraker or DirtTraker?

I've become concerned over what appears to be more than a casual involvement of the BAS in Discwasher's little damper. I'm concerned for three principal reasons:

(1) I don't believe in the BAS' giving what appears to be an endorsement of a product. The Speaker has given perhaps too much of its space to obviously advertising the damper. Up until this point, the Speaker has been commendably free of manufacturer's ads or Society endorsements, but now ... Did Discwasher pay the BAS to send out their flyer? I hope so. And I'd like to know where the money for the ad, if any, is going (went). Perhaps ads could defray membership dues, though I am really against ads altogether.

(2) I obtained the damper and did some testing with it. To my ears, and to all others who heard it, there was no difference in sound. Warped records or flat, sub-woofers or none, I heard nothing worth $30. On a scope, tracking was not improved; in fact, more anti-skate was needed to maintain previous tracking ability. Furthermore, it gets dirty quickly, necessitating tedious cleaning, and it exerts yet another force for wear on a record and is another addition of mass to the tonearm. Also, I talked to Northern California's leading high-end audio dealer, who has sold the damper to a number of his customers over the last month. He has personally seen no benefits from the device and, based on customer complaints of same or negative results, no longer recommends it.

(3) The damper is certainly not unique and, in fact, looks suspiciously like one developed several years ago in England, as mentioned in the Speaker. I trust the designs are original to each designer.

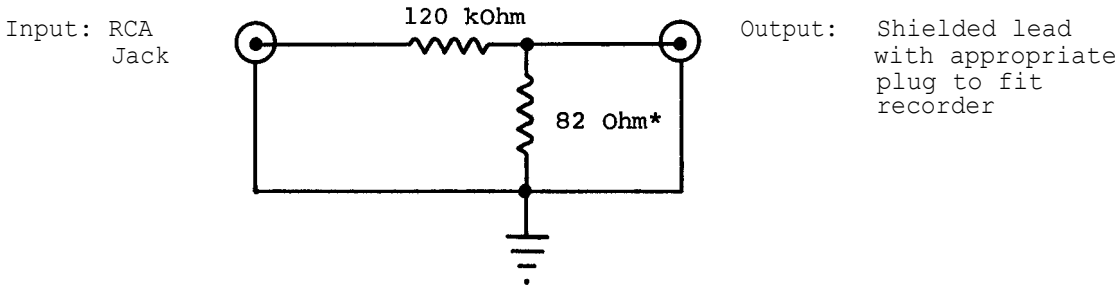
I' m sure many members must feel as I do, especially about advertising in the Speaker or endorsing products. I hope this incident won't cause hard feelings. But I was quite dismayed by the insert's appearance.

-- John Puccio (California)

I think Mr. Puccio will find the answers to most of his questions on the front page of the June issue; I won't repeat. The DiscTraker paper was not an advertisement. We do not solicit or accept advertising, other than from members selling personal equipment, and we give that away. The Speaker doesn't need the revenue. If that were to change, we would probably close up shop rather than deal with the hassles. We mailed the piece as a service to the membership, or so we thought and solicited member comment back on the content of the piece and the policy of inserting such. Though we may have done the wrong thing, our motives were pure. -- MR

Add a Line-Level Input to Your Portable Cassette Recorder

Most of us own inexpensive portable cassette recorders, which we use to record lectures and meetings. Often I would like to use mine to record similar material directly from my hi-fi, but I find that most of these recorders lack line-level inputs. The simple L-pad (attenuator) drawn below allows feeding the tape output from a preamp, receiver or tuner into the microphone input of a cassette recorder without overloading it. A headphone output (including those on tv sets and portable radios) can also be used, provided you adjust the volume control properly. (The output should be less than 0.3 Volts, or about the level set for medium to low headphone volume.)



Repeat for second channel

* 91 Ohm resistor will give a higher signal level on the tape, but increases the risk of overload with some recorders.

The L-pad and all connections should be enclosed in a shielded box, as the output levels are quite low (0.5 mV). The values of the resistors specified give an attenuation of about 1400 to 1 (A+B/B) and work well in most cases. Other values and ratios can be used as appropriate, but too high a value for resistor A may produce excessive noise.

Don't forget to set the tuner to mono, or you may get a one-sided conversation. My attenuator has two channels, allowing me to connect two recorders at the same time. A timer switches on the second machine after sixty minutes, giving a two-hour capability. -- Ira Leonard

Tape Topics

Further Thoughts on Open Reel Chrome

I have been using more of the Crolyn open-reel CrO_2 audio tape and remain very impressed with its quality. I have discovered one unusual property, which may be of interest to those of you interested in trying this tape. Chrome open-reel tape is difficult to erase. It seems to work okay on a Revox A77, but a bulk tape eraser can be hard put to erase it properly. I have a Robins 99 eraser, their best consumer model, and it cannot erase a reel unless you turn the reel over to erase both sides. [Just wait for the new pure metal formulations. -- HB] However, being hard to erase is a double-edged sword, as it also means that material recorded on the tape is less likely to be erased over a period of years by stray magnetic fields. I am concerned with the high frequencies, which I believe are partly lost on tapes over a period of years. This resistance to erasure should be especially helpful for master tapes. (Of course, if your heads are not demagnetized, you will definitely lose the high frequencies.)

I am also asking anyone who buys some of this tape from me to follow up with his comments and criticisms. For purchase details, see my note on pages 13-14 of the July Speaker, or write me: Bob Sellman, 14 Station Avenue, Haddon Heights, NJ 08035.

More on DAK

Some months ago I discussed a number of serious problems I had had with DAK tape and mentioned that I was returning a large number of the hundred reels I had purchased. I can report that I finally returned forty-six and have had no problem receiving my refund. DAK had seen my comment in the Speaker and complained that I had stated that I had purchased low-noise tape when, in fact, I had purchased their standard tape. Since they brought up the subject, I will explain why I called it low-noise tape.

In their catalog, DAK calls this tape standard tape by the stock number listing. However, when you read the promotional copy on the same page, they state that it is actually a low-noise tape and go on further to, compare it to Scotch 177, which is a low-noise tape. Therefore I called it what they call it in their write-up - "low-noise tape."

DAK also sent me five reels of their low-noise high-output reel tape for evaluation. So far, I have only run a quick test of relative sensitivity by adjusting the input level on my recorder for zero dB out, then measuring the output on the other four reels and comparing. Levels ran from -0.5 dB to a little over 0 dB, which may indicate that there is some limited variation in sensitivity in this small sample. After my last experience with DAK tape, I cannot recommend it.

Cassette Decks -- Not That Bad!

In the June issue of the Speaker, Dave Griesinger says he was asked to make some high-quality cassette dubs. He then states he used an inexpensive Sony deck, a Dokorder, and an Advent. After his interesting and valid comments about the need for accurate head alignment between decks, he condemns cassette duplicates on the basis of his experience.

Based on my own experience, I disagree with his conclusions. It's not fair to condemn cassette dubs on the basis of his experience with those particular machines. I have tested a Dokorder and found it to sound just awful in spite of very good frequency response, and he admits the Sony was a cheap model. It is necessary to use high-quality equipment to make high-quality cassettes -- equipment such as the Advent 201, the Harman/Kardon 2000, the Aiwa decks, the Sony 177, and some Nakamichis -- all after readjustment. I have used a Sony 177, a Sony 161SD, and a Nakamichi 350 for high-quality duplication of uncompressed open-reel master recordings of live choral music with very fine results. It is true, however, that as you approach -10 dB, high-frequency saturation sets in limiting the openness of the loudest passages of music. This is an especially severe problem with massed choral voices, but careful duplication minimizes this problem. Certainly, cassettes cannot begin to match the openness and S/N of good-quality open-reel tapes. But you can make some very good recordings with cassettes in spite of their limitations.

I have also found that although there are some differences in high-frequency response, cassettes sound very similar when recorded on one good machine and played on another good machine. I did, however, have to realign the head on my Nakamichi 350, because when I received it (new), it was badly out of alignment. It now works very well. In fact, tapes recorded on the 350 sound a lot better when played on the Sony 177, I would guess primarily because the 177 is a three-head machine and may have better playback characteristics. People who have heard duplicates I have made have normally been quite satisfied with them.

Used with care, cassettes can make a very good recording. They must be made with care and with attention paid to their limitations in order to minimize problems. Of course, they cannot match a well made 7.5 ips open-reel recording. -- Robert Sellman (New Jersey)

Equipment Evaluations

A Higher Mark for Denon

After composing a report on four cartridges with state-of-the-art pretensions (June Speaker), I had an opportunity to listen more extensively to one of the cartridges I evaluated for that article, the Denon DL-103S. I became particularly interested in reevaluating this pickup after reading

Mitchell Cotter's comments on the sensitivity of Shibata styli to vertical tracking angle misalignment. Sure enough, I found that careful adjustment of the arm height considerably changed the high end characteristics of the pickup. By adjusting the pickup so that the top of the cartridge was perfectly parallel to the record and then very subtly altering the height of the arm by no more than plus or minus a degree, it was possible to find a spot where most of the overbrightness I complained of was gone. I suppose this shows that the more complex the shape of the stylus, the more exact the adjustment must be. In particular, with Shibata-type styli such as those in the Denon and Sonus Blue Label, there is only one correct setting. Even a miniscule adjustment error will cause an audible degradation of that "absolute sound" we audiophiles crave.

So where does all this lead regarding my evaluation of the Denon DL-103S? Quite simply, I have upgraded my overall opinion of it to the point that I feel it to be about equal to the DL-103C. The differences between the two come down to the following. The 103S is slightly better in tracking ability and considerably better at tracing high frequency details. The extreme high end is considerably more transparent, which makes the overall definition seem slightly better. The C version still outpoints the S in high end smoothness on most discs; although the high frequency balance of both units is nearly identical, the character of those highs on the Shibata pickup remains a little too brittle, too incisive for my taste.

To rationalize this difference in character between the two, I suggest an analogy. It is inevitable in the real world that there will be brief, intermittent mistracking even with the best cartridge-arm combinations. Compare this brief overload of a cartridge system by the record groove (a frequent occurrence with today's highly modulated discs) with overload in an amplifier (clipping). It is my opinion that the conical stylus of the Denon 103C "clips" more gracefully that the Shibata of the 103S. Though the S mistracks less often than the C, the C sounds less strained when it does. It is, perhaps, significant that I find the Sonus, with its Shibata-style stylus, rather annoying when it mistracks.

Grado XL-Super. This $200-list cartridge is one step down from the famed Grado Signature in sound and a huge step down in price. It is typically discounted to half its list or less. As I understand it, the Grado XL-Super uses the same stylus assembly and generating system as the Signature One, but is QE'd to less demanding tolerances -- similar to the differences between, say, a Decca London and a Decca Export or an Audio Technica AT15 and an AT20.

Despite Joe Grado's infatuation with the high-mass Japanese arms, the XL-Super was a washout with the two I had on hand, the Grace 940 and the Stax UA-7m. I recommend the Mayware Formula 4. The Grado mated better with this arm than any other cartridge I have tried in it. The Grado in the Mayware outtracks any cartridge I have ever used. The Supex, the best tracker of the cartridges in my June survey, is now a runner-up. The other prime virtue of this pickup is its beautifully rounded sound quality -- perhaps a bit too rounded, as we shall see. It has a good sense of depth, better than the Supex by far, but not quite equal to the Sonus. Overall, the Grado is more pleasing than the Sonus, however.

The main problem with the Grado, and its only serious flaw, is its response in the mid- to upper-bass, which is rather bloated and ill-defined. Though the definition from the midrange up is quite respectable, this low-end wooliness lends a rather opaque quality to the overall sound -- very, very smooth, but opaque. Any of the moving-coils is more transparent, but none is as smooth.

If there is any type of music on which the Grado really shines, it is rock. If ever there were a rock cartridge, this is it. Its superb tracking ability perfectly complements today's overcut rock records, and the smooth, slightly veiled quality will soften the hard, edgy quality cut into many rock vocals.

