THE B.A.S. SPEAKER

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In This Issue

April is a month for just about everyone.

For the theoreticians, North Carolina member Elliott Berger corrects the common assumption that the Fletcher-Munson curves are state of the art, and describes the more accurate Robinson-Dadson data that shows our hearing is less frequency-sensitive than we may have thought. And there is a note by Scott Kent about what your tape recorder may be doing to your preamp—when the tape recorder is turned off.

For the hardware addicts, California member Steve Seto compares the Levinson JC-1 pre-preamp and the Fidelity Research FRT-3 transformer used with a Supex SD-900E. Harry Zwicker provides two brief notes on the Toyo peak-reading meters and the BSR/Metrotec FEW-3 equalizer. And appropriately bringing up the rear is Bob Graham's review of a revolutionary new amplifier.

For those who like to have something to play on their systems, we have an unusually large and varied record review section, with mention of some fine records produced by BAS members.

And for the bargain hunters, Ken Deen provides a sobering caveat concerning Audio International, the recently advertised West German mail-order house.

Marshall Leach Low-TIM Amplifier

At Audio Forum we are forming a "Leach amplifier users' group" for those members interested in building the amplifier described in the February issue of Audio. I would like to hear from BAS members interested in building this amplifier. I am especially interested in how they got or are getting the semiconductors. I have ordered the lower cost components in quantity, but the driver and output transistors cost too much for me to bear the investment. If we can get enough people together, we will quantity order the parts needed to complete the amplifier. Anyone interested should write to: Damon Hill, 3261 Circle Oak Drive, NW, Atlanta, Georgia 30339.

Membership dues are $12 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.

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For Sale

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

- Teac A-360S cassette deck, four months old, perfect condition, $225 or best offer. David Sherwood, (609) 466-3697 (call collect).
- Citation 12, one year old, $225; Advent 201, one year old, head in very good condition, $225; Advent 202, 1½ years old, factory modified, $125. Jeff Stake, 394 W. Iowa St., Urbana,Illinois 61801.
- Romagna-Kelly Mk. II ribbon horn tweeters (four), all with new ribbons, $50 each or will trade for dbx 119 or similar. John Civitello, 83 Murray St., New York, N.Y. 10007; (212) 962-2686.
- Heath W-5M mono tube amplifiers with WA-P2 preamps (two), Dynaco DSC-1 stereo control (mono inputs to stereo outputs), all for $45 plus shipping. Mike Drennan, 17th Company, U.S. Naval Academy, Annapolis, Maryland 21412.
- Quad 303 amplifiers (two), $175 each; Dynaco PAS-3X preamp, $75; Pickering ESL panel, 400-Hz crossover and power supply, make offer; Electro-Voice 6HD 600-Hz horn and driver, $50; University 4409/T30 driver, 700 Hz, $25; Janszen 150C woofers (two), $25 each; Electro-Voice T35 tweeter, $25; Concord DBA-9 Dolby noise-reduction unit, $40; JBL N1200 crossover, $25; two Sieler folded horn corner enclosures, with Stephens woofers and 824H horns, T15 drivers, and 800-Hz crossovers, $150 each negotiable. N. M. Garfinkle, 141 Greenway Drive, Walnut Creek, California 94596.
- Revox A77 Mk. III, carrying case, remote control, new heads, Scott Kent low-noise modification. Al Foster, 296-2622 evenings or 444-4100 ext 263 days.
- Pioneer SE-700 headphones, new, with warranty card; J. E. Sugden C.51 preamp, new; J. E. Sugden P.51 power amps (two), demos, under 20 hours use, class A, switchable for mono use, 100 watts, 8 ohms; Sony ST5000FW, walnut case, immaculate, under 30 hours use; B&W DM70 loudspeakers, dark teak, under warranty. Ross Robinson, 8888 Riverside Drive East, Windsor, Ontario, Canada N8S1H2; (519) 945-8486.
- Tandberg 9200XD, $699; Braun TG-1000-4, $549; Ohm-F (new), $700; Dyna Stereo 70, $55; Dyna PAS-2X, $40; AR-2, $40; Quad ESL, $245; McIntosh C24, $165; Klipsch Heresey, $295; Acoustech VII, $150. Robert Heenan, 1906 Beacon St., Brookline, Mass. 02146; (617) 731-0140 evenings.
- Records for the record collector. A large number of 78-rpm recordings, many in mint condition. For a complete list, send a SASE to David Weinberg, 7206 Valley Country Ct., Rockville, Maryland 21208.
- Norman Laboratories acoustic equalizer, model 5; complete with original box, instruction manual, and four connecting cables; $50 including shipping anywhere in U.S. Review of this unit in Hi-Fi Newsletter, Vol. 2, No. 6, available if interested. James Yount, 111 Third Ave., Apt. 13J, New York, N.Y. 10003; (212) 533-8477.

Charles Martin Loeffler House for Sale

Although we wouldn't normally run real estate ads, we felt that the property described below has enough special appeal to audiophiles and music lovers to justify its inclusion.

MEDFIELD. Acoustically designed 18 x 32 x 15 living room highlights a beautiful and expensive antique colonial on South Street extension. The original house was built in 1847; the living room with large central fireplace was added about 1900 by Charles Martin Loeffler (1861-1935), a then-prominent disciple of Brahms, whose works were often performed by the BSO. (Loeffler used the room as a music studio.)

The house has six rooms, 1½ baths, full basement and attic, screened porch, forced hot water gas heat, low taxes. In addition, there is a two-story 30 x 33 barn with a 22 x 24 attached two-car garage with loft. Also a separate 16 x 22 heated studio, recently refinished and used as an office. The house is situated on 1½ nicely landscaped acres.

Medfield is 18 miles southwest of Boston; the abutting towns are Dover, Sherborn, Millis, Norfolk, and Walpole.

Call Hal or Sheila Cail evenings at (617) 359-4631.

Wanted

- A good reel-to-reel tape recorder. N. M. Garfinkle, address above.
- Kensonic Accuphase T-100 AM/FM-stereo tuner or Luxman ST-310 AM/FM-stereo tuner with Dolby B; Quad AM11; Quad AM3; Dynaco Quadaptor; Revox A700 repair manual; 1/2-track, 7½-ips prerecorded tapes. Ross Robinson, address above.
- AR amplifier, any condition, price negotiable. Ken (617) 646-3427.

Erratum

In my review of Mark Tobak's Audio Alternative (BAS Speaker, Dec. 1975) I claimed that the Harman/Kardon Citation 11 has a standard low-cut filter. This once was the case, but Harman/Kardon's marketing representative tells me that it's now a true infrasonic filter, with a 25-Hz knee. My apologies to H/K and to Mr. Tobak. — Michael Riggs (Massachusetts)

Is Audio International a Fraud?

A recent issue of the BAS Speaker called attention to an ad in Audio for a West German mail-order house, Audio International, that advertised Revox A77's for $499. I wrote to them for more information. After receiving their reply and checking with several BAS members, I found that no one had had direct experience with AI, but that some seemed to think it was reputable. Being basically a trusting soul and an eager beaver, I sent AI a bank-certified check along with an order for a Revox A77. Soon afterward I heard a rumor that AI was a fraud. After an intensive telephone investigation, I still have no definite proof one way or the other, but here is what various people have told me.

J. Peter Lazarus, a Revox sales representative, claims that AI is crooked. Of course, Mr. Lazarus is hardly in a neutral position, since he has a strong interest in convincing people to buy locally.

I called the Revox factory in West Germany. They are aware that AI exists but have no information as to their honesty. They claim that AI is not getting Revoxes from their factory nor from either of the two Revox distributors in West Berlin.

The German/American Chamber of Commerce in New York has no information on German mail-order houses except phone numbers, but they have no number for AI. Neither does West Berlin directory assistance. So there's no apparent phone and the only address is a post office box.

A member of Audio magazine's editorial staff claims that AI owes Audio over $2000 and that AI has not responded to Audio's efforts to contact them and collect. Audio has quit running the ads. The spokesman said that it is his understanding that AI is under investigation for fraud, though he did not say by whom. He also says that he has letters on file from people who sent money and never received goods, although he declined to give names.

If anyone out there has any additional information about AI, please call me at (617) 646-3427 evenings or write via P.O. Box 7. I will keep the BAS posted on any further developments.

— Ken Deen (Massachusetts)

[Note: BAS members should note that the foregoing piece consists entirely of hearsay evidence; that's not to attack Ken Deen's integrity, but rather to keep things in perspective and to avoid any potential legal problems that might stem from publishing such an item. The BAS

now is trying to get some form of confirmation for the allegations in Deen's note, but we are having as much trouble with our sources as Deen had with his. We will note, however, that as presented, Deen's material passes the Woodward-Bernstein test of dual confirmation of information that was the basis of their decisions to publish or not during the Watergate era. Thus, while we cannot say with certainty that AI is a firm without merit, we would suggest that members planning to order from them would be well advised to wait until the smoke clears. If we find that AI is a legitimate operation, we will be very happy to print a retraction. — Jim Brinton]

Hold Off Before Buying Sound Guard

Preliminary testing of the new Sound Guard record lubricant indicates that it does affect the sound of the music. Ira Leonard and I independently came to the conclusion that Sound Guard definitely does reduce surface noise, as claimed. We also agree that a treated record does indeed sound smoother and less edgy, but we disagree as to why. Ira felt that the smoothness is a simple result of the quieter surface. However, I concluded that the change in sound was due to a deadening of the attack transients. We plan to continue with more objective analysis, but for the time being, I advise caution. — Al Foster (Massachusetts)

[Ed. Note: The smoothed attack transients could be due to reduced stylus-groove resonance effects. This would occur around 18 kHz and would show a reduction in high-end brightness and more subdued attack transients.]

Letters

What About the Music?

I think that the poor showing of "musical topics" in spite of requests for more indicates that most of us audiophiles are equipment/reproduction oriented as opposed to musically oriented. I have attempted to convince friends that I am more interested in music than equipment, but (partly due to their efforts) I don't believe that this is true. If I were primarily a musician, I'd be playing or attending more concerts. While I enjoy music tremendously, I also enjoy the thrill of realistic sound reproduction in my home, and I suspect that most of the members of the BAS have a similar orientation. The expressed desire to learn more about music probably indicates that were it not for music, we wouldn't have much of interest to reproduce on our fancy equipment. (I might add that I don't think the goal of increased accuracy in reproduction needs to be apologized for, or justified.) — Jim Thoroman (New Hampshire)

Zerostat

I'd like to share my experience with a product, Zerostat, from Discwasher, that has done everything I hoped it would do. The last place I lived apparently was the South Carolina generating point for static, and made records almost impossible to play enjoyably. Washing didn't work, Preeners and Dust Bugs didn't work, and neither did swearing or abstinence. Zerostat did though, to perfection! It was literally unbelievable, and fully justified its high price, at least to me. If you've got problems with static, this thing ought to do the trick. — Allan Fulton (South Carolina)

Preener Storage

A suggestion for storing the Watts Preener. Take the Preener from the original plastic tube and place in a slightly larger diameter container at least 41/8 inches high (large size capsule container, bottle, etc.). The velvet plush is squashed down in the regular Watts tube.
— Ross Robinson (Ontario)

Bi-Amping and Tri-Amping

Jim Thoroman, in his comments about the booklet published by Altec on biamplification (BAS Speaker, Feb. 1976, p. 8), asks if anyone can justify Altec's claims. Mr. William Gordon, in his article "All About Tri-Amping and Bi-Amping" in the March-April 1976 issue of Hi-Fi/Stereo Buyer's Guide (p. 48), does an excellent job of explaining how three 10-watt amplifiers in a tri-amped system are equivalent to one 90-watt amp. — Peter Nicholakakos (New York)

Telefunken Cassettes

Recently, Telefunken prerecorded cassettes have appeared in a few California stores. They use chromium dioxide tape and Dolby. The few I have listened to have good sound, better than the usual prerecorded cassettes, but not as good as Advent's. They compare favorably with the disc version of the same recording; however, Telefunken discs are among the best pressed I have, so the difference is not striking. Nevertheless, they are the best cassettes I have heard from a major record company. — Cary Lu (Massachusetts)

Record Reviews

BAS Record Importing Service

Dr. Brian Leeming is continuing to take orders for records to be purchased from England. As noted before, while orders may be placed via mail, records must be delivered at meetings. All orders should be pre-paid (checks payable to Dr. Leeming). Each month Dr. Leeming will supply a list of recommended records gathered from The Gramophone. If other records are desired, please provide the needed data, including record number and list price. So far not too many members have used the service; for it to be practical to continue, more record orders are needed.

For Tchaikovsky Lovers

The fifth symphony of Peter Ilyitch on Philips 6500922 is to me splenderous [sic]. The Concertgebouw's rendition under Haitink is a performance not be missed. The dynamic range has extra width that is immediately apparent; the openness of the winds, the lush strings combined with that super brass section are marvelous. This disc is as clean and clear as one is likely to hear. — Stuart Isveck (Massachusetts)

An Orchestral Test Record

I have a suggestion for an orchestral "standard test record": the Turnabout recording (TV 341455) of the Rachmaninoff "Symphonic Dances." The excellence of this recording is apparent even on bad phonographs, and it's a stunner on good ones. It's widely available and cheap. — Jim Thoroman (New Hampshire)

More on Teleman by Rampal

Has the experience in the Boston area with the PCM recording made by Jean-Pierre Rampal of Teleman's "Twelve Fantasies for Flute" (Odyssey 33200) been consistent with that reported by Nate Garfinkle in the December 1975 issue of the BAS Speaker? Our experience here has been different. A friend and I both have copies, and we do not find it to be the state-of-the-art recording described by Garfinkle. The surface noise is fairly high and the recording itself is also noisy (one can clearly hear an increase in noise level just before the music begins). The recording is a very good one, with a good balance of ambience and detail.

Another friend finds the basic sound quality grainy, and we feel that it is not as smooth as a live flute (these observations do bear on recorder quality). In general we find it to be a good but not a great recording, but its positive qualities are more a function of microphone technique than tape recorder quality. If this recording is representative of the quality of PCM tapes, we are not impressed. Our reaction is so much at variance with Garfinkle's that I was wondering if we have bad pressings. What has been the reaction of local Boston members to this disc?

I would like to second Gerald Johnson's recommendation (BAS Speaker, Feb. 1976) of the Metropolitan Opera Madrigal Singers album "Simple Gifts" (Advent 5018). It is excellent. The recording is quiet, very clean, with an airiness about the voices. It sounds like the fine singers of the Metropolitan Opera were enjoying themselves when they made this recording and I believe that members of the BAS will also when they hear it. — Collins Beagle (Virginia)

Penguin Stereo Guide

Dr. Brian Leeming has reviewed the Penguin Stereo Guide and has pulled together those records rated highest by this respected British publication. The reviewers for the Guide have all had in-depth training in musical theory. Two are reviewers for The Gramophone and the third is reviewer for The Long Playing Record Library, a large British commercial record lending library.

The following is an initial section of that list; additional sections will follow in later issues. Sufficient data is provided so that it should be possible for those interested to order the pressings directly from Europe or through the BAS Record Importing Service (more data on the BAS service appears elsewhere in this issue).

- Bach, C. P. E., Four Sinfonias for Strings and Continuo (original instruments), Collegium Aureum, BASF BAC 3013.
- Bach, J. S., Orchestral Suites 1-4, Marriner, ASMF, Argo ZRG 657/8.
- Bach, J. S., Cantatas 159 and 170, Marriner, ASMF, L'Oiseau Lyre SOL 205.
- Beethoven, Piano Concertos 1-5, Kempff (piano), Leitner, Berlin Philharmonic, DGG 2721 066 (4 discs).
- Beethoven, Symphony No. 5, Kleiber, Vienna Philharmonic, DGG 2530 516.
- Beethoven, Symphony No. 6, Klemperer, Philharmonia, HMV ASD 2565.
- Beethoven, Piano Sonatas 6 in F and 23 in F, Gilels, DGG 2530 406.
- Beethoven, Fidelio, Klemperer, Philharmonia, HMV SLS 5006 (3 discs).
- Berlioz, Benvenuto Cellini, Davis, BBS Symphony, Philips 6707 019 (4 discs).
- Berlioz, Les Troyens, Davis, Royal Opera House Chorus and Orchestra, Philips, 6709 002 (5 discs).
- Britten, War Requiem, Britten, London Symphony, various choirs, London 1255.
- Byrd, Masses for 3 and 4 Voices, Willcocks, King's College Choir, Argo ZRG 5362.
- Cavalli, LaCalisto, Leppard, London Philharmonic, Glyndebourne Chorus, Argo ZNF 11/12.
- Chopin, Piano Concerto No. 1, Pollini, Kletzki, Philharmonia, HMV SXLP 30160.
- Chopin, Nocturnes, Rubinstein, RCA SB 6731/2.
- Debussy, String Quartet in G minor, Italian Quartet (with Ravel Quartet), Philips SAL 3643.
- Debussy, Childrens Images 1 and 2, Michelangeli, DGG 2530 196.
- Delius, Brigg Fair, First Cuckoo, etc., Beecham, Royal Philharmonic, HMV ASD 357.
- DuFay, Se la Face ay Pace, Munrow, Early Music Consort of London, HMV CSD 3751.
- Elgar, Cello Concerto in E minor and Sea Pictures, duPre, Barbirolli, London Symphony, HMV ASD 655.
- Elgar, Introduction and Allegro, Barbirolli, Sinfonia of London, HMV ASD 521.
- Elgar, Symphony No. 1, Solti, London Philharmonic, London 6789.
- Grieg, Peer Gynt Suites 1 & 2, Karajan, Berlin Philharmonic, DGG 2530 243.
- Grieg, Lyric Pieces, Gilels, DGG 2530 476.

Louis Marchand Organ Works

You were looking for records to use as tests of phono systems, and asked for suggestions. I feel at least someone should suggest my records, so I thought it might as well be me.

By far the best organ record (technically) I have made is the latest record by Frank Taylor at the Old West organ. This is the complete works of Louis Marchand, Elysee Editions SDA 1005/6. This is a two-record set, complete with a very well-written booklet by Owen Jander describing the life of the composer and the various pieces. There is a tremendous variety of organ sounds on this record, and it can be used to test almost every type of cartridge problem. There are some passages of very full organ with heavy bass and rich reeds. There are other passages where just one pure bass tone is held while light clear lines above allow the detection of any intermodulation distortion. The surfaces are the best I have ever heard on a record and the sound is elegant.

This record is available at the Coop or from Elysee Editions, 88 Lowell Rd., Wellesley, Mass. 02181 for $15 postpaid.

I use this record as a test of cartridges, and still listen to it frequently, even though I have spent an enormous amount of time listening to this music during the editing process. The musicianship displayed in the playing is superb. I don't ever tire of hearing it, something that cannot be said of any other organ record I know of, except perhaps SD 1001.

To test a cartridge's ability to track high levels, try the Nonesuch version of "A Medieval Christmass," by the Boston Camarata. The sound on the tape was very clean. The record was cut at the highest level I have ever seen on a classical record, much higher than was necessary. If your cartridge can play it cleanly, you have a very good one. The difference between a Shure III on this record and an ADC 25 is incredible. The Shure is far better.

— Dave Griesinger (Massachusetts)

Another Private-Edition Record

Increasing frustration with the mediocre quality of many commercial recordings leads audiophiles in various directions in search of greater listening pleasure. For some of us that route is to invest in microphones and make our own recordings. Although this entails a lot of work, it also yields substantial rewards as one discovers that amateurs can indeed make lifelike, wide-range recordings. I know several BAS members who, like me, spend more at-home time enjoying their own tapes then listening to records. There's just one problem: sharing the resulting sound with friends and fellow audiophiles is difficult because of the slow speed of tape copying. Making more than two or three copies of each tape is simply too much drudge-work to bother with.

One solution is to send off the tape and have it made into a disc record. BAS member Charles Richardson of Maryland has done so. Entitled "Eternal Father," his professional-looking private-edition disc is a collection of hymns and organ solos recorded during Sunday services at the U.S. Naval Academy in Annapolis. As Richardson commented in a letter, "I recorded the record with the full frequency range and also the full dynamic range. I did not make any alterations in the sound, and I avoided the use of limiters and compressors. Also, I tried to capture the natural acoustics of the Naval Academy Chapel, and I paid careful attention to microphone placement."