In conclusion, my overall recommendations are the Grado XL-Super as the best moving-magnet cartridge of the group and the two Denons as the best moving-coils, with a slight preference for the conical. The Mayware is my recommendation for the Grado; for the Denons I recommend a high-mass, low-bearing-friction arm. The best sounding arm I have found for moving-coils in general, and the Denons in particular, is the Stax UA-7m. Disregard the bad writeup in The Absolute Sound. This arm is not intended to work with the high-compliance cartridges the staff of TAS craves. In fact, it seems to have been designed with the Denon cartridges in mind, as the

printed-in-Japan manual shows the arm with a Denon mounted in it. The arm is beautifully made, far superior in workmanship and sound to the Grace G-940, my former high-mass standard.

The Denons should only be used on state-of-the-art discs, such as the new Crystal Clear records and the new Sheffields and Audio Labs. On first-rate discs, the Denons are clearly superior to the Grado. On typical, everyday commercial records, the Grado will sound smoother.

-- Bill Feldman (New York)

Linn-Sondek LP12 vs. Megalon

The Japanese and Madison Avenue have had a lot to say of late about the supposed advantages of direct-drive turntables over turntables with other drive systems. Thorens and Linn Products have led a counterattack. Linn claims that all things being equal, their LP12 will sound audibly better or more musical than any direct-drive.

Recently we attempted to put these claims and counterclaims to the test. Two turntables, a Linn-Sondek LP12 and a highly regarded direct-drive unit priced in the $500 range were set up on a table resting on a very thick pile carpet. The experimenters regarded the direct-drive machine as fairly representative of the state of the direct-drive turntable craft at that time.

Both units were equipped with identical Dynavector DA505 arms and two Dynavector 20b cartridges hand picked for matching output voltages and so on. These cartridges are known in the U.K. under the trade name "Ultimo," but Charles Revson, the man who brings you Lauren Hutton, has it registered in the USA. We picked the arm-cartridge combination principally because they were designed as a total unit. The arms were set up by an experienced technician.

The direct-drive had shown a tendency towards acoustic feedback in some rooms, and so it was given additional isolation by placing it on a Discwasher base and Microsorber feet. Contrary to The Absolute Sound, the Linn had shown no such tendencies when properly set up, and so it sat directly on the table. [Removing them both to another room might have been better, as it remains unknown whether or not the isolation provided to the direct-drive unit was really as good as that of the Linn. -- Ed.]

Ancillary equipment included a Mark Levinson Audio Systems ML-1 preamp, a Son of Ampzilla, and Rogers LS3/5a monitors in a medium size, acoustically respectable room. With the acoustic feedback variable properly controlled, the experimenters began a series of intensive listening comparisons.

The actual test involved listening to duplicate and nonduplicate records, ranging from Kiki Dee to Mahler's Ninth. The records were Discwashed and Zerostated, and double blind switching was used. At first no differences were heard, but one member of the listening panel suggested checking the vertical adjustments of the two arms. The arm on the Linn had dropped out of adjustment. The arm was set up again, and the test continued.

This time the differences were easy to spot. I shall try to be as exact as possible in describing them. One passage from Mahler highlighted them: there was a cymbal crash followed by intense activity in the lower strings and woodwinds. On one turntable the crash was raucous and "clangy" rather than an impact followed by a shimmer. The string passage that followed sounded rather like one big cello rather than a group of cellos and basses. It was also difficult to clearly differentiate the identities of woodwinds -- a flute fro m an oboe in their statement over the lower strings.

Listening to this same passage on the other turntable was much more enjoyable. The cymbal had impact and shimmer, not clatter, and one was able to enjoy listening to woodwinds playing in tune above the accompaniment of the lower strings. Cartridges and finally arms were switched with no change in the listening results.

The winner was clearly the Linn. One way of describing the overall difference is that music played on the Linn is subtly softer sounding and therefore less fatiguing. It seemed the music was heard with less initial distortion on the Linn than on the direct-drive. The experience is similar to the difference between a properly driven electrostatic and a moving-coil loudspeaker -- the electrostatic usually sounds softer and has less harmonic distortion than the moving-coil.

We believe that this test vindicates the claim of the Linn organization. I don't feel that one can make the induction that belt-drives are inherently superior to direct-drives. This must be adjudged on a case-by-case basis. However, it does seem that the Linn-Sondek is superior to a more than representative direct-drive. I believe that this test is scientifically conclusive, but will leave it to the engineers to describe the mechanisms of this phenomenon.

-- William Juch (Massachusetts)

McIntosh C-28 Takes on the Big League Newcomers

Recently I decided to consider upgrading my preamp, a McIntosh C-28. Not one -hundred percent satisfied with my stereo system, I borrowed and auditioned a DB Systems preamp (new) and a Mark Levinson JC-2 preamp (used) from two local audio dealers. I intended to purchase one of the two. The Absolute Sound and other audio magazines had led me to expect at least a moderate improvement over my C-28.

I used my own equipment for this test: ADS-Braun LV-1020 speaker-amps (100 Watts rms per channel), a Thorens TD-160C turntable, and a Stanton 681EEE cartridge. I used A-B switching to compare two preamps at a time and level-matched each pair before making comparisons. I switched between preamps at intervals ranging from a few seconds to perhaps a minute. I found it desirable to check levels frequently, especially when one preamp sounded better than another. Records included the two Umbrella direct-discs and several Sheffield direct-discs.

To my surprise, and, paradoxically, to my dismay, I found that all three preamps sounded the same. Whenever one seemed to sound better, a quick level check showed the "better" preamp to be slightly louder than the other. After equalizing levels, I felt any differences I might have heard were so subtle that, to me, they were trivial. Besides, I couldn't consistently duplicate my impressions of "goodness" when I returned to passages which had previously shown one preamp to be "better" than the other.

Once, for about three minutes, the DB seemed to have a rather constricted sound, with all the instruments seemingly compressed together somewhere in the space between my speakers. However this phenomenon occurred only once, and again, I could not duplicate it later.

The JC-2 is quiet, but I wouldn't make a big deal about it. Cranking the volume all the way on all the preamps shows it to have the lowest noise, but my ears would split far before using that kind of level. At the loudest levels I listen to music, which are very loud, I could hear no differences in signal-to-noise among the preamps. Record noise was always louder.

I wish to thank Hi-Fi Haven and Audio Lab, both of New Brunswick, New Jersey, for allowing me to borrow the preamps and giving me no problems when I returned them. I feel both stores are safe to deal with.

The other components. I am extremely pleased with the LV-1020's. Their sound is very clean. They have excellent bass, midrange, and treble. As for the Thorens TD-160C, I haven't done a lot of turntable comparisons, but I am pleased with it. It has very low rumble. One quibble though: its suspension system is sensitive to motion in the second floor room it is in. If you walk heavily while a record is playing, the tonearm jumps. I bought Audio Technica turntable "shock absorbers, " and they made the problem worse. [The classic method of controlling acoustic feedback is to drop the resonance of the turntable suspension to a very low frequency -- right down there with the footsteps. The Audio Technica feet are feedback isolators. -- Ed.]

Regarding the Stanton, it seems to be at least a sonically satisfactory cartridge. It tracks well, but I always have a nagging feeling that there are much better cartridges.

-- Ronald B. Freeman (New Jersey)

Sound from a Shoebox

Because I strongly favor progress, and because my own speakers were designed about twelve years ago, I spent an afternoon at the local high-end emporium auditioning the Rogers LS3/5a and the Fried Model B. The outcome of that encounter is the subject of this report.

Though there will always be a Bozak, the equation Size x Price = Quality no longer holds. With the development of electronic means for overcoming acoustic limitations, we have a new generation of "minimonitors" with more musical and natural sound than the giants of a few years ago.

Both systems are truly "mini." The Fried measures about 12" x 8" x 7" and the Rogers about an inch less in each dimension. Both were nicely finished, with the Rogers just edging out the Fried for a quality look and "feel." Both systems use KEF drivers, the T-27 tweeter and the B-110 woofer, though the Rogers tweeter had tiny perforations and the Fried did not. The Rogers woofer is back-mounted, the Fried flush-mounted. Rogers has a wall of felt around its tweeter to tame the slight high-frequency rise. The Rogers is rated at fifteen Ohms nominal impedance, while the Fried is an eight-Ohm system.

The source was an AKG cartridge in a Grace arm on a Fons turntable, followed by a Nakamichi 410 preamp and 400 amplifier. (The electronics were excellent, with a great look and feel to complement their performance, and at $330, the preamp is a great bargain.) Level-matching was fairly easy with the stepped gain control on the 410, and tone controls were switched out.

We began with a DGG release of Tchaikovsky's "Romeo and Juliet" (by a conductor and orchestra I cannot remember). My first impression of the Frieds was wonderment at stuffing a big JBL system into that tiny box. Bright to the point of irritation and forward as Jimmy Carter's smile, they hit line drives at me from almost every section of the orchestra. The salesman explained that I obviously wasn't used to the "sparkle" of live music (I'm a union musician) and that I'd have to get used to listening all over again -- true enough with the Frieds! He then offered the "fact" that when <u>properly</u> reproduced, most records sound overly bright because they were mixed down on JBL monitors. The logic of that evaded me, because an overly bright mixdown monitor should result in dull-sounding records on neutral systems.

Switching to the Rogers, the violins returned to the stage, the orchestra took on a three-dimensional quality, and instrumental balance was excellent. Dynamic range was admirable, and perspective was maintained 450 off-axis.

Though neither system goes much below 60 Hz, both had taut and realistic bass within their usable ranges. The lower reaches of the string bass, for example, were there (a low E is 41.2 Hz at concert pitch), but without the drama of the better large systems available.

We then put on "The Last Record Album," by Little Feat. (Feat is the best rock band in the world, and any of their albums is a pleasure to hear over almost any system.) Again, the Rogers won. The Frieds acquitted themselves more effectively on rock, but the strident upper midrange was unpleasant.

The new Sheffield Dave Grusin recording was next. There's some good acoustic guitar on the third band of side two, which raised an interesting problem. On the Frieds, it sounded like a bright flat-top (Gibson J-200, for example), while on the Rogers it sounded like a good arch-top, such as the L-5. I suspect the instrument was an arch-top, but if anyone knows, let's hear from you.

The remainder of the comparison went essentially the same. I concluded that the Rogers were more natural than the Frieds, much to the salesman's chagrin. The dealer sells Fried but not Rogers. The pair of LS3/5a's were supposedly taken in on trade for a pair of Fried Model B's.

The salesman showed me what were supposed to be plots of frequency response of the systems measured by them with pink noise and identical equipment in the same room. His plots showed the Frieds to be flat from 70 to 20,000 Hz and down only a few dB at 50 Hz. The Rogers graph showed a deep upper-mid dip (about 8 dB down at 8 kHz) and a steep rolloff below 60 Hz. I don't believe the graphs were "fudged," as I know the owner personally and don't think he would do that, but something was wrong. In any event, by the time I left, each of us was convinced that the other was a tin-earred turkey.

Further listening to the Rogers in various systems revealed their superiority. Though the Frieds had a moderate degree of frequency- and amplitude-dependent depth, the Rogers' imaging was stable at any listening level and quite deep. The Rogers clearly show small differences in

their associated equipment. For example, the effect of added capacitance on a V-15 III was very noticeable, and the depth of an XLM was very apparent compared to the shallowness of the Shure cartridge. The Rogers speakers are not very room-dependent, except that the bass tautness can easily be overshadowed by boomy room resonances.

By adding a "subwoofer" as tight and clean as the Rogers, you should have a superb system. The Dahlquist electronic crossover is probably a good choice, as it is said not to affect the signal above its high-pass cutoff. I imagine a KEF B139 would be the logical choice for a low-end driver, if you're building your own, as the fine character of the B-110 will be lost with a sloppy subwoofer.