The pressing is flat and is farily quiet by American standards, though not the equal of the best European discs. Judging from the sound, the mikes probably were wide-range capacitor types, perhaps AKG C-451 cardioids. The stereo perspective varies slightly from one cut to the next, but on the average it tends to be deep rather than wide, a result of more distant microphone placement than we usually hear. This placement helps to make the chapel's reverberation audible; but the reflected sounds, bouncing off the stone walls of the church and arriving at the mikes off-axis, produce some mild treble coloration. I have experienced similar coloration when using distant cardioids in a stone church.

If your sole impression of pipe organ sound is based on twenty years of Power Biggs' records, you may be unprepared for the sound of this disc. But if you have made genuine two-mike stereo recordings yourself, you will at once recognize the sound of a completely unprocessed, ungimmicked record. The natural phasing information is preserved, so the stereo image expands nicely using Hafler ambience-recovery and even more using time-delay.

Side 1 consists of classical hymns by Tallis, Schutz, Franck, Brahms, et al., sung by the Midshipmen Choir with organ accompaniment. The performances are good but obviously "live," with some occasional brief lapses in intonation or ensemble. Side 2 consists of organ solos by Vierne, Bach, Stanley, et al., played on a Moller/Hutchings (evidently not a tracker instrument). It will exercise your woofers.

The record can be obtained directly by mail. To order it send $7 (which includes postage and packing) and a stamped self-addressed envelope to Charles A. Richardson, 1932 Old Annapolis Boulevard, Annapolis, Maryland 21401. — Peter Mitchell (Massachusetts)

Double-Blind Testing and Psychoacoustics

"Set" and "setting" are very important so far as comparison test results are concerned. "Set"—emotional attitudes—will have a subtle but pronounced influence on test results. In a previous issue of the Speaker Dan Shanefield stated, in reference to tests made by Sound Advice, that he felt that all amplifiers sound the same. It would not be difficult to transmit that "set" to the test panel, completely defeating the double-blind test procedure. How? The double-blind test presumes that some unknown difference actually exists. That difference must be defined by a procedure intended to eliminate bias or prejudice. However, if the test panel is convinced that there is no difference before the test is begun, the double-blind procedure becomes meaningless.

Contaminating a double-blind test with a "there are no differences" set is far easier than Shanefield might imagine. — Tom Mashey (Connecticut)

Preamp Test Update

Here are some additional comments about the Davis-Foster preamp tests, as reported in the November Speaker.

In performing the square-wave test, some preamps were measured using the equipment described in the article, others were measured with Tom Holman's equipment (i.e., the RIAA pre-emphasis network and the 30-kHz filter), and others were measured with both, to make sure that we were replicating Holman's setup properly.

We found that the results varied significantly with changes of just a few dB in the input level, and took care to adjust levels with the two setups so that we got identical results with each. When this was done, we found to our surprise that although the rms levels differed, the peak level was the same (about 700 mV), as was the risetime (1 microsecond, see Fig. 4 of the original report). We therefore postulate that it is these latter two parameters that must be held constant if the test results are to be comparable. Comparison of these figures with Holman's original report is not possible since he did not measure peak value and risetime, only the rms level on an average responding meter.

One area where Holman's results will differ from ours is ultimate resolution. The square-wave generator he used had a purity of 67 dB. The generator used in our tests had sufficiently greater purity that our resolution was limited by the 80 dB range of the GR spectrum analyzer used, so that the good-sounding preamps measure slightly better in our tests. Where a preamp has even harmonic content greater than -67 dB, our figures should match.

The harmonic levels obtained in the test are not comparable to normal harmonic distortion figures. For example, a THD level of 0.5% (-46 dB), second order, will generally be inaudible, yet a preamp with -46 dB second harmonic in this test will probably sound grainy. Generally the good-sounding preamps were able to reach performance levels of -60 dB or better.

Our report was intended as much to be a test of the test as a test of the preamps. Certainly a test that uses 700-mV peak/μsec signals is somewhat unrealistic, since no commercial magnetic cartridge puts out such signals. This is a major weakness of the test, as is the aforementioned level sensitivity and the fact that the results do not correlate with the sound quality of the FET preamps tested. However, correlation for the preamps using the more common bipolar transistor technology was excellent, even if we don't understand why this is so.

Also, while the test made great demands on the slew-rate capabilities of the preamps, it did not result in amplitude overload (clipping). Because the gain of a phono preamp varies with frequency, its overload margin is a function of frequency: a preamp with an overload point of 70 mV rms at 1000 Hz (hardly unusual) will generally have an overload figure of 1000 mV peak at 20 kHz. Since the 700-mV spike of the input test signal is almost entirely a high-frequency phenomenon, it is not an unreasonable test of the amplitude capabilities of a preamp. In fact, the outputs of the preamps tested were (sometimes distorted) square waves whose amplitudes never exceeded 2 V p-p. (usually 1 V p-p.), well within the capabilities of any preamp. Thus it is not a test of symmetrical clipping.

Clearly this is not a definitive test; neither we nor Tom Holman ever intended it to be taken as such. We do not advocate its adoption by other publications as standard procedure, although it may be of some use of manufacturers, if employed as a design tool with discretion. It appears to establish some link between slew-rate capabilities and audio quality, but the link is tenuous at best, and a race to develop a preamp with the highest possible slew rate would be premature at this point.

Certainly further work is needed: the basic cause of the difference in the sound of preamps needs to be determined. When it is, it will probably be a straightforward matter to design a definitive test for it, one that will use more representative signals. In the meantime, it is hoped that audiophiles and manufacturers of audio equipment will at least listen to some of the better sounding preamps and hear the differences for themselves. — Mark Davis (Massachusetts)

Additional tests have uncovered some new information about phono preamplifiers. Required slew rate for phono preamplifiers has been questioned from several perspectives. Dave Griesinger reported to me that he had measured 6×10^6 cm/sec^2 accelerations from difficult records. I can confirm this measurement with one I made of a very hot record, which yielded 5×10^6 cm/sec^2. The maximum velocity during a tone burst for the hottest cutter head yields an acceleration of about 13.5×10^6 cm/sec^2 (Neumann SX-74, 105 cm/sec velocity at 10 kHz in a 10-msec burst using 1/2 speed cutting). Using a high insertion gain preamplifier (40 dB at 1 kHz), and therefore taking all parts of the system at worst case, yields a required output level of 2.3 V rms at 20 kHz, necessitating a slew rate of 0.44 V/μsec. Slew-rate limiting is a phenomenon like clipping: it has a sharp onset which, if never provoked, will never cause a problem. Slew-rate limiting can be considered "rate clipping."

Mark Levinson said in a preamplifier seminar held recently at Minuteman Radio in Cambridge that he could hear the difference between two preamplifiers, one of which had about 6 V/μsec slew rate and the other 15 V/μsec slew rate. Without having experienced this test, I do not understand any possible source correlated with slew rate that could explain the differences. Since varying only one parameter at a time and using "blind" experiments are prerequisites for definitive listening tests, and since Levinson did not apply such techniques, I believe that the number derived from measurements of record slew rates and the performance capability of cutter heads should stand as the requirement. This neglects the possibility of scratches on the record requiring higher slew rates than program material, but how far should we go to exactly reproduce a scratch?

Preliminary difference tone intermodulation testing has been performed on three phono preamplifiers of greatly different reputation. Using a composite test signal with component parts within the dynamic range of cutter heads and phono cartridges has yielded no difference tone component. I conclude that difference tone intermodulation may be important in some kinds of phonograph preamplifiers, but it is not a crucial issue among high-quality preamplifiers.

— Tom Holman (Massachusetts)

Preamp Loading Problems

There is a potential source of distortion with any preamp or receiver that has equipment connected to its tape output jacks. If the device connected, be it tape recorder or an auxiliary processor (equalizer, dbx, etc.), is not turned on, its input circuitry may present a low-impedance nonlinear load on the preamp. (A transistor, when no voltages are applied to bias it as an amplifier, looks like a diode to the outside world.)

This will cause loading of whatever source is chosen by the input selector switch and may cause distortion in any unit that is not designed to drive low-impedance loads and diodes. Included in this category are most tuners, phono preamps, equalizers, and tape recorders not capable of driving moderate impedance headphones.

This problem cannot usually be determined by an ohmmeter measurement as most units have a coupling capacitor between the input jack and the problems. Turning the device on will solve the loading problem unless there are multiple units connected in parallel to the preamp's tape output jacks. Also, some equipment employs a potentiometer level control as the first input circuit element. If this control is set to minimum, the unit will present only that resistive load to the preamp, whether on or off.

The following table lists several tape recorders' and equalizers' input impedances when turned off.

Tandberg		Sony	
64, 64X	1 meg	355	100K
6000	70K	777	150K
3000	1 meg	124, 125	100K
Revox		Advent	
G36	47K or 1 meg	201	50K pot
A77	CNL	100, 100A	50K pot
A700	68K or CNL	FBC	150K
Teac		Metrotec Equalizer	CNL
3300	250K pot	SWTech Equalizer	100K
4000	110K pot	Dbx	
7030	150K pot	117, 119	50K in parallel with 220 pF
Crown CX series	100K pot	122, 124	CNL

Notes :

1. CNL = complex nonlinear load.
2. Values followed by "pot" are measured with the pot turned to minimum. Otherwise significant diode loading will occur.
3. The Revox loading can be removed by switching the input selector to any position other than "aux."
4. The dbx 122, 124 loading can be removed by pressing the "Play" button. "Bypass" has no effect on the loading.

The next table shows performance of several different preamps' phono sections when operated into a turned-off Revox and a turned-off dbx 124. All measurements are SMPTE IM distortion: 60 and 7000 Hz, 4 :1 at 1 volt equivalent output.

Unit Tested	No Load	dbx 124	Revox A77
Dyna PAS-3	0.0?%	0.08%*	1.4%*
Dyna PAT-4	0.12%	0.3%	1.1%*
IC design	0.04%	1.5%	5.5%
Passive bipolar	0.022%	0.21%	0.75%
Active bipolar	≤0.01%	0.65%	3.0%
Marantz 7B	0.035%	0.055%*	0.06%*
High-current, fast-slew-rate design	0.01%	1.2%	4.0%

* Indicates tilt and loss of 60-Hz waveform level 3 to 6 dB due to coupling capacitor size versus loading.

The above data should not be interpreted as a direct measure of IM distortion only, but do suggest that schematics should be checked, impedances added up, and the load-driving capability of sources be adequate for the entire load driven.

One additional note is that this loading problem can confuse A-B comparisons because the unit selected at the selector switch sees the load at the tape out jacks, whereas a unit selected by the tape monitor switch does not. Also, the behavior of a preamp into an abnormal load bears no relationship to its performance when operated correctly. One unit that may sound superior to another when driving a complex low-impedance load may sound inferior when both units are compared when correctly loaded. — Scott Kent (Massachusetts)

A Correction on Phono Input Capacitance

Dan Shanefield's suggestion (BAS Speaker, Jan. 1976) that phono preamp input capacitance typically exceeds 1000 pF is implausible, and his proposal that designers adopt a standard value of 1500 pF is inappropriate. Regardless of the presumed validity of his measurements of tape-monitor circuit capacitance (and I have doubts about that too), there is no justification for assuming that the phono input will have the same shunt capacitance as the tape-monitor input. In fact, when I explored the problem of turntable and phono preamp capacitance on "Shop Talk" several years ago, I found that there are two standard approaches in preamp design. One school of thought (represented by the classic AR amp and Dyna preamps for instance) aims for the least possible shunt capacity; the phono stage is located close to the input jacks and is connected via short wires, resulting in a stray capacitance of 50 pF or less. The other approach (Fisher and KLH receivers for example) is to wire a 300-pF capacitor across each input jack to minimize RFI problems. It was their discovery of the prevalence of the latter approach that led Shure engineers to tailor their cartridges for an optimum load of 500 pF (including cable).

— Peter Mitchell

Addendum to Review of KMAL Arm

A word of reassurance to those who've read the Sound Advice review of the KMAL tonearm. The problems are grossly overstated. This arm is somewhat more difficult to use than most, but it's not by any means impossible. For the first eight months I had mine, the contact pins required wiping about every two months. Since then, I've had no problems, cleaning them only

when I've had the top off for some other reason (about once in six months). I've never had to touch the contacts at the bottoms of the mercury basins. In any case, their claim that the contacts must be kept "surgically clean" is nonsense. Frequent removal of the top encourages formation of oxide deposits on the pins. One can prevent (or cure) this condition simply by wiping them whenever they are lifted out of the wells.

Getting the arm set up the first time is tricky, but a little practice results in complete mastery of the art. As most in a position to know consider me a first-class klutz, I can only assume that the SA staff exhibits an astonishing level of mechanical ineptitude.

— Michael Riggs (Massachusetts)

Toyo Model 67 Self-Contained Peak Level Meter

About two years ago, Toyo Co. of Japan introduced a self-contained peak reading VU meter, which readers may have spotted in Audio's advertising pages. I recently purchased a stereo pair plus a small Toyo power regulator module and some minor parts, and constructed a self-standing stereo peak-metering box. The cost of the two meters (complete), plus the regulator board, was a surprisingly low $33.90 post paid from Toyo Co. of America, 12627 Crenshaw Boulevard, Hawthorn, California 90250.

The only absolutely essential component required in addition to this package is a 24-volt, 100-mA transformer. Radio Shack advertises a "300 mA" unit as number 273-1386 for $2.19. This will supply the regulator board, but a source of 6.3 Vac at 200 to 300 mA is required to power the self-contained illumination lamps. Again, Radio Shack's 273-1384 at $1.69 will do this job. A single combination 24/6.3-Vac transformer would be preferable, and I used such a unit in my instrument, but I have not yet found widely available a source of this combined unit. If you are not cramped for space, a two-transformer approach is fine.

The builder must still provide a housing (if the meters will not be built into another piece of equipment) plus line cord and phono input jacks. Other frills such as fusing, a power switch, and a variable input attenuator (I used ten-turn pots) need not drive the cost above $40 to $45 unless you get fancy. If punching the 2 3/16-inch holes for the meters will be a problem, buy a pre-punched meter box. LMB offers an extremely attractive dual-metering box with sloping panels and space for controls at $5 to $6.40; it is the model 007-746MB and can be obtained locally from You-Do-It Electronics in Needham. (LMB is located at 725 Ceres Ave., Los Angeles, Calif. 90021 if you have trouble finding a supplier. The LMB holes are 2 inches in diameter, so a bit of enlarging is required.)

These really minor construction tasks aside, the question is, how well does it work? Quite well, and much better than a normal VU meter, but not perfectly. On the plus side, the indicated reading is only -2 dB below a 0 dB steady-state sine-wave signal for any transient input lasting longer than 1 msec; this is a single cycle of 1-kHz tone burst, or 10 cycles at 10 kHz. A single cycle at 10 kHz gives a reading of -8 dB; no musical transients have all of their energy at this high a fundamental frequency. Thus the meter is very much faster than any VU meter, which would nudge perhaps an unreadable -30 VU for these 1-msec bursts; about 100 to 300 msec of burst should be required for a near 0 VU reading. For a steady-state 0 dB input, the meters are perfectly flat from 20 to 20 kHz (i.e., flat within a pointer width, which is small). They are nearly flat to 100 kHz, if that matters. Input sensitivity is a rather non-standard 1 volt rms for a 0 dB reading.

My main reservation about these units is that they are not designed to hold the peaks as are some meters. This is a mixed blessing ! It is quite difficult to read the flying peaks (although the internal illumination helps visibility substantially), but in adjusting levels it is easier with a meter that does not hold the reading overly long. Nevertheless, the Toyo units are vastly superior to VU meters for tape recording sources with unknown but high peak to average ratios, such as live music or good discs.

The model I obtained is quite attractive, measuring about 2½ by 3½ inches externally and finished in black plastic. The faceplate is calibrated from -40 dB to +5 dB, with scales printed white on black, except for the upper 5 dB, which is in red. Another model of the same unit has the scales printed black on white.

Although the idea of construction may not appeal to some readers, do consider the simplicity of construction (even over the Audio Amateur peak metering units), plus the advantages of owning such a self-contained unit. First, with a bit of switching, the meters can be installed to monitor any signal in your audio chain—tape inputs, power amplifier output, or input/output levels in signal-processing (e.g., dbx) equipment. Second, with a single flexible metering system at hand, you will not be tempted to purchase a piece of equipment simply for its meters. For example, buy a Dyna 400 power amplifier less meters and save more than the cost of the Toyo units, or purchase the tape machine you really want (e.g., Revox) rather than another (e.g., Tandberg) simply because it boasts peak reading meters. Finally, with a home-built, external metering box, one can feel free to add special-purpose modifications that would be difficult to build into a commercially made device. A switch-selected tape pre-emphasis network could be included, for example, to monitor the signal reaching the tape. (An active network would be preferable to a passive one to keep readings near the 1-volt, 0 dB center-scale reading.)

At $45 or so, these meters can be recommended to anyone with even rudimentary "do-it-yourself" abilities. And the result is well worth about four hours of effort. — Harry Zwicker

BSR FEW-III Equalizer

There is one reason for purchasing the FEW-III stereo equalizer: it is cheap. The mailorder price is about $133, with local pricing about $150 at K&L Sound, Watertown, Mass.

The unit has three nice features, namely, (1) twelve control bands per channel, on a 30-50-90-160-300-500-. . . Hz frequency spacing; (2) dual meters with 24 dB, linearly spaced ranges (evidence of an internal log-amplifier); and (3) as is rather common on equalizers of this type, gentle control over boost or cut near the zero-settings of the control pots. Thus small corrections from flat should, in principle, be easily obtained with easily controlled movement of the sliders.

But the low cost of the unit does not mitigate one fatal flaw: very poor frequency response accuracy with all of the controls set to "zero" or flat. There is no center detent, so this zero must be set by eye—twenty-four times. And the response at these zero settings is as much as ±2 dB from flat in my unit. This is, of course, instantly audible if one attempts to A-B compare with the equalizer in and out of the signal path. A troublesome noise burst also occurs when switching from "equalize" to "bypass," especially if the unit is recently turned on. Finally, there is no overall gain control over either or both channels, so that even if response can be made flat by carefully setting each of the pots (using signal sources and test gear), it is yet another matter to set the pots for zero overall gain. Strangely, the meter sensitivity can be adjusted, although the lack of control knobs makes even this difficult.

After much fiddling, and never obtaining a really flat curve or good square-wave response, I obtained control settings that gave nearly flat response, zero gain, and balance between the channels. But the knobs were now as much as ±3 dB from their zero settings, while corresponding settings between the channels differed by as much as 4 dB. I doubt that I have the patience to find these flat settings again—nor do I expect that they would be the same as the first time.

A thorough review should discuss the circuit and the sound, but why bother? I have never found control settings that gave "no" audible difference for in/out comparison, which might have been my first test for audible quality. Many audiophiles have complained that the FEW-III's predecessor, the FEW-I, had a veiled sound and lacked transparency. Perhaps this is true of the FEW-III (I haven't listened enough to tell), but perhaps in the FEW-I it was the result of similar flat-setting inaccuracies, particularly at the top. Except for adjusting extremely out-of-whack

recordings (e.g., Berlioz' Nuits d'ete by Steber on a lovely but old mono recording), the FEW-III equalizer idles on my equipment shelf. It's just doo damn hard to use. Trimmers on each of the pots may cure the primary objection some day, but 24 pots added to the already dense PC board?

Yes, the FEW-III is cheap—but at what a price ! — Harry Zwicker

The Idea File

FM Antennas. Do antennas generate their own multipath-like distortion? The time delay between elements would seem to be on the order of nanoseconds, which is negligible, but is this true of all antenna designs?

Does anyone know how broadband RF amplifiers, such as those used in CATV systems, may affect reception quality? Can interaction among several terminals cause interference?

Finally, is it possible to design an antenna, perhaps a helical (for circularly polarized transmitter antennas) or a log-periodic, that might have performance superior to commercial products? Could it be built by the audiophile? What design considerations apply to printed-circuit antennas? [One design for a TV antenna constructed from copper tape and a mylar sheet was described in Electronic Design, March 15, 1975, p. 98 and March 29, 1975.—Ed.]

— Steve Seto (California)

Spectrum Analyzer. In response to a suggestion in the Idea File I would like to add my enthusiasm for a homemade, if perhaps crude, spectrum analyzer.

In a different vein, I note how linear the specifications are on the LM318 full wave phase detector; could this IC be of use in a high-quality AM tuner?