In summary, I found the Rogers LS3/5a to be a much more accurate and musical speaker system than the Fried Model B. The Fried is both more efficient and less demanding on a power amplifier and will handle more power. But the Rogers will put out plenty of sound in average rooms with thirty-five Watts per channel. I suspect the two systems could be made to sound more alike with careful use of an equalizer, in which case many of my comparisons might not be valid. But for the price of an equalizer you can buy a subwoofer and be that much further ahead.

-- Dave Reiter (Pennsylvania)

Sequerra Aeterna

In a world and an industry that are less than perfect, it's particularly comforting to find a company dedicated to service over the long haul, a company that continues to support its product with enthusiasm years after the purchase. Sequerra is such a company, and this tribute is well deserved. Simply put, I have never dealt with a company so anxious to see its users fully satisfied or so sensitive and responsive to user comments.

Since I bought my Sequerra Model I nearly three years ago, I have never suffered a major failure. I have returned it three times for various small problems, the last being a minor oscilloscope aberration about five months ago. In each case, the unit was returned in two weeks or less with the required work fully completed. But in addition, the unit was always carefully QC'd and cleaned up, with the end result being that the unit sounds and performs better now than when it was new (and it sounded excellent then). There is no question in my mind that the unit has simply been improved, rather than fixed in some obscure way, and I have intentionally refrained from writing about this until I was sure.

So my compliments to the staff of Sequerra and especially to Fred Barrett and Martin Cerini. If every company reflected their attitude, it would be a happy world indeed.

-- Steve Seto (California)

Observations on the dbx 124

Among purists (and I consider myself one) it goes without saying that the less electronics in the system, the better. Extra processing can only make the signal worse, not better. Right? Wrong!

I made a rather surprising discovery when I bought the dbx 124 for my Pioneer RT-2044. (This is a "semi-pro" machine that puts most professional units to shame. If readers are interested, I'd be happy to do an in-depth review.) One of the Pioneer's faults is the trace of "brightness" it adds to recordings, even though I've adjusted the machine for flat response. When I hooked up the dbx, it removed the machine's residual noise, as I expected, but it also removed the added brightness, a completely unexpected side-effect. A few minutes' thought provided a reasonable explanation.

Suppose we examined the distortion characteristics of an amp or tape deck on a graph which plotted percentage of distortion versus signal level in volts. Below clipping, the slope of this curve would be less than 45° -- usually much less. A doubling of the signal level would not cause a doubling of the percentage of distortion; it might only be a 20 or 30% increase. To put it another way, a 6 dB increase in signal level would be accompanied by a less-than-6 dB deterioration of the signal-to-distortion ratio (SDR). For example, if a doubling of signal level caused the percentage of distortion to increase by 40%, then the SDR would deteriorate by only $2^2/1.4^2 = 4/2 =$ 2 or 3 dB. So how does the dbx help?

The response of the dbx encoder rises at 6 dB/octave above 500 Hz. With modern heads and tapes, most tape decks can easily handle this added treble boost at 15 ips, even allowing peaks to go beyond 0 VU. (The RT-2044, for example, is flat to 35 kHz at 0 VU [200 nW/m!], with no audible birdies. It's also worth pointing out that the spectral content of orchestral music falls faster than 6 dB/octave above 1 kHz, so in using the dbx, you are in no way applying an equal-energy signal to the tape.) We now have a tape in which the treble has been greatly boosted at only a small increase in distortion. Where does that get us?

The dbx decoder, naturally, has a complementary 6 dB/octave rolloff. Imagine. applying a fundamental signal with harmonics to this circuit. The harmonics are attenuated more than the fundamental, so we get a net increase in SDR. The improvement would be 6 dB for the 2nd harmonic, 9.5 dB for the 3rd, 12 for the 4th, 14 for the 5th, and so on. Since the original boost caused much less of a deterioration of SDR, we wind up with a net distortion reduction. Neat, huh?

In the instructions for setting the level match controls, dbx suggests using a 400 to 1000 Hz signal. A 400 Hz signal is best, since it is not subject to the boost/cut cycle.

What's your opinion? Technically and otherwise. -- William Sommerwerck (Maryland)

Aiwa 1250 Cassette Deck

The Aiwa 1250, which lists for $250 and is available at a discount, is a very good cassette deck by any standard and an excellent deck at its price. Adjustments are all easily accessible with the top plate removed, an easy job. The cassette eject mechanism is beautiful to see in operation and to use. Response is very smooth, within about 1 dB, to around 15-16 kHz using XHE tape. Sound is very good. It handled the Sheffield Harry James record very well and just had minor problems with massed choral music. In addition to the great sound and ease of use it is even very well built. I bought it and set it up for a friend (it was recommended by a dealer I trust) and was truly amazed. If Aiwa can do all this at a list of $250, they must work miracles in their more expensive decks. I do plan to follow up with a more complete report.

-- Robert Sellman (New Jersey)

Nakamichi 350 Cassette Deck -- A Report

In order to pass along the more important aspects of my experiences with this deck and its battery pack/carrying case, I am writing this short set of notes. If possible, I will follow up in the future with more detail.

Overall, I have found that the 350 sounds good (but by no means great), lacks some important features, has some minor but significant mechanical and electrical flaws, and is supplied in less than completely reliable adjustment. If you have specific need for a relatively small but high quality cassette deck (stereo with Dolby), the 350 is recommended. (Otherwise, buy an Aiwa cassette deck -- even their model 1250, which lists for $250.)

I received the 350 with the head very much out of alignment. Adjusting the bias and record level was easily accomplished once the case of the deck was fully removed (something of a chore). With XHE C-90 tape, the frequency response was within about 1 dB to about 14-15 kHz and appeared to be smooth. It has only one meter, a serious lack, although space is admittedly at a premium, and it only indicates the higher channel. However, although it is small and does not have much resolution (no markings between -10 and 0 dB),. it does show levels as low as -50 dB, a real aid in many situations. Normal and chrome tapes are accommodated, with separate bias and record level adjustments for each type of tape. The deck is about 7.5 x 9.5 x 3.5 inches. In the optional super expensive ($100) battery pack/carrying case it is about 9.5 x 10.5 x 3.5. You must have the carrying case for true portable operation, other than in a car.

Occasionally the automatic shutoff does not work or works incorrectly, or a cassette may not eject, or a sudden short change in level on one channel may occur when recording (this is not due to cassette failure or mike/line failures, as I had originally suspected). Based on my experiences so far with the 350, I do not plan to purchase another Nakamichi deck in the future. They may be nice decks, but if the 350 is any example they are not constructed as reliably as they should be for their price.

One final note: Since Nakamichi manages to violate the spirit of Federal Law prohibiting fair trade pricing by limiting their dealers strictly, you will find that you must pay the full tab of $450 for the 350 and its carrying case, making them no bargain. -- Robert Sellman (New Jersey)

KEF 139 Transmission Line Woofer

On the basis of some information in the Speaker, I dug out the old article in Wireless World on a transmission line speaker system built around the KEF 139 woofer. I had intended (a la an article in Audio) to use this in a common-bass configuration using their crossover into a separate amplifier. Instead, I hooked up this speaker to the two positive terminals on the remote speaker taps of my Marantz 2325 and let the main outputs continue to feed my Rectilinear 7's. I don't know why or how it works, but the sound is nothing short of sensational. The placement of the new speaker does not appear to be critical. It delivers floor-shaking, stomach-vibrating, clean bass that is a revelation. I play a lot of organ music, mostly from discs, and never knew the records had this much in the grooves. Note that I have not been using any crossover network. The response is solid to 28 Hz, below which it rapidly diminishes. At middle C (256 Hz) there is a more gradual drop-off of sound. This addition is quite reasonable, and, even if not of purist caliber, most gratifying to me. -- M. Shuster (New Jersey)

Down the Street with Philips

Who buys recordings of marches? I do. So it comes as no wonder that I quickly obtained a copy of the Eastman Wind Ensemble's latest release (Philips 9500 151), unimaginatively called "Strike Up The Band -- Stars and Stripes Forever and Other Sousa Marches." (Sousa wrote about 140 marches, Philips, but not "Strike Up The Band.")

Donald Hunsberger, the present musical director of the Ensemble, has carried on the precision of performance given to these marches as Frederick Fennell did in the early 1960's. Likewise, Philips provides a luscious sound, strikingly similar to that of the original Mercury recordings of the 60's (reissued on Golden Imports). The Eastman folks have a unique way with marches. Their style provides an added swing to the old marches that other bands overlook. Something should also be said about the repertoire. In three albums of thirty-seven marches exclusively by Sousa, there is not a single repeated selection. In fact, the lay listener may recognize only three or four by title. How about "Nobles of the Mystic Shrine," with a harp part, or "The Bride-Elect," from a Sousa operetta? And there are about thirty other marches I would be shocked to hear at a football half-time. Bravo, Eastman, Fennell, Hunsberger.

-- Warren Schroeger (Massachusetts)

Kriptic Kritique

I would like to nominate the Philips record SAL-6500-430 for special merit. It is the Josef Krips reading of the Mozart symphonies 39 and 40 with the Concertgebouw Orchestra.

The readings of both works are leisurely but with a sense of constant flow. Number 40 obtains a depth of feeling unheard by me up to now.

The sound is close-up. The orchestra sounds relatively small and string tone is very natural, just like the sometimes dull sound you hear in person, and there are loads of details audible.

-- Carlos Bauza (Puerto Rico)

In The Literature

Audio, September 1977

E. T. Canby has a further look at the earliest Edison cylinder machines (p. 8).

Bert Whyte surveys some of the noteworthy new products seen at the Consumer Electronics Show in June (p. 16).

European Records: John Wright continues his good quarterly commentary on some of the best recent classical releases in England. Audio should make this column a bi-monthly feature so that Wright could provide more thorough coverage (p. 46).

Thinking About Print-through: A clear and thorough discussion of the cause of print-through, its behavior, and its cure. Probably the best article ever written on the subject. Especially important for the clear presentation of the dependence of print on storage conditions and for its illustration of the practical limits of reducing print via periodic rewinding of the tape (p. 55).

Equipment Profiles: Reports on the $1200 Pioneer 2022 tape deck, the McIntosh 2205 power amp, and the Nakamichi 630 tuner/preamp, all three enthusiastically received (p. 66).

The Audio Amateur, 1977 No. 3

The Speaker Saver: A circuit (actually three circuits with optional variations) for preventing thumps, DC, and other bad things from reaching the speakers (p. 4).

A hybrid amplifier of only modest complexity for driving transformerless electrostatic speakers (p. 8).

A $10 Yagi: Building a three-element FM antenna (p. 15).

An Amateur at an AES Convention: As the title implies, audiophiles are permitted to attend AES conventions if they pay the $20 fee; this article describes some of the things seen at last fall's New York convention (p. 18).

Slewing Induced Distortion, Part 3: Jung applies the Curl/Otala TIM test to various IC op amps and correlates its results with previously described ways of measuring or predicting the slewing distortions of the devices. Good correlations are found, and the other test methods are deemed easier and more sensitive, thus preferable. The popular belief that TIM is inherent in amplifiers having low open-loop bandwidth or large amounts of negative feedback is shown to be a fallacy. TIM is shown to be strongly correlated with slew rate (specifically, proportional to the inverse of the cube of the slew rate). Certain expensive op amps are found to be quite free of TIM; however, the cheap and popular 301A is also very good when lightly compensated for 20 dB gain, though poor at unity gain (p. 21).

The Gately Micromixer: A very compact mixer designed by Ed Gately, who has folded his own company and joined Hafler (p. 30).

Audio Aids: Several things, including a nice essay on why heavy power-supply filtering in a preamp may improve the sound (p. 40).

Book Talk: Favorable reviews of Microphones: Design and Application by Burroughs and Musical Acoustics by Benade (p. 44).

Audioscene Canada, February 1977

Of particular interest this month: technical article on cartridge/tonearm interaction.

Equipment reviews: AKGP8E, Decca London Gold Elliptical, FR-1 Mk 11 and Pickering X5V-300 cartridges; Decca New International, Denon DA307, Grace 704, J.A. Michell and SME 3009-11 tonearms, plus an evaluation of all combinations of the above tonearms and cartridges.

db, August 1977

Quad Sound and Docket 21310: The FCC is evaluating various proposed methods for quadraphonic FM broadcasting and is now soliciting the views of informed members of the public. The FCC wants to know whether there is sufficient prospective interest in four-channel sound to warrant the adoption of any broadcast technique; if so, advisory comments of a specific or general nature would also be welcomed. Mail your thoughts to Docket 21310, Federal Communications Commission, 1919 M Street, N.W., Washington, D.C. 20554 (p. 22).

The Equalization Myth: An expose of a basic flaw in room equalization. Because sound-level meters and spectrum analyzers produce readings that are time-averaged over periods much longer than musical transients, their measurements are strongly affected by the variation of the room's reverb decay time versus frequency. Equalization of those measurements will correct the sound of sustained chords, but will distort the tonal balance of the transients which comprise most music. Therefore, the best approach to room equalization is first to work on the room acoustics to

produce a reverberant decay time which is uniform with frequency (or smoothly changing, without ups and downs). Attempts to correct frequency-dependent time decay with amplitude equalization cannot yield ideal results (p. 32).

Music Alfresco in Central Park: On the sound-reinforcement system used for the New York Philharmonic's outdoor concerts (p. 34).

Test Report: The BGW Model 100-01 power amp (p. 38).

High Fidelity, September 1977

Letters: Arguing the question of anti-CB RFI legislation (p. 8).

Phonograph Historiography: Reviews of two books on recording history: The Fabulous Phonograph by Gelatt and Fred Gaisberg and the Golden Era of the Gramophone by Moore (p. 50).

Too Hot to Handle: Includes a report that replacing a metal headshell with a resonance-absorbing carbon-fiber headshell improved the sound (p. 54).

Equipment Reports: Crown EQ-2 equalizer (very flexible), Sansui 2000 power amp (superb), Satin M-18X moving-coil pickup ("beautiful"), Toshiba 420 receiver (mediocre), and Celestion Ditton 66 speaker (very good, with a mellow balance) (p. 63).

High-Fidelity Pathfinders: Biographical profile of Alex M. Poniatoff, founder of Ampex (p. 72).

Audio '78: A survey of the large assortment of new products scheduled for introduction this fall (p. 74).

Try Binaural: John Woram describes the faults of multi-mike technique and waxes enthusiastic about "two-eared" recording (p. 130).

Hi-Fi News and Record Review, July 1977

Record Player Roundup: Martin Collums, the author of the new Hi-Fi Choice volume on turntables and cartridges, summarizes the essential conclusions arising from tests of fifty-five turntables, forty cartridges, and assorted arms: (1) in most cases belt-drive turntables are preferable to direct-drives because of the superior feedback suppression provided by their spring suspensions; (2) most arms are too massive for proper compatibility with the compliance of most pickups; (3) viscous damping would benefit most arm/cartridge systems; (4) the optimum load for the pickup, both resistive and capacitive, is in many cases different from what the manufacturer claims and different from what most preamp inputs supply (p. 29).

Soundings: A disturbing note warning that when A/B comparisons between amplifiers are made with the aid of a switchbox which switches both the inputs and the outputs of the amplifiers (e. g. , the. "comparators" commonly used in stores), the use of common input and output grounds can alter the behavior and sound of some amps. So if an amplifier sounds inferior, separating its input and output grounds may restore it to proper operation (p. 33).

Equipment Reviews: Objective and subjective evaluations of eleven domestic British speakers; many pros and cons are cited, but none of the eleven emerges as the clear winner (p. 36).

Loudspeaker Distortions: By setting up adjustable electronic simulators mimicking several types of speaker distortion, Peter Fryer of Leak/Wharfedale discovered the audibility thresholds of the distortions both with music and with appropriate test signals. (A condensed version of the article is in the August issue of Stereo Review.) The distortions were IM, Doppler, delayed resonance (due to stored energy in moving drivers), and cabinet reflections. Conclusion: distortions which alter the frequency spectrum of the music (i.e., hermonic, IM, Doppler) are inaudible unless present in much larger amounts (two to six percent) than actually occur in speakers. However distortions which alter the time response of speakers are present in much larger amounts in speakers, amounts large enough to exceed their audibility thresholds, and so probably contribute significantly to speaker coloration (p. 51). [Note that these "time" distortions arise from the drivers themselves and the interior constructions of cabinets and therefore cannot be eliminated by linear phase design. -- Ed.]

Record Piracy: An amazing look at some of the clever tricks people are developing to ensure that pirated copies of recordings will either be preventable or, at least, accurately identifiable (p. 59).

Subjective Sounds: Some interesting Danish measurements of tonearm resonances (p. 67). [These seem to show that the pivot damping of commercially available arms (KMAL and Formula 4) does not effect a dramatic change in the fundamental resonance. -- Ed.]

Measuring What We Hear: Gordon King points out that most amplifier measurements (including SID and TIM) relate only to the large-signal capability of the amplifier, while subjective differences among amps often are (he says) more dramatically heard with low-level signals close to the background ambience level of a recording. He proposes that this is because in many amps the "transfer characteristic" of the circuit changes, with signal level, meaning that the character of

the distortion spectrum varies with level. Harmonic analysis measurements follow, at various levels, on each of eight amplifiers, but they don't prove the hypothesis; the amp judged "best" does have an admirably consistent distortion spectrum, but it also has the lowest level of high-order distortion components and the lowest over-all level of distortion (p. 71).

Quality Monitor: Assessing the sound quality of recent classical releases (p. 81).

Recorded Balance: A plea for genuine stereo recordings, instead of multi-mike productions (p. 95)

Rational Amplifier Testing: Peter Walker of Quad lays down some sensible ground rules for subjective amplifier evaluation, to insure that goblins will not cause misleading results (p. 135).

Disc vs. Cassette: Frank talk from Decca on the making of pre-recorded cassettes, and from BASF on cassette equalization test tapes and the question of Japanese (i. e. , Nakamichi) equalization standards (p. 137).

Gramophone, July 1977

Audio Circles: A note about SME Information Sheet No. 5, discussing various ways of improving phono sound by suppressing feedback vibrations and resonances in table and arm -- e.g. , installing damping material between pickup and headshell, loading up the inside of the turntable base with absorbing material, etc. (p. 242).

Equipment Reviews: AR-17 (unimpressive measurements, but subjective evaluation good), Panasonic 205C and 270C cartridges (with a rolled-off top end), and an anti-static record cleaner from Italy (judged less effective than the Zerostat) (p. 245).

Modern Recording, September 1977

Fathoming Specs: On the meaning of various microphone specifications, with examples (p. 29).

Blue Oyster Cult: Details on a recording session with a rock group (p. 36).

Disc Mastering Part 2: A realistic look at the practical problems and compromises in cutting records (p. 44).

Ambient Sound: A basic, introductory look at input and output impedances and how they affect interfacing of components (p. 54).

Lab Reports: Teac 650 cassette deck (good but overpriced), H. H. Electronic Echo tape-loop time-delay (good), BGW 500D power amp (superb), and Uni-Synch Trouper III mixer (fairly good) (p. 58).

The Boston Phoenix, August 30, 1977

Includes a 64-page supplement on audio, about half of it written by BAS members, as usual. Articles include a profile of David Hailer, an interview with Pioneer president Bernie Mitchell, hi-fi pricing trends, current trends in equipment as seen at CES, Holman on turntable design, Feldman on tuner specs, and background notes on British manufacturers. The issue can be back-ordered for 50¢ from The Boston Phoenix, 100 Massachusetts Avenue, Boston, MA 02115.

Popular Electronics, September 1977

Records and the Vertical Angle: Ralph Hodges is an audiophile. Here he describes how he learned from David Shreve about the difference vertical angle can make with a phono pickup, how he relayed this information to Mitch Cotter, and the conclusions they jointly have reached. The most startling result is that the "optimum" settings for a variety of records span a range of less than half a degree (despite the fact that the various brands of cutters used by manufacturers have nominal vertical angles ranging from 15 to 22 degrees) (p. 14).

Julian Hirsch: Single-driver versus multi-way speakers, pro and con (p. 22).

Test Reports: Akai 270DSS quad open-reel tape deck and Speakerlab S7 speaker kit, both judged pretty good (p. 32).

1/2-Octave Analyzer: The design for the circuitry of a half-octave real-time spectrum analyzer from Southwest Technical Products; it requires a flat microphone and a DC oscilloscope to work (p. 47).

Transformerless DC Voltage Doubler: The design for the sort of voltage doubler that makes it possible for car stereo power boosters to yield over ten-Watt levels from the car's twelve-Volt supply (p. 55).

Matching Tapes to Recorders: One month after displaying total ignorance of the importance of recorder/tape matching (in his review of the Advent 201A in last month's Recording), Len Feldman comes up with a fine, clear presentation of the effect of bias on the distortion and frequency response of a tape (p. 63).

A Multiplex Recorder: Description of a $25 kit for a complete add-on stereo decoder (based

on the 1310 PLL IC) to be added to older FM tuners; performance should be excellent, as the circuit includes input compensation for IF bandwidth and output subcarrier filtering (p. 67).

IC Audio Preamplifiers: Assorted recent ICs and sample circuits (p. 85).

The Real Paper, August 20, 1977

Includes a 48-page supplement on audio; principal items of interest are a profile of Radio Shack president Lew Kornfeld, another of Technics manager Mike Nakai, and an update on video components. The news section includes a feature on the hearing damage resulting from exposure to urban noise pollution, mostly accurate and disturbing; but its conclusion is wrong in dismissing cotton earplugs as useless. In fact, cotton plugs are ideal, since they provide a beneficial amount of high-frequency filtering, but can be worn all day, as they don't obstruct normal conversation. The issue can be back-ordered for 50¢ from The Real Paper, 929 Massachusetts Avenue, Cambridge, MA 02139.

Stereo Review, September 1977

Audio Q&A: Larry Klein waxes enthusiastic over the inexpensive IC version of the Tate SQ decoder (p. 26).

Tracking Force and Record Wear: A useful clarification (p. 28).

Harmonic vs. IM Distortion: A common-sense view of distortion measurements (p. 36).

Test Reports: Empire 698 turntable, Pioneer SA-9500/II integrated amplifier, Luxman 1050 receiver, Celestion Ditton 66 speaker, and Nikko Beta-1 preamp (p. 38).

New Audio Products: A detailed survey of the hundreds of new products shown at the Consumer Electronics Show. The cumulative is overwhelming. Are there really enough audiophiles around to buy all of these products? (p. 56). -- Peter Mitchell, Roger Foster

August BAS

Meeting Summary

Dennis Boyer spoke for a few minutes about potential policy changes at WBUR. In essence, the University is moving to exercise more control over news and public affairs programs. This could potentially result in the dropping of several programs and in significant staff changes. Boyer pointed out that two thirds of the budget of WBUR comes from the government and public support and suggested that members look into the situation and write to the University with their feelings.

Scott Kent distributed a small number of record catalogs for Supraphon, Qualiton and Hungaroton Qualiton. Scott is importing these at approximately $4.50 for Supraphon and Qualiton and $4.00 for Hungaroton, which he feels are the best of these recordings and equivalent to DGG. Scott also spoke in some detail about his findings of DC magnetic fields in the Revox A77 tape recorder. These are generated by the pinch roller solenoid and magnetic breaks. Although he could not detect any effect on the closest track to the face plate, i.e. , left channel, he did detect readings of 15 to 18 on an Annis magnetometer; Revox has said that anything greater than 5 is considered dangerous. Scott devised a shield, which can be applied to the back side of the top plate, and offered to install these for $5 each at the next BAS meeting.