Finally, do minicomputers have any place in the audiophile world, either as test instruments or in the signal chain? — Damon Hill (Georgia)

In the Literature

Audio, April 1976

- Understanding NAB EQ (tape recording) Standard: A rather roundabout but complete derivation of electronic frequency response shaping in the record and playback sections of a tape deck (p. 32).
  20,000 Watt Home Hi-Fi: Tour of Dick Burwen's house in Lexington, Mass. (p. 44).
- Equipment Prfiles: Otari MX-5050-2SH, whose low-end rolloff is a surprise; Sound Guard receives a review vastly inferior to that published in Radio Electronics; Mark Levinson JC-2 preamplifier; and a botched-up review of the Allison:One loudspeaker (suffers severely from non-reverberant measurement techniques).

Audio Amateur, 4/75 (Subscription rates now $9/year, $25/3 years)

- After its move, TAA again qualifies as a "periodical" with four do-it-yourself pieces: super-greening the Heath IG-18 audio oscillator, a stereo delay-tube system, a general-purpose IC low-frequency filter, and an electrostatic loudspeaker.
- Part II of "What is PCM?" is a short tour of the BBC's PCM system.

Audio Engineering Society

- Announces a series of anthologies. The first is on quadraphonic sound. The 264-page book is $9 for non-members, $7.50 for members.

Electronic Design, March 28, 1976

•COD's Reach Practical Stage for Analog Signal Processing: New Fairchild and other analog CCD shift registers will make delay systems simpler and of longer delay for less price.

High Fidelity, April 1976

• Twenty-Fifth Anniversary Issue: This is a must for anyone who doesn't subscribe; begins a history of high-fidelity sound, with some nice personality profiles and a flock of record recommendations from years past. History of tape recording is especially interesting. Plus a review of the Phase 2000 preamplifier.

New Scientist, January 29, 1976

•Will Ambi-Sound Shatter . . . the Stereo Market? : Discussion of the Ambisonics tetrahedral microphone and its effect on "stereo" image. Still a highly underdeveloped system, but in a small room ". . . the sounds created do not appear to originate from the loudspeakers themselves, and this suggests that the system may well be able to cope with the most difficult of all tests—a mobile sound source which moves slowly and smoothly in space rather than hugging one loudspeaker before jumping to the next." This is a four-into-one coded-signal system, hopefully compatible with a stereo groove disc. Three dimensions (surround sound plus height) can be reproduced.

Popular Electronics, April 1976

•Reviews of the Luxman T-310 tuner ($600) and the Pioneer RG-1 Dynamic Processor. The latter was the subject of "Shop Talk" for April 4, 1976, and seems to be a real innovation in the dynamic restoration game, acting on transients rather than on the overall average (rms) level, with short time constants unlike the dbx devices.

Radio Electronics, April 1976

•Cutting Audio Test Time: Discusses new equipment for the test shop, concentrating on sweep oscillators (including the new and inexpensive $525 Fidelity Sound sweep generator/6-digit frequency meter/peak-amplitude meter) and the new low-priced spectrum analyzers.
•Fuji FX (C-60) cassette tape is reviewed, but since this is the first test for RE in the tape field, the results are hard to relate to competing brands.
•First review of the Harman/Kardon Citation 16 amplifier. Shows fine distortion suppression and other specs, but tests of power amplifiers are no longer of much use in selecting such equipment; we must await subjective evaluation from reliable sources.

Sound Advice, Fall 1975

Sound Advice reemerges with another challenging issue. This time they listen to some heavyweight contenders among the current amps, preamps, and cartridges, along with other interesting items—tonearms, turntables, step-up devices for moving-coil cartridges, etc. The reviews note precious few small differences between components. These folks must have platinum ears.

Among the components tested: Audio Research SP-3a-1, Levinson JC-2, Phase 4000, Epicure Model Four, Soundcraftsmen PE-2217, Dyna PAT-5, Electro Research Class A amp, C/M 912, SAE 2500, Technics SE 9600, Audio Research Dual 76A, Fidelity Research FR-1 Mk. II, Decca Mk. V elliptical, Shure V-15-III, Denon DL-103 and DL-109, Win Labs SDT-10, Linn Sondek LP-12, Grace G-707, KMAL M9BA Mk. II, and the Levinson JC-1AC.

— H. Zwicker, D. Craig, J. Thompson, M. Riggs

March BAS Meeting

Business Meeting

The meeting was held at GTE Laboratories, Waltham, Mass. Jim Brinton announced that The Speaker press run has been increased to one thousand and issued a call for volunteers to assist in mailing them. Al Foster is coordinating this effort.

There was the usual "thieves' market," including Scott Kent's record, "Angle on Harpsichord," and Ira Leonard's offering of the Insight Record, "Fidelity First—An Unrehearsed Experiment." There were cut prices on TDK SA and Fuji cassette tapes, Dr. Brian Leeming delivered European pressings to those who had ordered them, and Peter Mitchell had the last BAS oscillator and 39-ohm resistors for those kits that had lacked them. He also had the last of the 814 mike capsules and mike cables in 20-foot lengths. The surprise bargain of the evening came from Rene Jaeger, who offered several dbx 117's and 119's at roughly 45-percent discounts. These were demo units with scratched cases but were in mint electronic condition.

Meeting Feature: Harman/Kardon

Guest speakers were Steve Phillips, H/K's advertising manager, Bernard Gaines, project engineer for the Citation 16 amplifier, and Jacob Rabinow, an H/K consultant and designer of the various Rabco arms and turntables. The ST7 turntable, Citation 11 preamp, and Citation 16 amplifier were demonstrated at the end of the meeting.

Rabinow, presently Chief Research Engineer for The Institute of Applied Technology, National Bureau of Standards, holds 209 U.S. patents and more than 150 foreign patents. Years of tinkering in high fidelity have filled his home with an impressive variety of exotic and esoteric record-playing devices:

- A record player with the arm mounted backwards to counteract the effects of eccentricity wow.
- An arm employing electrical feedback to effectively reduce its mass to zero. (He and Panasonic hold patents on this, but as of now the price tag is in five figures.)
- An anti-click device that eliminates the transients from a heavy scratch in a record. Two arms are employed tracking the same groove. When the gouge falls between the two styli, a reed relay activated by a magnet on the turntable switches momentarily to the other arm. Because of the continuous nature of music, and the speed with which the relay operates, the changeover is not heard. With delay lines, the second arm is not needed. The idea might be extended using electronic detection of scratch and dust transients.
- And perhaps the ultimate in record players—a unit that reads the groove with a beam of light. The trick here is accounting for adjacent grooves that overcut. The beam tends to skip into the next groove. A circuit detects these skips and jumps the beam back to the proper groove before anyone notices. A 1956 invention.

Rabinow's interest in high fidelity, and record players in particular, goes back to World War II when he was researching proximity fuses for the Bureau of Standards. The work involved recording, and the medium was records because tape was still unknown in this country. His curiosity led him to wonder why records worked and sounded as they did. He found that Thomas Edison anticipated a considerable amount of modern record technology. Edison used elliptical, diamond styli and he tilted the stylus. He noticed that when a stylus is vertical it oscillates, but when something is dragged at an angle, it tends to lift, thereby reducing friction and damping oscillation. [Edison was also the first to use plastic in records and he employed straight-line tracking in all his machines, cylinders and disc players alike.— H.B.]

Retreat from Edison. When the modern disc displaced Edison's equipment, technology took a step backward with the introduction of pivoted arms. Pivoting the arm greatly simplified the problem of providing an adequate acoustic coupling to the "tonearm." The tangency problems inherent in these early designs were masked by the gross distortions of the acoustical and early electrical records. The modern bent arm reduced tangency errors to the point that these errors are no longer a significant factor in playback distortion. In Rabinow's view, the major sin of pivoted arms is skating, and no mechanical anti-skating device can provide compensation tailored to all the factors that enter into this aberration. Skating force varies with the weight of cartridge and arm, the shape of the stylus, the intensity of modulation, and the frequency recorded; the stylus is a mass with a spring behind it and its mechanical impedance changes with how fast it moves.

Another inherent discrepancy in pivoted arms is wow due to the geometry of arms and records. Warp wow is one type. It results when the arm's pivot is set too high above the record. As the stylus tracks the up-and-down motion of the record, it moves fore and aft, and the effective distance from the stylus tip to the arm's pivot varies, causing a frequency shift. Place the pivot at the same level as the record, and this wow is effectively nulled. The arc described by the arm is nearly vertical here, but it falls away rapidly as the angle to the record is increased. A similar warp wow exists in cartridges because the tip of the stylus is placed at the end of a cantilever in the same way that a cartridge is placed at the end of an arm.

Another geometric wow occurs in the lateral plane when a pivoted arm tracks an off-center or non-circular record. (Most records become slightly ellipsoidal due to on-end storage.) Again the arm describes an oval path as opposed to the ideal circular path on the record. The arm travels away from the center and back as it tracks the eccentricity. In this situation, there is also a velocity error due to the different diameters of the same groove on opposite sides of the label. [If a typical bent arm is mounted backwards (but the cartridge forwards) so the record turns toward the pivot, the geometry of the arm's error is out of phase with the eccentricity error, providing some compensation. — H.B.]

Rabinow's Arm. All these problems led Rabinow to develop his first straight-line tracking tonearm in 1954. In 1968, the eighth version (SL8) reached the market after fourteen years of indifference on the part of established manufacturers. He sold 2,000 the first year—and lost $60,000. He designed the ST4 to expand the market, but capital outlays for each production run made it impossible for him to continue to underwrite the venture. Harman/Kardon now manufactures the ST7 turntable and he consults with the company.

The advantages of straight-line tracking are: (1) no skating force because the stylus moves along the disc's radius; (2) no tangency error; and (3) the arm is shorter than a pivoted arm, potentially lowering its mass. The shorter length also makes it possible to achieve equal rigidity with lighter gauge materials, further reducing mass.

A straight-line arm is less affected by eccentricity wow because its effective length does not vary. The ST7 is also pivoted vertically at nearly the plane of the record, minimizing warp wow. [Warp wow would otherwise be more critical due to the shorter vertical arc followed by this arm. —H. B.]

A range of topics arose during the question and answer period, some directly related to the Rabco products, others not. A question about pivot friction, or the side force exerted on grooves by an arm, brought both specific and general answers. With respect to the Rabco products, side force is in all cases considerably less than skating force in a pivoted arm. In the SL8, according to Rabinow, it's unmeasurable. The arm's only work is to close an electrical contact. The ST4's arm friction is very low because it is a rolling friction. So far, Rabinow has not been able to measure friction in an ST7. There should be some, but it is both intermittent and trivially small, he says.

Speaking generally, friction in arms is much overrated, he says. As long as the arm moves freely to the touch it's OK. Once the stylus is lowered onto the disc, vibration along the length of the arm makes any friction viscous. It's similar to tapping a meter or gauge to get a true reading.

What about modifying the SL8? Why not? Rabinow's own approach is to drill out the gimbal system, put a tube straight through, and move all connectors to the back. [BAS member Deen Slindee (Box 55, Lansing, Iowa 52151) sells a number of modifications for Rabco arms, including lightweight redwood cartridge shells. He also circulates a newsletter on the subject.—Ed.]

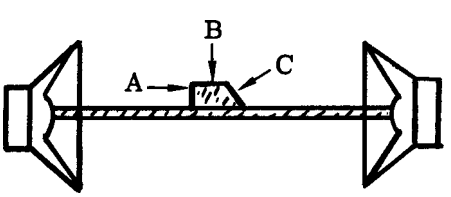
"Universal" cartridges are a poor compromise. Rabinow feels it's better to design arm and cartridge as an integral unit, thereby eliminating the mounting hardware and the extra mass and weight added to cartridge bodies to accommodate the screws.

He also noted that records make great microphones ! Because of the raised rim and label area, the groove area will resonate. Try placing a cartridge in the middle of a stopped record; then speak into the record. Speech should be quite intelligible on speakers in another room. Or play an oscillator in the room near a record player while it tracks silent grooves. Again the sound will be picked up by the record. The moral is to isolate the player as much as possible from the music. Perhaps because of such microphonics, the ST7 reverses what has been the practice since the mid-fifties and supports records in the groove area rather than the rim and label.

Counterweights on arms are basically undesirable simply because any force or vibration acting on the record player causes all the masses to move differently, possibly aggravating the effects of such vibrations. Ideally the center of gravity should be at the pivot point. But, he says, counterweights are cheap, easy, and they work. However, Rabinow would like to use a spring instead.

Rabinow's Heresy. And then there's arm damping. Rabinow: "DAMPING AN ARM IS AN UNFORTUNATE THING! " Needless to say this heresy brought spirited debate. When the dust settled, Rabinow's position boiled down to this: Do what you have to do to dampen undercontrolled resonances in your system. If it works, it works. But realize that viscous damping involves compromises in arm-cartridge performance that other methods of design (i.e., zero-mass arms and cartridges, etc.) do not. [It was obvious that Rabinow was arguing for an integrated arm/ cartridge system with "perfect" physical characteristics.—J.B.B.]

Rabinow drew a simple device for observing damping in a cartridge (see Fig. 1). A strip of balsa wood is glued between two 3-inch speakers. The stylus is settled on the wood and various signals are fed to the two speakers. These transducers will be essentially linear at discrete frequencies from dc to 100 Hz or so, especially at the low amplitudes used in this test. Below stylus resonance the arm and cartridge will move together. At resonance, "they do crazy things," says Rabinow. Above resonance only the stylus should move. For vertical modulation testing, mount a wedge on the balsa and tilt the resonance tester. Feed a filtered dc transient. The arm should stabilize after only one or two cycles.



A — vertical motion
B — horizontal motion
C — 45° motion

Fig. 1. Device for observing cartridge damping

In an ideal situation, he feels, the stylus/arm resonance should come very close to the low end of the audio band—near 20 Hz. If it falls substantially below this, warps and any other sub-sonic noise components will start nudging the stylus/arm resonance where "crazy things" happen.

So what price is paid for viscous damping? First it's not accurate to think of dashpots—in principle a viscous damping system is a dashpot—as having a breakover point restraining the arm only when it moves rapidly. Dashpots oppose all movements fast and slow proportionately, he points out. Therefore the stylus cantilever tends to be compressed as an arm rises on a warp and is fully released as the warp falls and the arm lags behind. Since most cartridges are not linear, this introduces modulation distortion during compression as well as "warp wow" in the stylus cantilever. With damping, you fight the mass of the cartridge and arm plus viscosity as you track warps. In Rabinow's view, if damping is so tuned as to not degrade performance, it's probably too little damped to do any good. [Most BAS members, forced to deal with real rather than ideal tonearms and cartridges, appeared to disagree.—J.B.B.]

Arm damping "improves" performance when an underdamped stylus (resonating well below the audio band) starts picking up sub-audio vibration such as rumble and room noise. It also holds down overshoot caused again by underdamped stylus assemblies, but the price is paid by degraded performance in those situations where the arm would track anyway. So if damping improves performance, says Rabinow, go back, find out where the problem is, and correct it at its source. One useful aid is to use a cheaper cartridge with a higher stylus resonance (less compliance). It's easier to damp a system that resonates close to 20 Hz rather than at 8 or 9 Hz.

With all this emphasis on the low-end stylus resonance, the question was raised, "Should cartridge makers specify the resonant point of their styli?" Rabinow hedged a bit. In theory, you can figure the resonant point from the figures for compliance and weight of the head (and mass), but in practice it depends on the condition of the rubber in the stylus cantilever, and that becomes an unknown variable over time. The mass of the stylus and its mounting is also critical to resonances, the ideal being zero mass as in the light-beam cartridge already described.

Decline of Invention. Rabinow presented his views in an entertaining and dogmatic way. By his own admission, he exaggerated and oversimplified to get his points across, but his provocative viewpoints served as starting points for fresh discussion of the issues. One subject, raised from the audience, took him away from high fidelity to a topic for which he has much obvious feeling—the sad state of U.S. inventors. There have now been some four million patents issued in the United States. The number issued to individuals is falling, the number to domestic corporations is holding steady, and the number of patents issued to foreign corporations is on the rise.

In Rabinow's view, great inventions are made by individuals, not corporations. In modern times only the transistor and the development of television came to mind as corporate inventions. Virtually all others were the work of individuals even though corporations may have taken credit for them or provided the funding or setting for their development. Now U.S. business has cut back on research and development and hacked away at the incentives for creative invention, first because many got burned with fashionable but mismanaged R&D operations. Second, because bigness makes a corporation conservative, it becomes very expensive to implement new developments. They want "improvements" to old ones. And finally, most companies are no longer run by their founders. To quote: "The thug about American industry that's particularly disgusting and tiresome is that they're no longer run by their founders or people who give a damn about their product. And when business becomes purely, purely business—only money—then you don't care whether you make spaghetti, rent cars, install swimming pools, run a bank, or make high fidelity. That kind of business is gonna die because the people under management don't care either.

"This is happening to more and more American business. All they want is for the stock to go up. And when you have a situation like this it's very hard to sell new ideas. An invention has to be more than a way of making money. It has to have stardust; it has to have glamor; it has to have excitement; it has to produce the same reaction in a man as a painting does to a collector. A great invention results as much from an emotional reaction as writing a book. And right now this is dying in the United States."

Rabinow the Raconteur. It wouldn't be fair to close this portion of the March meeting report without sharing some of Rabinow's anecdotes. He told us at the start of his talk that we had the reputation of piranhas that ate guest speakers alive, but he proved to be one of the most engaging lecturers we have heard in some time.

He compared arm damping to the use of a deodorant room spray: "The Bureau of Standards tested it to find out what it does. It kills your sense of smell. That's literally correct. So if you want to kill the smell in the room, the thing to do is to meet the guests before they come into your house—and spray them."

"If damping helps you, it helps you. But I suggest you build yourself one of these loudspeaker devices, which is very cheap and simple, and find out what sort of frequency is giving you trouble. And if you have a five-cycle resonance in the arm, repeat after me, `The Lord is my shepherd...'

The relationship between money and employee satisfaction interested him. The man who invented the Cobra arm for Zenith came to him and offered him a job. "I said, `What the hell can I do with money. I love where I'm working.' And I said, `Why don't you come work with us?" And he said, `What'll you pay me?' And I said, `I'll pay you a thousand less than you're getting now.' And he took the job . . . It shows you money isn't everything. Cartridges also have a place in life."

"If you're a very good employee and you don't need the job, the boss never fires you. That's one of the ironies of life. You always dream of having enough money and independence that you can tell the boss what he can do with the job. Comes the day you have enough money, and you never have to. The boss knows it, you know it, and the situation simply doesn't arise. It's one of the tragedies of life."

In the end, however, the BAS got the last laugh. Said Jim Brinton, "If we're piranhas, I think the BAS met JAWS tonight."

Citation History. Following the break, H/K ad manager Steve Phillips presented a brief overview of the Harman/Kardon Citation line's lineage and design philosophy. The earliest Citations owed their excellence to Stewart Hegeman who joined H/K around 1958 from the Victor Brociner Company. The Brociner amplifiers were held in very high esteem. Brociner never publicized his design philosophy, but in fact the amplifiers incorporated wide-band circuitry, and that seemed to contribute to their excellence.

And so from the Citation II on, wide bandwidth became a hallmark of Citation componentry. Harman/Kardon also pioneered transistor technology in the Citation A and B preamp and amplifier.

Another major design factor in recent Citations has been "twin power" meaning totally separate power supplies—which Harman/Kardon feels is particularly significant in the upper 20% of an amplifier's capacity.

The third touchstone of Citation technology, he continued, has been rugged, reliable designs that would withstand abuse. All of these qualities are embodied in the current line of Citation equipment: the Citation 11 preamp, the 12 and 16 amplifiers, and the 14 and 15 tuners.

What with the current interest in preamps, Holman tests, and whatnot, Phillips was asked whether a successor to the Citation 11 was' in the works. He replied that the 11 has undergone continuous change through the years and anew modification now in the works will result "in a completely different preamplifier." It was, not clear whether he felt the units presently in the stores will pass the Holman tests, but H/K is aware of the tests and the new units will pass these tests, he said.

Can the various modifications be retrofitted to older units? Maybe. The present modifications are now being evaluated with the aim of fitting the pin layout of the newest boards to the existing wiring harness.

The 16. Bernard Gaines, Citation 16 project engineer, was the last speaker. He described the design objectives of the Citation 16 with respect to bandwidth, slew rate, TIM, ruggedness, and quasi-complementary versus true complementary output circuits. The 16 is a direct-coupled amplifier with a bandwidth to about 120 kHz and quasi-complementary circuits. The aim of all that high end is to achieve maximum phase linearity throughout the audible range.

Quasi-complementary circuitry was selected to provide an output stage using all NPN transistors. NPN power transistors are faster, thereby contributing to the wide bandwidth and improved slew rates. They are also more rugged than PNP power transistors.