Peter Mitchell spoke recommending the Hungariton recordings, saying that some are very high quality, made with reasonable miking technique, for good stereo imaging, and featuring excellent but otherwise unrecorded European musicians. He also mentioned that a new Hi-Fi choice concerning turntables and cartridges is being imported by John M. Tooley, Box 120E, RD 2, Milton, Delaware 19968. [See next month's Speaker for details. -- Ed.] Peter also highly recommended two new Pioneer recorders, the RT707 open reel, which he had tested as having very flat frequency response, and the CTF1000 cassette machine, which he has not actually tested yet. He also suggested that Sound Reproduction in East Orange, New Jersey, seems to be offering exceptionally good prices.

Via a spokesman, Jim Richardson stated that he would be taking the annual tape order for Scotch 177 at exceptionally low prices at the next meeting.

Dick Burwen introduced and took orders for two of his "indirect discs," which ordinarily sell for $15 but are offered to members at $10. One on the Celia label, called "Misty," was pressed in Germany and features light rock and dance music. The second, on the Audiophile label, pressed

in the U.S., is of jazz piano solos.

Jim Brinton had copies of the Cleveland. Orchestra direct-disc record available at half price.

Wally Swanbon had an assortment of things available for sale to members, including Maxell UD35-90 at $4.40 and XL2 cassettes at $3.10, as well as TDK tape and a number of Discwasher products at substantial discount.

Al Foster spoke very briefly about a suggestion by Harry Zwicker that the BAS spend $200 to lobby against the government requirements for RFI suppression circuits in hi-fi and TV equipment, instead of squelching it at the offending source.

Someone commented on Barclay-Crocker tapes. The first are copies of Vanguard masters at 7 1/2 ips, quarter track with Dolby. His copies have random static bursts of about one second duration, occurring about twice per tape, albeit partially buried in high volume passages.

The main speaker was Mark Davis, who has examined the psychoacoustic effects of phase shift and devised demonstrations for the members. Without saying too much to pre-bias the audience, he did indicate that phase shift might be primarily an excuse for people who are "looking for a new 'reason' to replace their systems."

To do an orderly scientific investigation, it was necessary to derive a model of the human auditory system, relate the model to high fidelity, devise an experiment to see if the effects are truly audible, and finally, if having detected an audible phenomenon, decide whether it significantly affects music.

Mark has been studying under Dr. Campbell Searle, who has derived a model for the human auditory system that can be electronically simulated with good accuracy.

Mark set out to define phase and how phase differences between signals can be shown. A phase difference is directly related to a timing difference between two signals. By Fourier analysis, any signal can be represented as a sum of sine waves. When defining the effect of a system on the signals passing through it, the primary effect is amplitude versus frequency, usually plotted on a chart with dB on the vertical axis and frequency on a log scale on the horizontal axis. The second effect is the transit time through the system versus frequency. If, for example, the times for 1 kHz and 2 kHz are different, then the waveform of a 1 kHz signal with a 2 kHz harmonic will look different at the input than at the output. The plots for this effect can be in degrees of phase angle or as time on the vertical axis versus frequency on the horizontal. Phase angle and time are directly related, as $1/f$ equals 360°, making time shift equal to the phase shift in degrees divided by 360f. It's important to realize that in audio, the absolute phase shift is not important, because it may be just a constant delay time for all signals. We are only concerned with differential phase shifts, or the time alignment of different signals passing through the system. If the phase shift for all frequencies is the same, then the waveform is preserved. If the magnitude and phase response of a system is known, then through Fourier analysis, the impulse response can be deduced.

If we know the ear's sensitivity to magnitude and phase differences, we therefore know the necessary criteria for music reproduction equipment. For example, if ±1 dB in magnitude and 30 ms of time dispersion is the auditory threshold, we shouldn't need equipment with significantly greater accuracy. Dick Goldwater questioned the 1 dB sensitivity, and the conclusion was an average sensitivity of .5 dB in a fast A/B test and 1 dB for long-term retention.

Mark then presented the initial demonstration, which consisted of playing a 3 kHz square wave with harmonics at 9 and 15 kHz, first with no relative phase shift and then varying the phase of the 9 and 15 kHz signals a full 180°. This was displayed on an oscilloscope and simultaneously played through a loudspeaker. The conclusion seemed to be that the change was totally inaudible, although quite visible.

Mark then explained the ear model in detail. The human auditory system consists of three major components: the outer ear, the middle ear, consisting primarily of three bones, and the basal membrane, on which are thirty thousand hair cells (filters) connected to an equal number of nerves. Each of these is tuned to a different frequency, with a 1/6 to 1/3-octave bandwidth.

Nerves are binary in nature, firing pulses in response to stimulation, though even with no sound input, there are some sporadic, random firings. With sound input, there are more firings as pressure increases. Because the output cannot drop below the zero-sound-pressure level, there is a sort of half-wave filtering of the sonic input.

A model of the human auditory system has been built; it consists of a microphone and thirty 1/3-octave filters driving thirty envelope detectors. The output of this system can be connected to an oscilloscope and is the equivalent of a thirty-band, real-time spectrum analyzer. The key premise is that if a change in the pattern of the display is visible, the effect that caused it will be audible and, conversely, that any effect that does not change the display will not be audible. The model has been used in conjunction with a computer to recognize greatly varying speech patterns, which can be deciphered by humans but heretofore not reliably by computers.

Mark defined three timing resolution limits that had been derived. The first is difference left to right (precedence effect). This inter-aural time delay sensitivity is our primary localizer, and apparently we can resolve to as little as 10 μs. We can resolve no more than 600 μs, simply because that is the time it takes sound to travel around our head from the left to the right ear. The second is an approximately 1 ms limit to resolving a change within one band of the thirty-band system. The third is a 30 ms detection Iimit for a change that shows up across bands, such as a change in input wave form caused by shifting phase of the harmonic contents.

Repeating the premise that only changes visible in the thirty-band spectrum analysis output would be audible, Mark went back to the first demonstration, in which the phase of the 9 and 15 kHz harmonics in a 3 kHz fundamental square wave were varied. There was no visible change in the spectrum output, corresponding to no audible change. Considering all three sensitivities: there was no inter-aural time delay resolution possible, because the source was monaural from a single driver, the inband amplitudes of all three frequencies were steady, and the crossband relationships were steady. Q.E.D.

Mark then set up a second demonstration aimed at showing the sensitivity to inband amplitude changes caused by phase shift. The basic signal was a short pulse at a 400 Hz rate. This shows up as an amplitude spike every 400 Hz on a plot of amplitude versus frequency. First he reversed the phase of the 1200 Hz signal, which is about a half octave away from the 800 and 1600 Hz signals. Some little bit of the 1200 Hz signal is within the skirt passbands of the 800 and 1600 Hz filters, and vice versa. The result is minute changes in the amplitudes of these three filter outputs as the 1200 Hz phase is reversed. Mark then played back the complete signal, while switching the 1200 Hz totally in and out to sensitize the audience's ears. He then played back the signal while reversing the 1200 Hz phase periodically. Very few people claimed to hear a difference. Mark then did the same with the 12th harmonic at 4800 Hz. Here the distance between signals was about an eighth octave so the phase reversal of the 4800 Hz would have a significant effect within a single band. Again, he first switched the 4800 Hz in and out and then switched the phase by 180°, and most people clearly heard a difference. The model, therefore, seemed accurate.

There were then several questions from the floor concerning the effect of changing the speed with which the phase was varied and using angles other than 180°. The answers were that because a hi-fi system has a steady differential phase shift rather than a quickly varying one, the effect of that phase shift should be substantially lower than what was being observed in the demonstration, and smaller phase angles are both less noticeable and harder to accomplish for demonstration.

During the usual break, the members had an opportunity to experiment with another demonstration set-up. Peter Mitchell had suggested that time aligned speakers may give a better image. This might be true more because the phase lags were better matched between a pair of speakers than because the phase lag was constant for all frequencies within a single speaker. In theory, greater than 10 μs variations in arrival time (between speakers) could affect the apparent focus of the musical image. The demonstration consisted of a noise generator driving a stereo system with a pair of speakers and a set of headphones. The headphones should have provided the most steady source for comparison. The right channel was switched continually between a straight connection and the output of an Advent octave-band equalizer, which even at flat response generated significant relative time lags for particular frequencies -- e.g., +8000 μs at 20 Hz, +400 μs at 100 Hz, -33 μs at 250 Hz, and +97 μs at 315 Hz. The phase shift ran from -60° at 1 kHz to +20° at 20 kHz. Most listeners could detect very little or no change in the sound or the apparent source position.

Mark went on to describe the aural nerve action in more detail. It takes a minimum of 1 ms for a nerve to recharge after firing, therefore nerves cannot follow the envelope of high frequency sound, and the firings look constant with time for signals greater than 1 kHz. In other words, the firings lose sync with the input signal. Therefore, images may shift at low frequencies, but not at high frequencies. The ear can, however, be sensitive to low-frequency envelopes on high-frequency signals. Therefore, the shimmer, or low-frequency envelope of a cymbal, will provide image information, and, of course, all transients that are significant envelope modulations are very important to imaging. It is important to identify this modulation as a multiplier effect rather than the addition of a low- and high-frequency signal. If, for example, 5 kHz is modulated at 200 Hz, the effect will be a 200 Hz variation in the output amplitude of the 5 kHz filter. If, instead, a 200 Hz and 500 Hz signal are added, the 5 kHz filter output will be constant, and the 200 Hz will show up at the output of the 200 Hz filter.

The 30 ms crossband sensitivity seems somehow related to other short-term sensory memory times. Because the maximum phase shift on a continuous wave can't exceed one wavelength, the effect of crossband sensitivity should not be readily observable above 33 Hz, which has a period of 30 ms. Mark then performed a demonstration wherein he varied the phase of the harmonics of a signal at ever decreasing frequencies. The audience's threshold of audibility seemed to be around 20 Hz, with 2 Hz being very audible.

Mark summed up by grading the three sensitivities, his conclusion being that only the 30 ms crossband sensitivity is important when considering phase shift effects. He then mentioned a number of interesting associated points. With time delay systems, delays of under 30 ms are barely noticeable, and if much greater than 30 ms, a slap echo may be detected. (Note that the 30 ms is an average or approximate number and can vary with the individual listener.) The previously undiscussed middle ear is nonlinear and produces distortion products that may vary with phase shift. For example, if 200 Hz and 400 Hz signals are both applied, and the middle ear generates an 800 Hz harmonic distortion component on each, then if the phase between the 200 and 400 Hz signals shifts externally, the 800 Hz internally generated harmonics riding on these signals may add or subtract for a net change in amplitude. Therefore, middle ear distortion could indirectly generate a phase sensitivity.

Mark's conclusion for equipment was that phase correction in tape recorders is not needed, because they do not produce more than 1 ms of time shift, and the sensitivity limit of hearing is 30 ms. He also feels that phase linearity in loudspeakers is not important. Although there may be some difference in imaging, the effects of the room are substantially more important. There is, of course, a direct effect both within the speaker and in the room, where out-of-phase sound pressures between drivers or the direct and reflected sound can create dips in the frequency response or, conversely, when in phase, create peaks. These variations in amplitude are much more significant and readily apparent to the ear than the phase differences themselves. It is therefore important to be careful in the placement of the drivers within a speaker and the speaker within the room. It is also important to note that one can very easily detect peaks and dips in the frequency response of a loudspeaker in a room when using an audio oscillator, but that these substantial irregularities are barely, if at all, noticeable when listening to music.

Mark very briefly described some experiments which he will detail later concerning radiation patterns of loudspeakers, which he feels are vastly more important in aural effect than phase differences.

A Publication of the BAS

Commentary on
Peter Mitchell's Time Synchrony Presentation

Mark F. Davis

It is becoming increasingly evident that the (mis)information quagmire that exists in much of audio engineering today is unlikely to be relieved unless both investigators and audiophiles become conversant with two related areas. The two magic areas are:

- Classical electrical engineering systems theory: linearity, time invariance, Fourier theory, stochastic behavior;
- Psychophysics: the psychology of human perception.

Without taking these areas into consideration, it is virtually impossible to perform a controlled experiment that establishes anything at all. Unfortunately, a significant number of experiments reported in the audio engineering literature establish exactly that: nothing. And exactly because they fail to take these two areas into account.