Compared to the Citation 12, the 16 has a much improved slew rate. The 12 did pretty well following a pulse down, but going up, the circuit, because of the transistors used, had to charge a capacitor through a large resistance. The new transistors and symmetrical drive circuit in the 16 allow it to pump much more current into the shaping capacitor. On a pulse with a 1-microsecond rise time, the 12 might have an error of 10 to 12 microseconds as opposed to 3 in the Citation 16. The slew rate is 30 volts/Microsecond. As a comparison, Ampzilla measures about 20 volts/microsecond.

Metaphysics (TIM). Phillips pointed out that slew-rate limiting contributes to transient intermodulation distortion. An amplifier with equivalent power output and slower slewing will be in paralysis longer. However, Harman/Kardon views TIM cautiously. Gaines pointed out that there's no instrument or accepted test for measuring TIM. H/K's research in the literature turned up only one test that seemed to be worth further investigation. In this scheme a 6-kHz sine wave is superimposed on a low-frequency square wave. Supposedly an amplifier with high TIM would exhibit a misshaping of the sine wave at the top edge of the square wave's rise. They tried the test on a number of amplifiers and very close inspection turned up something that looked like TIM should look. But closer consideration led H/K to conclude that the phenomenon was exactly what one would expect to find when the slope of the sine wave was stretched the distance of the square wave's swing. The amplifiers were not saturated.

They also examined amplifiers specifically designed to minimize TIM. These amplifiers generally employed minimum feedback and ended up with higher IM and THD figures than the Citation designs. These distortions are audible and measurable, and it was felt to be a poor compromise to trade an unquantifiable design parameter for a definable and definitely undesirable one.

In addition to instrument analysis, Harmon/Kardon employs a listening panel. On one occasion the prototype Citation 16 was put into A-B competition against a Crown. The panel preferred the Crown. Gaines and an associate studied the results and came up with a theory. A potentiometer had been used to reduce the sensitivity of the 16 to match that of the Crown in the test. In conjunction with a blocking capacitor, this resulted in a 3 dB rolloff at 40 kHz. A pot of lower impedance was substituted and the test repeated. The Citation fared much better. Maybe there really are such things as golden ears.

Several questions were raised from the floor. Why do all the super-amps, Citation 16 included, have about the same signal-to-noise ratio, about 100 dB? Gaines responded that that figure reflected the noise inherent in modern semiconductors. Everyone has and will have the same limitation until there's a technological breakthrough in solid-state devices.

Why not a Harman/Kardon class A amplifier? Such amplifiers are under study at H/K, particularly with respect to research pointing to a hybrid design. However, total class A's are very inefficient. Not everyone wants a 90-pound amplifier with blowers included in his system. Most of the heat in class A is generated when the amplifier is idling or playing very quiet passages. So the blowers are most needed at the very time when their noise is most intrusive.

Another question was how well the Citation 16 handles 4-ohm loads and the variable load loudspeakers present to an amplifier. The amplifier is not rated into 4-ohm loads because of the preconditioning provision of FTC rules. However, the amp is good for 250 watts into 4 ohms.

A wide selection of speakers was evaluated to consider phase shift and the impedance loads they present to amplifiers. Phase shift under load is rough on an amplifier. If it ever reached 90 degrees, nothing would come out of the speakers because all the power would be dissipated in the transistors. In the tested speakers, phase angle never exceeded 50 degrees. The transistors selected for the Citation 16 have ample capacity for handling a 50-degree phase shift at 4 ohms and 250 watts steady state.

Together, Gaines and Phillips presented a rational case for the Citation products. The products acquitted themselves well in a demonstration of master tapes played at the end of the meeting.

— Henry G. Belot

A Publication of the BAS

It's Even More Complex Than You Thought

Elliott Berger*

Because psychoacoustics is one of my main interests, I found John Sprague's recent article "It's More Complex Than You Thought" (BAS Speaker Jan. 1976) of interest. Though I do not disagree with any of his basic comments or conclusions, I would like to correct a few inaccuracies.

Sprague is at pains to carefully analyze the Fletcher-Munson equal-loudness contours. But why does he—and many other authors in recent years-persist in using these relations? Fletcher and Munson's work was done in 1933 and Was repeated four years later by Churcher and King. The two investigations showed considerable discrepancies over some parts of the audible range. Partly because of these discrepancies, D. W. Robinson and R. S. Dadson published a very careful redetermination of the loudness curves in the British Journal of Applied Physics (Vol. 7, 1956) and in J.A.S.A. (Vol. 29, 1957). These curves, based primarily on the judgments of ninety persons of unimpaired hearing, show greater internal consistency and are the currently accepted standard (ISO/R226-1961).

Briefly, some of the differences between the Fletcher-Munson and Robinson-Dadson experiments, and the effect of these differences on Sprague's conclusions, are as follows:

1. The Robinson-Dadson 1-kHz threshold values are 3 to 4 dB less sensitive than those shown by Fletcher and Munson. In fact, the latter drew their threshold curves at values 3 to 4 dB more sensitive than their measured 1-kHZ average.

2. For the low frequencies, the Robinson-Dadson threshold values are more sensitive by approximately 10 dB.

3. Sprague's comment on page 5, next to last paragraph, next to last sentence should read: "At 100 dB SPL, the ear's average sensitivity to 2000-Hz energy is about -5 dB relative to its 1000-Hz sensitivity, about -6 dB at 110 dB SPL, and about -8 dB at 120 dB SPL."

4. The ear's maximum-sensitivity frequency range does not shift as SPL increases.

5. At 100 dB SPL, the ear's response is within about+2.7 dB/-3 dB from 20 to 1500 Hz.

6. The curves are drawn with respect to pressure, not, as stated in Sprague's article, to energy.

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7. Sprague often refers to "dB SPL," and is obviously referencing this to 1 kHz. It would be more accurate and less open to misinterpretation if he used the concept of phons—the SPL of a 1-kHz reference tone judged to be equal in loudness to the tone in question. The equal-loudness curves are in fact equal-phon curves. [Definitions of phons, sones, SPL, intensity, energy, etc., are well worth a separate article.—Ed.]

8. It is not strictly correct to analyze the curves as carefully as Sprague does and to draw specific conclusions from them for any individual. We must remember that these curves are statistical averages and therefore there is no way short of actual measurement to know the equal-phon curves for a particular individual. The standard deviations [a normal difference of an individual's hearing from the published curves—Ed.] for the Robinson-Dadson curves range from 3.5 dB at 1500 Hz to 20 dB at 15 kHz [evidence of high-frequency sensitivity loss with age, among other factors—Ed.].

9. Before applying these curves so assiduously to the problem of stereo listening in a room, let us not forget that they are free-field determinations. There are corrections that must be applied when dealing with random incidence fields (see Robinson, Whittle, and Bowsher, "The Loudness of Diffuse Sound Fields," Acustica, Vol. 11, 1961).

10. Lastly, as a point of interest, one might look up "Thresholds of Audibility for Very Low-Frequency Pure Tones," J.A.S.A., Vol. 55, 1974. The threshold of "audibility" at 2 Hz is in the neighborhood of 135 db !

With regard to Sprague's statement (page 6, first paragraph) that "these subjective alterations to frequency balance, caused merely by playback at other than a `suitable' level. . . may well be responsible for the common desire to reproduce sound at loud levels and for some of the differences of opinion among subjective reviewers," I have often wondered why listening to the Doobies [?—Ed.] or Pink Floyd at 80 dB SPL is not 1/100 the trip it is at 95 dB. My own feeling on the matter is that it has to do with total body involvement resulting from actual body irradiation, and also, perhaps, with another cause: It is well known that the ear is not a linear transducer. Distortion is always present in the cochlear microphonic, although this "electrical" distortion is poorly related to psychoacoustic data. Nonetheless, the data indicate that at levels as low as 60 dB, second-harmonic distortion of pure tones can be measured psychoacoustically with the proper experiment. The cochlear microphonic curves, and possibly the psychoacoustic ones (this is a conjecture), rise linearly (the distortion, that is) up to the 85- to 100-dB region. Possibly the increased aural distortion at these levels actually lends an added richness to the musical experience.

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Levinson JC-1 Versus Fidelity Research FRT-3: A Comparison

Steven L. Seto

Of all the many different stereo components, the moving-coil cartridge and its associated signal boosters must be one of the most esoteric. Unlike most other components, it is difficult to get information, much less comparative test reports, on these devices. Only recently—most notably in The Absolute Sound and in Audio—has any real testing been reported for the newer models of moving-coil cartridges and boosters.

Thus when I decided to replace a Shure V-15 Type III with a moving-coil system, I found it difficult to decide what system I should get The cartridge was reasonably easy to choose; I settled on the Supex SD-900E, a comparatively lightweight moving-coil device with smooth highs and really solid bass.

However, choosing the booster—either a pre-preamp or a transformer—was very difficult. I could find no useful comparative tests in the literature, and everyone's advice sounded like 90% opinion. Therefore, with the aid of a sympathetic dealer (Jonas Miller Sound in Los Angeles), I performed a comparative test of my own. I borrowed a Fidelity Research FRT-3 transformer and a Levinson JC-1 pre-preamp and used them both at home for several days. These two boosters were chosen because both are well regarded for their types. The FRT-3 is a small, well-shielded cube containing two toroidally wound transformers (one per channel). The front of the cube has a three-position switch with two impedance settings (10 ohms and 30 ohms) plus a bypass position. The JC-1 is a solid-state amplifier powered by two D cells. It is packaged in a moderately well-shielded black metal box with an on/off/battery-test switch on one side. (See article in The Absolute Sound, Vol. 1, No. 4, pp. 210-212.

Since I have only one turntable and one preamp, the test was arranged so that one channel from the cartridge went to the FRT-3 and then into the phono 1 input of the preamp. The other channel went to the JC-1 and then into the phono 2 preamp input. The preamp, an SAE 1B, was set to its L + R mode. An A-B comparison was thus possible by switching between the two phono inputs. (Both devices were grounded, since both were quieter that way.) Before any listening tests were conducted, a frequency sweep record was used to equalize the devices to give reasonably flat frequency response in the listening area. A single set of equalizer settings worked well for both devices.