The point of a controlled psychophysical experiment is generally to vary one physical parameter, observe its perceptual effect, and then ascribe a cause-effect relationship between the two. The key word is "one." If two or more perceptually significant parameters are varied concurrently, there is no basis for linking the perceived effect to just one of the parameters. This is true even when the experimenter is unaware of varying more than one parameter.

The design of a properly controlled experiment is thus an active examination of all possible relevant known parameters to make certain that undesired ones do not interfere, plus some reasonable argument as to why unknown, unspecified gremlins are not affecting the results. This is where the synthesis of psychophysics and systems theory becomes important. Each will suggest things to check, and it behooves one to check everything.

Even assuming knowledge of psychology and engineering, design of a truly airtight psychophysical experiment is something of an art, usually perfected only with much practice. This also applies to the process of appraising someone else's work, which may imply the need for a little self-education on the part of technically-oriented audiophiles desiring to distinguish the wheat from the chaff.

Rather than taking a detailed look at Peter Mitchell's compendium of experiments on the audibility of phase shift, let us consider just two experiments. These not only serve as examples of the application of psychology and systems theory to audio engineering, but also establish two central points about the possible relation of time synchrony to audible perception.

First Experiment

Much of Mr. Mitchell's argument seems to rest on an experiment involving the discriminability of two coincident pulses versus two pulses separated in time by a period of τ (tau) seconds. The two stimuli to be compared are illustrated in Fig. 1, where the arrows represent essentially zero-width pulses, and the numbers indicate their power; that is, both pulses contain the same total power. (Strictly speaking, they should be made equally loud regardless of whether the power is matched or not.)

The simple, perhaps simplistic, interpretation of this experiment is that we are varying the timing between two pulses, and that, as τ is increased from zero, we eventually reach a point

where the two separate pulses sound different from the two coincident pulses. This point, quoted by Mr. Mitchell to be about one millisecond, is assumed to be the threshold beyond which timing effects are audible. But are we indeed varying only one parameter, and is that parameter time synchrony?

Let us keep in mind that in speaking of time synchrony or time alignment we are speaking of maintaining the relative timing between different frequency components of an arbitrary, complex sound signal. Fourier theory says that we can express any signal as magnitude and phase-angle functions of frequency. Any constant time delay is of no perceptual significance, and therefore, given the phase function, we can remove any constant time delay from it. This will leave the actual variations of time synchrony as a function of frequency.

Let us apply these basic tenets of system theory and perception to the two stimuli in the coincident-delayed pulse experiment. By taking the Fourier transform of two pure pulses separated by an arbitrary delay T, we obtain the complex frequency response:

$$\text{Complex Frequency Response} = 1 + e^{j2\pi f\tau} \tag{1}$$

where e = *base of natural logarithms = 2.718 ...*
$j = \sqrt{-1}$
f = frequency in Hz
τ = interpulse delay in seconds.

The complex frequency response can be broken down into a magnitude and a phase function:

$$\text{Phase (degrees)} = \theta^{o} = \arctan\left[\frac{-\sin(360^{o}\tau f)}{1+\cos(360^{o}\tau f)}\right] \tag{2}$$

$$\text{Magnitude (dB)} = 20\log_{10}\left[2(1+\cos 360^{o}\tau f)\right]^{1/2} \tag{3}$$

Given the phase as a function of frequency, in general the time delay as a function of frequency is:

$$T = -\frac{\theta^{o}}{360^{o}f} \tag{4}$$

where T is the time delay in seconds of a phase shift of Θ (theta) degrees at a frequency of f Hertz. Phase synchrony is explicitly taken to be indicated by constant time delay, T, with variations in frequency, f.

The specific phase shift for the stimuli in question is given as a function of f and τ in equation 2. Plugging this into equation 4 and solving for the time delay, T, as functions of f and τ, yields:

$$T = \frac{\tau}{2} \tag{5}$$

For a given value of pulse separation, τ, there is an equivalent time delay, T, exactly half as long. What is surprising is that regardless of the value of τ, the time delay, T, (from equation 5) is always independent of frequency. All terms involving frequency, f, have cancelled out in deriving the equation. Once this time delay is removed from the phase function, the remaining phase shift is zero at all frequencies. Thus, for all values of τ, including $\tau = 0$, perfect time synchrony is preserved. We are not varying the one parameter we thought we were varying!

This is illustrated in Fig. 2 which shows plots of the phase shift, Θ, as given by equation 2 for $\tau = 0$ and $\tau = 1$ millisecond, the claimed threshold. Linear frequency coordinates are used to illustrate that in each case, the resulting plot is a straight line indicative of constant delay of all frequency components. Any deviation from perfect time alignment would show up as a deviation from constant slope on such coordinates. Whatever else we may be varying in changing the spacing between the pulses, we are not changing the time alignment.

What then does account for the observed perceptual discrimination of the stimuli illustrated in Figs. la and lb for $\tau = 1$ millisecond? The most probable, perhaps the only, explanation is

a

variations in the magnitude spectrum, that is, frequency response. The "Julian Hirsch syndrome" strikes again!

As can be seen from examining equation 3, the magnitude response is a strong function of both f and τ, except for $\tau = 0$, where a flat spectrum continuing out to infinite frequency obtains.

The response for finite values of τ is a comb filter. Equation 3 is plotted in Fig. 3 for frequencies between 10 Hz and 10 kHz and for $\tau = 0$ and $\tau = 1$ millisecond to show what happens. Spectrum levels have been adjusted for roughly equal total power in the two stimuli. As can be seen, there is a peak in the response at all frequencies which are multiples of $1/\tau$, in this case 1000 Hz (0, 1000, 2000, 3000, ... Hz), continuing out to infinite frequency. Exactly half way between each peak is a notch of infinite (dB) depth.

It is not hard to believe that such an alteration in response is audible; in fact, the "phasing" effects heard on some pop records are sometimes caused by just such a filter. But one might legitimately wonder why the effect didn't first become audible at smaller values of τ corresponding to fewer notches in the audio band. For example, an interpulse delay, τ, of 33 microseconds results in a single notch within the audio band at 15 kHz. It is conceivable that such a signal might be audibly distinguishable from a single pulse with a flat spectrum under optimal conditions.

One possible reason for the poorer than expected performance is the extremely short duration of the stimulus, which probably limits perceptual resolution significantly. Perhaps multiple presentation of each stimulus on each trial would permit higher resolution. In any case, the resolution is of frequency response, not time alignment.

Eventually, as the interpulse delay is increased enough, the two pulses will be heard as two distinct events. There is evidence that this does not become a factor until T is increased to about thirty to fifty milliseconds, well in excess of the variations in time synchrony encountered in any conventional loudspeaker. There is also some evidence that it is only at time misalignments of thirty to fifty milliseconds and higher that any audible aberrations are introduced in the timbre of music.

Second Experiment

Mr. Mitchell concedes the possibility that phase shifts of the order encountered in conventional music reproduction systems might not be sufficient to cause audible changes in timbre. He then hypothesizes that differences in time synchrony between left and right sides of a stereo system might lead to fuzzy imaging, an hypothesis which must be true if the alignment disparity is large enough. Imagine if everything above one kiloHertz came out of your right loudspeaker ten seconds late.

Mr. Mitchell suggests that in the case of loudspeakers, time alignment per se may not be important, but that unit-to-unit variation in time alignment may cause imaging problems. Unfortunately, he tries to tie what is basically an issue of quality control back into the topic of time alignment by hypothesizing that manufacturers of so-called time-aligned loudspeakers exert better quality control of this parameter, an hypothesis which is totally unsupported by any hard statistical data on the uniformity of different manufacturers' loudspeakers.

The ability of a conventional loudspeaker to produce a convincing image was tested in an experiment performed at MIT a few years ago. What was sought was an experimental protocol which gave some handle on the "goodness" of an image. After all, if one is to isolate the important factors leading to good imaging, it is important to be able to measure which speakers give better imaging than others.

The protocol chosen was fairly straightforward. A listener sat facing three loudspeakers (AR -4x's in this case) arrayed horizontally about ten feet in front of him, as if for three-channel stereo. Care was taken to insure that the three speakers were symmetrically placed and equidistant from the listener, who was instructed to keep his head as still as possible.

A monophonic music source was fed via a power amplifier and an A-B switch to either the two outer speakers or the center one. All levels were carefully matched. With the outer speakers on,

a phantom image was produced of the monophonic source exactly midway between the outer speakers where the center speaker was located. By switching between the outer speakers and the center speaker, one could effectively switch between a phantom source and a real source in the same position.

Tests were conducted in what was felt to be a fairly typical listening room. Listeners were instructed to alternate between the two switch positions as long as they liked and then indicate whether or not a difference, any difference, was discernible. Subjects consistently reported clearly perceivable differences between the two, usually after only operating the A-B switch a few times.

It is certainly possible on the basis of the test described to surmise that phase differences between the two outer loudspeakers produced an imperfect, hence discriminable, image. Once again, however, there are alternate explanations which fit the available facts. For example:

- Differences in frequency response among the three speakers could cause, or at least contribute to, discriminability.
- Differences in the room reverberation pattern between the outer speakers and the single center speaker might also be important.

The latter possibility seemed especially promising, because the phantom image often sounded more "echoey" then the real image. Even its proponents concede that if differential (left-right) phase alignment is to be of significance to imaging, its effect must be because of the direct (first arrival) sound, as the phase shift associated with the reverberent sound is astronomical, regardless of the speaker used.

We contrived to eliminate this parameter (reverberation) by repeating the experiment in an anechoic chamber. The same speakers and associated equipment were used. Each speaker was kept in exactly the same relative position. Any possible disparities in frequency response and phase integrity remained intact. When the protocol was now repeated, subjects reported that they could no longer differentiate between the real and phantom images.

This experiment does not rule out the possibility that differences in Unit-to-unit phase response could in some speakers produce impaired imaging. It does demonstrate that speakers as mundane as AR-4x's are capable of "perfect" imaging in anechoic space. It illustrates again the need to actively seek out all possible experimental hypotheses. And it firmly establishes that reverberation in the listening room is predominant in establishing perceived imaging. It calls into question any study purporting to link time alignment to imaging unless the study was performed in anechoic space.

What can we conclude from all this? In general, the not uncommon practice in some audio engineering circles of publishing conjectural hypotheses based on "informal" or nonexistent listening experiments is not only inefficient, but actually counterproductive, because it results in the promulgation of fallacious information. This state of affairs is unlikely to improve unless audio engineers become proficient as a group in applying principles of the disciplines of human perceptual psychology and electrical engineering systems theory in resolving fundamental issues of audio engineering. When these principles are applied to reported studies on the audibility of phase shift (time alignment, time synchrony, etc.) one finds that, virtually without exception, the reported experiments are either improperly controlled (alternate hypotheses are possible) or fail to establish their results as being relevant to the reproduction of music by commercial high fidelity systems, circa 1977. In short, there appears to be no concrete data to indicate that phase shifts of the type and quantity found in such reproduction systems have any effect on timbre, imaging, depth, or any other perceivable sound quality.

Caveat emptor.

a

Figure 1a

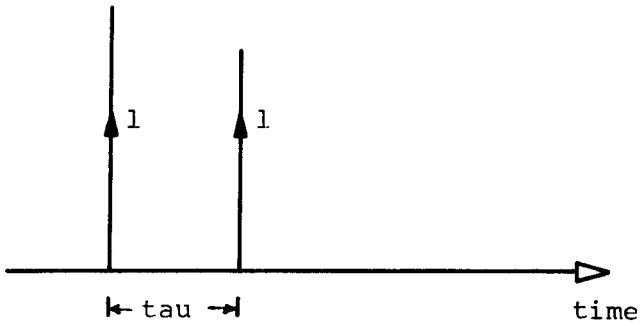


Figure 1b

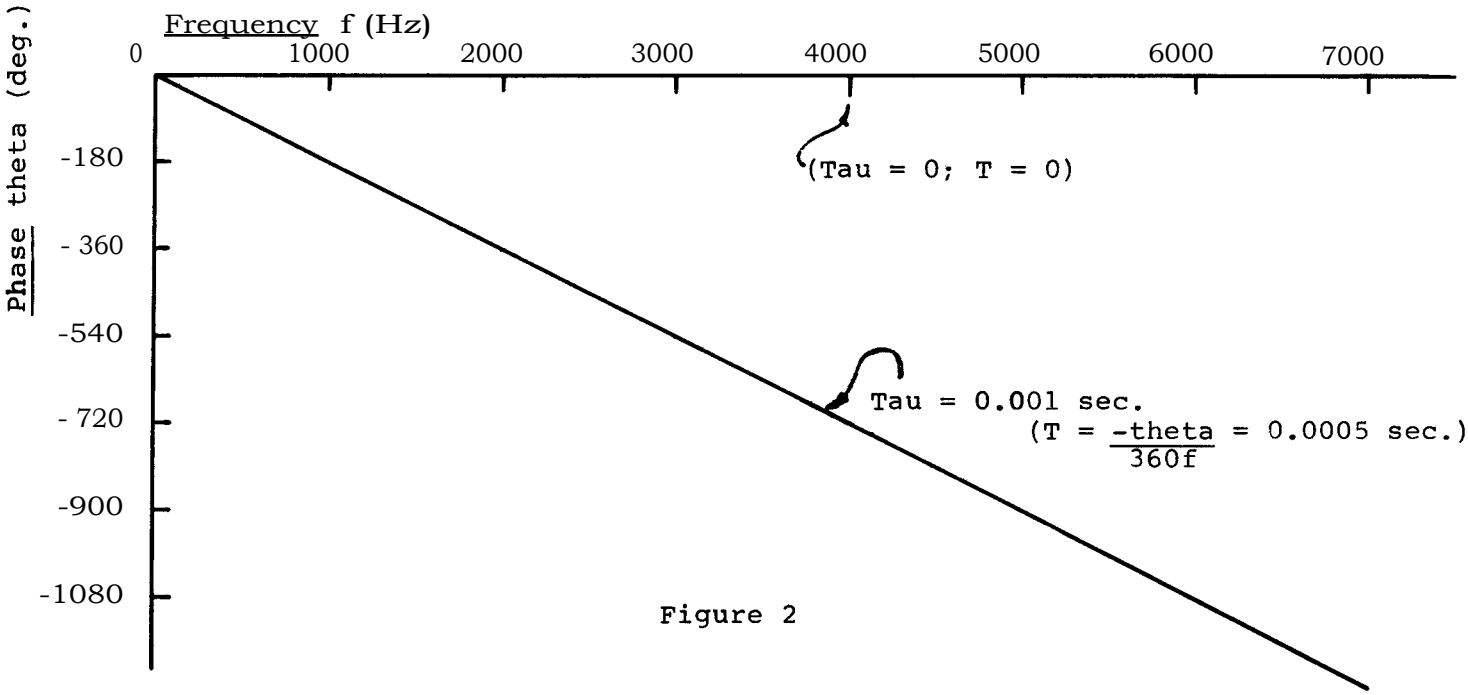


Figure 2

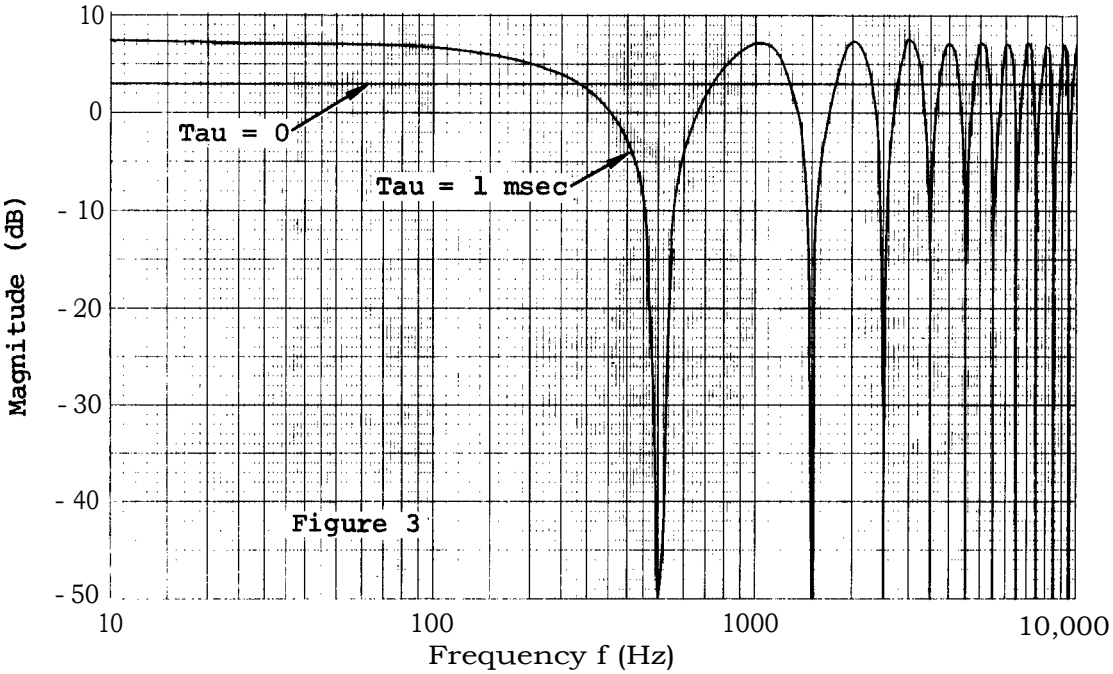


Figure 3

Guide to The BAS Speaker, Volume 4

October 1975 - September 1976

Compiled by Mike Riggs

This guide is in the form of a table of contents covering Volume 4 of the Speaker. A table covering Volumes 1 and 2 appeared in the December 1974 issue; another in the December 1975 issue covers Volume 3. The following abbreviations are used: S - guest speaker, P - publication, N - short note, R - recommended recording. Certain regular features, such as "In this Issue" and "In the Literature, " are omitted.

N: Another Record Cleaning Device (Gupta, Borden)
N: A Wire-Wound Delay Line (Shanefield)
N: Calibrating Your BAS Oscillator (see also 7/74, Pub; 8/75, Pub; 10/75, p. 4) (Borden)
R: A Review of the Latest Sheffield: "Lab II" (Foster)
N: The Exodus of Advent Averted (Zwicker)
N: The Idea File -- Driving Loudspeakers, Servo Woofers, Power Meters, Spectrum Analyzers, and Comparison of Record Cleaning Devices (Saklad, Borden)
S: Tom Holman: New Factors in Preamplifier Design
P: How Preamps Compare Using the Holman Tests, Alvin Foster and Mark Davis
P: The Holman Tests -- Missing Specifications?, Alvin Foster
P: The Holman Tests -- Some Questions and Answers, James Brinton
(For the above four items, see also 12/75, pp. 203; 1/76, pp. 3-6; 2/76, pp. 7-8; 4/76, pp. 8-10)

Dec. 1975, No. 3
N: More Holmania (see also 11/75, Pub; 1/76, pp. 3-6; 2/76, pp. 7-8; 4/76, pp. 8-10) (Brinton)
N: BEEPer's Workshop
N: Audio Equalizer from ACE
N: Sound Advice to Sound Advice Subscribers (see also 1/76, p. 3; 6/76, p. 5)
N: Dynaco Stereo 400 Modification (Boyer)
R: Going on (About) Record(s) -- PCM, MHS and Insight (see also 4/76, p. 5; 7/76, p. 3; 8/76, p. 16) (Brinton, Garfinkle, Riggs, Leonard, Erickson)
N: The Dual 1249: A Brief User's Report (Feinstein)
N: More on Phono Cable Capacitance (see also 6/75, pp. 8-9; 10/75, pp. 4-5; 1/76, pp. 9-10; 3/76, p. 4; 7/76, p. 3) (Kobziar)
N: Cartridge Capsules -- Sonus Blue Label and ADC-XLM Mk. II (see" also 7/76, pp. 9-10) (Stake, Brinton, Riggs)
N: X-Rays and Your Color TV (Foster)
N: Noted at the AES Show (Saklad)
N: The Fulton J Modular -- Background and Review (see also 2/76, p. 10; 5/76, p. 4; 6/76, pp. 12-13) (Fretz)
N: Room Placement of Folded Horns (Nichol)
N: The Idea File -- Cost and Price (Saklad)
N: Book Reviews -- Audio Alternative (see also 3/76, p. 3) and Modern Recording magazine (Riggs, Garfinkle, Lewis)
S: David Griesinger: Reducing Distortion in Tape Recorders
P: Amplifier Pricing: Dollars per Watt or Dollars per dB?, Tom Mashey (see also 1/76, p. 3; 2/76, pp. 8-9; 3/76, pp. 7-8, Pub)
P: Guide to The BAS Speaker, Volume 3

Jan. 1976, No. 4
N: Speaker Articles for the Speaker (Brinton)
N: Spring Reverb Revisited ... Visited ... Visited (see also 11/75, pp. 7-8) (Shanefield)
N: S/dB at Four Ohms (see also 12/75, Pub; 3/76, pp. 7-8, Pub) (Riggs)
N: The Continuing Saga of Sound Advice (see also 12/75, pp. 3-4; 6/76, p. 5) (Riggs)
N: Preamplifier Testing (see also 11/75, Pub) (Holman)
N: How to Identify Edgy and Good-Sounding Preamps (see also 11/75, Pub; 1/76, pp. 3-6) (Foster)
N: The Rectilinear III Revisited (see also 9/75, pp. 7-8; 3/76, p. 7; 8/76, p. 10) (Bauza)
N: KEF 104 Loudspeakers (see also 6/76, pp. 12-13) (Riggs)
N: More on Headphone Amps (see also 6/75, Pub; 8/75, pp. 10-11) (Sprague)
N: Disc Exporters (see also 11/75, pp. 2-3) (Robinson)
N: The Shanefield Report on Cable Capacitance (see also 6/75, pp. 8-9; 8/75, p. 9; 12/75, p. 7; 3/76, p. 4; 4/76, p. 11; 6/76, p. 10) (Shanefield)
N: Chrome Cassette Tapes: Are They Really All the Same? (Satz)
N: Reeling Them In (Shanefield)
N: An Amplifier for Quad ESL's (Robinson)
N: Feedback Damper (see also 2/76, p. 6; 5/76, p. 3) (Robinson)
N: Book Reviews Solicited (Riggs)
P: The Ride of the New Jersey "Epistemologiphiles" (see also 6/75, p. 7; 8/75, p. 9;

10/75, pp. 9-11; 3/76, p. 5; 4/76, p. 8; 6/76, pp. 8-9), Daniel Shanefield and John Sprague

P: Cartridges: Supex SD900/E Versus Shure V15-III, Alvin Foster and Ira Leonard (see also 3/76, p. 8; 4/76, Pub; 7/76, pp. 10-11)

P: Improving the High-End Sound of Your Loudspeaker System, Robert Graham (see also 3/76, pp. 6-7)

Feb. 1976, No. 5

N: What's Selling In and About the BAS

N: Attention Detroit Area Audiophiles

N: More on Damping Feedback (see also 1/76, p. 14; 5/76, p. 3) (Roboff)

N: Audio International (see also 4/76, p. 3; 6/76, p. 5; 7/76, pp. 2-3) (Sherwood)

N: Wilmex (and Stax) Recommended (Tooley)

N: A Note on Quad (see also 1/76, p. 14) (Tooley)

N: More on the Holman Tests (see also 11/75, Pub; 12/75, pp. 2-3; 1/76, pp. 3-6; 4/76, pp. 8-10) (Lipshitz)

N: The Holman Interaction Test: Two Views (see also 11/75, Pub; 12/75, pp. 2-3; 1/76, pp. 3-6; 2/76, p. 7; 4/76, pp. 8-10) (Foster, Spiegel, Holman)