In the listening tests, I chose records that contain primarily solo artists or small ensembles with minimal differences between the right and left channel material. Even so, the channels to the two devices were frequently switched and occasionally both channels from one device or the other were connected to see if the sonic linage changed with full-scale operation. It did not. Most of the critical listening was performed using the Acoustic Research disc, "The Sound of Musical Instruments" (AR-1) pressed by Ensayo. This record was ideally suited to the test.

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The listening sessions led me to the conclusion that the JC-1 was the better device for my system. The sound quality of both devices was very clean, with good bass and airy highs, and both devices seemed to have equal detail through most of the audible range. However, the JC-1 had something more: when listening, especially to the AR disc, my friends and I all noticed that the JC-1 produced a sound with far greater ambience, resulting in far better three-dimensional sonic imaging. By contrast, the FRT-3's sound was flat and two-dimensional, although very detailed and seemingly wide-ranging. At first we suspected that perhaps this was a loudness effect due to the lower gain of the FRT-3, but increasing the gain when switching to the FRT-3 did not restore the missing dimension.

On only one occasion did the FRT-3 sound better than the JC-1, and curiously that was on the solo soprano cut of the AR disc. For this one cut, the tables were completely turned, with the JC-1 sounding flat and two-dimensional while the FRT-3 yielded a fine three-dimensional sonic image. Of course, both devices continued to sound smooth and detailed, but in this one case the sense of depth was clearly there with the FRT-3 while with the JC-1 it clearly was not.

Intuitively, I feel that the difference must have been due, at least in part, to a difference in the infrasonic performance of the two devices, but I could not prove this in my tests. I can say only that the JC-1 sounded better and I chose it for my system.

Author's Note

This article was written before the article by Foster and Leonard appeared in the January 1976 BAS Speaker. Although my tests were not as technically detailed as theirs, I do, in general, agree with Foster and Leonard, but I have choosen the Supex over the Shure V-15 Type III because to my ears the Supex sounds significantly better, and the difference is apparently greater than that found by Foster and Leonard. Of course, this does not contradict their conclusion, since I am speaking of my individual case.

As an example, while playing the AR disc, the V-15 sounded "correct" (i.e., almost true to life) on only a few cuts, while the Supex sounded "correct" on almost all the cuts. In addition, the Supex required less equalization to give a nearly flat frequency response in my listening room.

I disagree somewhat with Foster's and Leonard's statement that the difference between the pre-preamp and the transformer can be explained solely on the basis of frequency response differences. I tried bass-boosting the transformer in direct A-B comparison with the JC-1, but met with little success. I do not, however, have any alternative explanation for the difference in sound. Also, I did not feel that the Supex/JC-1 was less transparent than the Supex/FRT-3. In fact, I felt that if anything the reverse was true. All differences were really quite small. I have also never found the Supex to accentuate surface noise, and I have not had any hum problems with my Supex, although I did notice that the FRT-3 was quieter than the JC-1 at very high gain settings.

Incidentally, all the above comments apply also to the Supex SD-900 Super, which I am now using instead of the SD-900E. The Super is 20% lighter than the SD-900E, with slightly tighter bass and smoother highs.

To conclude, let me state, in deference to Shanefield, Sprague, et al., that this A-B test leaves something to be desired, but I arrived at a definite conclusion for my situation and my system, and that is sufficient for me.

Additional Comment—Ira Leonard

I agree with some of Seto's comments, but perhaps some additional description of the test method used by Al Foster and me is called for .

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Our first test limitation was that we used only one sample of each cartridge, transformer, and pre-preamp. Second, we used only one type of test record for the frequency response measurements, although other records were used for additional tests (e.g., tracking).

It is well known that all magnets, but especially the high-permeability types used in cartridges and transformers, can be affected by both thermal and mechanical shocks. Great variability seems to exist among different samples of both moving-coil cartridges and transformers, and such shocks may be the cause—in addition to manufacturing variants, since both devices are handmade. We must remember that these items are shipped halfway around the world before we get them.

As for the frequency response, and in particular the high-frequency peak of the Supex, many dealers and serious listeners have given various explanations of where the peak comes from and whether or not it is supposed to be present in a good unit. In our tests, the big advantage of the JC-1AC over the transformer was its ability to provide switch-selectable amounts of high-frequency attenuation. We used the maximum attenuation setting in our tests.

The JC-1 used by Seto lacks this option. (It is also reputed to be slew-rate-limited.) The JC-1 has been superseded in the product line by the JC-1DC, which is slightly inferior to the JC-1AC but much better than the JC-1 that it replaces.

As for the test record, I should note that many people have measured differences between such records, even when all were intended to provide quantitative frequency response data. It is rumored that the one we used is not perfect, but it is useful for comparisons between components, and it is as good as any available on the market.

All subjective hi-fi testing is performed by people, and all people have personal tastes and priorities. In our listening tests, we had conflicting feelings about the results—before, during, and after the tests.

One of us (Foster) has developed the opinion that many of the differences we heard were strictly due to aberrations in frequency response. He has done much testing and listening with the Shure V-15 HI and is familiar with its performance. He is also concerned with cost-versus performance tradeoffs. He enjoyed the sound of the Supex, but required convincing to prove that the sound was not caused primarily by a frequency response difference. I, on the other hand, already owned the Supex and transformer, and thus had a stake in hoping it tested superior. He had used the Shure III for over a year and liked it, but had found the sound sterile, veiled (or non-open), and dimensionally (front to back) very flat. In spite of the measured frequency response, I still felt that the sound of the Supex was superior. (I did use my tone controls to remove the high-frequency peak.)

In the end, both opinions were expressed in the article, both rather conservatively. Let the readers listen for themselves and then decide.

Since the reported session, I have compared the same Supex and transformer with a Denon, although using a different listening system and environment. The high-end rise in the Supex was still audible and the Denon sounded a little smoother, but both cartridges sounded very good, maintaining the superior qualities first heard in the comparison with the Shure. There was no obvious difference to me in stereo imagery or dimensionality, but both were far superior to the Shure.

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The Tawdry "Turtle" Amplifier

Robert Graham

It's not often that a reviewer gets a chance to audition a product as unique as this one. When I was approached to try out the Turtle amplifier, I was both surprised and hesitant. Even though I protested that I was seriously thinking of giving up hi-fi, I was encouraged (nay, badgered) to at least look at the amplifier's design features.

The creator of the Turtle is an obscure haberdasher-turned-audio-enthusiast named Elias Pudge. I had seen examples of his work before, including the cast-aluminum fedora and the Drossage Rock-Solid-State amplifier, which was reviewed several years ago in The Stereophile. I was under the impression that Pudge was out of circulation, but apprently he has recovered enough to be considered normal once again. The Tawdry Turtle is a direct result of Pudge's shock therapy.

Several weeks went by and I had not received my sample unit. I was beginning to breathe easier. Unfortunately, one day I found it in my mailbox, and so, since I couldn't put it off any longer, I began putting the Turtle through its paces.

According to the instruction booklet, the Tawdry amplifier is designed to combine economy of construction and a lack of frills. They've succeeded. For example, the chassis is a clever recycling of an English cookie tin, and there are only three controls on the front, reading from left to right, "Select," "Volume," and "Bass/Treble." (This last control is a holdover from Pudge's revolutionary Drossage amplifier.) There are no knobs attached to the controls, for as the booklet explains, Tawdry doesn't want to force its own design ideas on everyone. They prefer to let the owner choose his or her own knobs.

On the back of the amplifier is an ac cord (attach your own plug) and the output connectors marked "8-ohm banana jacks." Not being able to locate an 8-ohm banana, I turned once again to my seldom-used reference speaker system, the renowned imported Humbley-Fogsworth "Dinkel," which is, as everyone knows, a fine mediocre speaker.

Operation of the controls was not the smoothest I've ever seen, but I found that I could usually operate the "Volume" or "Bass/Treble" with one hand, as long as I steadied the amplifier with the other. Operation of the selector knob, unfortunately, requires the assisitance of another person. Once the desired volume is reached, it is then necessary to adjust the balance between the speakers. The Turtle does not come with a balance control; instead, the instruction booklet (actually a hand written notebook page) suggests that one speaker be moved toward or away from the other one to obtain the best balance. Alternatively, one can move one's chair.

It's the lack of such frills as a balance control (or an on-off switch) that has allowed the Tawdry Co. to keep the list price of the Turtle down to $9.95, plus 30¢ postage.

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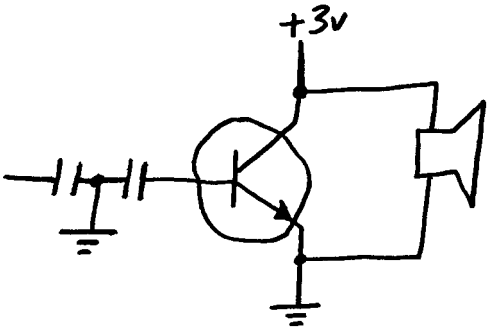
Now to the measurements. The frequency response was about ±15 dB from 200 to 5000 Hz, but this is apparently in keeping with the design philosophy of the company: "What you don't hear can't hurt you." Also, Pudge feels that tweeters last longer if they aren't required to reproduce anything. The power output of the Turtle was particularly surprising. Using an oil immersed 1/8-watt resistor as a load, I found the output to be well below the resolution of my meter! I don't recall ever seeing that kind of performance before.

Hum and noise was about -10 dB, but this could be improved slightly by turning off the amplifier. I feel that the hum content might have been further improved if Pudge had elected to put a rectifier and filter capacitor in the power supply.

When I attempted to measure the slew rate of the amplifier, the derivation of the name "Turtle" became all too clear. For the record, the slew-rate is 1 volt per minute.

Saving the best for last, the output stage is Elias Pudge's brain-child. He calls it the "Pseudo-Satisfactory-No-Comment Output," utilizing a single transistor wired in parallel with the speaker. (See sketch.)



Listening tests confirmed the measurements. I have never heard music reproduced like this before. There was very little muddiness in the bass range, due in part, I feel, to the fact that there was no bass range. Instrument detail was generally lacking, but it was occasionally possible to tell the difference between a trumpet and a violin. This is the first amplifier I have heard that makes organ records sound like all the pipes are playing at the same time, continuously. Although the dynamic range was not too good, the Turtle did offer plenty of listener fatigue.

In conclusion, I must ask myself, "Is this perhaps the worst amplifier I have yet heard?" The answer is not no. Although I tried to make this a brief review, I am left with the nagging feeling that it was not brief enough.

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