N: $/dB Altec Style (see also 12/75, Pub; 1/76, p. 3; 3/76, pp. 7-8, Pub; 4/76, p. 5) (Thoroman)

N: Additional Comments on Amplifier Power (see also 10/74, pp. 5, 9-10; 12/75, Pub) (Craig)

N: Comments on Fulton Speakers (see also 12/75, pp. 10-11; 5/76, p. 4; 6/76, pp. 12-13) (Johnson, Thoroman)

R: On Record (Johnson, Beagle, Leonard)

N: D-Stat by Discwasher (Green)

N: Problem with the Stanton 681EEE (Green)

N: Capitol Music Tape -- Cautions (Green)

N: Advent/Wollensak (Green)

N: Help Needed on Tone Arm Damping (Green)

N: An Antenna for AM Listening (Green)

N: A Plug for Maintenance (Atwater)

N: Hearing the Difference (Sherwood)

N: Teac and dbx (see also 11/75, p. 6) (Beagle, Brinton)

N: Old or New Advent 201? (Vicari)

N: BAS Membership Preference Questionnaire

S: Phil Collella of ESS

P: The Dynaco PAT-5 Preamplifier: A B.A.S. Users' Report, Michael Riggs and Harry Zwicker

P: Dayton-Wright XG-8 Electrostatics: A B. A. S. User's Report, Collins Beagle (see also 5/76, p. 5)

Mar. 1976, No. 6

R: A Recommended Recording: Beethoven by Kleiber (Shanefield)

N: Levinson JC-1 at Low Battery Voltages (Seto)

N: RFI: The Constant Complaint (see also 8/76, pp. 12-14) (Zwicker)

N: Feedback on Service: Satisfaction with EV (Wolf)

N: Cable Capacitance (see also 6/75, pp. 8-9; 8/75, p. 9; 12/75, p. 7; 1/76, pp. 9-10) (Leonard)

N: Domestic Power MOSFET (Leonard)

N: A-B Testing and "Golden" Versus "Tin" Ears (see also 6/75, p. 7; 8/75, pp. 8-9; 10/75, pp. 9-11; 1/76, Pub; 4/76, p. 8, Pub; 6/76, pp. 8-9) (Sprague)

N: Stereo Woodworking (Seto)

N: Ionovacs and Electrostatics (see also 1/76, Pub) (Lipshitz, Graham)

N: The Rectilinear III: Three Versions of One (see also 9/75, pp. 7-8; 1/76, p. 8) (Elwell)

N: $/dB and Product Pricing Formulas (see also 12/75, Pub; 1/76, p. 3; 2/76, pp. 8-9; 3/76, Pub) (Barrett, Zwicker)

N: Three Moving-Coil Cartridges (see also 1/76, Pub; 4/76, Pub; 7/76, pp. 10-11) (Foster)

N: Onkyo 4055 Tuner (Temple)

N: Book Review: Hi-Fi in the Home (Lipshitz)

N: Modern Recording Techniques at Discount

b

S: Henry Niklas, Clint Van Arsdale, Gene Leger and Scott Kent: Hi-Fi Servicing
P: Dollars and dB Revisited, Dana Craig (see also 12/75, Pub; 1/76, p. 3; 2/76, pp. 8-9; 3/76, pp. 7-8)
P: A Filing System for Audio Articles, John E. Gombos
P: The KMAL M9BA Mk. III Tone Arm: A B.A.S. User's Report, Michael Riggs (see also 4/76, pp. 11-12)

Apr. 1976, No. 7
N: Marshall Leach Low-TIM Amplifier (see also 7/76, p. 3)
N: Erratum: Audio Alternative (see also 12/75, pp. 13-14) (Riggs)
N: Is Audio International a Fraud? (see also 2/76, p. 6; 6/76, p. 5; 7/76, pp. 2-3) (Deen)
N: Hold Off Before Buying Sound Guard (see also 5/76, p. 4; 8/76, pp. 7-8) (Foster)
N: What About the Music? (Thoroman)
N: Zerostat (Fulton)
N: Preener Storage (Robinson)
N: Bi-Amping and Tri-Amping (see also 2/76, p. 8) (Nicholakakos)
N: Telefunken Cassettes (Lu)
N: BAS Record Importing Service
R: For Tchaikovsky Lovers (Isveck)
R: An Orchestral Test Record (Thoroman)
R: More on Telemann by Rampal (see also 12/75, p. 5; 7/76, p. 3; 8/76, p. 16) (Beagle)
R: Penguin Stereo Guide (see also 5/76, pp. 5-6; 6/76, p. 6; 7/76, p. 7) (Leeming)
R: Louis Marchand Organ Works (Griesinger)
R: Another Private-Edition Record (Mitchell)
N: Double-Blind Testing and Psychoacoustics (see also 6/75, p. 7; 8/75, p. 9; 10/75, pp. 9-11; 1/76, Pub; 6/76, pp. 8-10) (Mashey)
N: Preamp Test Update (see also 11/75, Pub; 1/76, pp. 5-6) (Davis, Holman)
N: Preamp Loading Problems (Kent)
N: A Correction on Phono Input Capacitance (see also 1/76, pp. 9-10; 6/76, p. 10) (Mitchell)
N: Addendum to Review of KMAL Arm (see also 3/76, Pub) (Riggs)
N: Toyo Model 67 Self-Contained Peak Level Meter (Zwicker)
N: BSR FEW-III Equalizer (Zwicker)
S: Steve Phillips, Bernard Gaines and Jake Rabinow: Harman/Kardon Products (see also 7/76, p. 9)
P: It's Even More Complex Than You Thought, Elliott Berger (see also 1/76, Pub; 3/76, p. 5; 6/76, pp. 8-9)
P: Levinson JC-1 Versus Fidelity Research FRT-3: A Comparison, Steven L. Seto (see also 1/76, Pub; 3/76, p. 8; 7/76, pp. 10-11)
P: The Tawdry Turtle Amplifier, Robert Graham

May 1976, No. 8
N: An Interesting New Amplifier (Bell)
N: A Preamp-Cartridge Switchbox (Lahti)
N: Micro-Seiki Mounts (see also 1/76, p. 14; 2/76, p. 6) (Roboff)
N: Empire 598 Turntable (Riggs)
N: Sounding Off on Sound Guard (see also 4/76, p. 4) (Gupta)
N: More on the Fulton J (see also 12/75, pp. 10-11; 2/76, p. 10; 5/76, pp. 12-13) (Fretz)
N: Update on Dayton-Wright Speakers (see also 2/76, Pub) (Beagle)
R: Ensayo on MI-IS (see also 7/76, p. 7) (Gupta)
S: Peter Pritchard: Sonus Cartridges and Cartridge Design
P: A Subject Guide to The BAS Speaker, John E. Gombos (see also 3/76, Pub)
P: Some Notes on Tone Arms: Effective Mass and Seesaw Frequency, Michael Riggs
P: Transcriptors Turntable with Vestigal and SME Arms: A B.A.S. User's Report, Mark Dimirsky
P: The Formula 4 PLS4/D Tone Arm: A B. A. S. Users' Report, Jeffrey S. Nelson and Dow O. Williams (see also 7/76, pp. 9-10)
P: The Phase Linear 1000: A B.A.S. User's Report, Steven L. Seto
P: The Quad 405 Current Dumping Amplifier: A B. A. S. User's Report, Nate Garfinkle (see also 3/76, p. 13; 6/76, p. 12; 7/76, p. 11)

June 1976, No. 9
- N: BAS Officers and Publications Staff
- N: DAK Tape (McCarthy)
- N: The Case Against Audio International (see also 2/76, p. 6; 4/76, p. 3) (Deen)
- N: Direct Equipment Import (Robinson)
- N: Sound Advice/International Audio Review Fission Unraveled (see also 12/75, pp. 3-4; 1/76, p. 3) (Puccio)
- N: The CSO
- R: Penguin Stereo Guide -- Part III (see also 4/76, p. 6; 5/76, pp. 5-6; 7/76, p. 7) (Leeming)
- R: Good Vinyl: "Unrehearsed Experiment" and Imported Decca (Puccio)
- R: Looking for that Low End (see also 11/75, p. 6)
- R: Nonclassical Classics (Beagle)
- N: Feedback from Authors: Epistemology (see also 6/75, p. 7; 8/75, p. 9; 10/75, pp. 9-11; 1/76, Pub; 3/76, p. 5; 4/76, p. 8) (Berger, Sprague)
- N: Otala Reports on TIM Measurements (see also 4/75, p. 8) (Otala)
- N: Input Capacitance: A Reply (see also 1/76, pp. 9-10; 4/76, p. 11) (Shanefield)
- N: Double-Blind Testing: A Reply (see also 4/76, p. 8) (Shanefield)
- N: Consumers Union (Puccio)
- N: Oscillator Queries (see also 7/74, Pub; 8/75, Pub; 10/75, Pub) (Bauza)
- N: Help Wanted: Antenna Advice (Garlitz)
- N: The Quad 405 Gains Another Fan (see also 3/76, p. 13; 5/76, Pub; 6/76, p. 12; 7/76, p. 11) (Shedd)
- N: More on the Quad 405 (see also 5/76, Pub; 6/76, p. 12) (Garfinkle)
- N: KEF 104, and Fulton 80 and J Loudspeakers (see also 12/75, pp. 10-11; 1/76, p. 8; 2/76, p. 10; 5/76, p. 4) (Puccio)
- N: B&W Loudspeakers (Sherwood)
- N: Some Impressions of the New I. M. Fried Loudspeakers (Eastman)
- N: The Beveridge Loudspeaker/Amplifier System (Disend)
- N: Helpful Hints for Speaker Builders (Bauza)
- S: Gordon Gow, Sidney Corderman and Roger Russell: McIntosh Products and Phase Shift
- P: A Test for Preamplifier Audio Quality, Alvin Foster

July 1976, No. 10
- N: More on Audio International (see also 2/76, p. 6; 4/76, p. 3; 6/76, p. 5) (Brinton)
- N: Low-TIM Amplifier Kit Delayed (see also 4/76, p. 1)
- N: Correction on Sony Cable Capacitance (see also 12/75, p. 7) (Weinberg)
- R: PCM Again (see also 12/75, p. 5; 4/76, p. 5; 8/76, p. 16) (Lipshitz)
- N: Other Audio Societies (see also 2/76, p. 5) (Brinton)
- N: The Digital World Approaches (Saklad)
- N: More on Audio Epistemology (Bowser)
- N: Mahler Festival in New York (Sarper)
- R: Penguin Stereo Guide -- Part IV (see also 4/76, p. 6; 5/76, pp. 5-6; 6/76, p. 6) (Leeming)
- R: Record Recommendations -- Ensayo/MHS (see also 5/76, p. 6) (Phillips)
- N: Japanese Products (Sayanagi)
- N: A Magazine That Couldn't (?) Happen Here (Sayanagi)
- N: Biting Back at "Jaws" (see also 4/76, pp. 18-19) (Lipshitz)
- N: Problems with Moving-Coil Cartridges (Garfinkle)
- N: Sonua/Formula 4/AR Combination (see also 12/75, p. 8; 5/76, Pub) (Henry)
- N: Minority Report on Shure Versus Supex (see also 1/76, Pub; 3/76, p. 8; 4/76, Pub) (Puccio)
- N: Quad 405 Addendum (see also 3/76, p. 13; 5/76, Pub; 6/76, p. 12) (Lipshitz)
- N: A Turn-On/Off Transient Eliminator (see also 7/76, pp. 12-13) (Shedd, Borden)
- N: Another Transient Eliminator (see also 7/76, pp. 11-12) (Lahti)
- S: Geoff Langdon of AKG: Microphones
- P: A New Method for Estimating Phase Distortion and Experiments in Phase Audibility, Daniel Shanefield
- P: Speaker Wiring: What Size Wire is Sufficient?, Roy Cizek